US00D754357S

(12) **United States Design Patent**
**Lindekugel et al.**

(10) **Patent No.: US D754,357 S**
(45) **Date of Patent: ** Apr. 19, 2016**

(54) **ULTRASOUND PROBE HEAD**

(71) Applicant: **C. R. Bard, Inc.**, Murray Hill, NJ (US)

(72) Inventors: **Eric W. Lindekugel**, Salt Lake City, UT (US); **Amir Orome**, Sandy, UT (US)

(73) Assignee: **C. R. Bard, Inc.**, Murray Hill, NJ (US)

(**) Term: **14 Years**

(21) Appl. No.: **29/480,317**

(22) Filed: **Jan. 24, 2014**

**Related U.S. Application Data**

(60) Division of application No. 29/428,649, filed on Aug. 1, 2012, now Pat. No. Des. 699,359, which is a continuation-in-part of application No. 13/206,396, filed on Aug. 9, 2011.

(51) **LOC (10) Cl.** ..... **24-01**

(52) **U.S. Cl.**
USPC ..... **D24/187**

(58) **Field of Classification Search**
USPC ..... D24/133, 158, 186–187, 200; 600/437, 600/439, 446, 453, 459, 463, 424, 443, 600/461; 128/916; D10/60, 80, 103
CPC ..... A61B 5/14532; A61B 5/14546; A61B 5/1455; A61B 5/14551; A61B 5/14552; A61B 7/003; A61B 5/0476; A61B 5/021; A61B 5/0478; A61B 8/4281; A61B 8/00; A61B 5/0002; A61B 5/042; A61B 17/3403; C12Q 1/006
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

3,133,244 A 5/1964 Wojtulewicz
3,297,020 A 1/1967 Mathiesen
(Continued)

FOREIGN PATENT DOCUMENTS

AU 642647 11/1990
AU 1860597 B2 6/1999
(Continued)

OTHER PUBLICATIONS

PCT/US2009/056567 filed Sep. 10, 2009 International Preliminary Report on Patentability dated Mar. 15, 2011.
(Continued)

*Primary Examiner* — T. Chase Nelson
*Assistant Examiner* — Mark Cavanna
(74) *Attorney, Agent, or Firm* — Rutan & Tucker, LLP

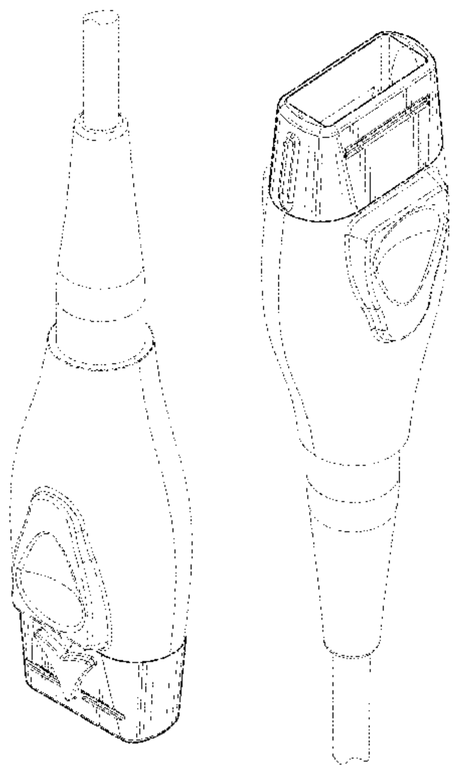
(57) **CLAIM**

We claim the ornamental design for an ultrasound probe head, as shown and described.

**DESCRIPTION**

FIG. **1** is a front perspective view of an ultrasound probe head showing my new design;
FIG. **2** is a rear perspective view of the ultrasound probe head illustrated in FIG. **1**;
FIG. **3** is a front elevation view of the ultrasound probe head illustrated in FIG. **1**;
FIG. **4** is a first side elevation view of the ultrasound probe head illustrated in FIG. **1**;
FIG. **5** is a bottom view of the ultrasound probe head illustrated in FIG. **1**;
FIG. **6** is a rear elevation view of the ultrasound probe head illustrated in FIG. **1**;
FIG. **7** is a second side elevation view of the ultrasound probe head illustrated in FIG. **1**; and,
FIG. **8** is a top view of the ultrasound probe head illustrated in FIG. **1**.
The broken lines are included for the purpose of illustrating portions of the ultrasound probe head that forms no part of the claimed design.

**1 Claim, 3 Drawing Sheets**



(56) **References Cited**

U.S. PATENT DOCUMENTS

| | | | |
|---|---|---|---|
| 3,625,200 | A | 12/1971 | Muller |
| 3,674,014 | A | 7/1972 | Tillander et al. |
| 3,817,241 | A | 6/1974 | Grausz |
| 3,847,157 | A | 11/1974 | Caillouette et al. |
| 3,868,565 | A | 2/1975 | Kuipers |
| 3,902,501 | A | 9/1975 | Citron et al. |
| 3,995,623 | A | 12/1976 | Blake et al. |
| 4,003,369 | A | 1/1977 | Heilman et al. |
| 4,063,561 | A | 12/1977 | McKenna |
| 4,072,146 | A | 2/1978 | Howes |
| 4,114,601 | A | 9/1978 | Abels |
| 4,149,535 | A | 4/1979 | Volder et al. |
| 4,173,228 | A | 11/1979 | Van Steenwyk et al. |
| 4,175,566 | A | 11/1979 | Millar |
| 4,181,120 | A | 1/1980 | Kunii et al. |
| 4,224,949 | A | 9/1980 | Scott et al. |
| 4,244,362 | A | 1/1981 | Anderson |
| 4,246,792 | A | 1/1981 | Matzuk |
| 4,289,139 | A | 9/1981 | Enjoji et al. |
| 4,317,078 | A | 2/1982 | Weed et al. |
| 4,327,722 | A | 5/1982 | Groshong et al. |
| 4,362,166 | A | 12/1982 | Furler et al. |
| 4,365,639 | A | 12/1982 | Goldreyer |
| 4,380,237 | A | 4/1983 | Newbower |
| 4,402,324 | A | 9/1983 | Lindgren et al. |
| 4,407,294 | A | 10/1983 | Vilkomerson |
| 4,429,693 | A | 2/1984 | Blake et al. |
| 4,431,005 | A | 2/1984 | McCormick |
| 4,431,214 | A | 2/1984 | Buffington |
| 4,445,501 | A | 5/1984 | Bresler |
| 4,459,854 | A | 7/1984 | Richardson et al. |
| 4,469,106 | A | 9/1984 | Harui |
| 4,483,343 | A | 11/1984 | Beyer et al. |
| 4,491,137 | A | 1/1985 | Jingu |
| 4,565,201 | A | 1/1986 | Lass |
| 4,572,198 | A | 2/1986 | Codrington |
| 4,577,634 | A | 3/1986 | Gessman |
| 4,582,067 | A | 4/1986 | Silverstein et al. |
| 4,588,394 | A | 5/1986 | Schulte et al. |
| 4,593,687 | A | 6/1986 | Gray |
| 4,593,699 | A | 6/1986 | Poncy et al. |
| 4,595,012 | A | 6/1986 | Webler et al. |
| 4,601,706 | A | 7/1986 | Aillon |
| 4,608,989 | A | 9/1986 | Drue |
| 4,608,992 | A | 9/1986 | Hakim et al. |
| 4,619,247 | A | 10/1986 | Inoue et al. |
| 4,622,644 | A | 11/1986 | Hansen |
| 4,644,960 | A | 2/1987 | Johans |
| 4,652,820 | A | 3/1987 | Maresca |
| 4,665,925 | A | 5/1987 | Millar |
| 4,667,230 | A | 5/1987 | Arakawa et al. |
| 4,674,518 | A | 6/1987 | Salo |
| 4,676,249 | A | 6/1987 | Arenas et al. |
| 4,681,106 | A | 7/1987 | Kensey et al. |
| 4,681,117 | A | 7/1987 | Brodman et al. |
| 4,688,578 | A | 8/1987 | Takano et al. |
| 4,692,148 | A | 9/1987 | Kantrowitz et al. |
| 4,697,595 | A | 10/1987 | Breyer et al. |
| 4,700,997 | A | 10/1987 | Strand |
| 4,706,681 | A | 11/1987 | Breyer et al. |
| 4,710,708 | A | 12/1987 | Rorden et al. |
| 4,733,669 | A | 3/1988 | Segal |
| 4,737,794 | A | 4/1988 | Jones |
| 4,741,356 | A | 5/1988 | Letzo et al. |
| 4,742,356 | A | 5/1988 | Kuipers |
| 4,753,247 | A | 6/1988 | Kirsner et al. |
| 4,770,185 | A | 9/1988 | Silverstein et al. |
| 4,771,788 | A | 9/1988 | Millar |
| 4,781,685 | A | 11/1988 | Lehmann et al. |
| 4,784,646 | A | 11/1988 | Feingold |
| 4,787,070 | A | 11/1988 | Suzuki et al. |
| 4,787,396 | A | 11/1988 | Pidorenko |
| 4,793,361 | A | 12/1988 | DuFault |
| 4,794,930 | A | 1/1989 | Machida et al. |
| 4,796,632 | A | 1/1989 | Boyd et al. |
| 4,798,588 | A | 1/1989 | Aillon |
| 4,798,598 | A | 1/1989 | Bonello et al. |
| 4,809,681 | A | 3/1989 | Kantrowitz et al. |
| 4,809,713 | A | 3/1989 | Grayzel |
| 4,813,729 | A | 3/1989 | Speckhart |
| 4,821,731 | A | 4/1989 | Martinelli et al. |
| 4,836,214 | A | 6/1989 | Sramek |
| 4,840,622 | A | 6/1989 | Hardy |
| 4,849,692 | A | 7/1989 | Blood |
| 4,850,358 | A | 7/1989 | Millar |
| 4,852,580 | A | 8/1989 | Wood |
| 4,856,317 | A | 8/1989 | Pidorenko et al. |
| 4,856,529 | A | 8/1989 | Segal |
| 4,860,757 | A | 8/1989 | Lynch et al. |
| 4,867,169 | A | 9/1989 | Machida et al. |
| 4,869,263 | A | 9/1989 | Segal et al. |
| 4,869,718 | A | 9/1989 | Brader |
| 4,887,606 | A | 12/1989 | Yock et al. |
| 4,887,615 | A | 12/1989 | Taylor |
| 4,889,128 | A | 12/1989 | Millar |
| 4,899,756 | A | 2/1990 | Sonek |
| 4,901,725 | A | 2/1990 | Nappholz et al. |
| 4,905,698 | A | 3/1990 | Strohl, Jr. et al. |
| 4,911,173 | A | 3/1990 | Terwilliger |
| 4,911,174 | A | 3/1990 | Pederson et al. |
| 4,924,870 | A | 5/1990 | Wlodarczyk et al. |
| 4,943,770 | A | 7/1990 | Ashley-Rollman et al. |
| 4,945,305 | A | 7/1990 | Blood |
| 4,947,852 | A | 8/1990 | Nassi et al. |
| 4,957,111 | A | 9/1990 | Millar |
| 4,961,433 | A | 10/1990 | Christian |
| 4,966,148 | A | 10/1990 | Millar |
| 4,967,753 | A | 11/1990 | Haase et al. |
| 4,977,886 | A | 12/1990 | Takehana et al. |
| 4,989,608 | A | 2/1991 | Ratner |
| 4,995,396 | A | 2/1991 | Inaba et al. |
| 4,998,916 | A | 3/1991 | Hammerslag et al. |
| 5,005,592 | A | 4/1991 | Cartmell |
| 5,016,173 | A | 5/1991 | Kenet et al. |
| 5,025,799 | A | 6/1991 | Wilson |
| 5,029,585 | A | 7/1991 | Lieber et al. |
| 5,040,548 | A | 8/1991 | Yock |
| 5,042,486 | A | 8/1991 | Pfeiler et al. |
| 5,045,071 | A | 9/1991 | McCormick et al. |
| 5,046,497 | A | 9/1991 | Millar |
| 5,050,607 | A | 9/1991 | Bradley et al. |
| 5,057,095 | A | 10/1991 | Fabian |
| 5,058,595 | A | 10/1991 | Kern |
| 5,067,489 | A | 11/1991 | Lind |
| 5,076,278 | A | 12/1991 | Vilkomerson et al. |
| 5,078,140 | A | 1/1992 | Kwoh |
| 5,078,148 | A | 1/1992 | Nassi et al. |
| 5,078,149 | A | 1/1992 | Katsumata et al. |
| 5,078,678 | A | 1/1992 | Katims |
| 5,078,714 | A | 1/1992 | Katims |
| 5,084,022 | A | 1/1992 | Claude |
| 5,092,341 | A | 3/1992 | Kelen |
| 5,099,845 | A | 3/1992 | Besz et al. |
| 5,099,850 | A | 3/1992 | Matsui et al. |
| 5,100,387 | A | 3/1992 | Ng |
| 5,105,829 | A | 4/1992 | Fabian et al. |
| 5,109,862 | A | 5/1992 | Kelen et al. |
| 5,114,401 | A | 5/1992 | Stuart et al. |
| 5,121,750 | A | 6/1992 | Katims |
| D327,740 | S | 7/1992 | Arioka et al. |
| 5,134,370 | A | 7/1992 | Jefferts et al. |
| 5,144,955 | A | 9/1992 | O'Hara |
| 5,158,086 | A | 10/1992 | Brown et al. |
| 5,160,342 | A | 11/1992 | Reger et al. |
| 5,161,536 | A | 11/1992 | Vilkomerson et al. |
| 5,174,295 | A | 12/1992 | Christian et al. |
| 5,184,601 | A | 2/1993 | Putman |
| 5,190,045 | A | 3/1993 | Frazin |
| 5,202,985 | A | 4/1993 | Goyal |
| 5,211,165 | A | 5/1993 | Dumoulin et al. |
| 5,211,636 | A | 5/1993 | Mische |
| 5,212,988 | A | 5/1993 | White et al. |
| 5,214,615 | A | 5/1993 | Bauer et al. |
| 5,217,026 | A | 6/1993 | Stoy et al. |

(56) **References Cited**

U.S. PATENT DOCUMENTS

| | | | |
|---|---|---|---|
| 5,220,924 | A | 6/1993 | Frazin |
| 5,235,987 | A | 8/1993 | Wolfe |
| 5,239,464 | A | 8/1993 | Blair et al. |
| 5,240,004 | A | 8/1993 | Walinsky et al. |
| 5,243,995 | A | 9/1993 | Maier |
| 5,246,007 | A | 9/1993 | Frisbie et al. |
| 5,247,171 | A | 9/1993 | Wlodarczyk et al. |
| 5,251,635 | A | 10/1993 | Dumoulin et al. |
| 5,255,680 | A | 10/1993 | Darrow et al. |
| 5,257,636 | A | 11/1993 | White |
| 5,257,979 | A | 11/1993 | Jagpal |
| 5,259,386 | A | 11/1993 | Sharkawy |
| 5,261,409 | A | 11/1993 | Dardel |
| 5,265,610 | A | 11/1993 | Darrow et al. |
| 5,265,614 | A | 11/1993 | Hayakawa et al. |
| 5,267,569 | A | 12/1993 | Lienhard |
| 5,270,810 | A | 12/1993 | Nishimura |
| 5,271,404 | A | 12/1993 | Corl et al. |
| 5,273,025 | A | 12/1993 | Sakiyama et al. |
| 5,273,042 | A | 12/1993 | Lynch et al. |
| 5,274,551 | A | 12/1993 | Corby, Jr. |
| 5,275,053 | A | 1/1994 | Wlodarczyk et al. |
| 5,279,129 | A | 1/1994 | Ito |
| 5,279,607 | A | 1/1994 | Schentag et al. |
| 5,280,786 | A | 1/1994 | Wlodarczyk et al. |
| 5,287,331 | A | 2/1994 | Schindel et al. |
| 5,289,373 | A | 2/1994 | Zarge et al. |
| 5,292,342 | A | 3/1994 | Nelson et al. |
| 5,295,485 | A | 3/1994 | Shinomura et al. |
| 5,307,072 | A | 4/1994 | Jones, Jr. |
| 5,311,871 | A | 5/1994 | Yock |
| 5,313,949 | A | 5/1994 | Yock |
| 5,318,025 | A | 6/1994 | Dumoulin et al. |
| 5,325,860 | A | 7/1994 | Seward et al. |
| 5,325,873 | A | 7/1994 | Hirschi et al. |
| 5,330,496 | A | 7/1994 | Alferness |
| 5,331,966 | A | 7/1994 | Bennett et al. |
| 5,333,614 | A | 8/1994 | Feiring |
| 5,337,678 | A | 8/1994 | Grout et al. |
| 5,341,807 | A | 8/1994 | Nardella |
| 5,343,865 | A | 9/1994 | Gardineer et al. |
| 5,345,940 | A | 9/1994 | Seward et al. |
| 5,348,020 | A | 9/1994 | Hutson |
| 5,350,352 | A | 9/1994 | Buchholtz et al. |
| 5,357,961 | A | 10/1994 | Fields et al. |
| 5,369,624 | A | 11/1994 | Fukukita et al. |
| 5,375,596 | A | 12/1994 | Twiss et al. |
| 5,376,083 | A | 12/1994 | Mische |
| 5,377,678 | A | 1/1995 | Dumoulin et al. |
| 5,385,053 | A | 1/1995 | Wlodarczyk et al. |
| 5,391,199 | A | 2/1995 | Ben-Haim |
| 5,394,876 | A | 3/1995 | Ma |
| 5,394,877 | A | 3/1995 | Orr et al. |
| 5,395,366 | A | 3/1995 | D'Andrea et al. |
| 5,398,683 | A | 3/1995 | Edwards et al. |
| 5,398,691 | A | 3/1995 | Martin et al. |
| 5,405,366 | A | 4/1995 | Fox et al. |
| 5,411,485 | A | 5/1995 | Tennican et al. |
| 5,413,107 | A | 5/1995 | Oakley et al. |
| 5,422,478 | A | 6/1995 | Wlodarczyk et al. |
| 5,425,367 | A | 6/1995 | Shapiro et al. |
| 5,425,370 | A | 6/1995 | Vilkomerson |
| 5,425,382 | A | 6/1995 | Golden et al. |
| 5,427,114 | A | 6/1995 | Colliver et al. |
| 5,429,132 | A | 7/1995 | Guy et al. |
| 5,429,617 | A | 7/1995 | Hammersmark et al. |
| 5,431,641 | A | 7/1995 | Grozinger et al. |
| 5,433,729 | A | 7/1995 | Adams et al. |
| 5,437,276 | A | 8/1995 | Takada |
| 5,437,277 | A | 8/1995 | Dumoulin et al. |
| 5,438,873 | A | 8/1995 | Wlodarczyk et al. |
| 5,443,066 | A | 8/1995 | Dumoulin et al. |
| 5,443,489 | A | 8/1995 | Ben-Haim |
| 5,445,150 | A | 8/1995 | Dumoulin et al. |
| 5,450,846 | A | 9/1995 | Goldreyer |
| 5,453,575 | A | 9/1995 | O'Donnell et al. |
| 5,456,256 | A | 10/1995 | Schneider et al. |
| 5,456,718 | A | 10/1995 | Szymaitis |
| 5,464,016 | A | 11/1995 | Nicholas et al. |
| 5,469,851 | A | 11/1995 | Lipschutz |
| 5,474,065 | A | 12/1995 | Meathrel et al. |
| 5,476,090 | A | 12/1995 | Kishi |
| 5,480,422 | A | 1/1996 | Ben-Haim |
| 5,487,729 | A | 1/1996 | Avellanet et al. |
| 5,490,522 | A | 2/1996 | Dardel |
| 5,492,538 | A | 2/1996 | Johlin, Jr. |
| 5,494,038 | A | 2/1996 | Wang et al. |
| 5,500,012 | A | 3/1996 | Brucker et al. |
| 5,505,205 | A | 4/1996 | Solomon et al. |
| 5,509,822 | A | 4/1996 | Negus et al. |
| 5,513,637 | A | 5/1996 | Twiss et al. |
| 5,515,853 | A | 5/1996 | Smith et al. |
| 5,522,878 | A | 6/1996 | Montecalvo et al. |
| 5,526,812 | A | 6/1996 | Dumoulin et al. |
| 5,531,664 | A | 7/1996 | Adachi et al. |
| 5,540,033 | A | 7/1996 | Fox et al. |
| 5,540,230 | A | 7/1996 | Vilkomerson |
| 5,540,681 | A | 7/1996 | Strul et al. |
| 5,542,938 | A | 8/1996 | Avellanet et al. |
| 5,546,949 | A | 8/1996 | Frazin et al. |
| 5,546,951 | A | 8/1996 | Ben-Haim |
| 5,558,091 | A | 9/1996 | Acker et al. |
| 5,568,809 | A | 10/1996 | Ben-haim |
| D375,450 | S | 11/1996 | Bidwell et al. |
| 5,570,671 | A | 11/1996 | Hickey |
| 5,575,291 | A | 11/1996 | Hayakawa et al. |
| 5,583,286 | A | 12/1996 | Matsuyama |
| 5,588,442 | A | 12/1996 | Scovil et al. |
| 5,592,939 | A | 1/1997 | Martinelli |
| 5,598,846 | A | 2/1997 | Peszynski |
| 5,599,299 | A | 2/1997 | Weaver et al. |
| 5,600,330 | A | 2/1997 | Blood |
| 5,610,967 | A | 3/1997 | Moorman et al. |
| 5,615,678 | A | 4/1997 | Kirkham et al. |
| 5,617,864 | A | 4/1997 | Stouffer et al. |
| 5,617,866 | A | 4/1997 | Marian, Jr. |
| 5,622,169 | A | 4/1997 | Golden et al. |
| 5,622,170 | A | 4/1997 | Schulz |
| 5,622,184 | A | 4/1997 | Ashby et al. |
| 5,623,931 | A | 4/1997 | Wung et al. |
| 5,624,430 | A | 4/1997 | Eton et al. |
| 5,626,554 | A | 5/1997 | Ryaby et al. |
| 5,626,870 | A | 5/1997 | Monshipouri et al. |
| 5,630,419 | A | 5/1997 | Ranalletta |
| 5,640,960 | A | 6/1997 | Jones et al. |
| 5,644,612 | A | 7/1997 | Moorman et al. |
| 5,645,065 | A | 7/1997 | Shapiro et al. |
| 5,651,047 | A | 7/1997 | Moorman et al. |
| 5,654,864 | A | 8/1997 | Ritter et al. |
| D383,968 | S | 9/1997 | Bidwell et al. |
| 5,662,115 | A | 9/1997 | Torp et al. |
| 5,665,477 | A | 9/1997 | Meathrel et al. |
| 5,666,473 | A | 9/1997 | Wallace |
| 5,666,958 | A | 9/1997 | Rothenberg et al. |
| 5,668,888 | A | 9/1997 | Doi et al. |
| 5,669,383 | A | 9/1997 | Johnson |
| 5,669,388 | A | 9/1997 | Vilkomerson |
| 5,676,159 | A | 10/1997 | Navis |
| 5,676,673 | A | 10/1997 | Ferre et al. |
| 5,691,898 | A | 11/1997 | Rosenberg et al. |
| 5,694,945 | A | 12/1997 | Ben-Haim |
| 5,695,479 | A | 12/1997 | Jagpal |
| 5,697,377 | A | 12/1997 | Wittkampf |
| 5,699,801 | A | 12/1997 | Atalar et al. |
| 5,700,889 | A | 12/1997 | Blair |
| 5,713,362 | A | 2/1998 | Vilkomerson |
| 5,713,363 | A | 2/1998 | Seward et al. |
| 5,713,946 | A | 2/1998 | Ben-Haim |
| 5,715,817 | A | 2/1998 | Stevens-Wright et al. |
| 5,716,389 | A | 2/1998 | Walinsky et al. |
| 5,718,241 | A | 2/1998 | Ben-Haim et al. |
| D391,838 | S | 3/1998 | Bidwell et al. |
| 5,722,412 | A | 3/1998 | Pflugrath et al. |
| 5,727,550 | A | 3/1998 | Montecalvo |

(56) **References Cited**

U.S. PATENT DOCUMENTS

| | | | | |
|---|---|---|---|---|
| 5,727,552 | A | 3/1998 | Ryan | |
| 5,727,553 | A | 3/1998 | Saad | |
| 5,729,055 | A | 3/1998 | Manning | |
| 5,729,129 | A | 3/1998 | Acker | |
| 5,729,584 | A | 3/1998 | Moorman et al. | |
| 5,730,129 | A | 3/1998 | Darrow et al. | |
| 5,731,996 | A | 3/1998 | Gilbert | |
| 5,733,323 | A | 3/1998 | Buck et al. | |
| 5,738,096 | A | 4/1998 | Ben-Haim | |
| 5,738,099 | A | 4/1998 | Chang | |
| 5,740,808 | A | 4/1998 | Panescu et al. | |
| 5,742,394 | A | 4/1998 | Hansen | |
| 5,744,953 | A | 4/1998 | Hansen | |
| 5,748,767 | A | 5/1998 | Raab | |
| 5,749,835 | A | 5/1998 | Glantz | |
| 5,749,938 | A | 5/1998 | Coombs | |
| 5,751,785 | A | 5/1998 | Moorman et al. | |
| 5,752,513 | A | 5/1998 | Acker et al. | |
| 5,758,650 | A * | 6/1998 | Miller | A61B 17/3403 600/461 |
| 5,762,064 | A | 6/1998 | Polvani | |
| 5,767,669 | A | 6/1998 | Hansen et al. | |
| 5,767,960 | A | 6/1998 | Orman et al. | |
| 5,769,786 | A | 6/1998 | Wiegel | |
| 5,769,843 | A | 6/1998 | Abela et al. | |
| 5,769,881 | A | 6/1998 | Schroeppel et al. | |
| 5,771,896 | A | 6/1998 | Sliwa, Jr. et al. | |
| 5,775,322 | A | 7/1998 | Silverstein et al. | |
| 5,775,332 | A | 7/1998 | Goldman | |
| 5,779,638 | A | 7/1998 | Vesely et al. | |
| 5,782,767 | A | 7/1998 | Pretlow, III | |
| 5,782,769 | A | 7/1998 | Hwang et al. | |
| 5,785,657 | A | 7/1998 | Breyer et al. | |
| 5,787,049 | A | 7/1998 | Bates | |
| 5,792,055 | A | 8/1998 | McKinnon et al. | |
| 5,795,297 | A | 8/1998 | Daigle | |
| 5,795,298 | A | 8/1998 | Vesely et al. | |
| 5,795,632 | A | 8/1998 | Buchalter | |
| 5,797,849 | A | 8/1998 | Vesely et al. | |
| 5,800,352 | A | 9/1998 | Ferre et al. | |
| 5,800,410 | A | 9/1998 | Gawreluk | |
| 5,800,497 | A | 9/1998 | Bakels et al. | |
| 5,803,089 | A | 9/1998 | Ferre et al. | |
| 5,810,733 | A | 9/1998 | Van Creveld et al. | |
| 5,816,245 | A | 10/1998 | Manseur et al. | |
| 5,817,022 | A | 10/1998 | Vesely | |
| 5,817,024 | A | 10/1998 | Ogle et al. | |
| 5,820,549 | A | 10/1998 | Marian, Jr. | |
| 5,824,031 | A | 10/1998 | Cookston et al. | |
| 5,829,444 | A | 11/1998 | Ferre et al. | |
| 5,830,145 | A | 11/1998 | Tenhoff | |
| 5,831,260 | A | 11/1998 | Hansen | |
| 5,833,608 | A | 11/1998 | Acker | |
| 5,833,622 | A | 11/1998 | Meathrel et al. | |
| 5,835,561 | A | 11/1998 | Moorman et al. | |
| 5,836,882 | A | 11/1998 | Frazin | |
| 5,836,990 | A | 11/1998 | Li | |
| 5,840,024 | A | 11/1998 | Taniguchi et al. | |
| 5,840,025 | A | 11/1998 | Ben-Haim | |
| 5,840,030 | A | 11/1998 | Ferek-Petric et al. | |
| 5,840,031 | A | 11/1998 | Crowley | |
| 5,842,986 | A | 12/1998 | Avrin et al. | |
| 5,843,076 | A | 12/1998 | Webster, Jr. et al. | |
| 5,843,153 | A | 12/1998 | Johnston et al. | |
| 5,844,140 | A | 12/1998 | Seale | |
| 5,846,198 | A | 12/1998 | Killmann | |
| 5,855,553 | A | 1/1999 | Tajima et al. | |
| 5,855,558 | A | 1/1999 | Nakao et al. | |
| 5,859,893 | A | 1/1999 | Moorman et al. | |
| 5,865,748 | A | 2/1999 | Co et al. | |
| 5,868,673 | A | 2/1999 | Vesely | |
| 5,873,822 | A | 2/1999 | Ferre et al. | |
| 5,876,328 | A | 3/1999 | Fox et al. | |
| 5,879,297 | A | 3/1999 | Haynor et al. | |
| 5,893,363 | A | 4/1999 | Little et al. | |
| 5,897,495 | A | 4/1999 | Aida et al. | |
| 5,899,860 | A | 5/1999 | Pfeiffer et al. | |
| 5,902,238 | A | 5/1999 | Golden et al. | |
| 5,907,487 | A | 5/1999 | Rosenberg et al. | |
| 5,908,385 | A | 6/1999 | Chechelski et al. | |
| 5,910,113 | A | 6/1999 | Pruter | |
| 5,910,120 | A | 6/1999 | Kim et al. | |
| 5,913,820 | A | 6/1999 | Bladen et al. | |
| 5,913,830 | A | 6/1999 | Miles | |
| 5,919,141 | A | 7/1999 | Money et al. | |
| 5,919,170 | A | 7/1999 | Woessner | |
| 5,928,145 | A | 7/1999 | Ocali et al. | |
| 5,929,607 | A | 7/1999 | Rosenberg et al. | |
| 5,931,788 | A | 8/1999 | Keen et al. | |
| 5,931,818 | A | 8/1999 | Werp et al. | |
| 5,941,858 | A | 8/1999 | Johnson | |
| 5,941,889 | A | 8/1999 | Cermak | |
| 5,941,904 | A | 8/1999 | Johnston et al. | |
| 5,944,022 | A | 8/1999 | Nardella et al. | |
| 5,944,023 | A | 8/1999 | Johnson et al. | |
| 5,953,683 | A | 9/1999 | Hansen et al. | |
| 5,957,857 | A | 9/1999 | Hartley | |
| 5,961,923 | A | 10/1999 | Nova et al. | |
| 5,967,978 | A | 10/1999 | Littmann et al. | |
| 5,967,980 | A | 10/1999 | Ferre et al. | |
| 5,967,991 | A | 10/1999 | Gardineer et al. | |
| 5,969,722 | A | 10/1999 | Palm | |
| 5,978,705 | A | 11/1999 | KenKnight et al. | |
| 5,982,915 | A | 11/1999 | Doi et al. | |
| 5,983,126 | A | 11/1999 | Wittkampf | |
| 5,984,908 | A | 11/1999 | Davis et al. | |
| 5,991,693 | A | 11/1999 | Zalewski | |
| 5,997,473 | A | 12/1999 | Taniguchi et al. | |
| 5,997,481 | A | 12/1999 | Adams et al. | |
| 6,006,123 | A | 12/1999 | Nguyen et al. | |
| 6,011,988 | A | 1/2000 | Lynch et al. | |
| 6,014,473 | A | 1/2000 | Hossack et al. | |
| 6,014,580 | A | 1/2000 | Blume et al. | |
| 6,015,414 | A | 1/2000 | Werp et al. | |
| 6,017,496 | A | 1/2000 | Nova et al. | |
| 6,019,724 | A | 2/2000 | Gronningsaeter et al. | |
| 6,019,725 | A | 2/2000 | Vesely et al. | |
| 6,023,638 | A | 2/2000 | Swanson | |
| 6,026,312 | A | 2/2000 | Shemwell et al. | |
| 6,031,765 | A | 2/2000 | Lee et al. | |
| 6,032,070 | A | 2/2000 | Flock et al. | |
| 6,039,694 | A | 3/2000 | Larson et al. | |
| 6,050,718 | A | 4/2000 | Schena et al. | |
| 6,052,610 | A | 4/2000 | Koch | |
| 6,052,618 | A | 4/2000 | Dahlke et al. | |
| D424,693 | S | 5/2000 | Pruter | |
| 6,059,718 | A | 5/2000 | Taniguchi et al. | |
| 6,064,903 | A | 5/2000 | Riechers et al. | |
| 6,064,905 | A | 5/2000 | Webster, Jr. et al. | |
| 6,066,094 | A | 5/2000 | Ben-Haim | |
| 6,068,599 | A | 5/2000 | Saito et al. | |
| 6,073,043 | A | 6/2000 | Schneider | |
| 6,074,367 | A | 6/2000 | Hubbell | |
| 6,075,442 | A | 6/2000 | Welch | |
| 6,076,007 | A | 6/2000 | England et al. | |
| 6,082,366 | A | 7/2000 | Andra et al. | |
| 6,083,170 | A | 7/2000 | Ben-Haim | |
| 6,099,524 | A | 8/2000 | Lipson et al. | |
| 6,100,026 | A | 8/2000 | Nova et al. | |
| 6,102,044 | A | 8/2000 | Naidyhorski | |
| 6,106,472 | A | 8/2000 | Chiang et al. | |
| 6,107,699 | A | 8/2000 | Swanson | |
| 6,112,111 | A | 8/2000 | Glantz | |
| 6,113,504 | A | 9/2000 | Kuesters | |
| 6,113,547 | A | 9/2000 | Catallo et al. | |
| 6,115,624 | A | 9/2000 | Lewis et al. | |
| 6,117,085 | A | 9/2000 | Picatti et al. | |
| 6,120,445 | A | 9/2000 | Grunwald | |
| 6,126,608 | A | 10/2000 | Kemme et al. | |
| 6,128,174 | A | 10/2000 | Ritter et al. | |
| 6,129,668 | A | 10/2000 | Haynor et al. | |
| 6,132,378 | A | 10/2000 | Marino | |
| 6,132,379 | A | 10/2000 | Patacsil et al. | |
| 6,135,961 | A | 10/2000 | Pflugrath et al. | |

(56) **References Cited**

U.S. PATENT DOCUMENTS

| | | | |
|---|---|---|---|
| 6,136,274 | A | 10/2000 | Nova et al. |
| 6,138,681 | A | 10/2000 | Chen et al. |
| 6,139,496 | A | 10/2000 | Chen et al. |
| 6,139,502 | A | 10/2000 | Fredriksen |
| 6,142,946 | A | 11/2000 | Hwang et al. |
| 6,144,300 | A | 11/2000 | Dames et al. |
| 6,148,823 | A | 11/2000 | Hastings |
| 6,152,933 | A | 11/2000 | Werp et al. |
| 6,157,853 | A | 12/2000 | Blume et al. |
| 6,165,144 | A | 12/2000 | Talish et al. |
| 6,166,496 | A | 12/2000 | Lys et al. |
| 6,166,806 | A | 12/2000 | Tjin |
| 6,167,765 | B1 | 1/2001 | Weitzel |
| 6,172,499 | B1 | 1/2001 | Ashe |
| 6,173,199 | B1 | 1/2001 | Gabriel |
| 6,173,715 | B1 | 1/2001 | Sinanan et al. |
| 6,175,756 | B1 | 1/2001 | Ferre et al. |
| 6,176,829 | B1 | 1/2001 | Vilkomerson |
| 6,193,743 | B1 | 2/2001 | Brayton et al. |
| 6,200,305 | B1 | 3/2001 | Berthiaume et al. |
| 6,203,498 | B1 | 3/2001 | Bunce et al. |
| 6,203,499 | B1 | 3/2001 | Imling et al. |
| 6,206,843 | B1 | 3/2001 | Iger et al. |
| 6,208,884 | B1 | 3/2001 | Kumar et al. |
| 6,211,626 | B1 | 4/2001 | Lys et al. |
| 6,211,666 | B1 | 4/2001 | Acker |
| 6,212,426 | B1 | 4/2001 | Swanson |
| 6,216,027 | B1 | 4/2001 | Willis et al. |
| 6,216,028 | B1 | 4/2001 | Haynor et al. |
| 6,216,029 | B1 | 4/2001 | Paltieli |
| 6,223,087 | B1 | 4/2001 | Williams |
| 6,226,547 | B1 | 5/2001 | Lockhart et al. |
| 6,230,046 | B1 | 5/2001 | Crane et al. |
| 6,233,476 | B1 | 5/2001 | Strommer et al. |
| 6,233,479 | B1 | 5/2001 | Haddad et al. |
| 6,238,344 | B1 | 5/2001 | Gamelsky et al. |
| 6,241,673 | B1 | 6/2001 | Williams |
| 6,246,231 | B1 | 6/2001 | Ashe |
| 6,246,898 | B1 | 6/2001 | Vesely et al. |
| 6,248,072 | B1 | 6/2001 | Murkin |
| 6,248,074 | B1 | 6/2001 | Ohno et al. |
| 6,248,075 | B1 | 6/2001 | McGee et al. |
| 6,251,073 | B1 | 6/2001 | Imran et al. |
| 6,253,770 | B1 | 7/2001 | Acker et al. |
| 6,259,941 | B1 | 7/2001 | Chia et al. |
| 6,261,231 | B1 | 7/2001 | Damphousse et al. |
| 6,263,230 | B1 | 7/2001 | Haynor et al. |
| 6,266,550 | B1 | 7/2001 | Selmon et al. |
| 6,266,551 | B1 | 7/2001 | Osadchy et al. |
| 6,266,552 | B1 | 7/2001 | Slettenmark |
| 6,266,563 | B1 | 7/2001 | KenKnight et al. |
| 6,271,833 | B1 | 8/2001 | Rosenberg et al. |
| 6,272,371 | B1 | 8/2001 | Shlomo |
| 6,272,374 | B1 | 8/2001 | Flock et al. |
| 6,275,258 | B1 | 8/2001 | Chim |
| 6,275,724 | B1 | 8/2001 | Dickinson et al. |
| 6,277,077 | B1 | 8/2001 | Brisken et al. |
| 6,284,459 | B1 | 9/2001 | Nova et al. |
| 6,285,898 | B1 | 9/2001 | Ben-Haim |
| 6,288,704 | B1 | 9/2001 | Flack et al. |
| 6,292,678 | B1 | 9/2001 | Hall et al. |
| 6,292,680 | B1 | 9/2001 | Somogyi et al. |
| 6,292,901 | B1 | 9/2001 | Lys et al. |
| 6,293,955 | B1 | 9/2001 | Houser et al. |
| 6,296,604 | B1 | 10/2001 | Garibaldi et al. |
| 6,296,614 | B1 | 10/2001 | Pruter |
| 6,298,261 | B1 | 10/2001 | Rex |
| 6,304,768 | B1 | 10/2001 | Blume et al. |
| 6,306,097 | B1 | 10/2001 | Park et al. |
| 6,311,082 | B1 | 10/2001 | Creighton, IV et al. |
| 6,315,709 | B1 | 11/2001 | Garibaldi et al. |
| 6,315,727 | B1 | 11/2001 | Coleman et al. |
| 6,319,668 | B1 | 11/2001 | Nova et al. |
| 6,323,769 | B1 | 11/2001 | Dames et al. |
| 6,323,770 | B1 | 11/2001 | Dames et al. |
| 6,324,416 | B1 | 11/2001 | Seibert |
| 6,325,540 | B1 | 12/2001 | Lounsberry et al. |
| 6,325,762 | B1 | 12/2001 | Tjin |
| 6,329,139 | B1 | 12/2001 | Nova et al. |
| 6,329,916 | B1 | 12/2001 | Dames et al. |
| 6,330,467 | B1 | 12/2001 | Creighton, IV et al. |
| 6,332,089 | B1 | 12/2001 | Acker et al. |
| 6,332,874 | B1 | 12/2001 | Eliasen et al. |
| 6,340,588 | B1 | 1/2002 | Nova et al. |
| 6,340,868 | B1 | 1/2002 | Lys et al. |
| 6,341,231 | B1 | 1/2002 | Ferre et al. |
| 6,346,081 | B1 | 2/2002 | Vilkomerson |
| 6,348,911 | B1 | 2/2002 | Rosenberg et al. |
| 6,350,160 | B1 | 2/2002 | Feuersanger et al. |
| 6,352,363 | B1 | 3/2002 | Munger et al. |
| 6,355,026 | B1 | 3/2002 | Mick |
| 6,361,499 | B1 | 3/2002 | Bates et al. |
| 6,364,823 | B1 | 4/2002 | Garibaldi et al. |
| 6,364,839 | B1 | 4/2002 | Little et al. |
| 6,366,804 | B1 | 4/2002 | Mejia |
| 6,368,285 | B1 | 4/2002 | Osadchy et al. |
| 6,370,411 | B1 | 4/2002 | Osadchy et al. |
| 6,373,240 | B1 | 4/2002 | Govari |
| 6,373,388 | B1 | 4/2002 | Dames et al. |
| 6,374,134 | B1 | 4/2002 | Bladen et al. |
| 6,374,670 | B1 | 4/2002 | Spelman et al. |
| 6,375,606 | B1 | 4/2002 | Garibaldi et al. |
| 6,375,639 | B1 | 4/2002 | Duplessie et al. |
| 6,377,857 | B1 | 4/2002 | Brayton et al. |
| 6,379,302 | B1 | 4/2002 | Kessman et al. |
| 6,379,303 | B1 | 4/2002 | Seitz et al. |
| 6,379,307 | B1 | 4/2002 | Filly et al. |
| 6,381,485 | B1 | 4/2002 | Hunter et al. |
| 6,383,139 | B1 | 5/2002 | Hwang et al. |
| 6,385,472 | B1 | 5/2002 | Hall et al. |
| 6,385,476 | B1 | 5/2002 | Osadchy et al. |
| 6,398,736 | B1 | 6/2002 | Seward |
| 6,401,723 | B1 | 6/2002 | Garibaldi et al. |
| 6,406,442 | B1 | 6/2002 | McFann et al. |
| 6,412,978 | B1 | 7/2002 | Watanabe et al. |
| 6,412,980 | B1 | 7/2002 | Lounsberry et al. |
| 6,416,475 | B1 | 7/2002 | Hwang et al. |
| 6,417,839 | B1 | 7/2002 | Odell |
| 6,418,332 | B1 | 7/2002 | Mastrototaro et al. |
| 6,418,335 | B2 | 7/2002 | Avrin et al. |
| 6,423,002 | B1 | 7/2002 | Hossack |
| 6,423,050 | B1 | 7/2002 | Twardowski |
| 6,427,079 | B1 | 7/2002 | Schneider et al. |
| 6,428,551 | B1 | 8/2002 | Hall et al. |
| 6,430,315 | B1 | 8/2002 | Makram-Ebeid |
| 6,432,069 | B1 | 8/2002 | Godo et al. |
| 6,436,050 | B2 | 8/2002 | Garrison et al. |
| 6,438,411 | B1 | 8/2002 | Guttman et al. |
| 6,442,416 | B1 | 8/2002 | Schultz |
| 6,443,902 | B1 | 9/2002 | Sasady |
| 6,443,907 | B1 | 9/2002 | Mansy et al. |
| 6,445,943 | B1 | 9/2002 | Ferre et al. |
| 6,459,919 | B1 | 10/2002 | Lys et al. |
| 6,463,121 | B1 | 10/2002 | Milnes |
| 6,473,167 | B1 | 10/2002 | Odell |
| 6,474,341 | B1 | 11/2002 | Hunter et al. |
| 6,475,146 | B1 | 11/2002 | Frelburger et al. |
| 6,475,152 | B1 | 11/2002 | Kelly, Jr. et al. |
| 6,475,223 | B1 | 11/2002 | Werp et al. |
| 6,477,402 | B1 | 11/2002 | Lynch et al. |
| 6,484,118 | B1 | 11/2002 | Govari et al. |
| 6,485,426 | B2 | 11/2002 | Sandhu |
| 6,487,916 | B1 | 12/2002 | Gomm et al. |
| 6,491,671 | B1 | 12/2002 | Larson, III et al. |
| 6,493,573 | B1 | 12/2002 | Martinelli et al. |
| 6,496,715 | B1 | 12/2002 | Lee et al. |
| 6,498,944 | B1 | 12/2002 | Ben-Haim et al. |
| 6,500,141 | B1 | 12/2002 | Irion et al. |
| 6,505,062 | B1 | 1/2003 | Ritter et al. |
| 6,507,751 | B2 | 1/2003 | Blume et al. |
| 6,508,802 | B1 | 1/2003 | Rosengart et al. |
| 6,512,958 | B1 | 1/2003 | Swoyer et al. |
| 6,514,249 | B1 | 2/2003 | Maguire et al. |
| 6,515,657 | B1 | 2/2003 | Zanelli |

(56) **References Cited**

U.S. PATENT DOCUMENTS

6,516,212 B1 2/2003 Bladen et al.
6,516,231 B1 2/2003 Flammang
6,516,807 B1 2/2003 Panescu et al.
6,517,491 B1 2/2003 Thiele et al.
6,517,520 B2 2/2003 Chang et al.
6,522,906 B1 2/2003 Salisbury, Jr. et al.
6,522,907 B1 2/2003 Bladen et al.
6,522,909 B1 2/2003 Garibaldi et al.
6,524,303 B1 2/2003 Garibaldi
6,528,954 B1 3/2003 Lys et al.
6,528,991 B2 3/2003 Ashe
6,529,761 B2 3/2003 Creighton, IV et al.
6,530,887 B1 3/2003 Gilbert et al.
6,534,982 B1 3/2003 Jakab
6,535,625 B1 3/2003 Chang et al.
6,537,192 B1 3/2003 Elliott et al.
6,537,196 B1 3/2003 Creighton, IV et al.
6,538,634 B1 3/2003 Chui et al.
6,540,685 B1 4/2003 Rhoads et al.
6,540,699 B1 4/2003 Smith
6,542,766 B2 4/2003 Hall et al.
6,544,251 B1 4/2003 Crawford
6,546,270 B1 4/2003 Goldin et al.
6,546,279 B1 4/2003 Bova et al.
6,546,787 B1 4/2003 Schiller et al.
6,549,794 B1 4/2003 Nadeau, Jr. et al.
6,552,841 B1 4/2003 Lasser et al.
6,556,858 B1 4/2003 Zeman
6,562,019 B1 5/2003 Sell
6,564,087 B1 5/2003 Pitris et al.
6,569,101 B2 5/2003 Quistgaard et al.
6,571,004 B1 5/2003 Florent et al.
6,574,518 B1 6/2003 Lounsberry et al.
6,575,908 B2 6/2003 Barnes et al.
6,577,080 B2 6/2003 Lys et al.
6,577,896 B2 6/2003 Werner et al.
6,584,343 B1 6/2003 Ransbury et al.
6,593,754 B1 7/2003 Steber et al.
6,593,884 B1 7/2003 Gilboa et al.
6,596,791 B2 7/2003 Santar et al.
6,597,943 B2 7/2003 Taha et al.
6,599,249 B1 7/2003 Nordgren et al.
6,607,488 B1 8/2003 Jackson et al.
6,610,058 B2 8/2003 Flores
6,611,141 B1 8/2003 Schulz et al.
6,615,071 B1 9/2003 Casscells, III et al.
6,615,155 B2 9/2003 Gilboa
6,618,612 B1 9/2003 Acker et al.
6,626,832 B1 9/2003 Paltieli et al.
6,626,834 B2 9/2003 Dunne et al.
6,626,902 B1 9/2003 Kucharczyk et al.
6,630,879 B1 10/2003 Creighton, IV et al.
6,635,027 B1 10/2003 Cragg et al.
6,645,148 B2 11/2003 Nguyen-Dinh et al.
6,648,875 B2 11/2003 Simpson et al.
6,649,914 B1 11/2003 Moorman et al.
6,652,506 B2 11/2003 Bowe et al.
6,662,034 B2 12/2003 Segner et al.
6,669,633 B2 12/2003 Brodsky et al.
6,672,308 B1 1/2004 Gaspari
6,677,752 B1 1/2004 Creighton, IV et al.
6,679,857 B1 1/2004 Bastia et al.
6,684,176 B2 1/2004 Willins et al.
6,685,644 B2 2/2004 Seo
6,687,531 B1 2/2004 Ferre et al.
6,689,119 B1 2/2004 Di Caprio et al.
6,690,963 B2 2/2004 Ben-Haim et al.
6,690,964 B2 2/2004 Bieger et al.
6,690,968 B2 2/2004 Mejia
6,694,167 B1 2/2004 Ferre et al.
6,695,786 B2 2/2004 Wang et al.
6,701,179 B1 3/2004 Martinelli et al.
6,701,918 B2 3/2004 Fariss et al.
6,702,749 B2 3/2004 Paladini et al.
6,702,804 B1 3/2004 Ritter et al.
6,704,590 B2 3/2004 Haldeman
6,709,390 B1 3/2004 Marie Pop
6,711,429 B1 3/2004 Gilboa et al.
6,711,431 B2 3/2004 Sarin et al.
6,719,698 B2 4/2004 Manor et al.
6,719,699 B2 4/2004 Smith
6,719,724 B1 4/2004 Walker et al.
6,719,756 B1 4/2004 Muntermann
6,720,745 B2 4/2004 Lys et al.
6,733,511 B2 5/2004 Hall et al.
6,736,782 B2 5/2004 Pfeiffer et al.
6,738,656 B1 5/2004 Ferre et al.
6,740,103 B2 5/2004 Hall et al.
6,743,177 B2 6/2004 Ito et al.
6,746,402 B2 6/2004 Ustuner
6,754,596 B2 6/2004 Ashe
6,755,789 B2 6/2004 Stringer et al.
6,755,816 B2 6/2004 Ritter et al.
6,757,557 B1 6/2004 Bladen et al.
6,763,261 B2 7/2004 Casscells, III et al.
6,764,449 B2 7/2004 Lee et al.
6,768,496 B2 7/2004 Bieger et al.
6,772,001 B2 8/2004 Maschke
6,774,624 B2 8/2004 Anderson et al.
6,780,154 B2 8/2004 Hunt et al.
6,783,493 B2 8/2004 Chiang et al.
6,783,536 B2 8/2004 Vilsmeier et al.
6,784,660 B2 8/2004 Ashe
6,785,571 B2 8/2004 Glossop et al.
6,786,219 B2 9/2004 Garibaldi et al.
6,788,967 B2 9/2004 Ben-Haim et al.
6,794,667 B2 9/2004 Noshi
6,799,066 B2 9/2004 Steines et al.
6,814,704 B2 11/2004 Weilandt
6,815,651 B2 11/2004 Odell
6,816,266 B2 11/2004 Varshneya et al.
6,817,364 B2 11/2004 Garibaldi
6,832,199 B1 12/2004 Kucek et al.
6,834,201 B2 12/2004 Gillies et al.
6,844,713 B2 1/2005 Steber et al.
6,845,142 B2 1/2005 Ohishi
6,856,823 B2 2/2005 Ashe
6,860,422 B2 3/2005 Hull et al.
6,862,467 B2 3/2005 Moore et al.
6,869,390 B2 3/2005 Elliott et al.
6,869,401 B2 3/2005 Gilbert et al.
6,875,179 B2 4/2005 Ferguson et al.
6,879,160 B2 4/2005 Jakab
6,884,219 B1 4/2005 Pruter
6,889,091 B2 5/2005 Hine et al.
6,895,268 B1 5/2005 Rahn et al.
6,902,528 B1 6/2005 Garibaldi et al.
6,908,433 B1 6/2005 Pruter
6,911,026 B1 6/2005 Hall et al.
6,923,782 B2 8/2005 O'Mahony et al.
6,926,673 B2 8/2005 Roberts et al.
6,934,575 B2 8/2005 Ferre et al.
6,936,010 B2 8/2005 Fang et al.
6,940,379 B2 9/2005 Creighton
6,941,166 B2 9/2005 MacAdam et al.
6,947,788 B2 9/2005 Gilboa et al.
6,950,689 B1 9/2005 Willis et al.
6,953,754 B2 10/2005 Machida et al.
6,958,677 B1 10/2005 Carter
6,959,214 B2 10/2005 Pape et al.
6,962,566 B2 11/2005 Quistgaard et al.
6,968,846 B2 11/2005 Viswanathan
6,969,352 B2 11/2005 Chiang et al.
6,975,197 B2 12/2005 Creighton, IV
6,976,962 B2 12/2005 Bullis
6,976,987 B2 12/2005 Flores
6,980,843 B2 12/2005 Eng et al.
6,980,852 B2 12/2005 Jersey-Willuhn et al.
6,980,921 B2 12/2005 Anderson et al.
6,986,739 B2 1/2006 Warren et al.
6,999,821 B2 2/2006 Jenney et al.
7,001,355 B2 2/2006 Nunomura et al.
7,008,418 B2 3/2006 Hall et al.
7,010,338 B2 3/2006 Ritter et al.

(56) **References Cited**

U.S. PATENT DOCUMENTS

| | | | |
|---|---|---|---|
| 7,015,393 | B2 | 3/2006 | Weiner et al. |
| 7,017,584 | B2 | 3/2006 | Garibaldi et al. |
| 7,019,610 | B2 | 3/2006 | Creighton, IV et al. |
| 7,020,512 | B2 | 3/2006 | Ritter et al. |
| D518,574 | S | 4/2006 | Chaggares |
| 7,022,075 | B2 | 4/2006 | Grunwald et al. |
| 7,022,082 | B2 | 4/2006 | Sonek |
| 7,026,927 | B2 | 4/2006 | Wright et al. |
| 7,027,634 | B2 | 4/2006 | Odell |
| 7,028,387 | B1 | 4/2006 | Huynh et al. |
| 7,029,446 | B2 | 4/2006 | Wendelken et al. |
| 7,033,603 | B2 | 4/2006 | Nelson et al. |
| D520,139 | S | 5/2006 | Chaggares |
| D520,140 | S | 5/2006 | Chaggares |
| 7,038,398 | B1 | 5/2006 | Lys et al. |
| 7,038,657 | B2 | 5/2006 | Rosenberg et al. |
| 7,043,293 | B1 | 5/2006 | Baura |
| 7,054,228 | B1 | 5/2006 | Hickling |
| 7,066,914 | B2 | 6/2006 | Andersen |
| 7,066,924 | B1 | 6/2006 | Garibaldi et al. |
| D525,363 | S | 7/2006 | Chaggares |
| 7,070,565 | B2 | 7/2006 | Vaezy et al. |
| 7,072,704 | B2 | 7/2006 | Bucholz |
| 7,082,325 | B2 | 7/2006 | Hashimshony et al. |
| 7,090,639 | B2 | 8/2006 | Govari |
| 7,096,148 | B2 | 8/2006 | Anderson et al. |
| 7,096,870 | B2 | 8/2006 | Lamprich et al. |
| 7,098,907 | B2 | 8/2006 | Houston et al. |
| 7,103,205 | B2 | 9/2006 | Wang et al. |
| 7,104,980 | B1 | 9/2006 | Laherty et al. |
| 7,106,043 | B1 | 9/2006 | Da Silva et al. |
| 7,106,431 | B2 | 9/2006 | Odell |
| 7,106,479 | B2 | 9/2006 | Roy et al. |
| 7,107,105 | B2 | 9/2006 | Bjorklund et al. |
| 7,132,804 | B2 | 11/2006 | Lys et al. |
| 7,137,976 | B2 | 11/2006 | Ritter et al. |
| 7,141,812 | B2 | 11/2006 | Appleby et al. |
| 7,142,905 | B2 | 11/2006 | Slayton et al. |
| 7,148,970 | B2 | 12/2006 | de Boer |
| 7,153,291 | B2 | 12/2006 | Bierman |
| 7,161,453 | B2 | 1/2007 | Creighton, IV |
| 7,162,291 | B1 | 1/2007 | Nachaliel |
| 7,167,738 | B2 | 1/2007 | Schweikard et al. |
| 7,169,107 | B2 | 1/2007 | Jersey-Willuhn et al. |
| 7,174,201 | B2 | 2/2007 | Govari et al. |
| 7,175,646 | B2 | 2/2007 | Brenneman et al. |
| 7,180,252 | B2 | 2/2007 | Lys et al. |
| 7,184,820 | B2 | 2/2007 | Jersey-Willuhn et al. |
| 7,189,198 | B2 | 3/2007 | Harburn et al. |
| 7,190,819 | B2 | 3/2007 | Viswanathan |
| 7,194,295 | B2 | 3/2007 | Vilsmeier |
| 7,204,798 | B2 | 4/2007 | Zdeblick et al. |
| 7,206,064 | B2 | 4/2007 | Rogers et al. |
| 7,207,941 | B2 | 4/2007 | Sharf |
| 7,211,082 | B2 | 5/2007 | Hall et al |
| 7,214,191 | B2 | 5/2007 | Stringer et al. |
| 7,215,326 | B2 | 5/2007 | Rosenberg |
| 7,221,104 | B2 | 5/2007 | Lys et al. |
| 7,223,256 | B2 | 5/2007 | Bierman |
| 7,229,400 | B2 | 6/2007 | Elliott et al. |
| 7,231,243 | B2 | 6/2007 | Tearney et al. |
| 7,236,157 | B2 | 6/2007 | Schena et al. |
| 7,236,816 | B2 | 6/2007 | Kumar et al. |
| 7,237,313 | B2 | 7/2007 | Skujins et al. |
| 7,241,267 | B2 | 7/2007 | Furia |
| 7,244,234 | B2 | 7/2007 | Ridley et al. |
| 7,248,032 | B1 | 7/2007 | Hular et al. |
| 7,248,914 | B2 | 7/2007 | Hastings et al. |
| 7,264,584 | B2 | 9/2007 | Ritter et al. |
| 7,270,662 | B2 | 9/2007 | Visram et al. |
| 7,275,682 | B2 | 10/2007 | Excoffier et al. |
| 7,276,044 | B2 | 10/2007 | Ferry et al. |
| 7,286,034 | B2 | 10/2007 | Creighton |
| 7,291,146 | B2 | 11/2007 | Steinke et al. |
| 7,297,140 | B2 | 11/2007 | Orlu et al. |
| 7,308,296 | B2 | 12/2007 | Lys et al. |
| 7,310,150 | B2 | 12/2007 | Guillermo et al. |
| 7,321,228 | B2 | 1/2008 | Govari |
| 7,322,990 | B1 | 1/2008 | Mark et al. |
| 7,342,058 | B2 | 3/2008 | Peppmoller et al. |
| D566,284 | S | 4/2008 | Kitayama et al. |
| 7,355,716 | B2 | 4/2008 | de Boer et al. |
| 7,360,427 | B2 | 4/2008 | Drinkwater et al. |
| 7,366,376 | B2 | 4/2008 | Shishkov et al. |
| 7,366,562 | B2 | 4/2008 | Dukesherer et al. |
| 7,366,563 | B2 | 4/2008 | Kleen et al. |
| 7,373,271 | B1 | 5/2008 | Schneider |
| 7,382,949 | B2 | 6/2008 | Bouma et al. |
| 7,418,169 | B2 | 8/2008 | Tearney et al. |
| 7,447,408 | B2 | 11/2008 | Bouma et al. |
| 7,452,331 | B1 | 11/2008 | Pruter |
| 7,452,358 | B2 | 11/2008 | Stern et al. |
| D585,556 | S | 1/2009 | Kosaku |
| 7,479,141 | B2 | 1/2009 | Kleen et al. |
| 7,534,223 | B2 | 5/2009 | Boutilette et al. |
| 7,538,859 | B2 | 5/2009 | Tearney et al. |
| 7,547,282 | B2 | 6/2009 | Lo et al. |
| 7,551,293 | B2 | 6/2009 | Yelin et al. |
| D599,909 | S | 9/2009 | Rinott et al. |
| 7,588,541 | B2 | 9/2009 | Floyd et al. |
| D603,050 | S | 10/2009 | Chen |
| 7,599,730 | B2 | 10/2009 | Hunter et al. |
| 7,604,596 | B2 | 10/2009 | Hwang et al. |
| D603,520 | S | 11/2009 | Ninomiya et al. |
| 7,635,336 | B1 | 12/2009 | Pruter |
| 7,637,163 | B2 | 12/2009 | Fetzer et al. |
| 7,640,053 | B2 | 12/2009 | Verin |
| 7,651,469 | B2 | 1/2010 | Osborne et al. |
| 7,652,080 | B2 | 1/2010 | Peppmoller et al. |
| D609,814 | S | 2/2010 | Banryu |
| 7,665,893 | B2 | 2/2010 | Buchalter |
| 7,668,583 | B2 | 2/2010 | Fegert et al. |
| 7,670,294 | B2 | 3/2010 | Kisen et al. |
| 7,686,766 | B2 | 3/2010 | Quistgaard et al. |
| 7,699,782 | B2 | 4/2010 | Angelsen et al. |
| 7,727,192 | B2 | 6/2010 | Tokumoto et al. |
| 7,740,586 | B2 | 6/2010 | Hwang et al. |
| 7,751,865 | B2 | 7/2010 | Jascob et al. |
| 7,766,839 | B2 | 8/2010 | Rogers et al. |
| 7,774,051 | B2 | 8/2010 | Voth |
| 7,794,407 | B2 | 9/2010 | Rothenberg |
| 7,798,970 | B2 | 9/2010 | Lo et al. |
| 7,819,807 | B2 | 10/2010 | Barnes et al. |
| 7,819,810 | B2 | 10/2010 | Stringer et al. |
| 7,837,627 | B1 | 11/2010 | Pruter |
| D629,526 | S | 12/2010 | Ladwig et al. |
| D629,527 | S | 12/2010 | Crunkilton |
| 7,850,613 | B2 | 12/2010 | Stribling |
| D630,756 | S | 1/2011 | Kitayama |
| D630,757 | S | 1/2011 | Kitayama |
| 7,909,815 | B2 | 3/2011 | Whitmore, III et al. |
| 7,931,596 | B2 | 4/2011 | Rachlin et al. |
| 7,976,469 | B2 | 7/2011 | Bonde et al. |
| 7,998,073 | B2 | 8/2011 | Roth et al. |
| 8,052,606 | B2 | 11/2011 | Barnes et al. |
| 8,073,529 | B2 | 12/2011 | Cermak et al. |
| 8,118,743 | B2 | 2/2012 | Park et al. |
| 8,137,281 | B2 | 3/2012 | Huang et al. |
| 8,147,408 | B2 | 4/2012 | Bunce et al. |
| 8,216,146 | B2 | 7/2012 | Hwang et al. |
| 8,257,264 | B2 | 9/2012 | Park et al. |
| 8,388,541 | B2 | 3/2013 | Messerly et al. |
| 8,388,546 | B2 | 3/2013 | Rothenberg |
| 8,430,889 | B2 | 4/2013 | Zeng et al. |
| 8,437,833 | B2 | 5/2013 | Silverstein |
| 8,449,531 | B2 | 5/2013 | Whitmore, III et al. |
| D684,265 | S | 6/2013 | Cadera |
| 8,478,382 | B2 | 7/2013 | Burnside et al. |
| 8,496,592 | B2 | 7/2013 | Ridley et al. |
| 8,496,593 | B2 | 7/2013 | Park et al. |
| 8,512,256 | B2 | 8/2013 | Rothenberg |
| 8,801,693 | B2 | 8/2014 | He et al. |
| D724,745 | S | 3/2015 | Orome et al. |
| 2002/0019447 | A1 | 2/2002 | Renn et al. |

(56) **References Cited**

U.S. PATENT DOCUMENTS

2002/0022777 A1 2/2002 Crieghton et al.
2002/0032391 A1 3/2002 McFann et al.
2002/0055680 A1 5/2002 Miele et al.
2002/0082559 A1 6/2002 Chang et al.
2002/0113555 A1 8/2002 Lys et al.
2002/0114518 A1 8/2002 Wilt
2002/0120193 A1 8/2002 Chiang et al.
2002/0123679 A1 9/2002 Dominguez
2002/0128554 A1 9/2002 Seward
2002/0133079 A1 9/2002 Sandhu
2002/0151789 A1 10/2002 Mansy et al.
2002/0156363 A1 10/2002 Hunter et al.
2002/0156376 A1 10/2002 Wang et al.
2002/0165448 A1 11/2002 Ben-Haim et al.
2002/0165534 A1 11/2002 Hayzelden et al.
2002/0198568 A1 12/2002 Hafer et al.
2003/0002727 A1 1/2003 MacMahon
2003/0009132 A1 1/2003 Schwartz et al.
2003/0011359 A1 1/2003 Ashe
2003/0013966 A1 1/2003 Barnes et al.
2003/0018276 A1 1/2003 Mansy et al.
2003/0028113 A1 2/2003 Gilbert et al.
2003/0036696 A1 2/2003 Willis et al.
2003/0040671 A1 2/2003 Somogyi et al.
2003/0072805 A1 4/2003 Miyazawa et al.
2003/0073894 A1 4/2003 Chiang et al.
2003/0076281 A1 4/2003 Morgan et al.
2003/0083698 A1 5/2003 Whitehurst et al.
2003/0088195 A1 5/2003 Vardi et al.
2003/0100849 A1 5/2003 Jang
2003/0114742 A1 6/2003 Lewkowicz et al.
2003/0114777 A1 6/2003 Griffin et al.
2003/0120150 A1 6/2003 Govari
2003/0120154 A1 6/2003 Sauer et al.
2003/0139661 A1 7/2003 Kimchy et al.
2003/0139664 A1 7/2003 Hunt et al.
2003/0149328 A1 8/2003 Elliott et al.
2003/0149359 A1 8/2003 Smith
2003/0152290 A1 8/2003 Odell
2003/0158482 A1 8/2003 Poland et al.
2003/0160721 A1 8/2003 Gilboa et al.
2003/0163037 A1 8/2003 Bladen et al.
2003/0171691 A1 9/2003 Casscells et al.
2003/0173953 A1 9/2003 Ashe
2003/0176787 A1 9/2003 Gilbert et al.
2003/0184544 A1 10/2003 Prudent
2003/0191392 A1 10/2003 Haldeman
2003/0191460 A1 10/2003 Hobbs et al.
2003/0195418 A1 10/2003 Barnes et al.
2003/0195420 A1 10/2003 Mendlein et al.
2003/0199746 A1 10/2003 Fuimaono et al.
2003/0208142 A1 11/2003 Boudewijn et al.
2003/0216639 A1 11/2003 Gilboa et al.
2003/0220557 A1 11/2003 Cleary et al.
2003/0220578 A1 11/2003 Ho et al.
2003/0229298 A1 12/2003 Iwami et al.
2003/0233042 A1 12/2003 Ashe
2004/0015070 A1 1/2004 Liang et al.
2004/0015079 A1 1/2004 Berger et al.
2004/0024301 A1 2/2004 Hockett et al.
2004/0030319 A1 2/2004 Korkor et al.
2004/0043688 A1 3/2004 Soerens et al.
2004/0054278 A1 3/2004 Kimchy et al.
2004/0082916 A1 4/2004 Jenkins
2004/0087877 A1 5/2004 Besz et al.
2004/0088136 A1 5/2004 Ashe
2004/0097803 A1 5/2004 Panescu
2004/0097804 A1 5/2004 Sobe
2004/0097805 A1 5/2004 Verard et al.
2004/0097806 A1 5/2004 Hunter et al.
2004/0116809 A1 6/2004 Chow et al.
2004/0127805 A1 7/2004 MacAdam et al.
2004/0131998 A1 7/2004 Marom et al.
2004/0133111 A1 7/2004 Szczech et al.
2004/0133130 A1 7/2004 Ferry et al.
2004/0135069 A1 7/2004 Odell
2004/0138564 A1 7/2004 Hwang et al.
2004/0138570 A1 7/2004 Nita et al.
2004/0147837 A1 7/2004 Macaulay et al.
2004/0150963 A1 8/2004 Holmberg et al.
2004/0152972 A1 8/2004 Hunter
2004/0155609 A1 8/2004 Lys et al.
2004/0158140 A1 8/2004 Fuimaono et al.
2004/0171924 A1 9/2004 Mire et al.
2004/0176688 A1 9/2004 Haldeman
2004/0186461 A1 9/2004 DiMatteo
2004/0199069 A1 10/2004 Connelly et al.
2004/0210289 A1 10/2004 Wang et al.
2004/0230271 A1 11/2004 Wang et al.
2004/0231065 A1 11/2004 Daniel et al.
2004/0234453 A1 11/2004 Smith
2004/0253365 A1 12/2004 Warren et al.
2004/0254470 A1 12/2004 Drinkwater et al.
2004/0260174 A1 12/2004 Keene
2004/0267086 A1 12/2004 Anstadt et al.
2005/0004450 A1 1/2005 Ben-Haim et al.
2005/0021019 A1 1/2005 Hashimshony et al.
2005/0033150 A1 2/2005 Takahashi et al.
2005/0033177 A1 2/2005 Rogers et al.
2005/0038355 A1 2/2005 Gellman et al.
2005/0049486 A1 3/2005 Urquhart et al.
2005/0049510 A1 3/2005 Haldeman et al.
2005/0063194 A1 3/2005 Lys et al.
2005/0070788 A1 3/2005 Wilson et al.
2005/0075561 A1 4/2005 Golden
2005/0085716 A1 4/2005 Hamm et al.
2005/0085718 A1 4/2005 Shahidi
2005/0085720 A1 4/2005 Jascob et al.
2005/0101868 A1 5/2005 Ridley et al.
2005/0101869 A1 5/2005 Burba et al.
2005/0105081 A1 5/2005 Odell
2005/0105101 A1 5/2005 Duling et al.
2005/0112135 A1 5/2005 Cormier et al.
2005/0113669 A1 5/2005 Helfer et al.
2005/0113676 A1 5/2005 Weiner et al.
2005/0113700 A1 5/2005 Yanagihara et al.
2005/0113873 A1 5/2005 Weiner et al.
2005/0113874 A1 5/2005 Connelly et al.
2005/0113876 A1 5/2005 Weiner et al.
2005/0131291 A1 6/2005 Floyd et al.
2005/0149002 A1 7/2005 Wang et al.
2005/0151489 A1 7/2005 Lys et al.
2005/0154308 A1 7/2005 Quistgaard et al.
2005/0159644 A1 7/2005 Takano
2005/0159790 A1 7/2005 Shalev
2005/0165301 A1 7/2005 Smith et al.
2005/0165313 A1 7/2005 Byron et al.
2005/0175665 A1 8/2005 Hunter et al.
2005/0175703 A1 8/2005 Hunter et al.
2005/0178395 A1 8/2005 Hunter et al.
2005/0178396 A1 8/2005 Hunter et al.
2005/0182295 A1 8/2005 Soper et al.
2005/0203368 A1 9/2005 Verin
2005/0203396 A1 9/2005 Angelsen et al.
2005/0205081 A1 9/2005 Barker et al.
2005/0215901 A1 9/2005 Anderson et al.
2005/0215945 A1 9/2005 Harris et al.
2005/0222532 A1 10/2005 Bertolero et al.
2005/0228281 A1 10/2005 Nefos
2005/0240102 A1 10/2005 Rachlin et al.
2005/0256398 A1 11/2005 Hastings et al.
2005/0256541 A1 11/2005 Stypulkowski
2006/0015003 A1 1/2006 Moaddes et al.
2006/0025677 A1 2/2006 Verard et al.
2006/0025684 A1 2/2006 Quistgaard et al.
2006/0058633 A1 3/2006 Hoshino et al.
2006/0068074 A1 3/2006 Stefandl
2006/0084867 A1 4/2006 Tremblay et al.
2006/0116571 A1 6/2006 Maschke et al.
2006/0116578 A1 6/2006 Grunwald et al.
2006/0149134 A1 7/2006 Soper et al.
2006/0173329 A1 8/2006 Irioka et al.
2006/0173407 A1 8/2006 Shaughnessy et al.
2006/0176242 A1 8/2006 Jaramaz et al.

(56) **References Cited**

U.S. PATENT DOCUMENTS

2006/0184074 A1 8/2006 Vaezy et al.
2006/0188487 A1 8/2006 Thomas et al.
2006/0206037 A1 9/2006 Braxton
2006/0211944 A1 9/2006 Mauge et al.
2006/0224188 A1 10/2006 Libbus et al.
2006/0247746 A1 11/2006 Danek et al.
2006/0264756 A1 11/2006 Lo et al.
2006/0276867 A1 12/2006 Viswanathan
2007/0010753 A1 1/2007 MacAdam
2007/0016007 A1 1/2007 Govari et al.
2007/0016013 A1 1/2007 Camus
2007/0016068 A1 1/2007 Grunwald et al.
2007/0016069 A1 1/2007 Grunwald et al.
2007/0016070 A1 1/2007 Grunwald et al.
2007/0016072 A1 1/2007 Grunwald et al.
2007/0049822 A1 3/2007 Bunce et al.
2007/0049846 A1 3/2007 Bown et al.
2007/0055141 A1 3/2007 Kruger et al.
2007/0055142 A1 3/2007 Webler
2007/0060992 A1 3/2007 Pappone
2007/0062544 A1 3/2007 Rauk Bergstrom et al.
2007/0073155 A1 3/2007 Park et al.
2007/0087038 A1 4/2007 Richardson et al.
2007/0093710 A1 4/2007 Maschke
2007/0100285 A1 5/2007 Griffin et al.
2007/0112282 A1 5/2007 Skujins et al.
2007/0123769 A1 5/2007 Fuller et al.
2007/0123805 A1 5/2007 Shireman et al.
2007/0129770 A1 6/2007 Younis
2007/0135803 A1 6/2007 Belson
2007/0135886 A1 6/2007 Maschke
2007/0156205 A1 7/2007 Larson et al.
2007/0161904 A1 7/2007 Urbano
2007/0161915 A1 7/2007 Desai
2007/0167738 A1 7/2007 Timinger et al.
2007/0167801 A1 7/2007 Webler et al.
2007/0167808 A1 7/2007 Nozaki
2007/0167817 A1 7/2007 Huang et al.
2007/0167997 A1 7/2007 Forsberg et al.
2007/0197905 A1 8/2007 Timinger et al.
2007/0208255 A1 9/2007 Ridley et al.
2007/0225589 A1 9/2007 Viswanathan
2007/0225610 A1 9/2007 Mickley et al.
2007/0232882 A1 10/2007 Glossop et al.
2007/0232910 A1 10/2007 Hwang et al.
2007/0238984 A1 10/2007 Maschke et al.
2007/0239018 A1 10/2007 Fetzer et al.
2007/0244413 A1 10/2007 Biggins
2007/0247454 A1 10/2007 Rahn et al.
2007/0249911 A1 10/2007 Simon
2007/0265526 A1 11/2007 Govari et al.
2007/0280974 A1 12/2007 Son et al.
2007/0282196 A1 12/2007 Birk et al.
2007/0282197 A1 12/2007 Bill et al.
2007/0299352 A1 12/2007 Harlev et al.
2008/0008745 A1 1/2008 Stinchcomb et al.
2008/0009720 A1 1/2008 Schefelker et al.
2008/0015442 A1 1/2008 Watson et al.
2008/0027320 A1 1/2008 Bolorforosh et al.
2008/0045908 A1 2/2008 Gould et al.
2008/0051626 A1 2/2008 Sato et al.
2008/0081958 A1 4/2008 Denison et al.
2008/0082136 A1 4/2008 Gaudiani
2008/0097232 A1 4/2008 Rothenberg
2008/0108949 A1 5/2008 Beasley et al.
2008/0110261 A1 5/2008 Randall et al.
2008/0110263 A1 5/2008 Klessel et al.
2008/0110266 A1 5/2008 Randall et al.
2008/0112265 A1 5/2008 Urbano et al.
2008/0114095 A1 5/2008 Peppmoller et al.
2008/0114239 A1 5/2008 Randall et al.
2008/0114241 A1 5/2008 Randall et al.
2008/0114246 A1 5/2008 Randall et al.
2008/0114247 A1 5/2008 Urbano et al.
2008/0114248 A1 5/2008 Urbano et al.
2008/0114249 A1 5/2008 Randall et al.
2008/0114250 A1 5/2008 Urbano et al.
2008/0114251 A1 5/2008 Weymer et al.
2008/0114252 A1 5/2008 Randall et al.
2008/0114253 A1 5/2008 Randall et al.
2008/0114370 A1 5/2008 Schoenefeld
2008/0119737 A1 5/2008 Urbano et al.
2008/0125772 A1 5/2008 Stone et al.
2008/0139944 A1 6/2008 Weymer et al.
2008/0146939 A1 6/2008 McMorrow et al.
2008/0146940 A1 6/2008 Jenkins et al.
2008/0152204 A1 6/2008 Huo et al.
2008/0154100 A1 6/2008 Thalmeier et al.
2008/0166453 A1 7/2008 Steele et al.
2008/0171934 A1 7/2008 Greenan et al.
2008/0183075 A1 7/2008 Govari et al.
2008/0188747 A1 8/2008 Randall et al.
2008/0188750 A1 8/2008 Randall et al.
2008/0188752 A1 8/2008 Randall et al.
2008/0200754 A1 8/2008 Buchalter
2008/0228082 A1 9/2008 Scheirer et al.
2008/0255404 A1 10/2008 Nogawa et al.
2008/0255475 A1 10/2008 Kondrosky et al.
2008/0275765 A1 11/2008 Kuchar
2008/0281206 A1 11/2008 Bartlett et al.
2009/0005675 A1 1/2009 Grunwald et al.
2009/0018497 A1 1/2009 Birchard et al.
2009/0018574 A1 1/2009 Martin
2009/0024018 A1 1/2009 Boyden et al.
2009/0036774 A1 2/2009 Weng et al.
2009/0036790 A1 2/2009 Landesberg et al.
2009/0043205 A1 2/2009 Pelissier et al.
2009/0076327 A1 3/2009 Ohki
2009/0082661 A1 3/2009 Saladin et al.
2009/0084382 A1 4/2009 Jalde et al.
2009/0101577 A1 4/2009 Fulkerson et al.
2009/0118612 A1 5/2009 Grunwald et al.
2009/0118706 A1 5/2009 Schweikert et al.
2009/0124901 A1 5/2009 Fink et al.
2009/0136099 A1 5/2009 Boyden et al.
2009/0143736 A1 6/2009 Mittermeyer et al.
2009/0149748 A1 6/2009 Lenhardt et al.
2009/0156926 A1 6/2009 Messerly et al.
2009/0163810 A1 6/2009 Kanade et al.
2009/0171217 A1 7/2009 Kim et al.
2009/0171219 A1 7/2009 Uchibori
2009/0177083 A1 7/2009 Matsumura
2009/0177090 A1 7/2009 Grunwald et al.
2009/0177092 A1 7/2009 Riechers et al.
2009/0203989 A1 8/2009 Burnside et al.
2009/0204113 A1 8/2009 MacAdam et al.
2009/0209950 A1 8/2009 Starksen
2009/0227952 A1 9/2009 Blakstvedt et al.
2009/0234328 A1 9/2009 Cox et al.
2009/0258171 A1 10/2009 Uang
2009/0259124 A1 10/2009 Rothenberg
2009/0262982 A1 10/2009 Markowitz et al.
2009/0270722 A1 10/2009 Floyd et al.
2009/0275828 A1 11/2009 Shachar et al.
2009/0275833 A1 11/2009 Ikeda et al.
2009/0297441 A1 12/2009 Canham et al.
2010/0004543 A1 1/2010 Ahlund et al.
2010/0004547 A1 1/2010 Scholz et al.
2010/0016726 A1 1/2010 Meier
2010/0036227 A1 2/2010 Cox et al.
2010/0049062 A1 2/2010 Ziv
2010/0055153 A1 3/2010 Majmudar
2010/0055184 A1 3/2010 Zeitels et al.
2010/0057157 A1 3/2010 Govari et al.
2010/0060472 A1 3/2010 Kimura et al.
2010/0083719 A1 4/2010 Peppmoller et al.
2010/0094116 A1 4/2010 Silverstein
2010/0106011 A1 4/2010 Byrd et al.
2010/0114573 A1 5/2010 Huang et al.
2010/0126149 A1 5/2010 Kondou
2010/0143119 A1 6/2010 Kooijman et al.
2010/0179429 A1 7/2010 Ho et al.
2010/0185097 A1 7/2010 Hall
2010/0198048 A1 8/2010 Togawa

(56) **References Cited**

U.S. PATENT DOCUMENTS

| | | | |
|---|---|---|---|
| 2010/0204569 | A1 | 8/2010 | Burnside et al. |
| 2010/0217116 | A1 | 8/2010 | Eck et al. |
| 2010/0222663 | A1 | 9/2010 | Wilder et al. |
| 2010/0222664 | A1 | 9/2010 | Lemon et al. |
| 2010/0234733 | A1 | 9/2010 | Wahlheim |
| 2010/0249598 | A1 | 9/2010 | Smith et al. |
| 2010/0258033 | A1 | 10/2010 | Yang et al. |
| 2010/0273895 | A1 | 10/2010 | Stinchcomb et al. |
| 2010/0298702 | A1 | 11/2010 | Rogers et al. |
| 2010/0312121 | A1 | 12/2010 | Guan |
| 2010/0317981 | A1 | 12/2010 | Grunwald |
| 2010/0318026 | A1 | 12/2010 | Grunwald |
| 2010/0331712 | A1 | 12/2010 | Rothenberg |
| 2011/0015527 | A1 | 1/2011 | Heasty et al. |
| 2011/0015533 | A1 | 1/2011 | Cox et al. |
| 2011/0040187 | A1 | 2/2011 | Matsumura |
| 2011/0040212 | A1 | 2/2011 | Dietz et al. |
| 2011/0052694 | A1 | 3/2011 | Stinchcomb et al. |
| 2011/0060215 | A1 | 3/2011 | Tupin, Jr. et al. |
| 2011/0087107 | A1 | 4/2011 | Lindekugel et al. |
| 2011/0087117 | A1 | 4/2011 | Tremper et al. |
| 2011/0171286 | A1 | 7/2011 | Cecile et al. |
| 2011/0196248 | A1 | 8/2011 | Grunwald |
| 2011/0278500 | A1 | 11/2011 | Bergeron |
| 2011/0282188 | A1 | 11/2011 | Burnside et al. |
| 2011/0295108 | A1 | 12/2011 | Cox et al. |
| 2011/0313293 | A1 | 12/2011 | Lindekugel et al. |
| 2012/0046562 | A1 | 2/2012 | Powers et al. |
| 2012/0059270 | A1 | 3/2012 | Grunwald |
| 2012/0095319 | A1 | 4/2012 | Kondrosky et al. |
| 2012/0108950 | A1 | 5/2012 | He et al. |
| 2012/0143029 | A1 | 6/2012 | Silverstein et al. |
| 2012/0165679 | A1 | 6/2012 | Orome et al. |
| 2012/0220854 | A1 | 8/2012 | Messerly et al. |
| 2013/0006102 | A1 | 1/2013 | Wilkes et al. |
| 2013/0060116 | A1 | 3/2013 | Messerly et al. |
| 2013/0085391 | A1 | 4/2013 | Matsumura et al. |
| 2013/0116571 | A1 | 5/2013 | Cox et al. |
| 2013/0123597 | A1 | 5/2013 | Rothenberg |
| 2013/0131704 | A1 | 5/2013 | Pechoux |
| 2013/0245488 | A1 | 9/2013 | Quinn et al. |
| 2014/0180116 | A1 | 6/2014 | Lindekugel et al. |

FOREIGN PATENT DOCUMENTS

| | | | |
|---|---|---|---|
| AU | 20009592 | | 9/2000 |
| AU | 20015250 | | 6/2001 |
| AU | 768362 | B2 | 12/2003 |
| AU | 2001229024 | B2 | 9/2005 |
| AU | 2001283703 | B2 | 5/2006 |
| AU | 2006202149 | | 6/2006 |
| AU | 2006904933 | | 9/2006 |
| AU | 2006283022 | B2 | 2/2012 |
| CA | 2420676 | | 2/2002 |
| CN | 1672649 | A | 9/2005 |
| CN | 102209490 | A | 10/2011 |
| CN | 102802514 | A | 11/2012 |
| CN | 102821679 | A | 12/2012 |
| CN | 103037761 | A | 4/2013 |
| CN | 103037762 | A | 4/2013 |
| CN | 103118591 | A | 5/2013 |
| CN | 103228219 | A | 7/2013 |
| DE | 4319033 | C1 | 6/1994 |
| DE | 9404028 | U1 | 8/1994 |
| EP | 0359697 | | 3/1990 |
| EP | 0362821 | | 4/1990 |
| EP | 0399536 | A1 | 11/1990 |
| EP | 0815793 | A2 | 1/1998 |
| EP | 0823261 | A2 | 2/1998 |
| EP | 0928976 | A2 | 7/1999 |
| EP | 1311226 | A1 | 5/2003 |
| EP | 1504713 | A1 | 2/2005 |
| EP | 2313143 | A1 | 4/2011 |
| EP | 2440122 | A1 | 4/2012 |
| EP | 2464407 | A2 | 6/2012 |
| EP | 2482719 | A1 | 8/2012 |
| EP | 2575610 | A1 | 4/2013 |
| EP | 2575611 | A1 | 4/2013 |
| EP | 2603145 | A2 | 6/2013 |
| EP | 2605699 | A2 | 6/2013 |
| FR | 2545349 | | 11/1984 |
| JP | 01097440 | | 4/1989 |
| JP | 03023853 | A | 1/1991 |
| JP | 03173542 | A | 7/1991 |
| JP | 4090741 | | 8/1992 |
| JP | 9-503054 | | 3/1997 |
| JP | 09-094298 | A | 4/1997 |
| JP | 10043310 | | 2/1998 |
| JP | 10290839 | A | 11/1998 |
| JP | 11128237 | A | 5/1999 |
| JP | 2001161683 | | 6/2001 |
| JP | 2001340334 | | 12/2001 |
| JP | 2003501127 | A | 1/2003 |
| JP | 2003061752 | A | 3/2003 |
| JP | 2003299654 | | 10/2003 |
| JP | 2003334191 | | 11/2003 |
| JP | 2002520893 | | 2/2004 |
| JP | 2004505748 | T | 2/2004 |
| JP | 2004515298 | A | 5/2004 |
| JP | 2006508744 | A | 3/2006 |
| JP | 5010604 | | 6/2012 |
| JP | 2012-529929 | | 11/2012 |
| JP | 2013-518676 | A | 5/2013 |
| JP | 2013-535301 | A | 9/2013 |
| WO | 9112836 | A1 | 9/1991 |
| WO | 9203090 | | 3/1992 |
| WO | 9403159 | A1 | 2/1994 |
| WO | 9404938 | | 3/1994 |
| WO | 9605768 | A1 | 2/1996 |
| WO | 9607352 | A1 | 3/1996 |
| WO | 9641119 | | 12/1996 |
| WO | 9729683 | A1 | 8/1997 |
| WO | 9743989 | A1 | 11/1997 |
| WO | 9916495 | A1 | 4/1999 |
| WO | 9949407 | A1 | 9/1999 |
| WO | 0019906 | | 4/2000 |
| WO | 0040155 | | 7/2000 |
| WO | 0074775 | A1 | 12/2000 |
| WO | 0176479 | A1 | 10/2001 |
| WO | 0215973 | A1 | 2/2002 |
| WO | 0225277 | A1 | 3/2002 |
| WO | 03061752 | | 7/2003 |
| WO | 03077759 | A1 | 9/2003 |
| WO | 2004049970 | A2 | 6/2004 |
| WO | 2005033524 | A1 | 4/2005 |
| WO | 2005033574 | A1 | 4/2005 |
| WO | 2005117690 | A1 | 12/2005 |
| WO | 2006074509 | A1 | 7/2006 |
| WO | 2006074510 | A1 | 7/2006 |
| WO | 2006078677 | A2 | 7/2006 |
| WO | 2006103661 | A2 | 10/2006 |
| WO | 2006111056 | A1 | 10/2006 |
| WO | 2007002541 | A2 | 1/2007 |
| WO | 2007005976 | A1 | 1/2007 |
| WO | 2007014447 | A1 | 2/2007 |
| WO | 2007034196 | A2 | 3/2007 |
| WO | 2007067324 | A1 | 6/2007 |
| WO | 2007069168 | A2 | 6/2007 |
| WO | 2007109123 | A2 | 9/2007 |
| WO | 2007126536 | A2 | 11/2007 |
| WO | 2007144894 | A1 | 12/2007 |
| WO | 2008005480 | A1 | 1/2008 |
| WO | 2008024596 | A2 | 2/2008 |
| WO | 2008028253 | | 3/2008 |
| WO | 2008083111 | | 7/2008 |
| WO | 2008118992 | A1 | 10/2008 |
| WO | 2008126074 | A2 | 10/2008 |
| WO | 2008131017 | A2 | 10/2008 |
| WO | 2008136008 | A2 | 11/2008 |
| WO | 2009002514 | A2 | 12/2008 |
| WO | 2009009064 | A1 | 1/2009 |
| WO | 2009057774 | A1 | 5/2009 |
| WO | 2009070616 | A2 | 6/2009 |

(56) **References Cited**

FOREIGN PATENT DOCUMENTS

| | | | |
|---|---|---|---|
| WO | 2009100158 | A1 | 8/2009 |
| WO | 2009123819 | A2 | 10/2009 |
| WO | 2009126340 | A1 | 10/2009 |
| WO | 2009129475 | A1 | 10/2009 |
| WO | 2009129477 | A1 | 10/2009 |
| WO | 2009134605 | A2 | 11/2009 |
| WO | 2009137262 | A2 | 11/2009 |
| WO | 2010002313 | A1 | 1/2010 |
| WO | 2010018500 | A1 | 2/2010 |
| WO | 2010022370 | A1 | 2/2010 |
| WO | 2010027349 | A1 | 3/2010 |
| WO | 2010027471 | A2 | 3/2010 |
| WO | 2010030820 | A1 | 3/2010 |
| WO | 2010132857 | A1 | 11/2010 |
| WO | 2010143196 | A1 | 12/2010 |
| WO | 2010144922 | A1 | 12/2010 |
| WO | 2011019760 | A2 | 2/2011 |
| WO | 2011041450 | A1 | 4/2011 |
| WO | 2011044421 | A1 | 4/2011 |
| WO | 2011051406 | A1 | 5/2011 |
| WO | 2011064209 | A1 | 6/2011 |
| WO | 2011084593 | A2 | 7/2011 |
| WO | 2011097312 | A1 | 8/2011 |
| WO | 2011128052 | A2 | 10/2011 |
| WO | 2011150358 | A1 | 12/2011 |
| WO | 2012021542 | A2 | 2/2012 |
| WO | 2012024577 | A2 | 2/2012 |
| WO | 2012058461 | A1 | 5/2012 |
| WO | 2012060562 | A2 | 5/2012 |
| WO | 2012083245 | A1 | 6/2012 |
| WO | 2012088535 | A1 | 6/2012 |
| WO | 2013006817 | A1 | 1/2013 |
| WO | 2013070775 | A1 | 5/2013 |
| WO | 2013188833 | A2 | 12/2013 |
| WO | 2014134171 | A1 | 9/2014 |

OTHER PUBLICATIONS

PCT/US2009/056567 filed Sep. 10, 2009 Search Report dated Nov. 6, 2009.
PCT/US2009/056567 filed Sep. 10, 2009 Written Opinion dated Nov. 6, 2009.
PCT/US2010/038555 filed Jun. 14, 2010 Search Report dated Oct. 5, 2010.
PCT/US2010/038555 filed Jun. 14, 2010 Written Opinion dated Oct. 5, 2010.
PCT/US2010/045084 filed Aug. 10, 2010 International Preliminary Report on Patentability dated Feb. 23, 2012.
PCT/US2010/045084 filed Aug. 10, 2010 Search Report dated Apr. 14, 2011.
PCT/US2010/045084 filed Aug. 10, 2010 Written Opinion dated Apr. 14, 2011.
PCT/US2010/050773 filed Sep. 29, 2010 Search Report dated Jan. 24, 2011.
PCT/US2010/050773 filed Sep. 29, 2010 Written Opinion dated Jan. 24, 2011.
PCT/US2010/051917 filed Oct. 8, 2010 Search Report dated Nov. 29, 2010.
PCT/US2010/051917 filed Oct. 8, 2010 Written Opinion dated Nov. 29, 2010.
PCT/US2011/023497 filed Feb. 2, 2011 Search Report dated Jun. 6, 2011.
PCT/US2011/023497 filed Feb. 2, 2011 Written Opinion dated Jun. 6, 2011.
PCT/US2011/038391 filed May 27, 2011 International Preliminary Report on Patentability and Written Opinion dated Dec. 4, 2012.
PCT/US2011/038391 filed May 27, 2011 International Search Report dated Sep. 21, 2011.
PCT/US2011/038415 filed May 27, 2011 International Preliminary Report on Patentability dated Dec. 13, 2012.
PCT/US2011/038415 filed May 27, 2011 International Search Report dated Sep. 28, 2011.
PCT/US2011/038415 filed May 27, 2011 Written Opinion dated Sep. 28, 2011.
PCT/US2011/047127 filed Aug. 9, 2011 International Preliminary Report on Patentability dated Apr. 18, 2013.
PCT/US2011/047127 filed Aug. 9, 2011 International Search Report dated Feb. 29, 2012.
PCT/US2011/047127 filed Aug. 9, 2011 Written Opinion dated Feb. 29, 2012.
PCT/US2011/048403 filed Aug. 19, 2011 International Search Report dated Dec. 15, 2011.
PCT/US2011/048403 filed Aug. 19, 2011 Written Opinion dated Dec. 15, 2011.
PCT/US2011/052793 filed Sep. 22, 2011 International Preliminary Report on Patentability dated Apr. 4, 2013.
PCT/US2011/052793 filed Sep. 22, 2011 International Search Report dated Jan. 6, 2012.
PCT/US2011/052793 filed Sep. 22, 2011 Written Opinion dated Jan. 6, 2012.
PCT/US2011/058138 filed Oct. 27, 2011 International Preliminary Report on Patentability dated May 10, 2013.
PCT/US2011/058138 filed Oct. 27, 2011 International Search Report dated Feb. 7, 2012.
PCT/US2011/058138 filed Oct. 27, 2011 Written Opinion dated Feb. 7, 2012.
PCT/US2011/067268 filed Dec. 23, 2011 International Preliminary Report on Patentability dated Jul. 4, 2013.
PCT/US2011/067268 filed Dec. 23, 2011 International Search Report and Written Opinion dated Apr. 27, 2012.
PCT/US2012/045814 filed Jul. 6, 2012 International Search Report and Written Opinion dated Oct. 1, 2012.
Pennington, C.R., Right Atrial Thrombus: a Complication of Total Parenteral Nutrition, British Medical Journal, pp. 446-447, vol. 295, Aug. 15, 1987.
Petersen, J et al, Silicone Venous Access Devices Positioned with their Tip High in the Superior Vena Cava are More Likely to Malfunction, Am J Surg, pp. 38-41, vol. 178 No. 1, Jul. 1999.
Pittiruti, et al, Intracavitary EKG Monitoring: A reliable method for controlling tip position during and after PICC Insertion presentation in Catholic University, Rome, Italy in 2008.
Pittiruti, et al. "The EKG Method for Positioning the Tip of PICCs: Results from Two Preliminary Studies." JAVA, vol. 13, No. 4, pp. 179-185, 2008.
Polos, PG et al, Tips for Monitoring the Position of a Central Venous Catheter—How Placement can go awry—even when the anatomy is normal, J Crit Illn, pp. 660-674, vol. 8 No. 6, Jun. 1993 (Abstract only).
Pop, Gheorghe A. et al., Catheter-based impedance measurements in the right atrium for continuously monitoring hematocrit and estimating blood viscosity changes; an in vivo feasibility study in swine, Biosensors and Bioelectronics 19 (2004) 1685-1693.
Popp, M. B. et al., Accuracy of implanted port placement with the use of the electromagnetic Cath Track® catheter locator system, The Journal of Vascular Access 2005; 6: 9-12.
Randolph AG et al, Ultrasound guidance for placement of central venous catheters: a meta-analysis of the literature, Critcal Care Medicine, pp. 2053-2058, vol. 24, Dec. 1996.
Reece, A et al, Posititioning Long Lines: Contrast Versus Plain Radiography, Arch Dis Child Fetal Neonatal Ed, pp. 129-130, vol. 84 No. 2, Mar. 2001.
Reynolds, N et al, Assessment of Distal Tip Position of Long Term Central Venous Feeding Catheters using Transesophageal Echocardiology, JPEN J Parenter Enteral Nutr, pp. 39-41, vol. 25 No. 1, Jan.-Feb. 2001.
Ruschulte, Heiner et al, Prevention of Central Venous Catheter related infections with chlorhex idine gluconate impregnated wound dressings: A randomized controlled trial, presented as an abstract at the Annual meeting of the European Society of Anaesthesiologists (ESA) in Madrid, Spain in Jun. 2006, 12 pages, Annals of Hematology, Jul. 14, 2008.
Rutherford, J. S. et al., Depth of Central Venous Catheterization: An Audit of Practice in a Cardiac Surgical Unit, Anaesth Intens Care 1994; 22: 267-271.

(56) **References Cited**

OTHER PUBLICATIONS

Sacolick, et al. "Electromagnetically Tracked Placement of a Peripherally Inserted Central Catheter." SPIE Medical Imaging, 2004 Proceedings.
Salem, et al. "A New Peripherally Implanted Subcutaneous Permanent Central Venous Access Device for Patients Requiring Chemotherapy." Journal of Clinical Oncology, vol. 11, No. 11, pp. 2181-2185, Nov. 1993.
Savary, D et al, Intra-atrial Monitoring to Add Insertion of a Central Venous Line in Pre-Hospital Emergency Care Journal Europeen des Urgences, pp. 75-78, vol. 17 No. 2, 2004.
Schafer et al. "Incorrect placement of a vena cava catheter and its prevention by intra-atrial ECG." Anaesthesist. Jan. 1988;37(1):49-51.
Schummer, et al. "Central Venous Catheters—The inability of 'intra-atrial ECG' to prove adequate positioning." British Journal of Anaesthesia, vol. 93, No. 2, pp. 193-198, 2004.
CN 200880125528.4 filed Nov. 25, 2008 Second Office Action dated Mar. 6, 2013.
CN 200880125528.4 filed Nov. 25, 2008 Third Office Action dated Jul. 1, 2013.
CN 200980123021.X filed Dec. 17, 2010 First Office Action dated Nov. 19, 2012.
CN 200980144663.8 filed May 9, 2011 First Office Action dated Dec. 5, 2012.
Colley, Peter S et al, ECG-Guided Placement of Sorenson CVP Catheters via Arm Veins, Anesthesia and Analgesia, pp. 953-956, vol. 63, 1984.
Collier, PE et al, Cardiac Tamponade from Central Venous Catheters, Am J Surg, pp. 212-214, vol. 176 No. 2, Aug. 1998.
ComboWire® Pressure/Flow Guide Wire Ref 9500 Series, Instructions for Use, Apr. 2011.
Corsten, et al., "Central Placement Catheter Placement Using the ECG-Guided Cavafix-Certodyn SD Catheter." Journal of Clinical Anesthesiology, vol. 6, Nov./Dec. 1994.
Cucchiara, Roy et al, Time Required and Success Rate of Percantaneous Right Atrial Catherization: Description of a Technique, Canad. Anaesth. Soc. J., pp. 572-573, vol. 27, No. 6, Nov. 1980.
Cullinane, DC et al, The Futility of Chest Roentgenograms Following Routine Central Venous Line Changes, Am J Surg, pp. 283-285, vol. 176 No. 3, Sep. 1998.
Curet, Myriam J. et al., University and Practice-based Physicians' Input on the Content of a Surgical Curriculum, The American Journal Of Surgery® vol. 178 Jul. 1999, 78-84.
David, et al., "Is ECG-Guidance a Helpful Method to Correctly Position a Central Venous Catheter During Prehospital Emergency Care?" ACTA Anaesthesiologica Scandinavica, vol. 49, pp. 1010-1014, 2005.
Deltec Cath-Finder® Tracking System Operation Manual, 1994.
Egelhof, Petra, Effects of Somatostatin on Portal Blood Flow and Portal Vein Pressure in Patients with Portal Hypertension due to Liver Cirrhosis Invasive Monitoring during TIPSS Procedures, Dissertation submitted to: Technical University of Munich, Faculty of Medicine, May 13, 2002; Date of examination: Jan. 26, 2003.
Engelhardt, W et al, ECG-Controlled Placement of Central Venous Catheters in Patients with Atrial Fibrallation, Anaesthesist, pp. 476-479, vol. 38 No. 9, Sep. 1989 (Abstract only).
EP 08855396.1 filed Jun. 15, 2010 European Search Report dated Jul. 31, 2012.
EP 08855396.1 filed Jun. 15, 2010 Intent to Grant dated Jul. 5, 2013.
EP 09707467.8 supplemental European search report dated Jun. 18, 2013.
EP 09808901.4 filed Aug. 21, 2009 European Search Report dated May 23, 2012.
EP 09808901.4 filed Aug. 21, 2009 Examination Report dated May 10, 2013.
EP 09813632.8 filed Apr. 5, 2011 European Search Report dated Jul. 4, 2012.
EP 09813632.8 filed Apr. 5, 2011 Office Action dated Apr. 30, 2013.
EP 12177438.4 filed Jul. 23, 2012 European Search Report dated Dec. 4, 2012.
EP 12177438.4 filed Jul. 23, 2012 extended European Search Report dated Mar. 25, 2013.
Fearon, William F et al, Evaluating Intermediate Coronary Lesions in the Cardiac Catheterization Laboratory, vol. 4, No. 1, 7 pages, Reviews in Cardiovascular Medicine, 2003.
Felleiter P et al, Use of Electrocardiographic Placement Control of Central Venous Catheters in Austria, Acta Med Austriaca, pp. 109-113, vol. 26 No. 3, 1999 (Abstract only).
Forauer, AR et al, Change in Peripherally Inserted Central Catheter Tip Location with Abduction and Adduction of the Upper Extremity, J Vasc Interv Radiol, pp. 1315-1318, vol. 11 No. 10, Nov.-Dec. 2000.
Frassinelli, P et al, Utility of Chest Radiographs after Guidewire Exchanges of Central Venous Catheters, Crit Care Med, pp. 611-615, vol. 26 No. 3, Mar. 1998.
Frazin L et al, A Doppler Guided Retrograde Catheterization System, Cathet. Cardiovasc Diagn, pp. 41-50, May 1992.
French, PJ et al, Sensors for Catheter Applications, Sensors Update, vol. 13 Issue 1 pp. 107-153, Dec. 2003.
GB Application 0800474.9 filed Aug. 24, 2006 Office Action dated Aug. 9, 2010.
GB Application 0800474.9 filed Aug. 24, 2006 Office Action dated Mar. 17, 2010.
Gebauer, B et al, Ultrasound and Fluoroscopy-guided Implantation of Peripherally Inserted Central Venous Catheters (PICCs), ROFO, pp. 386-391, vol. 176 No. 3, Mar. 2004 (Abstract only).
Gebhard, et al., "The accuracy of Electrocardiogram-Controlled Central Line Placement." The International Anesthesia Research Society, vol. 104, No. 1 Jan. 2007.
Gjendemsjo, Anders, et al., Energy and Power, The Connexions Project, Version 1.2, Feb. 20, 2004.
Gladwin, MT et al, Cannulation of the Internal Jugular Vein: is postpocedural chest radiography always necessary?, Crit Care Med, 33 pages, Oct. 2000.
Gonzales, et al. "Peripherally Inserted Central Catheter Placement in Swine Using Magnet Detection." Journal of Intravenous Nursing, vol. 22, No. 3, May/Jun. 1999.
Greenall, M.J. et al, Cardiac Tamponade and Central Venous Catheters, British Medical Journal, pp. 595-597, Jun. 14, 1975.
Guillory, "Basic Principles of Technologies for Catheter Localization." C.R. Bard internal paper, Oct. 20, 2004.
Guth, AA, Routine Chest X-rays after Insertion of Implantable Long-Term Venous Catheters: Necessary or Not?, Am Surg, pp. 26-29, vol. 67 No. 1, Jan. 2001 (Abstract only).
Hill, Bradley et al, Abstract of article discussing VasaNova VPS as guide for placement of PICCs. 2009.
Hill, Bradley, Identifying the Caval-Atrial Junction Using Smart-Catheter Technology presentation, 22nd Annual Scientific Meeting of the AVA in Savannah, Georgia, Sep. 13, 2008.
Hoffman, Thomas et al, Simultaneous Measurement of Pulmonary Venous Flow by Intravascular Catheter Doppler Velocimetry and Transesophageal Doppler Echocardiography: Relation to Left Atrial Pressure and Left Atrial and Left Ventricular Function, pp. 239-249, J Am Coll Cardiol, Jul. 1995.
Hoffmann, et al. "New Procedure in Transesophageal Echocardiography: Multiplane Transesophageal Echocardiography and Transesophageal Stress Echocardiography." Herz, vol. 18, No. 5, pp. 269-277, Oct. 1993.
Iacopino, Domenico Gerardo et al, Intraoperative Microvascular Doppler Monitoring of Blood Flow within a Spinal Dural Arteriovenous Fistula: A Precious Surgical Tool, vol. 10, 5 pages, Neurosurg. Focus, Feb. 2001.
Joosting, Jean-Pierre, "Dual-interface RFID-compatible EEPROM enables remote access to electronic device parameters," EE Times, Mar. 8, 2010.
JP 2008-528151 filed Aug. 24, 2006 Notice of Grant dated May 6, 2012.
JP 2010-504220 filed Sep. 3, 2009 Final Office Action dated Apr. 18, 2013.
JP 2010-504220 filed Sep. 3, 2009 Office Action dated May 21, 2012.

(56) **References Cited**

OTHER PUBLICATIONS

Kim, Ko et al, Positioning Internal Jugular Venous Catheters using the Right Third Intercostal Space in Children, Acta Anaesthesiol Scand, pp. 1284-1286, vol. 47 No. 10, Nov. 2003.
U.S. Appl. No. 13/213,622, filed Aug. 19, 2011 Final Office Action dated Feb. 19, 2013.
U.S. Appl. No. 13/213,622, filed Aug. 19, 2011 Non-Final Office Action dated Jul. 31, 2012.
U.S. Appl. No. 13/283,395, filed Oct. 27, 2011 Non-Final Office Action dated Apr. 23, 2013.
U.S. Appl. No. 13/336,919, filed Dec. 23, 2011 Advisory Action dated May 23, 2013.
U.S. Appl. No. 13/336,919, filed Dec. 23, 2011 Final Office Action dated Mar. 1, 2013.
U.S. Appl. No. 13/336,919, filed Dec. 23, 2011 Non-Final Office Action dated Oct. 16, 2012.
U.S. Appl. No. 13/337,987, filed Dec. 27, 2011 Non-Final Office Action dated Mar. 15, 2013.
U.S. Appl. No. 29/428,649, filed Aug. 1, 2012 Notice of Allowance dated Jul. 5, 2013.
Valdivieso, J.R. Perez, et al., Evaluation of a formula for optimal positioning of a central venous catheter inserted through the right internal jugular vein, Rev. Esp. Anestesiol. Reanim. 2003; 50: 77-79.
VasoNova Inc, Vascular navigation system for accurate placement of PICCs, Start-Up Emerging Medical Ventures, pp. 44-45, vol. 14 No. 7, Jul.-Aug. 2009.
Vesely, Thomas M. et al., Central Venous Catheter Tip Position: A Continuing Controversy, J Vasc Intery Radiol 2003; 14:527-534.
Viasys Health Care Inc. Cortrak © Fact Sheet, 2005.
Viasys Healthcare MedSystems, Navigator® Benefits, 2008.
Viasys Healthcare MedSystems, Navigator® Research in Cost Justification, 2008.
Viasys MedSystems, Cortrak™ Systems Brochure, 2005.
Volcano ComboMap Features and Benefits/Technical Specifications, 2 pages, 2011.
Watters, et al. "Use of Electrocardiogram to Position Right Atrial Catheters During Surgery." Annals of Surgery, vol. 225, No. 2, pp. 165-171, 1997.
Welch Allyn Cardioperfect® PC-Based Resting ECG, 2003.
Wilson, R. G. et al, Right Atrial Electrocardiography in Placement of Central Venous Catheters, The Lancet, pp. 462-463, Feb. 27, 1988.
Wong, Jeffrey J. et al., Azygos Tip Placement for Hemodialysis Catheters in Patients with Superior Vena Cava Occlusion, Cardiovasc Intervent Radiol (2006) 29:143-146.
Worley, Seth J. "Use of a Real-Time Three-Dimensional Magenetic Navigation System for Radiofrequency Ablation of Accessory Pathways." PACE, vol. 21 pp. 1636-1643, Aug. 1998.
Yilmazlar A et al, Complications of 1303 Central Venous Cannulations, J R Soc Med, pp. 319-321, vol. 90 No. 6, Jun. 1997 (Abstract only).
Yoon, SZ et al, Usefulness of the Carina as a Radiographic Landmark for Central Venous Catheter Placement in Paediatric Patients, Br J Anaesth, Jul. 2005.
Yoshida, Teruhisa et al, Detection of Concealed Left Sided Accessory Atrioventricular Pathway by P Wave Signal Averaged Electrocardiogram, J Am Coll Cardiol, pp. 55-62, 1999.
Zaaroor, et al. "Novel Magnetic Technology for Intraoperative Intracranial Frameless Navigation: In Vivo and in Vitro Results." Neurosurgery, vol. 48, No. 5. pp. 1100-1107, May 2001.
Zachariou, Zacharias et al., Intra-atrial ECG recording: a new and safe method for implantation of Broviac catheters in children, Pediatr Surg Int (1994) 9: 457-458.
"Ascension to Launch New 3D Guidance™ Tracker at TCT 2006." Press Releases from Ascension website: www.ascension-tech.com/news/press_101106.php, last accessed Dec. 1, 2006.
Acuson—The Value of Vision, AcuNav Diagnostic Ultrasound Catheter, 2000.
Advertising flyer for GAVECELT—The Italian Group for Long Term Venous Access Devices, for program on International Meeting on PICC's, Midline Catheters and Long Term Venous Access Devices in Catholic University, Rome, Italy on Dec. 3, 4, 5, 2008.
Alexander, GD et al, The Role of Nitrous Oxide in Postoperative Nausea and Vomiting, Collection of Abstracts Presented at the International Anesthesia Research Society by various speakers, 58th Congress, Mar. 12-14, 1984, Anesthesia and Analgesia, pp. 175-284, vol. 63, 1984.
Allan, P.L. et al, Role of Ultrsound in the Assessment of Chronic Venous Insufficiency, Ultrasound Quarterly, vol. 17, No. 1, pp. 3-10, 2001.
Andropoulos, et al. "A Controlled Study of the Transesophageal Echocardiography to Guide Central Venous Catheter Placement in Congetital Heart Surgery Patients." The International Anesthesia Research Society, vol. 89, pp. 65-70, 1999.
Anonymous author, Correct Catheter Placement with a low-impact, reliable and economical method, <http://www.cvc-partner.com/index.cfm?103A955CC6844BF58ACFE3C9C1471959>, last accessed Dec. 22, 2011.
Arai, J et al, Detection of Peripherally Inserted Central Catheter Occlusion by in-line Pressure Monitoring, Paediatr Anaesth, pp. 621-624, vol. 12 No. 7, Sep. 2002.
Arrow International, Inc., The Arrow-Johans RAECG Adapter-Making Proper Central Venous Catheter Placement More Reliable (Modle No. EG-04900), Technical Report 1987, USA.
Aslamy, et al. "MRI of Central Venous Anatomy: Implications for Central Venous Catheter Insertion." American College of Chest Physicians, Jun. 8, 2009.
AU 2006283022 filed Aug. 24, 2006 Office Action dated Dec. 22, 2010.
AU 2008329807 exam requested Aug. 13, 2012 Examination Report No. 1 dated Feb. 15, 2013.
AU 2011289513 filed Jan. 21, 2013 Examiner's Report dated Jul. 5, 2013.
AU 2012202293 filed Apr. 19, 2012 Examination Report No. 1 dated Apr. 24, 2013.
AU 2013204243 filed Apr. 12, 2013 Examiner's Report dated Jun. 5, 2013.
Aurora® System Technical Specifications, Oct. 2003.
B. Braun Website, "The Optimal Position of the Central Venous Catheter." http://www.cvcpartner.com/index.cfm18F1BDEA1310466194960A39F4E90968 (2009).
B. Braun, Certofix Central Venous Catheter for Placement Using the Seldinger Technique with Simultaneous ECG Lead Option, Feb. 2010.
Bailey, SH et al, Is Immediate Chest Radiograph Necessary after Central Venous Catheter Placement in a Surgical Intensive Care Unit?, Am J Surg, pp. 517-522, vol. 180 No. 6, Dec. 2000.
Bankier, Alexander A., Azygos Arch Cannulation by Central Venous Catheters: Radiographic Detection of Malposition and Subsequent Complications, Journal of Thoracic Imaging 12:64-69 (1997).
Barber, JM et al, A Nurse led Peripherally Inserted Central Catheter Line Insertion Service is Effective with Radiological Support, Clin Radiol, pp. 352-354, vol. 57 No. 5, May 2002.
Bard Access Systems, Sherlock Tip Location System, 5 pages, 2006.
Bard Access Systems, Site Rite Vascular Acess Ultrasound System, 4 pages, 2005.
Benchimol, Alberto at al, Right Atrium and Superior Vena Cava Flow Velocity in Man Measured with the Doppler-Catheter Flowmeter-Telemetry System, The Amer Journal of Medicine, pp. 303-309, vol. 48, Mar. 1970.
BioAdvance Lumen Vu, Greenhouse Fund Feb. 2004 Recipient, www.bioadvance.com <http://www.bioadvance.com>, 2005.
Borgobello, Bridget, App allows users to view electrocardiograms on smartphones dated Oct. 15, 2010; printed from http://www.gizmag.com/app-to-view-electrocardiograms-on-smartphones/16664/ on Feb. 4, 2011.
Buehrle, Douglas, PICC Placement in Humans using Electromagnetic Detection, <http://www.corpakmedsystems.com/supplement_material/supplementpages/navigator/navarticle.html>, 2008.
C.R. Bard, CathTrack™ Catheter Location System at www.bardaccess.com <http://www.bardaccess.com>, last accessed Apr. 28, 2011.

(56) **References Cited**

OTHER PUBLICATIONS

C.R. Bard, Inc., Bard Electrophysiology Product Catalogue, Bard Catheters, pp. 74-75 (2002), USA.
CA 2,619,909 filed Aug. 24, 2006 Examiner's Report dated Oct. 26, 2012.
Cadman, A et al, To Clot or Not to Clot? That is the question in Central Venous Catheters, Clinical Radiology, pp. 349-355, vol. 59 No. 4, Apr. 2004.
Calvert, N et al, The Effectiveness and Cost-effectiveness of Ultrasound Locating Devices for Central Venous Access: A Systematic Review and Economic Evaluation, Health Technology Assessment, vol. 7, No. 12, 2003.
Cardella, John F. et al., Interventinal Radiologic Placement of Peripherally Inserted Central Catheters, Journal of Vascular and Interventional Radiology 1993; 4:653-660.
Carlon, R et al, Secondary Migration of a Central Venous Catheter—A Case Report, Minerva Anestesiol, pp. 927-931, vol. 69 No. 12, Dec. 2003.
Caruso, LJ et al, A Better Landmark for Positioning a Central Venous Catheter, J Clinical Monitoring and Computing, pp. 331-334, vol. 17 No. 6, Aug. 2002.
Cavatorta, et al., "Central Venous Catheter Placement in Hemodialysis: Evaluation of Electrocardiography Using a Guidewire." The Journal of Vascular Access, vol. 2, pp. 45-50, 2001.
Chalkiadis, GA et al, Depth of Central Venous Catheter Insertion in Adults: An Audit and Assessment of a Technique to Improve Tip Position, Anaesth Intensive Care, pp. 61-66, vol. 26 No. 1, Feb. 1998.
Chamsi-Pasha, Hassan et al, Cardiac Complications of Total Parenteral Nutrition: The Role of Two-Dimensional Echocardiography in Diagnosis, Annals of the Royal College of Surgeons of England, pp. 120-123, vol. 71, 1989.
Chang, Thomas C. et al., Are Routine Ch Ladiographs Necessary After Image-Guided Placement of Internal Jugular Central Venous Access Devices?, AJR Feb. 1998;170:335-337.
Chaturvedi et al., "Catheter Malplacement During Central Venous Cannulation Through Arm Veins in Pediatric Patients." Journal of Neurosurgical Anesthesiology, vol. 15, No. 3 pp. 170-175, Jan. 2003.
Chen, Zhongping et al, Optical Doppler Tomography: Imaging in vivo Blood Flow Dynamics Following Pharmacological Intervention and Photodynamic Therapy, 7 pages, vol. 67, Photochemistry and Photobiology, 1998.
Cheng, KI et al, A Novel Approach of Intravenous Electrocardiograph Technique in Correct Position the Long-Term Central Venous Catheter, Kaohsiung J Med Sci, pp. 241-247, vol. 16 No. 5, May 2000 (Abstract only).
Cheung, P., et al., The Effect of a Disposable Probe Cover on Pulse Oximetry, Anaesth Intensive Care 2002; 30: 211-214.
Chu, et al., "Accurate Central Venous Port-A Catheter Placement: Intravenous Electrocardiography and Surface Landmark Techniques Compared by Using Transesophageal Echocardiography." The International Anesthesia Research Society, vol. 98, pp. 910-914, 2004.
Claasz, Antonia et al, A Study of the Relationship of the Superior Vena Cava to the Bony Landmarks of the Sternum in the Supine Adult: Implications for Magnetic Guidance Systems, Journal, vol. 12 No. 3, JAVA, Jul. 24, 2007.
Clifford, et al. "Assessment of Hepatic Motion Secondary to Respiration for Computer Assisted Interventions." Computer Aided Surgery, vol. 7, pp. 291-299, 2002.
CN 200880012117.4 filed Apr. 16, 2008 First Office Action dated Dec. 23, 2011.
CN 200880012117.4 filed Apr. 16, 2008 Second Office Action dated Oct. 8, 2012.
CN 200880012117.4 filed Apr. 16, 2008 Third Office Action dated Apr. 27, 2013.
CN 200880125528.4 filed Nov. 25, 2008 First Office Action dated Jun. 5, 2012.
Schummer, W et al, ECG-guided Central Venous Catheter Positioning: Does it detect the Pericardial Reflection rather than the Right Atrium?, Eur J Anaesthesiol, pp. 600-605, vol. 21 No. 8, Aug. 2004 (Abstract only).
Schummer, W et al, Intra-Atrial ECG is not a Reliable Method for Positioning Left Internal Jugular Vein Catheters, Br J Anaesth, pp. 481-486, vol. 91 No. 4, Oct. 2003.
Schummer, W, Central Venous Catheter—The Inability of "Intra-Atrial ECG" to prove Adequate Positioning, Br J Anaesth, pp. 193-198, vol. 93 No. 2, Aug. 2004.
Schuster, M. et al., The carina as a landmark in central venous catheter placement, British Journal of Anaesthesia 85 (2): 192-4 (2000).
Siela, Debra, Using Chest Radiography in the Intensive Care Unit, Crit Care Nurse Aug. 1, 2002 vol. 22 No. 4, pp. 18-27.
Simon, et al., "Central Venous Catheter Placement in Children: Evaluation of Electrocardiography Using J-Wire." Paediatric Anaesthesia vol. 9, pp. 501-504, 1999.
Smith, Brigham, et al., Intravenous electrocardiographic guidance for placement of peripherally inserted central catheters, Journal of Electrocardiology 43 (2010) 274-278.
Stark, DD et al, Radiographic Assessment of Venous Catheter Position in Children: Value of the Lateral View, Pediatric Radiology, pp. 76-80, vol. 14 No. 2, 1984.
Starkhammar et al. "Cath-Finder Catheter Tracking System: A New Device for Positioning of Central Venous Catheters. Early Experience from Implantation of Brachial portal Systems." Acta Anaesthesiol Scandinavia, vol. 34, No. 4 pp. 296-300, May 1990.
Starkhammer, H et al, Central Venous Catheter Placement using Electromagnetic Position Sensing: A Clinical Evaluation, Biomed. Instrum Technol, vol. 30 No. 2, pp. 164-170; Mar.-Apr. 1996.
Starr, David S et al, EKG Guided Placement of Subclavian CVP Catheters Using J-Wire, pp. 673-676, Ann. Surg, Dec. 1986.
Stas, M et al, Peroperative Intravasal Electrographic Control of Catheter Tip Position in Access Ports Placed by Venous Cut-Down Technique, EJSO, pp. 316-320, vol. 27, 2001.
Stereotaxis Magetic Navigation System with Navigant™ User Interface, 2005 Brochure.
Stereotaxis, Expanding the Possibilites of Interventional Medicine: Remote Navigation and Automation, pp. 1-8, Apr. 2011.
Tepa® Health Innovation PC based ECG System Introduction and Technical Specifications, EKG Master USB, 2 pages, Nov. 2003.
The FloWire Doppler Guide Wire located <http://www.volcanocorp.com/products/flowire-doppler-guide-wire.php>, 2011.
Traxal Technologies, Tracking Technology website overview: www.traxal.com/rd/rd_classroom_trackingtechnology.htm, last accessed Dec. 1, 2006.
UAB Health Systems, Arrhythmias, retrieved from http://www.health,uab.edu/14564/ on Nov. 15, 2007, 12 pages.
U.S. Appl. No. 11/466,602, filed Aug. 23, 2006 Advisory Action dated Jun. 22, 2009.
U.S. Appl. No. 11/466,602, filed Aug. 23, 2006 Appeal Board Decision dated Sep. 17, 2012.
U.S. Appl. No. 11/466,602, filed Aug. 23, 2006 Final Office Action dated Apr. 8, 2010.
U.S. Appl. No. 11/466,602, filed Aug. 23, 2006 Final Office Action dated Jan. 30, 2009.
U.S. Appl. No. 11/466,602, filed Aug. 23, 2006 Non-Final Office Action dated Mar. 28, 2013.
U.S. Appl. No. 11/466,602, filed Aug. 23, 2006 Non-Final Office Action dated Sep. 25, 2009.
U.S. Appl. No. 11/466,602, filed Aug. 23, 2006 Notice of Allowance dated Dec. 3, 2012.
U.S. Appl. No. 11/552,094, filed Oct. 23, 2006 Notice of Allowability dated Apr. 2, 2010.
U.S. Appl. No. 11/552,094, filed Oct. 23, 2006 Non-Final Office Action dated Apr. 27, 2009.
U.S. Appl. No. 11/552,094, filed Oct. 23, 2006 Notice of Allowance dated May 20, 2010.
U.S. Appl. No. 12/104,253, filed Apr. 16, 2008 Final Office Action dated Jul. 27, 2011.
U.S. Appl. No. 12/104,253, filed Apr. 16, 2008 Non-Final Office Action dated Nov. 29, 2010.
U.S. Appl. No. 12/323,273, filed Nov. 25, 2008 Non-Final Office Action dated Jun. 8, 2012.
U.S. Appl. No. 12/369,625, filed Feb. 11, 2009 Final Office Action dated Feb. 23, 2012.

(56) **References Cited**

OTHER PUBLICATIONS

U.S. Appl. No. 12/369,625, filed Feb. 11, 2009 Notice of Allowance dated Oct. 5, 2012.
U.S. Appl. No. 12/369,625, filed Feb. 11, 2009 Notice of Panel Decision dated Aug. 1, 2012.
U.S. Appl. No. 12/369,625, filed Feb. 11, 2009 Non-Final Office Action dated Jul. 20, 2011.
U.S. Appl. No. 12/426,175, filed Apr. 17, 2009 Non-Final Office Action dated Dec. 3, 2012.
U.S. Appl. No. 12/427,244, filed Apr. 21, 2009 Non-Final Office Action dated Jan. 19, 2012.
U.S. Appl. No. 12/545,762, filed Aug. 21, 2009 Final Office Action dated Mar. 7, 2013.
U.S. Appl. No. 12/545,762, filed Aug. 21, 2009 Non-Final Office Action dated Aug. 1, 2012.
U.S. Appl. No. 12/557,401, filed Sep. 10, 2009 Non-Final Office Action dated Apr. 24, 2012.
U.S. Appl. No. 12/575,456, filed Oct. 7, 2009 Non-Final Office Action dated Oct. 5, 2012.
U.S. Appl. No. 12/715,556, filed Mar. 2, 2010 Non-Final Office Action dated Sep. 13, 2012.
U.S. Appl. No. 12/854,083, filed Aug. 10, 2010 Non-Final Office Action dated Jan. 29, 2013.
U.S. Appl. No. 12/878,915, filed Sep. 9, 2010 Final Office Action dated Sep. 26, 2012.
U.S. Appl. No. 12/878,915, filed Sep. 9, 2010 Non-Final Office Action dated Mar. 15, 2012.
U.S. Appl. No. 12/878,915, filed Sep. 9, 2010 Notice of Allowance dated Jan. 8, 2013.
U.S. Appl. No. 12/900,750, filed Oct. 8, 2010 Final Office Action dated Dec. 3, 2013.
U.S. Appl. No. 12/900,750, filed Oct. 8, 2010 Non-Final Office Action dated Jun. 3, 2013.
U.S. Appl. No. 13/118,138, filed May 27, 2011 Final Office Action dated Apr. 3, 2013.
U.S. Appl. No. 13/118,138, filed May 27, 2011 Non-Final Office Action dated Oct. 3, 2012.
Kjelstrup T et al, Positioning of Central Venous Catheters using ECG, Tidssk Nor Laegeforen, pp. 599-601, vol. 111 No. 5, Feb. 1999 (Abstract only).
Kofler, Julia, et al., Epinephrine application via an endotracheal airway and via the Combitube in esophageal position, Critical Care Medicine: May 2000, vol. 28: Issue 5, pp. 1445-1449.
Konings, MK, et al., Development of an intravascular impedance catheter for detection of fatty lesions in arteries, IEEE Trans Med Imaging Aug. 1997; 16(4):439-46.
Kowalski, CM et al, Migration of Central Venous Catheters: Implications for Initial Catheter Tip Positioning, J Vasc Intery Radiol, pp. 443-447, vol. 8 No. 3, May-Jun. 1997.
Leowenthal, MR et al, The Peripherally Inserted Central Catheter (PICC): A Prospective Study of its Natural History after Fossa Insertion, Anaesth Intensive Care, pp. 21-24; vol. 30 No. 1, Feb. 2002.
Lepage Ronan et al. ECG Segmentation and P-wave Feature Extraction: Application to Patients Prone to Atrial Fibrillation, IEEE/EMBS Proceedings, 23rd Annual Conference, Istanbul, Turkey, Oct. 25-28, 2001.
Liu , Ji-Bin et al, Catheter-Based Intralumincal Sonography, J Ultrasound Med, pp. 145-160, vol. 23, 2004.
Lucey, B et al, Routine Chest Radiographs after Central Line Insertion: Mandatory Postprocedural Evaluation or Unnecessary Waste of Resources?, Cardiovasc Intervent Radiol, pp. 381-384, vol. 22 No. 5, Sep.-Oct. 1999.
Lum, Phillip, A New Formula-Based Measurement Guide for Optimal Positioning of Central Venous Catheters, JAVA, vol. 9, No. 2, pp. 80-85, 2004.
Lynch, RE et al, A Procedure for Placing Pediatric Femoral Venous Catheter Tips near the Right Atrium, Pediatr Emerg Care, pp. 130-132, vol. 18 No. 2, Apr. 2002.
Madan, et al. "Right Atrial Electrocardiography: A Technique for the Placement of Central Venous Catheters for Chemotherapy or Intravenous Nutrition." British Journal of Surgery, vol. B1, pp. 1604-1605, 1994.
Madias, John E, Intracardiac (Superior Vena Cava/Right Atrial) ECGs using Saline Solution as the Conductive Medium for the Proper Positioning of the Shiley Hemodialysis Catheter: Is it Not Time to Forego the Postinsertion Chest Radiograph?, pp. 2363-2367, Chest, 2003.
Markovich, Mary B., Central Venous Catheter Tip Placement: Determination of Posterior Malposition—A Case Study, JAVA, vol. 11, No. 2, pp. 85-89, 2006.
Martin, Roy W, An Ultrasoundic Catheter for Intravascular Measurement of Blood Flow: Technical Details, IEEE Transactions on Sonics and Ultrasonics, vol. SU-27, No. 6, pp. 277-286, Nov. 1980.
McDonnall, "Intra-Atrial Electrocardiography (ECG) for Catheter Placement." Literature review prepared for Bard Access Systems, Oct. 2007.
McGee et al., "Accurate Placement of Central Venous Catheters: A Prospective, Randomize, Multicenter Trail." Critical Care Medicine, vol. 21 No. 8, Aug. 1993.
MedGraphics, CardioPerfect® Resting/Stress Ecg System, 3 pages, 2001.
Michenfelder, John et al, Air Embolism During Neurosurgery—An Evaluation of Right-Atrial Catheters for Diagnosis and Treatment, JAMA, pp. 1353-1358, vol. 208, No. 8, May 26, 1969.
Michenfelder, John et al, Air Embolism During Neurosurgery. A New Method of Treatment, Anesthesia and Analgesia. Current Researches, pp. 390-395, vol. 45, No. 4, Jul.-Aug. 1966.
Microbird™ Miniaturized DC Magnetic Sensors for Intra-body Navigation and Localization, Specifications, 2005.
Micronix CathRite™ Cardiac Access Device Brochure. Jun. 2004.
Micronix Pty Ltd "CathRite" Guiding Styled Core Manufacturing, Jun. 15, 2006.
Murthy, Vrudhula et al, Analysis of Power Spectral Densities of Electrocardiograms, Mathematical Biosciences, pp. 41-51, vol. 12 No. 1-2, Oct. 1971.
Nadroo, AM et al, Changes in Upper Extremity Position Cause Migration of Peripherally Inserted Central Catheters in Neonates, Pediatrics, pp. 131-136, vol. 110, Jul. 2002.
Nakatani, K et al, Accurate Placement of Central Venous Catheters—ECG-guided method vs Patient Height Method, MASUI, pp. 34-38, vol. 51 No. 1, Jan. 2002.
Nazarian, GK et al, Changes in Tunneled Catheter Tip Position when a patient is Upright, J Vasc Intery Radio!, pp. 437-441, vol. 8 No. 3, May-Jun. 1997.
Neurometer® CPT, Clinical Applications. Neurotron , Inc. website: www.neurotron.com/CLINAPS.html, last accessed Oct. 23, 2006.
Neurometer® CPT, Frequently Asked Questions. Neurotron , Inc. website: www.neurotron.com/CPTFAQ/html, last accessed Oct. 23, 2006.
Neurometer® CPT, Products Page. Neurotron , Inc. website: www.neurotron.com/products.html, last accessed Oct. 23, 2006.
Neurometer® Electrodiagnostic Neuroselective Sensory Nerve Evaluation: Charts, Tables, Documents & Downloads. Neurotron , Inc. website: www.neurotron.com/downloads.html, last accessed Oct. 23, 2006.
Odd, De et al, Does Radio-opaque Contrast Improve Radiographic localisation of Percutaneous Central Venous Lines?, Arch Dis Child Fetal Neonatal Ed, pp. 41-43, vol. 89 No. 1, Jan. 2004.
Palesty, JA et al, Routine Chest Radiographs Following Central Venous Recatherization over a Wire are not Justified, Am J Surg, pp. 618-621, vol. 176 No. 6, Dec. 1998.
Paliotti, Roberta P. et al, Intravascular Doppler Technique for Monitoring Renal Venous Blood Flow in Man, J Nephrol, pp. 57-62, 2003.
Parker, K.H. et al, Cardiovascular Fluid Dynamics, Department of Bioengineering, National Heart and Lung Institute, Imperial College of Science, Technology and Medicine, Cardiovascular Haemodynamics, pp. 1-28, Sep. 26, 2005.
Pawlik, et al., "Central Venous Catheter Placement: Comparison of the Intravascular Guidewire and the Fluid Column Electrocardiograms." European Journal of Anaesthesiology, vol. 41, pp. 594-599, 2004.

(56) **References Cited**

OTHER PUBLICATIONS

PCT/US2006/033079 filed Aug. 24, 2006 International Preliminary Report on Patentability dated Feb. 26, 2008.
PCT/US2006/033079 filed Aug. 24, 2006 Search Report dated Dec. 19, 2006.
PCT/US2006/033079 filed Aug. 24, 2006 Written Opinion dated Dec. 19, 2006.
PCT/US2008/060502 filed Apr. 16, 2008 International Search Report and Written Opinion dated Oct. 16, 2008.
PCT/US2008/084751 filed Nov. 25, 2008 International Preliminary Report on Patentability dated Jun. 1, 2010.
PCT/US2008/084751 filed Nov. 25, 2008 Search Report dated May 20, 2009.
PCT/US2008/084751 filed Nov. 25, 2008 Written Opinion dated May 20, 2009.
PCT/US2009/033116 filed Feb. 4, 2009 International Preliminary Report on Patentability dated Aug. 10, 2010.
PCT/US2009/033116 filed Feb. 4, 2009 Search Report dated Mar. 13, 2009.
PCT/US2009/033116 filed Feb. 4, 2009 Written Opinion dated Mar. 13, 2009.
PCT/US2009/041051 filed Apr. 17, 2009 Search Report dated Jul. 28, 2009.
PCT/US2009/041051 filed Apr. 17, 2009 Written Opinion dated Jul. 28, 2009.
PCT/US2009/054687 filed Aug. 21, 2009 International Preliminary Report on Patentability dated Feb. 22, 2011.
PCT/US2009/054687 filed Aug. 21, 2009 Search Report dated Oct. 6, 2009.
PCT/US2009/054687 filed Aug. 21, 2009 Written Opinion dated Oct. 6, 2009.
CN 201180048882.3 filed Apr. 9, 2013 First Office Action dated Jun. 30, 2014.
CN 201180048882.3 filed Apr. 9, 2013 Second Office Action dated Mar. 18, 2015.
JP 2013-524183 filed Feb. 8, 2015 First Office Action dated Jun. 24, 2015.
PCT/US2012/063956 filed Nov. 7, 2012 International Seach Report and Written Opinion dated Apr. 1, 2013.
PCT/US2013/045999 filed Jun. 14, 2013 International Search Report and Written Opinion dated Nov. 21, 2013.
PCT/US2014/018681 filed Feb. 26, 2014 International Search Report and Written Opinion dated May 19, 2014.
Rutala, Guideline for Disinfection and Sterilization in Healthcare Facilities, 2008.
Silindir, M. et al., "Sterilization Methods and the Comparison of E-Beam Sterilization with Gamma Radiation Sterilization," Fabad J. Pharm. Sci., 34, 43-53, 2009.
U.S. Appl. No. 12/900,750, filed Oct. 8, 2010 Final Office Action dated Sep. 4, 2014.
U.S. Appl. No. 12/900,750, filed Oct. 8, 2010 Non-Final Office Action dated Apr. 10, 2014.
U.S. Appl. No. 12/900,750, filed Oct. 8, 2010 Non-Final Office Action dated Jan. 30, 2015.
U.S. Appl. No. 13/206,396, filed Aug. 9, 2011 Final Office Action dated Jul. 31, 2014.
U.S. Appl. No. 13/206,396, filed Aug. 9, 2011 Non-Final Office Action dated Dec. 16, 2014.
U.S. Appl. No. 13/206,396, filed Aug. 9, 2011 Non-Final Office Action dated Feb. 27, 2014.
U.S. Appl. No. 13/206,396, filed Aug. 9, 2011, Final Office Action dated Jun. 10, 2015.
U.S. Appl. No. 13/671,382, filed Nov. 7, 2012 Advisory Action dated May 27, 2015.
U.S. Appl. No. 13/671,382, filed Nov. 7, 2012 Final Office Action dated Mar. 12, 2015.
U.S. Appl. No. 13/671,382, filed Nov. 7, 2012 Final Office Action dated Sep. 23, 2014.
U.S. Appl. No. 13/671,382, filed Nov. 7, 2012 Non-Final Office Action dated Mar. 10, 2014.
Butler et al. "Practical Considerations for Analog Operation of Bucket-Brigade Circuits" IEEE Journal of Solid-State Circuits, vol. SC-8, No. 2, Apr. 1973.
CN 201180048882.3 filed Apr. 9, 2013 Third Office Action dated Aug. 19, 2014.
Freeman et al. "Delta-Sigma Oversampled Ultrasound Beamformer with Dynamic Delays" IEEE Transactions on Ultrasonics, Ferroelectrics, and Frequency control, vol. 46, No. 2,—Mar. 1999.
Mo et al. "Front-End Processor Using BBD Distributed Delay-Sum Architecture for Micromachined Ultrasonic Sensor Array" Journal of Microelectromechanical Systems, vol. 12, No. 4, Aug. 2003.
Mo et al. "Integrated analog beam former based on bucket brigade device for micromachined ultrasonic sensor array" Sensors and Actuators A 101 (2002) 203-211—Apr. 22, 2012.
Mo et al. "Pipelined Delay-Sum Architecture Based on Bucket-Brigade Devices for On-Chip Ultrasound Beamforming" IEEE Journal of Solid-State Circuits, vol. 38, No. 10, Oct. 2003.
Mucci, R. A. "A Comparison of Efficient Beamforming Algorithms" IEEE Transactions on Acoustics, Speech, and Signal Processing, vol. ASSP-32, No. 3,—Jun. 1984.
Savord et al. "Fully Sampled Matrix Transducer for Real Time 3D Ultrasonic Imaging" IEEE Ultrasonics Symposium—945—2003.
Tanaka el al. "Development of BBD Adding-Delay Architecture for Utrasonic Micro Array Sensor" IEEJ Trans. SM, vol. 125, No. 4 2005.
Thomenius "Evolution of Ultrasound Beamformers" IEEE Ultrasonics Symposium 1996.

* cited by examiner

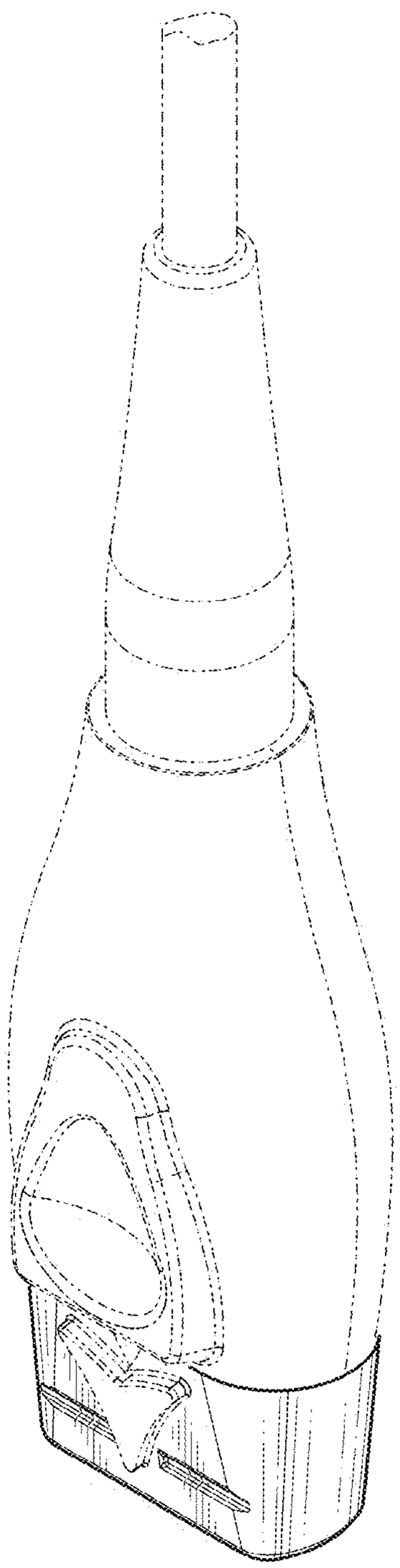


FIG. 1

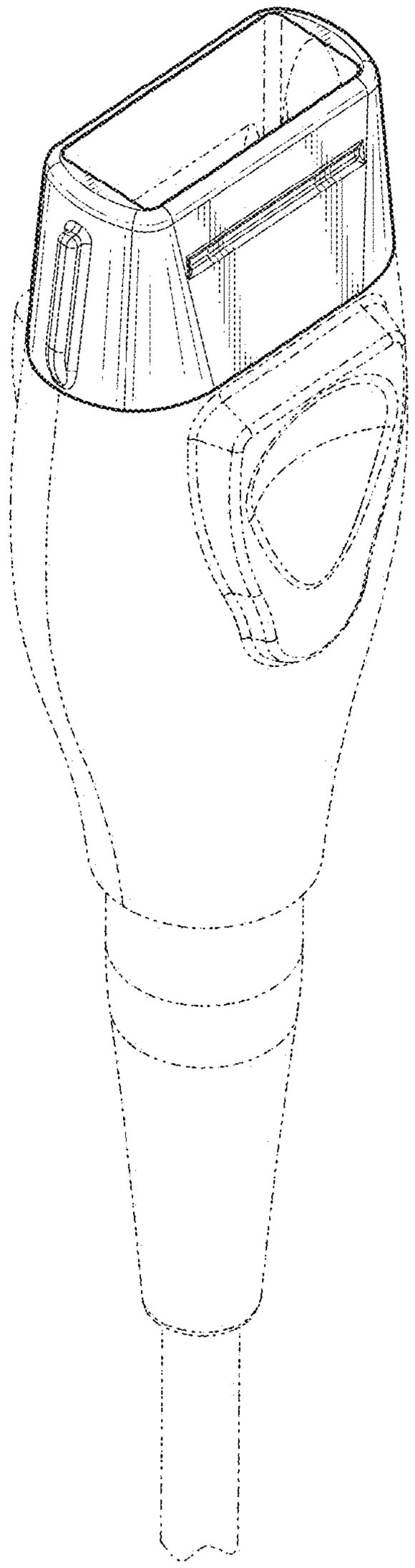


FIG. 2

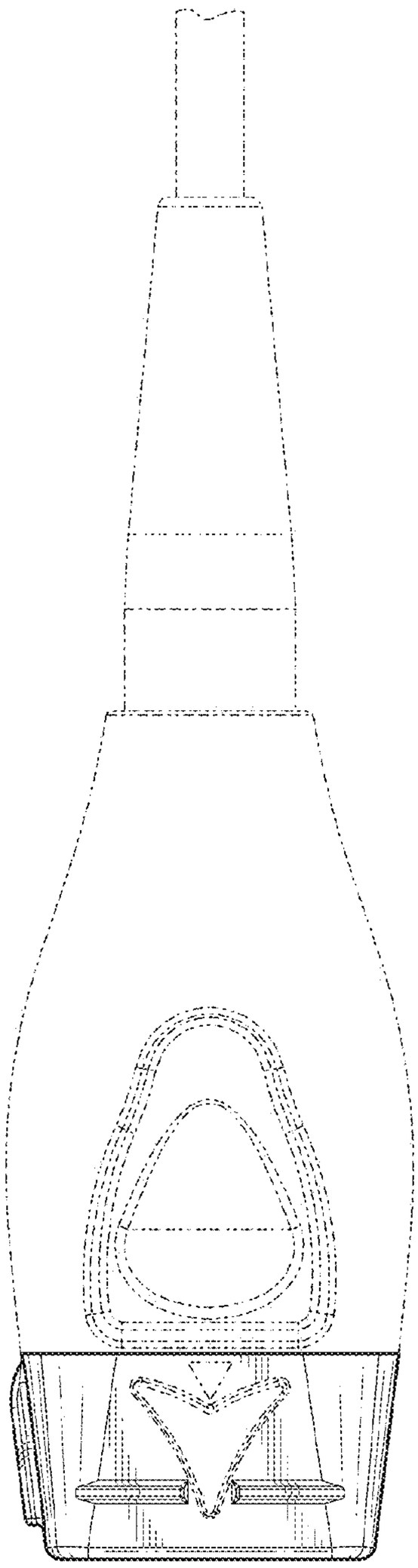


FIG. 3

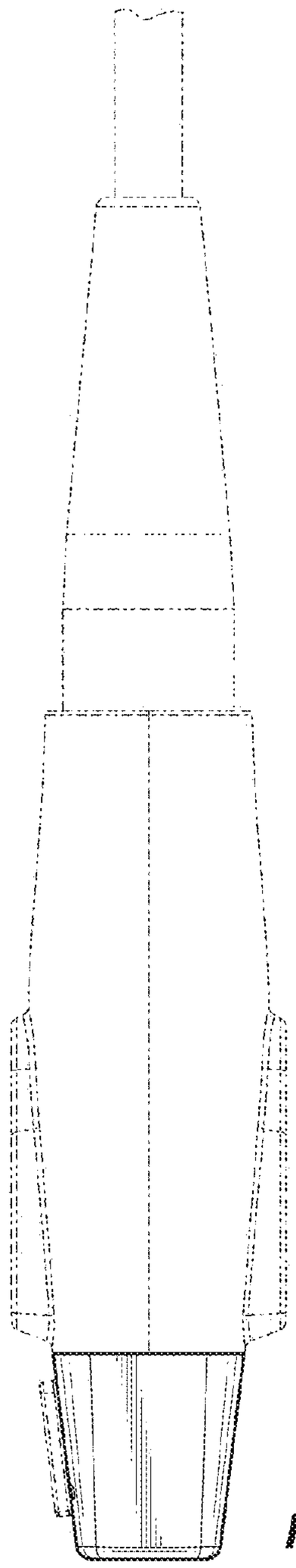


FIG. 4

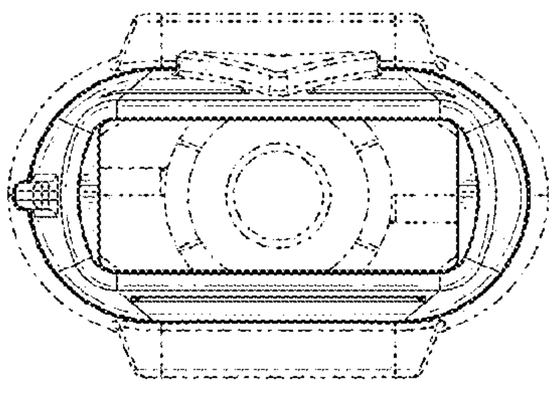


FIG. 5

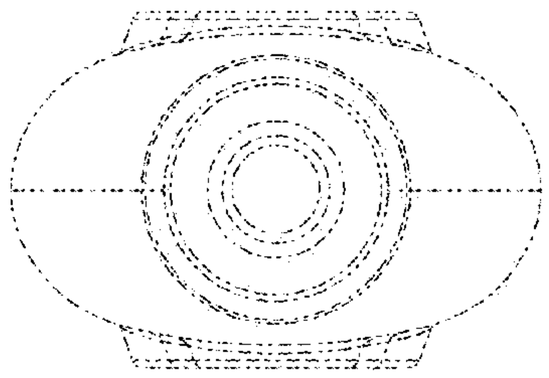


FIG. 8

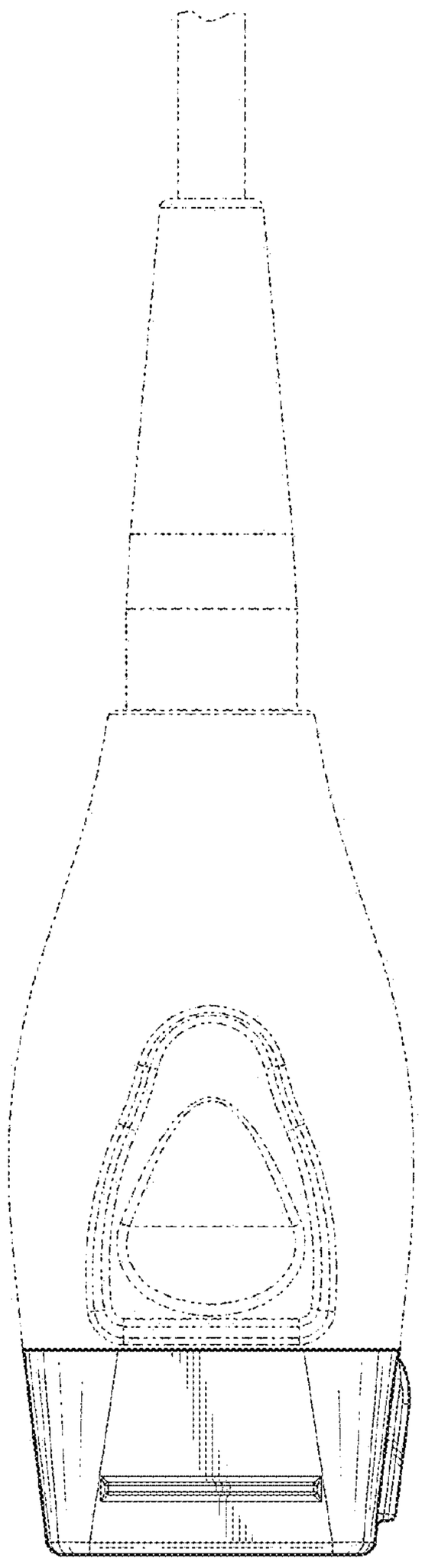


FIG. 6

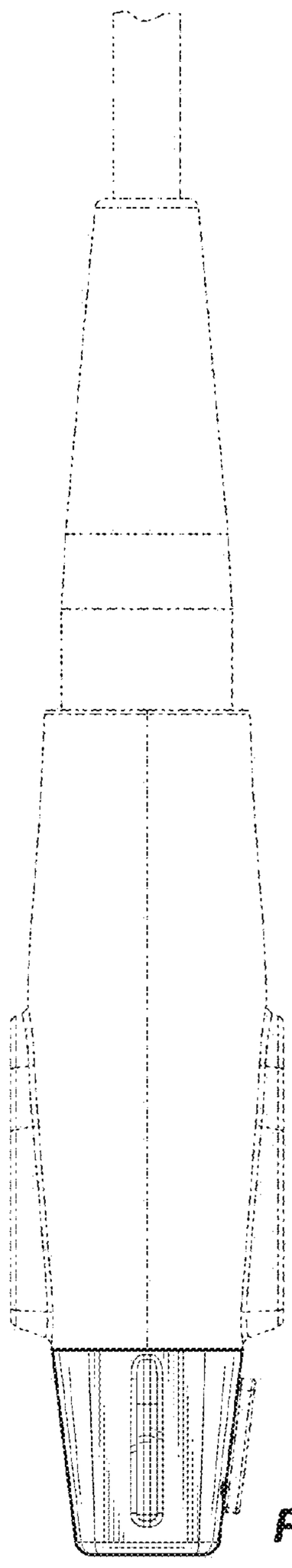


FIG. 7