

EXHIBIT B



US007947022B2

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

(10) **Patent No.:** **US 7,947,022 B2**
(45) **Date of Patent:** ***May 24, 2011**

(54) **ACCESS PORT IDENTIFICATION SYSTEMS
AND METHODS**

(56) **References Cited**

(75) Inventors: **Murtaza Yusuf Amin**, Farmington, UT
(US); **Kevin Sheetz**, Sandy, UT (US);
David M. Cise, Herriman, UT (US);
Matt Draper, North Salt Lake, UT (US);
Kelly B. Powers, North Salt Lake, UT
(US)

U.S. PATENT DOCUMENTS
574,387 A 1/1897 Buckler
611,357 A 9/1898 Dembinski
966,696 A 8/1910 Merrill
1,713,267 A 5/1929 Crowley
2,029,553 A 2/1936 Bartschi et al.
2,433,480 A 12/1947 Rendich
2,891,689 A 6/1959 Gould
D198,453 S 6/1964 Weichselbaum

(Continued)

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

FOREIGN PATENT DOCUMENTS

(*) Notice: Subject to any disclaimer, the term of this
patent is extended or adjusted under 35
U.S.C. 154(b) by 212 days.

EP 619101 10/1994

(Continued)

This patent is subject to a terminal dis-
claimer.

OTHER PUBLICATIONS

Costa, Nancy, "More Than Skin Deep: An Overview of Iodinated
Contrast Media." Journal for the Association for Vascular Access,
vol. 8, No. 4, 2003.

(21) Appl. No.: **12/420,028**

(Continued)

(22) Filed: **Apr. 7, 2009**

Primary Examiner — Nicholas D Lucchesi

Assistant Examiner — Aarti B Berdichevsky

(65) **Prior Publication Data**

US 2009/0204072 A1 Aug. 13, 2009

(74) *Attorney, Agent, or Firm* — Rutan & Tucker, LLP

(57) **ABSTRACT**

Related U.S. Application Data

(63) Continuation-in-part of application No. 11/368,954,
filed on Mar. 6, 2006, now Pat. No. 7,785,302.

(60) Provisional application No. 60/658,518, filed on Mar.
4, 2005.

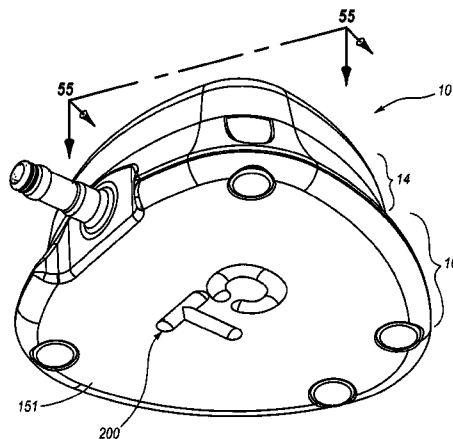
(51) **Int. Cl.**
A61M 37/00 (2006.01)

(52) **U.S. Cl.** **604/288.02**

(58) **Field of Classification Search** 604/288.01,
604/288.02

See application file for complete search history.

20 Claims, 46 Drawing Sheets



US 7,947,022 B2

Page 2

U.S. PATENT DOCUMENTS

3,293,663 A	12/1966	Cronin	4,781,685 A	11/1988	Lehmann et al.
3,341,417 A	9/1967	Sinaiko	4,781,695 A	11/1988	Dalton
3,518,428 A	6/1970	Ring	4,802,885 A	2/1989	Weeks et al.
3,529,633 A	9/1970	Vailancourt	4,804,054 A	2/1989	Howson et al.
3,643,358 A	2/1972	Morderosian	4,820,273 A	4/1989	Reinicke
3,829,904 A	8/1974	Ling et al.	4,822,341 A	4/1989	Colone
3,831,583 A	8/1974	Edmunds, Jr. et al.	4,840,615 A	6/1989	Hancock et al.
3,840,009 A	10/1974	Michaels et al.	4,848,346 A	7/1989	Crawford
3,891,997 A	7/1975	Herbert	4,857,053 A	8/1989	Dalton
3,915,162 A	10/1975	Miller	4,861,341 A	8/1989	Woodburn
3,919,724 A	11/1975	Sanders et al.	4,863,470 A	9/1989	Carter
3,922,726 A	12/1975	Trentani et al.	4,886,501 A	12/1989	Johnston et al.
3,951,147 A	4/1976	Tucker et al.	4,892,518 A	1/1990	Cupp et al.
4,027,391 A	6/1977	Samis et al.	4,904,241 A	2/1990	Bark
4,035,653 A	7/1977	Karasko	4,905,709 A	3/1990	Bieganski et al.
4,121,108 A	10/1978	Manor	4,909,250 A	3/1990	Smith
4,123,806 A	11/1978	Amstutz et al.	4,915,690 A	4/1990	Cone et al.
4,168,586 A	9/1979	Samis	4,928,298 A	5/1990	Tanaka et al.
4,190,040 A	2/1980	Schulte	4,929,236 A	5/1990	Sampson
4,190,057 A	2/1980	Hill et al.	4,955,861 A	9/1990	Enegren et al.
4,194,122 A	3/1980	Mitchell et al.	4,963,133 A	10/1990	Whipple
4,202,349 A	5/1980	Jones	4,966,583 A	10/1990	Debbas
4,222,374 A	9/1980	Sampson et al.	4,973,319 A	11/1990	Melsky
4,233,964 A	11/1980	Jefferts et al.	4,983,162 A	1/1991	Metais et al.
4,274,006 A	6/1981	Caine	5,009,644 A	4/1991	McDonald
4,349,498 A	9/1982	Ellis et al.	5,013,298 A	5/1991	Moden et al.
4,361,153 A	11/1982	Slocum et al.	5,041,098 A	8/1991	Loiterman et al.
4,405,305 A	9/1983	Stephen et al.	5,044,955 A	9/1991	Jagmin
4,406,567 A	9/1983	Samis et al.	5,045,060 A	9/1991	Melsky et al.
4,425,119 A	1/1984	Berglund	5,045,064 A	9/1991	Idriss
4,445,896 A	5/1984	Gianturco	5,084,015 A	1/1992	Moriuchi et al.
4,450,592 A	5/1984	Niederer et al.	5,085,216 A	2/1992	Henley, Jr. et al.
4,450,985 A	5/1984	Beard	5,090,066 A	2/1992	Schoepe et al.
4,456,011 A	6/1984	Warnecke et al.	5,092,849 A	3/1992	Sampson
4,469,483 A	9/1984	Becker et al.	5,108,317 A	4/1992	Beinhaur et al.
4,494,545 A	1/1985	Slocum et al.	5,108,377 A	4/1992	Cone et al.
4,506,676 A	3/1985	Duska	5,112,301 A	5/1992	Fenton, Jr. et al.
4,529,635 A	7/1985	Sheldon	5,112,303 A	5/1992	Pudenz et al.
4,543,088 A	9/1985	Bootman et al.	5,129,891 A	7/1992	Young
4,549,879 A	10/1985	Groshong et al.	5,137,529 A	8/1992	Watson et al.
4,559,046 A	12/1985	Groshong et al.	5,147,483 A	9/1992	Melsky et al.
4,571,749 A	2/1986	Fischell	5,152,753 A	10/1992	Laguetta et al.
4,576,595 A	3/1986	Aas et al.	5,156,600 A	10/1992	Young
4,612,877 A	9/1986	Hayes et al.	5,158,547 A	10/1992	Doan et al.
4,627,844 A	12/1986	Schmitt	5,167,629 A	12/1992	Vertenstein et al.
4,634,427 A	1/1987	Hannula et al.	5,167,633 A	12/1992	Mann et al.
4,636,194 A	1/1987	Schulte et al.	5,167,638 A	12/1992	Felix et al.
4,636,213 A	1/1987	Pakiam	5,171,228 A	12/1992	McDonald
4,645,495 A	2/1987	Vaillancourt	5,176,653 A	1/1993	Metals et al.
4,653,508 A	3/1987	Cosman	5,176,662 A	1/1993	Bartholomew et al.
4,655,765 A	4/1987	Swift	5,178,612 A	1/1993	Fenton, Jr.
4,657,024 A	4/1987	Coneys	5,185,003 A	2/1993	Brethauer et al.
4,662,652 A	5/1987	Hargis	5,189,690 A	2/1993	Samuel
4,668,221 A	5/1987	Luther	5,193,106 A	3/1993	DeSena
4,671,796 A	6/1987	Groshong et al.	5,195,122 A	3/1993	Fabian
4,673,394 A	6/1987	Fenton, Jr. et al.	5,195,123 A	3/1993	Clement
4,684,365 A	8/1987	Reinicke	5,201,715 A	4/1993	Masters
4,685,447 A	8/1987	Iversen et al.	5,203,771 A	4/1993	Melker et al.
4,685,905 A	8/1987	Jeanneret nee Aab	5,203,777 A	4/1993	Lee
4,692,146 A	9/1987	Hilger	5,213,574 A	5/1993	Tucker
4,695,273 A	9/1987	Brown	5,215,537 A	6/1993	Lynn et al.
4,697,595 A	10/1987	Breyer et al.	5,222,499 A	6/1993	Allen et al.
4,701,166 A	10/1987	Groshong et al.	D337,637 S	7/1993	Tucker
4,704,103 A	11/1987	Stober et al.	5,224,938 A	7/1993	Fenton, Jr.
4,710,174 A	12/1987	Moden et al.	5,263,930 A	11/1993	Ensminger
4,718,894 A	1/1988	Lazorthes et al.	5,281,205 A	1/1994	McPherson
4,728,894 A	3/1988	Yoda et al.	5,290,263 A	3/1994	Wigness et al.
4,743,231 A	5/1988	Kay et al.	5,295,658 A	3/1994	Atkinson et al.
4,753,640 A	6/1988	Nichols et al.	5,299,253 A	3/1994	Wessels
4,755,173 A	7/1988	Konopka et al.	5,309,863 A	5/1994	Leeb, Jr.
4,760,837 A	8/1988	Petit	5,312,337 A	5/1994	Flaherty et al.
4,762,517 A	8/1988	McIntyre et al.	5,318,545 A	6/1994	Tucker
4,767,410 A	8/1988	Moden et al.	5,320,100 A	6/1994	Herweck et al.
4,772,270 A	9/1988	Wiita et al.	5,328,480 A	7/1994	Melker et al.
4,772,276 A	9/1988	Wiita et al.	5,332,398 A	7/1994	Miller et al.
4,773,552 A	9/1988	Boege et al.	5,336,194 A	8/1994	Polaschegg et al.
4,778,452 A	10/1988	Moden et al.	5,338,398 A	8/1994	Szwejkowski et al.
4,781,680 A	11/1988	Redmond et al.	5,350,360 A	9/1994	Ensminger et al.
			5,352,204 A	10/1994	Ensminger

US 7,947,022 B2

Page 3

5,360,407 A	11/1994	Leonard et al.	5,895,424 A	4/1999	Steele, Sr. et al.
5,383,223 A	1/1995	Inokuchi et al.	5,906,596 A	5/1999	Tallarida
5,383,233 A	1/1995	Russell	5,908,414 A	6/1999	Otto et al.
5,383,858 A	1/1995	Reilly et al.	5,913,998 A	6/1999	Butler et al.
D355,240 S	2/1995	Gladfelter et al.	5,916,263 A	6/1999	Goicoechea et al.
5,387,192 A	2/1995	Glantz et al.	5,925,017 A	7/1999	Kriesel et al.
5,394,457 A	2/1995	Leibinger et al.	5,925,030 A	7/1999	Gross et al.
5,395,324 A	3/1995	Hinrichs et al.	5,928,197 A	7/1999	Niehoff
5,397,329 A	3/1995	Allen	5,931,829 A	8/1999	Burbank et al.
5,399,168 A	3/1995	Wadsworth, Jr. et al.	5,944,023 A	8/1999	Johnson et al.
5,405,402 A	4/1995	Dye et al.	5,944,688 A	8/1999	Lois
5,417,565 A	5/1995	Long	5,944,712 A	8/1999	Frassica et al.
5,417,656 A	5/1995	Ensminger et al.	5,947,953 A	9/1999	Ash et al.
5,421,814 A	6/1995	Geary	5,951,512 A	9/1999	Dalton
5,423,334 A	6/1995	Jordan	5,951,522 A	9/1999	Rosato et al.
5,425,762 A	6/1995	Muller	5,954,687 A	9/1999	Baudino
5,456,698 A	10/1995	Byland et al.	5,957,890 A	9/1999	Mann et al.
5,476,460 A	12/1995	Montalvo	5,968,011 A	10/1999	Larsen et al.
5,476,880 A	12/1995	Cooke et al.	5,970,162 A	10/1999	Kawashima et al.
5,484,402 A	1/1996	Saravia et al.	5,989,216 A	11/1999	Johnson et al.
5,503,630 A	4/1996	Ensminger et al.	5,989,239 A	11/1999	Finch et al.
5,507,813 A	4/1996	Dowd et al.	5,997,524 A	12/1999	Burbank et al.
5,509,805 A	4/1996	Jagmin	6,007,516 A	12/1999	Burbank et al.
5,513,637 A	5/1996	Twiss et al.	6,013,051 A	1/2000	Nelson
5,514,103 A	5/1996	Srisathapat et al.	6,013,058 A	1/2000	Prosl et al.
5,520,632 A	5/1996	Leveen et al.	6,017,331 A	1/2000	Watts et al.
5,527,277 A	6/1996	Ensminger et al.	6,022,335 A	2/2000	Ramadan
5,527,307 A	6/1996	Srisathapat et al.	6,033,389 A	3/2000	Cornish
5,531,684 A	7/1996	Ensminger et al.	6,039,712 A	3/2000	Fogarty et al.
5,545,143 A	8/1996	Fischell	6,077,756 A	6/2000	Lin et al.
5,556,381 A	9/1996	Ensminger et al.	6,086,555 A	7/2000	Eliassen et al.
5,558,641 A	9/1996	Glantz et al.	6,090,066 A	7/2000	Schnell
5,562,617 A	10/1996	Finch, Jr. et al.	6,102,884 A	8/2000	Squitieri
5,562,618 A	10/1996	Cai et al.	6,113,572 A	9/2000	Gailey et al.
5,575,770 A	11/1996	Melsky et al.	6,120,492 A	9/2000	Finch et al.
5,607,393 A	3/1997	Ensminger et al.	6,161,033 A	12/2000	Kuhn et al.
5,607,407 A	3/1997	Tolkoff et al.	6,171,198 B1	1/2001	Lizama Troncoso et al.
5,613,945 A	3/1997	Cai et al.	6,171,298 B1	1/2001	Matsuura et al.
5,620,419 A	4/1997	Lui et al.	6,190,352 B1	2/2001	Haarala et al.
5,632,729 A	5/1997	Cai et al.	6,193,684 B1	2/2001	Burbank et al.
5,637,102 A	6/1997	Tolkoff et al.	6,198,807 B1	3/2001	DeSena
5,638,832 A	6/1997	Singer et al.	6,203,570 B1	3/2001	Baeke
5,647,855 A	7/1997	Trooskin	6,213,973 B1	4/2001	Eliassen et al.
5,662,612 A	9/1997	Niehoff	6,228,088 B1	5/2001	Miller et al.
5,676,146 A	10/1997	Scarborough	6,251,059 B1	6/2001	Apple et al.
5,695,490 A	12/1997	Flaherty et al.	D445,175 S	7/2001	Bertheas
5,702,128 A	12/1997	Maxim et al.	6,269,148 B1	7/2001	Jessop et al.
5,702,363 A	12/1997	Flaherty	6,287,293 B1	9/2001	Jones et al.
5,704,915 A	1/1998	Melsky et al.	6,290,677 B1	9/2001	Arai et al.
5,709,668 A	1/1998	Wacks	6,305,413 B1	10/2001	Fischer et al.
5,713,844 A	2/1998	Peyman	D450,115 S	11/2001	Bertheas
5,713,858 A	2/1998	Heruth et al.	6,332,874 B1	12/2001	Eliassen et al.
5,713,859 A	2/1998	Finch, Jr. et al.	6,355,021 B1	3/2002	Nielsen et al.
5,718,382 A	2/1998	Jaeger	6,356,782 B1	3/2002	Sirimanne et al.
5,718,682 A	2/1998	Tucker	6,361,557 B1	3/2002	Gittings et al.
5,725,507 A	3/1998	Petrick	6,398,764 B1	6/2002	Finch, Jr. et al.
5,733,336 A	3/1998	Neuenfeldt et al.	6,419,680 B1	7/2002	Cosman et al.
5,733,400 A	3/1998	Gore et al.	6,450,937 B1	9/2002	Mercereau et al.
5,741,228 A	4/1998	Lambrecht et al.	6,473,638 B2	10/2002	Ferek-Petric
5,743,873 A	4/1998	Cai et al.	6,478,783 B1	11/2002	Moorehead
5,743,891 A	4/1998	Tolkoff et al.	6,482,217 B1	11/2002	Pintor et al.
5,746,460 A	5/1998	Marohl et al.	6,494,867 B1	12/2002	Elver et al.
5,758,667 A	6/1998	Slettenmark	6,497,062 B1	12/2002	Koopman et al.
5,769,823 A	6/1998	Otto	6,500,155 B2	12/2002	Sasso
5,773,552 A	6/1998	Hutchings et al.	6,503,228 B1	1/2003	Li et al.
5,776,188 A	7/1998	Shepherd et al.	6,527,754 B1	3/2003	Tallarida et al.
5,792,104 A	8/1998	Speckman et al.	6,537,255 B1	3/2003	Raines
5,792,116 A	8/1998	Berg et al.	RE38,074 E	4/2003	Recinella et al.
5,810,789 A	9/1998	Powers et al.	6,582,418 B1	6/2003	Verbeek et al.
5,824,071 A	10/1998	Nelson et al.	6,613,002 B1	9/2003	Clark et al.
5,830,172 A	11/1998	Leveen et al.	6,613,662 B2	9/2003	Wark et al.
5,833,654 A	11/1998	Powers et al.	6,626,936 B2	9/2003	Stinson
5,835,563 A	11/1998	Navab et al.	6,629,950 B1	10/2003	Levin
5,836,935 A	11/1998	Ashton et al.	6,632,217 B2	10/2003	Harper et al.
5,840,063 A	11/1998	Flaherty	6,652,486 B2	11/2003	Bialecki et al.
5,843,069 A	12/1998	Butler et al.	6,652,503 B1	11/2003	Bradley
5,853,394 A	12/1998	Tolkoff et al.	6,676,633 B2	1/2004	Smith et al.
5,868,702 A	2/1999	Stevens et al.	6,697,664 B2	2/2004	Kienzle, III et al.
5,882,353 A	3/1999	VanBeek et al.	6,705,316 B2	3/2004	Blythe et al.

US 7,947,022 B2

Page 4

6,719,721 B1	4/2004	Okazaki et al.	2003/0139812 A1	7/2003	Garcia et al.
6,719,739 B2	4/2004	Verbeek et al.	2003/0181878 A1	9/2003	Tallarida et al.
6,738,531 B1	5/2004	Funahashi et al.	2003/0191452 A1	10/2003	Meglin et al.
6,755,842 B2	6/2004	Kanner et al.	2004/0006316 A1	1/2004	Patton
6,758,841 B2	7/2004	Haarala et al.	2004/0020462 A1	2/2004	Sauler et al.
6,767,356 B2	7/2004	Kanner et al.	2004/0044306 A1	3/2004	Lynch et al.
6,784,783 B2	8/2004	Scoggin et al.	2004/0054352 A1	3/2004	Adams et al.
6,826,257 B2	11/2004	Sayre et al.	2004/0056266 A1	3/2004	Suh et al.
6,852,106 B2	2/2005	Watson et al.	2004/0064110 A1	4/2004	Forsell
6,878,136 B2	4/2005	Fleury et al.	2004/0073196 A1	4/2004	Adams et al.
6,878,137 B2	4/2005	Benchetrit et al.	2004/0106891 A1	6/2004	Langan et al.
6,949,084 B2	9/2005	Marggi et al.	2004/0157952 A1	8/2004	Soffiati et al.
6,962,580 B2	11/2005	Adams et al.	2004/0158207 A1	8/2004	Hunn et al.
6,994,315 B2	2/2006	Ryan et al.	2004/0167543 A1	8/2004	Mazzocchi et al.
6,997,914 B2	2/2006	Smith et al.	2004/0176743 A1	9/2004	Morris et al.
7,008,377 B2	3/2006	Beane et al.	2004/0199129 A1	10/2004	DiMatteo
7,008,412 B2	3/2006	Maginot	2004/0199220 A1	10/2004	Cantlon
7,016,456 B2	3/2006	Basu et al.	2004/0204692 A1	10/2004	Eliassen
7,018,361 B2	3/2006	Gillespie, Jr. et al.	2004/0225254 A1	11/2004	Tanaka et al.
7,044,942 B2	5/2006	Jolly et al.	2004/0254536 A1	12/2004	Conlon et al.
7,056,316 B1	6/2006	Burbank et al.	2004/0254537 A1	12/2004	Conlon et al.
7,070,591 B2	7/2006	Adams et al.	2005/0038390 A1	2/2005	Fago et al.
7,072,704 B2	7/2006	Bucholz	2005/0049553 A1	3/2005	Triplett et al.
7,074,232 B2	7/2006	Kanner et al.	2005/0070875 A1	3/2005	Kulesa
7,083,593 B2	8/2006	Stultz	2005/0075614 A1	4/2005	Bunodiore et al.
7,108,686 B2	9/2006	Burke et al.	2005/0113806 A1	5/2005	De Carvalho et al.
7,123,690 B1	10/2006	Brown et al.	2005/0131352 A1	6/2005	Conlon et al.
7,127,040 B2	10/2006	Sayre et al.	2005/0148866 A1	7/2005	Gunderson
7,131,962 B1	11/2006	Estabrook et al.	2005/0148956 A1	7/2005	Conlon et al.
7,140,769 B2	11/2006	Kay	2005/0148957 A1	7/2005	Girard et al.
7,191,011 B2	3/2007	Cantlon	2005/0152841 A1	7/2005	Sayre et al.
7,198,631 B2	4/2007	Kanner et al.	2005/0171502 A1	8/2005	Daly et al.
7,214,207 B2	5/2007	Lynch et al.	2005/0182857 A1	8/2005	Kong
7,214,215 B2	5/2007	Heinzerling et al.	2005/0209573 A1	9/2005	Brugger et al.
7,223,257 B2	5/2007	Shubayev et al.	2005/0215874 A1	9/2005	Wang et al.
7,229,417 B2	6/2007	Foerster et al.	2005/0241203 A1	11/2005	Lizotte et al.
7,235,067 B2	6/2007	Morris et al.	2005/0256451 A1	11/2005	Adams et al.
D546,440 S	7/2007	Burnside	2005/0256500 A1	11/2005	Fujii
7,242,982 B2	7/2007	Singhal et al.	2005/0277899 A1	12/2005	Conlon et al.
7,252,469 B2	8/2007	Zaluzec et al.	2005/0283119 A1	12/2005	Uth et al.
7,252,649 B2	8/2007	Sherry	2006/0009788 A1	1/2006	Freeman et al.
7,261,705 B2	8/2007	Edoga et al.	2006/0017341 A1	1/2006	Hahn et al.
D554,253 S	10/2007	Kornerup et al.	2006/0084929 A1	4/2006	Eliassen
7,275,682 B2	10/2007	Excoffier et al.	2006/0089619 A1	4/2006	Ginggen
7,276,075 B1	10/2007	Callas et al.	2006/0100592 A1	5/2006	Eliassen
D556,153 S	11/2007	Burnside	2006/0116648 A1	6/2006	Hamatake
7,306,579 B2	12/2007	Fujii	2006/0173410 A1	8/2006	Moberg et al.
7,311,702 B2	12/2007	Tallarida et al.	2006/0173424 A1	8/2006	Conlon
7,318,816 B2	1/2008	Bobroff et al.	2006/0178647 A1	8/2006	Stats
7,318,818 B2	1/2008	Yashiro et al.	2006/0184141 A1	8/2006	Smith et al.
7,322,953 B2	1/2008	Redinger	2006/0184142 A1	8/2006	Schon et al.
D562,442 S	2/2008	Blateri	2006/0217359 A1	9/2006	Wentworth et al.
D562,443 S	2/2008	Zinn et al.	2006/0217659 A1	9/2006	Patton
7,331,130 B2	2/2008	Schweikert	2006/0224128 A1	10/2006	Lurvey et al.
7,331,948 B2	2/2008	Skarda	2006/0224129 A1	10/2006	Beasley et al.
7,333,013 B2	2/2008	Berger	2006/0247584 A1	11/2006	Sheetz et al.
D564,449 S	3/2008	Dewberry	2006/0253076 A1	11/2006	Butts et al.
7,347,838 B2	3/2008	Kulli	2006/0264898 A1	11/2006	Beasley et al.
7,347,843 B2	3/2008	Adams et al.	2007/0007839 A1	1/2007	Lin
7,351,233 B2	4/2008	Parks	2007/0049876 A1	3/2007	Patton
7,377,915 B2	5/2008	Rasmussen et al.	2007/0055290 A1	3/2007	Lober
D574,950 S	8/2008	Zawacki et al.	2007/0073250 A1	3/2007	Schneider
7,413,564 B2	8/2008	Morris et al.	2007/0078391 A1	4/2007	Wortley et al.
D578,203 S	10/2008	Bizup	2007/0078416 A1	4/2007	Eliassen
7,445,614 B2	11/2008	Bunodiore et al.	2007/0078432 A1	4/2007	Halseth et al.
D582,032 S	12/2008	Bizup et al.	2007/0083156 A1	4/2007	Muto et al.
7,465,847 B2	12/2008	Fabian	2007/0120683 A1	5/2007	Flippen et al.
D595,892 S	7/2009	Smith et al.	2007/0149920 A1	6/2007	Michels et al.
7,563,025 B2	7/2009	Kay	2007/0149921 A1	6/2007	Michels et al.
7,713,251 B2	5/2010	Tallarida et al.	2007/0161958 A1	7/2007	Glenn
2001/0016717 A1	8/2001	Haarala et al.	2007/0179456 A1	8/2007	Glenn
2001/0051766 A1	12/2001	Gazdzinski	2007/0185462 A1	8/2007	Byrum
2001/0053889 A1	12/2001	Marggi et al.	2007/0191773 A1	8/2007	Wojcik
2001/0056266 A1	12/2001	Tallarida et al.	2007/0208313 A1	9/2007	Conlon et al.
2002/0095205 A1	7/2002	Edwin et al.	2007/0219510 A1	9/2007	Zinn et al.
2002/0138068 A1	9/2002	Watson et al.	2007/0233017 A1	10/2007	Zinn et al.
2002/0173769 A1	11/2002	Gray et al.	2007/0233018 A1	10/2007	Bizup et al.
2003/0028173 A1	2/2003	Forsberg	2007/0255234 A1	11/2007	Haase et al.
2003/0130627 A1	7/2003	Smith et al.	2007/0270691 A1	11/2007	Bailey et al.

US 7,947,022 B2

Page 5

2007/0270770 A1 11/2007 Bizup
 2007/0276344 A1 11/2007 Bizup et al.
 2007/0299408 A1 12/2007 Alferness et al.
 2008/0004642 A1 1/2008 Birk et al.
 2008/0008654 A1 1/2008 Clarke et al.
 2008/0015701 A1 1/2008 Garcia et al.
 2008/0039820 A1 2/2008 Sommers et al.
 2008/0048855 A1 2/2008 Berger
 2008/0114308 A1 5/2008 di Palma et al.
 2008/0138387 A1 6/2008 Machiraju
 2008/0140025 A1 6/2008 Sheetz et al.
 2008/0208236 A1 8/2008 Hobbs et al.
 2008/0281279 A1 11/2008 Hoendervoogt et al.
 2008/0319398 A1 12/2008 Bizup
 2008/0319399 A1 12/2008 Schweikert et al.
 2008/0319405 A1 12/2008 Bizup
 2009/0024024 A1 1/2009 Zinn
 2009/0024098 A1 1/2009 Bizup et al.
 2009/0035582 A1 2/2009 Nakatani et al.
 2009/0118683 A1 5/2009 Hanson et al.
 2009/0156928 A1 6/2009 Evans et al.
 2009/0204072 A1 8/2009 Amin et al.
 2009/0204074 A1 8/2009 Powers et al.
 2009/0221976 A1 9/2009 Linden
 2009/0227862 A1 9/2009 Smith et al.
 2009/0227951 A1 9/2009 Powers et al.
 2010/0042073 A1 2/2010 Oster et al.
 2010/0069743 A1 3/2010 Sheetz et al.

FOREIGN PATENT DOCUMENTS

EP 0619101 A1 10/1994
 JP 2006025948 A 2/2006
 WO WO-8600213 1/1986
 WO WO-9305730 4/1993
 WO WO-9701370 1/1997
 WO WO-9706845 2/1997
 WO 98017337 A1 4/1998
 WO WO-9942166 8/1999
 WO WO-0033901 6/2000
 WO WO-0247549 6/2002
 WO WO-0247549 A1 6/2002
 WO WO-2004004800 A2 1/2004
 WO 2004071555 A2 8/2004
 WO 2004091434 A2 10/2004
 WO 2005037055 A2 4/2005
 WO 2006078915 A2 7/2006
 WO WO-2006096686 A1 9/2006
 WO WO-2006116438 A2 11/2006
 WO 2006130133 A1 12/2006
 WO WO-2006/134100 A1 12/2006
 WO WO-2007079024 A2 7/2007
 WO 2007094898 A2 8/2007
 WO WO-2007092210 8/2007
 WO 2007098771 A2 9/2007
 WO 2007109164 A2 9/2007
 WO 2007126645 A2 11/2007
 WO WO-2007136538 11/2007
 WO WO-2008008126 A2 1/2008
 WO WO-2008019236 A1 2/2008
 WO WO-2008048361 4/2008
 WO WO-2008063226 A2 5/2008
 WO 2008147760 A1 12/2008
 WO 2009002839 A1 12/2008
 WO WO-2008157763 A1 12/2008
 WO WO-2009012385 A1 1/2009
 WO WO-2009012395 1/2009
 WO WO-2009035582 3/2009
 WO WO-2009035582 A1 3/2009
 WO 2009046725 A1 4/2009
 WO WO-2009046439 4/2009
 WO WO-2009046439 A2 4/2009
 WO 2009108669 A1 9/2009

OTHER PUBLICATIONS

Costa, Nancy, "Understanding Contrast Media." *Journal of Infusion Nursing*, vol. 27, No. 5, Sep./Oct. 2004.
 Fallscheer, et al., "Injury to the Upper Extremity Caused by Extravasation of Contrast Medium: A True Emergency." *Scandina-*

vian Journal of Plastic and Reconstructive Surgery and Hand Surgery, vol. 41, pp. 26-32, 2007.

Johnson, Kathleen A., "Power Injectable Portal Systems." *Journal of Radiology Nursing*, vol. 28, Issue 1, Mar. 2009.

Jul. 21, 2009 Non-Final Office Action in U.S. Appl. No. 11/368,954, filed Mar. 6, 2006.

Jul. 21, 2009 Office Action in U.S. Appl. No. 11/368,954, filed Mar. 6, 2006.

Jun. 30, 2009 Non-Final Office Action in U.S. Appl. No. 12/419,957, filed Apr. 7, 2009.

Sanelli, et al., "Safety and Feasibility of Using a Central Venous Catheter for Rapid Contrast Injection Rates." *American Journal of Radiology*, vol. 183, pp. 1829-1834, Dec. 2004.

Smith, Lisa Hartkoph, "Implanted Ports, Computed Tomography, Power Injectors, and Catheter Rupture." *Clinical Journal of Oncology Nursing*, vol. 12, No. 5, Oct. 2008.

Soloman, et al., "CIN Strategies: Anticipate, Manage, Prevent." *Supplement to Imaging Economics*, May 2007.

U.S. Food and Drug Administration, "Guidance for Institutional Review Boards and Clinical Investigators 1998 Update: Medical Devices." Version Sep. 10, 2008.

Vergara, et al., "Adverse Reactions to Contrast Media in CT: Effects of Temperature and Ionic Property." *Radiology*, vol. 199, No. 2, May 1996.

Vogelzang, Robert L., "Power Injection Through Central Venous Catheters: Physiological and Hemodynamic Considerations." *The McGraw Medical Center of Northwestern University, Feinberg School of Medicine*.

Williamson, et al., "Assessing the Adequacy of Peripherally Inserted Central Catheters for Power Injection of Intravenous Contrast Agents for CT." *Journal of Computer Assisted Tomography*, vol. 6, No. 6, pp. 932-937, 2001.

Dec. 10, 2009 International Search Report in international application No. PCT/US09/62854 filed on Oct. 30, 2009.

Dec. 10, 2009 Written Opinion of the ISA in international application No. PCT/US09/62854 filed on Oct. 30, 2009.

Jan. 21, 2010 Non-Final Office Action in U.S. Appl. No. 11/320,223, filed Dec. 28, 2005.

Extreme Access Bard™ Access Systems, Inc. Product Brochure, 2003.

Port-A-Cath® P.A.S. PORT® Systems by Deltec, Product Specifications, 1999.

Feb. 18, 2010 Non-Final Office Action in U.S. Appl. No. 12/419,957, filed Apr. 7, 2009.

Feb. 18, 2010 Final Office Action in U.S. Appl. No. 12/420,007, filed Apr. 7, 2009.

Cardiovascular and Interventional Radiology, Review Article, "Central Venous Access Catheters: Radiological Management of Complications," by U.K. Teichgraber, B. Gebauer, T. Benter, H.J. Wagner, published online Jul. 31, 2003.

European Patent Office communication, dated Dec. 15, 2005, for Application No. 99 964 086.5-1257, Applicant STD Manufacturing, Inc.

European Patent Office Communication, dated Mar. 1, 2005, for Application No. 99 964 086.5-1257, Applicant STD Manufacturing, Inc.

European Patent Office communication, dated Mar. 30, 2005, for Application No. 99 964 086.5-1257, Applicant STD Manufacturing, Inc.

European Patent Office communication, dated Sep. 2, 2008, for Application No. 06 751 411.7-1526, Applicant C.R. Bard, Inc.

International Search Report and Written Opinion, dated Oct. 1, 2007, from PCT/US06/49007, filed Dec. 21, 2006.

International Search Report from related International Application No. PCT/US2006/008022, dated Jul. 5, 2006.

MedComp "PortCT Technology", display at SIR Conference (Mar. 2006), Toronto, Canada.

Non-Final Office Action issued on Feb. 13, 2008, in U.S. Appl. No. 11/320,223, filed Dec. 28, 2005.

Non-Final Office Action issued on Jan. 16, 2009, in U.S. Appl. No. 11/380,124, filed Apr. 25, 2006.

Non-Final Office Action issued on Sep. 18, 2008, in U.S. Appl. No. 11/320,223, filed Dec. 28, 2005.

US 7,947,022 B2

Page 6

Nucleus Cochlear Implant Systems; User Manual for the ESprit 3G speech processor and accessories, Issue 2, Dec. 2001 <http://www.cochlearamericas.com/PDFs/UserManualSprint.pdf>.

Office Action Issued on Aug. 28, 2007, in U.S. Appl. No. 10/374,000 (published as U.S. Publication No. 2003/0181878 A1).

Office Action issued on Feb. 13, 2006, in U.S. Appl. No. 10/374,000 (published as U.S. Publication No. 2003/0181878 A1).

Office Action issued on Feb. 28, 2007, in U.S. Appl. No. 10/374,000 (published as U.S. Publication No. 2003/0181878 A1).

Office Action issued on Jul. 28, 2006, in U.S. Appl. No. 10/374,000 (published as U.S. Publication No. 2003/0181878 A1).

Partial International Search Report dated Sep. 29, 2006 from related Patent Cooperation Treaty Application No. PCT/US2006/015695.

Preliminary Amendment filed on Dec. 19, 2007 in U.S. Appl. No. 11/368,954 (published as U.S. Publication No. 2006/0247584).

Response to Office Action dated May 12, 2006, filed in U.S. Appl. No. 10/374,000 (published as U.S. Publication No. 2003/0181878 A1).

Response to Office Action dated May 28, 2007, filed in U.S. Appl. No. 10/374,000 (published as U.S. Publication No. 2003/0181878 A1).

Response to Office Action dated Nov. 28, 2006, Filed in U.S. Appl. No. 10/374,000 (published as U.S. Publication No. 2003/0181878 A1).

Response to Office Action dated Oct. 31, 2007, filed in U.S. Appl. No. 10/374,000 (published as U.S. Publication No. 2003/0181878 A1).

U.S. Appl. No. 29/284,454, filed Sep. 7, 2007, titled Implantable Port Device, listing John A. Zawacki and Annmarie Boswell as inventors, in which a Continued Prosecution Application was filed on Jan. 30, 2008.

U.S. Appl. No. 29/284,456, filed Sep. 7, 2007, titled Implantable Port Device, listing John A. Zawacki and Annmarie Boswell as inventors. "Extravasation of Radiologic Contrast." PA-PSRS Patient Safety Advisory—vol. 1, No. 3, Sep. 2004.

Biffi, R., et al. "Use of totally implantable central venous access ports for high-dose chemotherapy and peripheral blood stem cell transplantation: results of a monocentre series of 376 patients." *Annals of Oncology* 15:296-300, 2004.

Biffi, R., et al. "Best Choice of Central Venous Insertion Site for the Prevention of Catheter-Related Complications in Adult Patients Who Need Cancer Therapy: A Randomized Trial." *Annals of Oncology*, Jan. 29, 2009.

Biffi, Roberto, et al. "A Randomized, Prospective Trial of Central Venous Ports Connected to Standard Open-Ended or Groshong Catheters in Adult Oncology Patients." *American Cancer Society*, vol. 92, No. 5, pp. 1204-1212, Sep. 1, 2001.

Hou, Shaw-Min et al. "Comparisons of Outcomes and Survivals for Two Central Venous Access Port Systems." *Journal of Surgical Oncology*, 91:61-66, 2005.

International Application No. PCT/US1999/028695 filed Dec. 3, 1999 International Preliminary Examination Report dated Apr. 21, 2001.

International Application No. PCT/US1999/028695 filed Dec. 3, 1999 International Search Report dated Apr. 11, 2000.

International Application No. PCT/US2006/008022 filed Mar. 6, 2006 International Preliminary Report on Patentability dated Dec. 9, 2007.

International Application No. PCT/US2006/008022 filed Mar. 6, 2006 Written Opinion dated Apr. 9, 2007.

International Application No. PCT/US2006/015695 filed Apr. 25, 2006 International Search Report dated Jan. 11, 2007.

International Application No. PCT/US2006/015695 filed Apr. 25, 2006 Written Opinion dated Oct. 27, 2007.

International Application No. PCT/US2006/016056 filed Apr. 27, 2006 International Preliminary Report on Patentability dated Oct. 30, 2007.

International Application No. PCT/US2006/016056 filed Apr. 27, 2006 International Search Report dated Sep. 20, 2006.

International Application No. PCT/US2006/016056 filed Apr. 27, 2006 Written Opinion dated Oct. 27, 2007.

International Application No. PCT/US2006/049007 filed Dec. 21, 2006 International Preliminary Report on Patentability dated Jul. 1, 2008.

International Application No. PCT/US2007/006776 (PCT Written opinion, dated Dec. 18, 2007).

International Application No. PCT/US2007/006776 International Preliminary Report on Patentability dated Jan. 2, 2009.

International Application No. PCT/US2007/006776 International Search Report, dated Dec. 18, 2007.

International Application No. PCT/US2007/011015 (International Preliminary Report on Patentability dated Oct. 29, 2008).

International Application No. PCT/US2007/011015 (PCT Search Report dated Jun. 10, 2008).

International Application No. PCT/US2007/011015 (PCT Written Opinion dated Jun. 10, 2008).

International Application No. PCT/US2007/011456 (PCT Search Report dated Aug. 28, 2008).

International Application No. PCT/US2007/011456 (PCT Written Opinion dated Aug. 28, 2008).

International Application No. PCT/US2008/010520 (PCT Search Report dated Feb. 24, 2009).

International Application No. PCT/US2008/010520 (PCT Written Opinion dated Feb. 24, 2009).

International Application No. PCT/US2008/067679; PCT Search Report mailed on Sep. 30, 2008.

International Application No. PCT/US2008/067679; PCT Written Opinion mailed on Sep. 30, 2008.

International Application No. PCT/US2008/070330 filed Jul. 17, 2008; PCT Search Report.

International Application No. PCT/US2008/070330 filed Jul. 17, 2008; PCT Written Opinion.

International Application No. PCT/US2008/070345; PCT Search Report mailed on Dec. 1, 2008.

International Application No. PCT/US2008/070345; PCT Written Opinion mailed on Dec. 1, 2008.

International Application No. PCT/US2008/078976 (PCT Search Report and Written Opinion dated Apr. 3, 2009).

LAP-BANDa System Access Port Fill Guide I, "9.75/10.0 cm LAP-BAND System vs. 11 cm LAP-BAND System: For Product Manufactured Prior to Jul. 2001" BioEnterics Corporation.

Sandstede, Joern, "Pediatric CT," available online at www.multislice-ct.com, MultiSLICE-CT.com, version 02, May 2, 2003.

Steinbach, Barbara G., Hardt, N. Sisson, Abbitt, Patricia L., Lanier, Linda, Caffee, H. Hollis, "Breast Implants, Common Complications, and Concurrent Breast Disease." *RadioGraphics*, vol. 13, No. 1, pp. 95-118, 1993.

Sullivan et al. "Radiopaque Markers on Mammary Implants." *American Journal of Roentgenology* 153(2):428, Aug. 1989.

U.S. Appl. No. 10/374,000, filed Feb. 25, 2003 ; Non-final Office Action mailed Mar. 20, 2008.

U.S. Appl. No. 10/374,000, filed Feb. 25, 2003 Advisory Action dated Jan. 23, 2007.

U.S. Appl. No. 10/374,000, filed Feb. 25, 2003 Response to Office Action dated Dec. 28, 2006.

U.S. Appl. No. 10/374,000, filed Feb. 25, 2003 Response to Office Action dated Jun. 20, 2008.

U.S. Appl. No. 10/374,000, filed Feb. 25, 2003 Response to Office Action dated Mar. 30, 2009.

U.S. Appl. No. 10/374,000, filed Feb. 25, 2003 Response to Office Action dated Sep. 21, 2009.

U.S. Appl. No. 10/374,000, filed Feb. 25, 2003; non-final Office Action, mailed May 20, 2009.

U.S. Appl. No. 10/374,000, filed Feb. 25, 2003; Office Action mailed Sep. 30, 2008.

U.S. Appl. No. 11/320,223, filed Dec. 28, 2005 Final Office Action dated Jun. 19, 2009.

U.S. Appl. No. 11/368,954, filed Mar., 6, 2006 Final Office Action dated Jan. 27, 2010.

U.S. Appl. No. 11/380,124, filed Apr. 25, 2006 Non-Final Office Action dated Apr. 26, 2010.

U.S. Appl. No. 11/380,621, filed Apr. 27, 2006 Final Office Action dated Jan. 14, 2010.

U.S. Appl. No. 11/380,621, filed Apr. 27, 2006 Final Office Action dated Jan. 23, 2009.

U.S. Appl. No. 11/380,621, filed Apr. 27, 2006 Non-Final Office Action dated Jul. 1, 2009.

US 7,947,022 B2

Page 7

- U.S. Appl. No. 11/380,621, filed Apr. 27, 2006 Non-Final Office Action dated Jun. 6, 2008.
- U.S. Appl. No. 11/725,287, filed Mar. 19, 2007; Non-final Office Action issued on Dec. 3, 2008.
- U.S. Appl. No. 11/725,287, filed Mar. 19, 2007; Non-final Office Action issued on Jun. 12, 2009.
- U.S. Appl. No. 11/725,287, filed Mar. 19, 2007; Non-final Office Action issued on Mar. 29, 2010.
- U.S. Appl. No. 12/023,280, filed Jan. 31, 2008 Final Office Action dated Mar. 9, 2010.
- U.S. Appl. No. 12/023,280, filed Jan. 31, 2008 Non-Final Office Action dated Jul. 23, 2009.
- U.S. Appl. No. 12/143,377, filed Jun. 20, 2008, Non-final Office Action mailed Apr. 27, 2009.
- U.S. Appl. No. 12/143,377, filed Jun. 20, 2008; Final Office Action mailed Oct. 19, 2009.
- U.S. Appl. No. 12/175,182, filed Jul. 17, 2008; Non-final Office Action mailed Sep. 3, 2009.
- U.S. Appl. No. 29/239,163, filed Sep. 27, 2005.
- U.S. Appl. No. 29/247,954, filed Jul. 21, 2006 Non-Final Office Action dated Apr. 6, 2007.
- U.S. Appl. No. 29/247,954, filed Jul. 21, 2006 Notice of Allowability dated Jul. 30, 2007.
- U.S. Appl. No. 29/247,954, filed Jul. 21, 2006.
- U.S. Appl. No. 60/658,518, filed Mar. 4, 2005, publicly accessible Oct. 5, 2006.
- Wells, S. "Venous Access in Oncology and Haematology Patients: Part One." Nursing Standard, vol. 22, No. 52, pp. 39-46, Sep. 3, 2008.
- International Application PCT/US2010/030256 filed Apr. 7, 2010 Search Report and Written Opinion dated Jun. 4, 2010.
- U.S. Appl. No. 11/320,223, filed Dec. 28, 2005 Final Office Action dated Jun. 22, 2010.
- U.S. Appl. No. 11/368,954, filed Mar. 6, 2006 Notice of Allowance dated Jun. 24, 2010.
- AngioDynamics, Smart Port Guidelines for Health Care Providers, 1996.
- EP Application No. 06845998.1 filed Dec. 21, 2006 Supplementary Search Report dated Jul. 22, 2010.
- U.S. Appl. No. 11/380,124, filed Apr. 25, 2006 Final Office Action dated Aug. 13, 2010.
- U.S. Appl. No. 11/937,302, filed Nov. 8, 2007 Non-Final Office Action dated Sep. 13, 2010.
- U.S. Appl. No. 12/419,957, filed Apr. 7, 2009 Non-Final Office Action dated Jul. 29, 2010.
- BARD Access Systems Mar. 21, 1995 Product Release to Market form for "M.R.I. Port with 8 Fr. ChronoFlex® Catheter", "M.R.I. Port with 8Fr. ChronoFlex Catheter with Intro-Eze™" "M.R.I. Port with 8. Fr ChronoFlex Catheter and Peel Apart", "M.R.I. Port with 8Fr. ChronoFlex Catheter Demo Kit". Drawings included.
- BioEnterics® LAP-BAND® "Adjustable Gastric Banding System" by Inamed Health. Product Brochure.
- LaMaitre Vascular "Port Implantations: using the OptiLock Implantable Port" product information, http://www.lemaitre.com/specs_pop.asp.
- LAP-BANDAP™ "System with Adjustable Gastric Banding System with OMNIFORM™ Design" Product Brochure.
- LAP-BAND® "Adjustable Gastric Banding System" by BioEnterics Corporation. Product Brochure.
- LAP-BAND® System Fact Sheet. © 2007 Allergan, Inc.
- Oct. 22, 2009 Declaration of Kelly Christian, Director of Product Development at Bard Access Systems, Inc.
- PORT-A-CATH® "Implantable Epidural, Aterial and Peritoneal Access Systems" Internet Product Listing. <http://web.archive.org/web/20001119035900/www.deltec.com/cPacspl.htm>.
- PORT-A-CATH® "Many PORT-A-CATH® System Choices" Product Brochure. © 1996 SIMS Deltec, Inc.
- PORT-A-CATH® "Single-lumen Implantable Vascular Access Systems" Product Specifications. 2004 Smith Medical family of companies.
- Rappolt, Richard T., et al. "Radiopaque Codification and X-ray Identification of Ingested Drugs." Ingestive Radiology, May-Jun. 1966.
- Shah, Tilak M., "Radiopaque Polymer Formulations for Medical Devices." Medical Device and Diagnostic Industry, Mar. 200.
- Urquiola, Javier, et al., "Using Lead Foil as a Radiopaque Marker for Computerized Tomography Imaging When Implant Treatment Planning." The Journal of Prosthetic Dentistry, 1997.
- Oct. 2, 2009 Non-Final Office Action in U.S. Appl. No. 11/368,954, filed Mar. 6, 2006.
- Oct. 5, 2009 Non-Final Office Action in U.S. Appl. No. 12/023,280, filed Jan. 31, 2008.
- Jun. 30, 2009 Non-Final Office Action in U.S. Appl. No. 12/419,957, filed Apr. 7, 2009.
- Jul. 14, 2009 Non-Final office action in U.S. Appl. No. 12/420,007, filed Apr. 7, 2009.
- Sep. 21, 2009 Final Office Action in U.S. Appl. No. 11/380,124, filed Apr. 25, 2006.

U.S. Patent

May 24, 2011

Sheet 1 of 46

US 7,947,022 B2

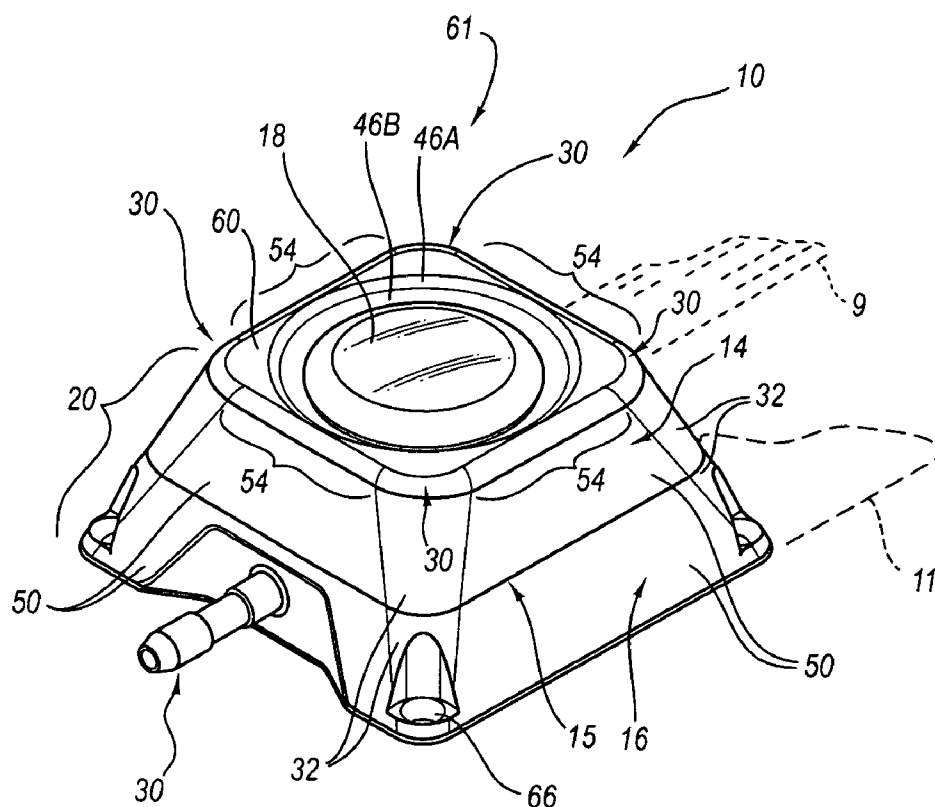


FIG. 1A

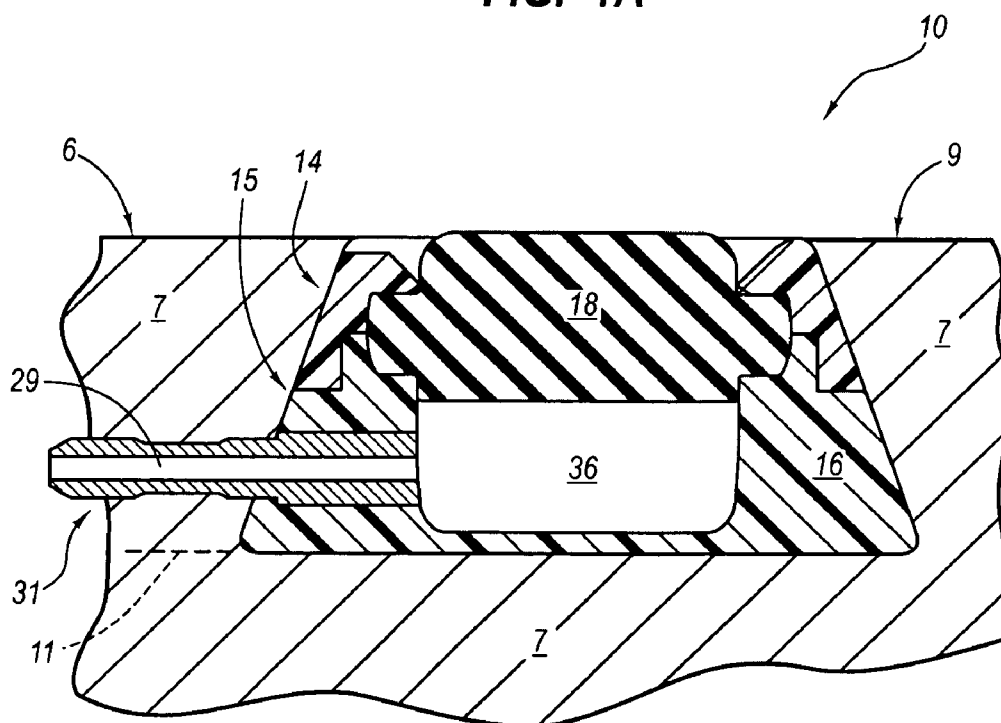


FIG. 1B

U.S. Patent

May 24, 2011

Sheet 2 of 46

US 7,947,022 B2

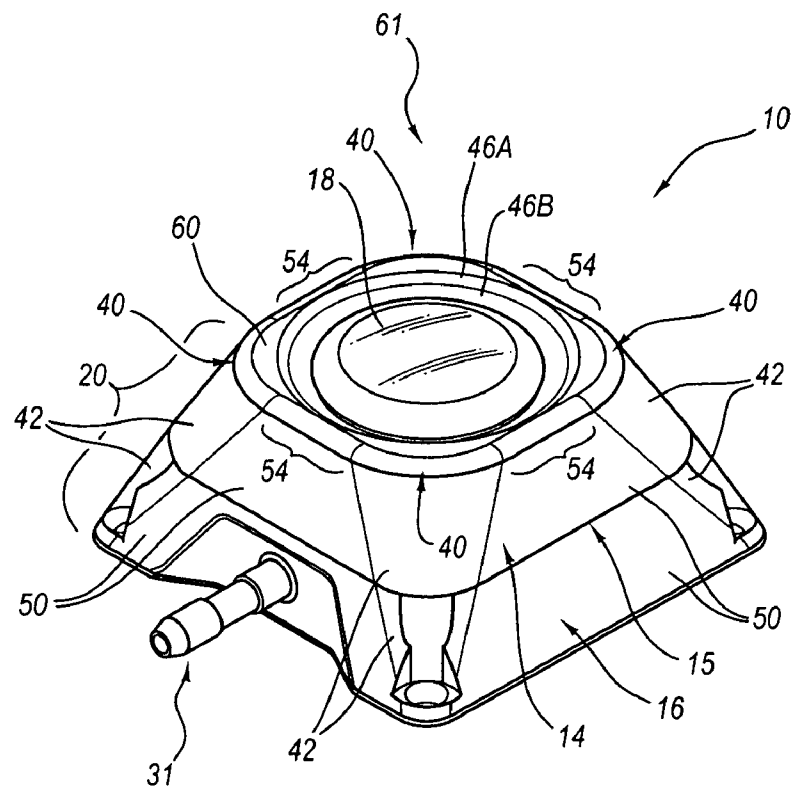


FIG. 2

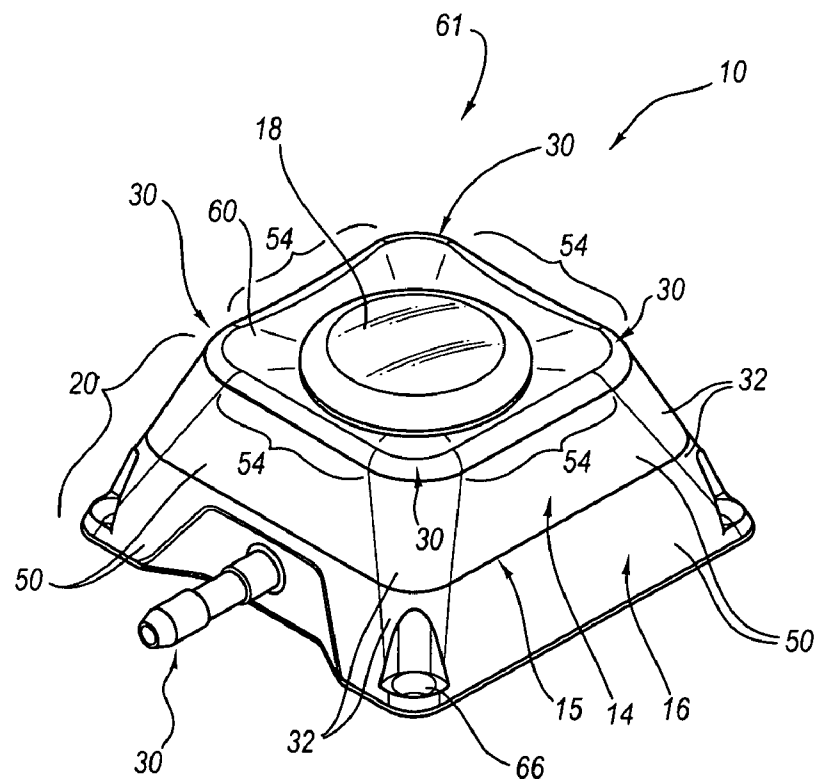


FIG. 3

U.S. Patent

May 24, 2011

Sheet 3 of 46

US 7,947,022 B2

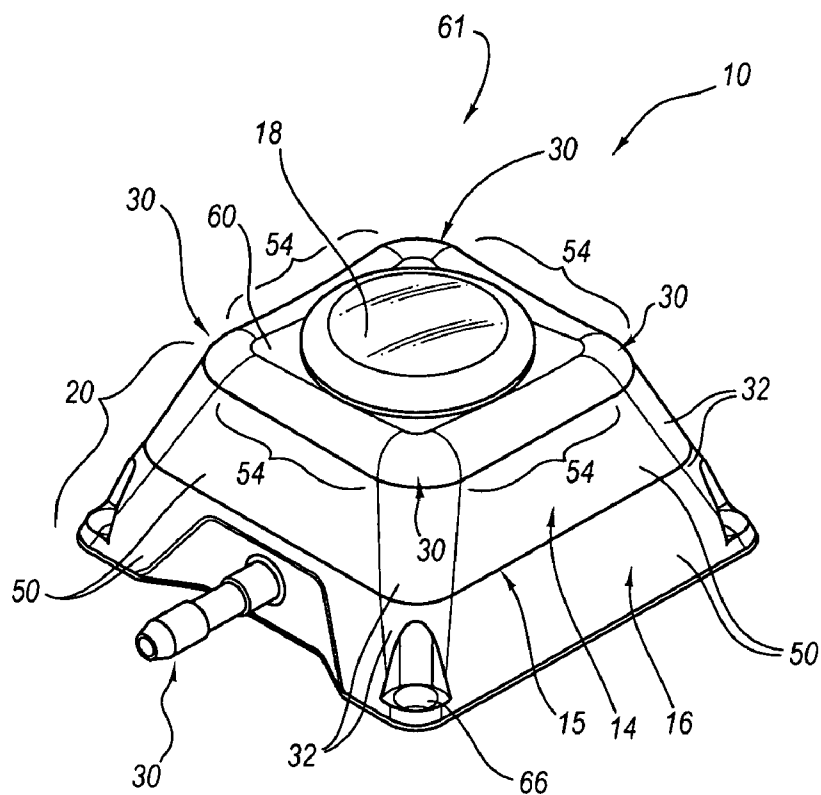


FIG. 4

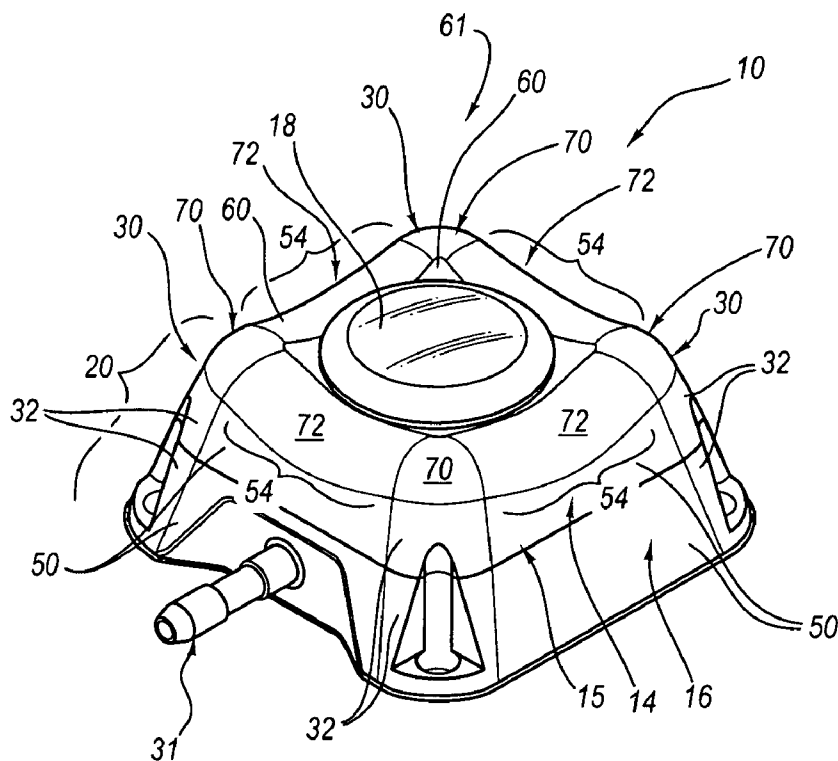


FIG. 5

U.S. Patent

May 24, 2011

Sheet 4 of 46

US 7,947,022 B2

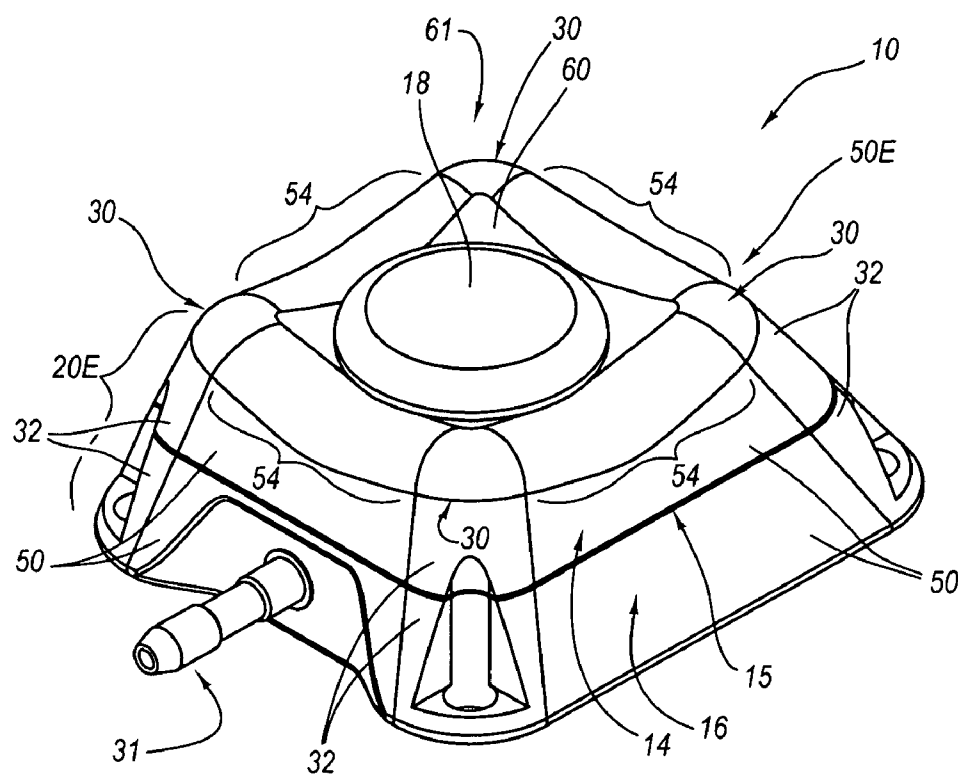


FIG. 6A

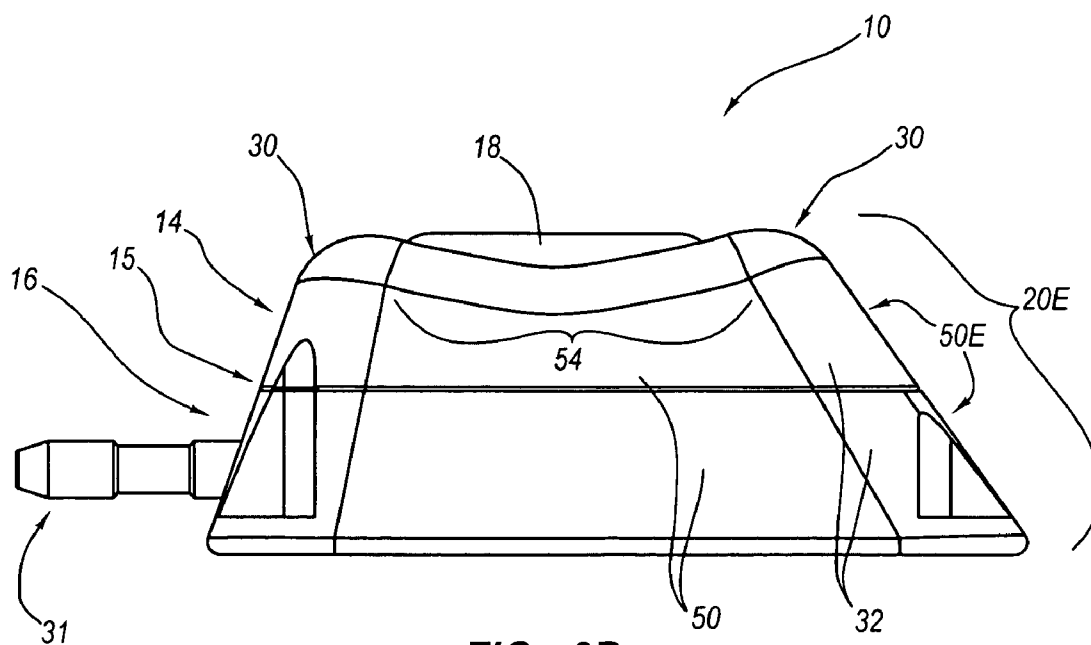


FIG. 6B

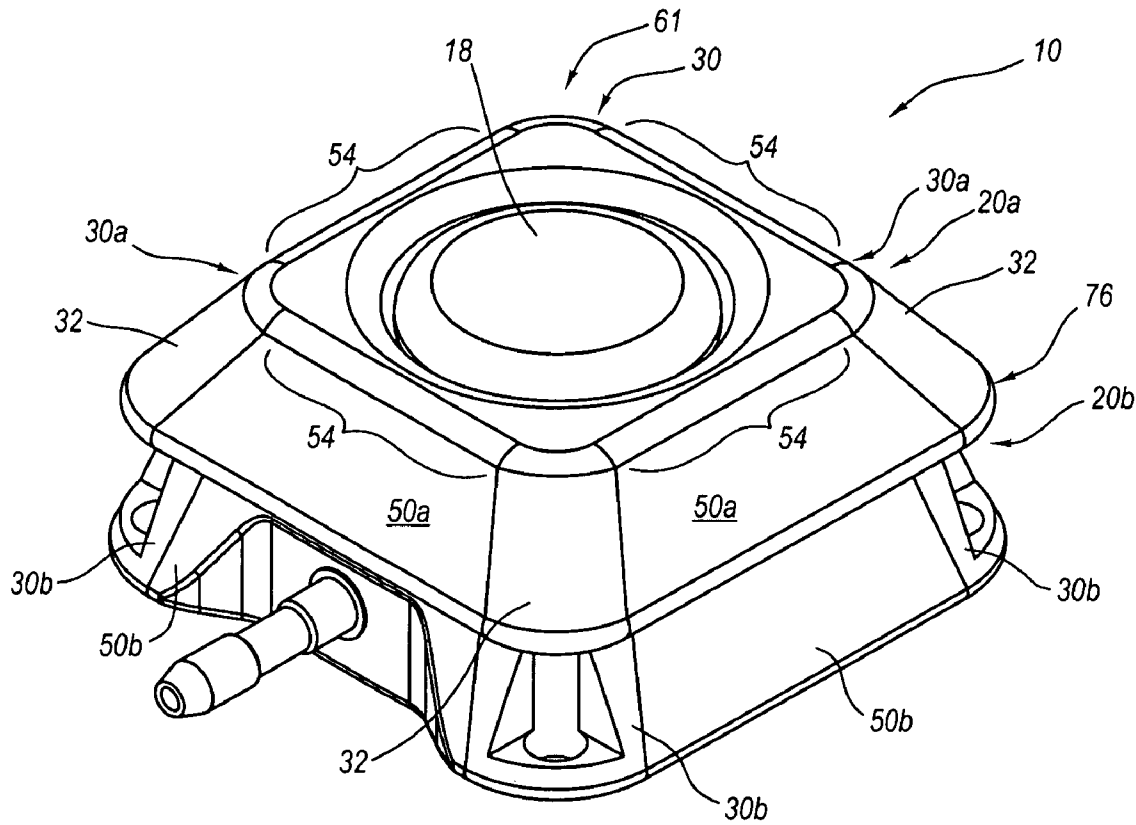


FIG. 7

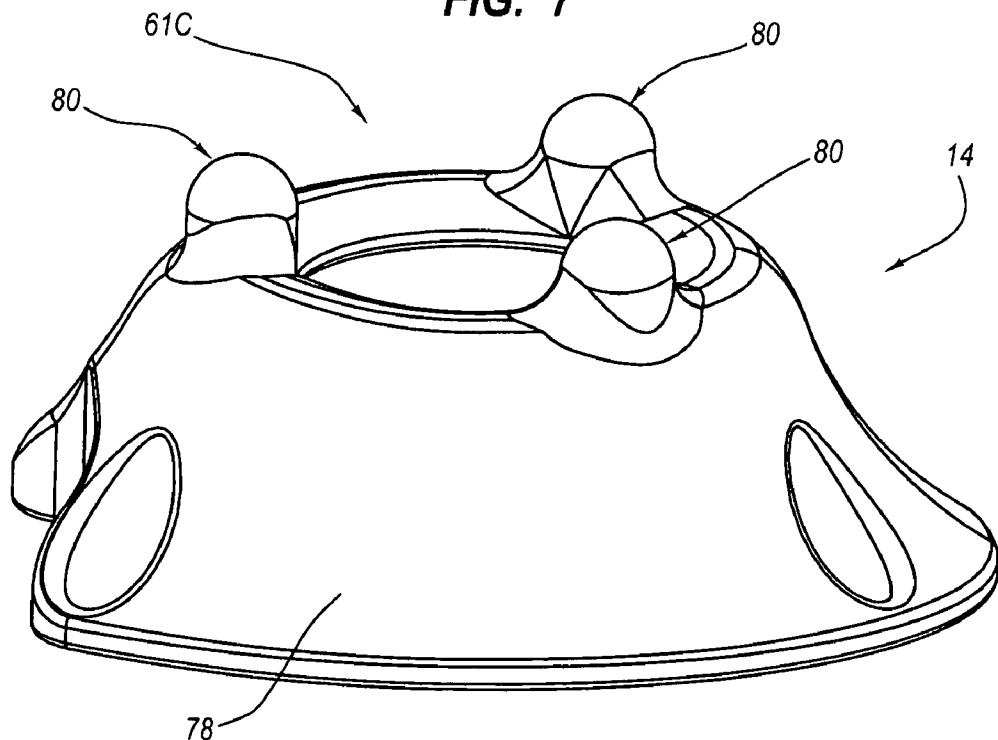


FIG. 8

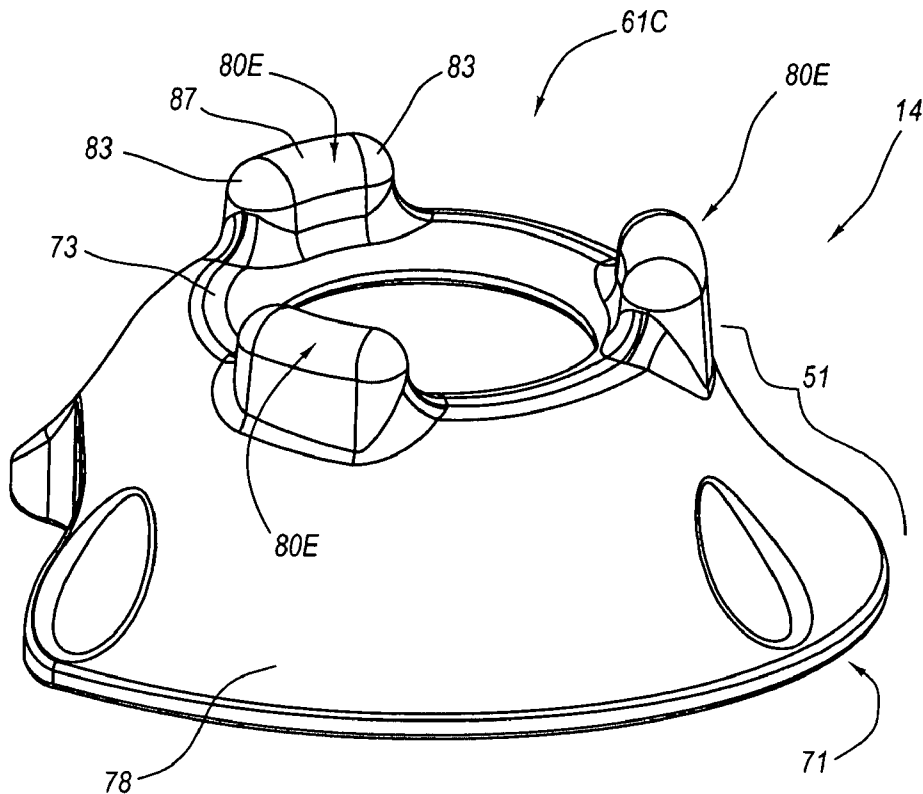


FIG. 9

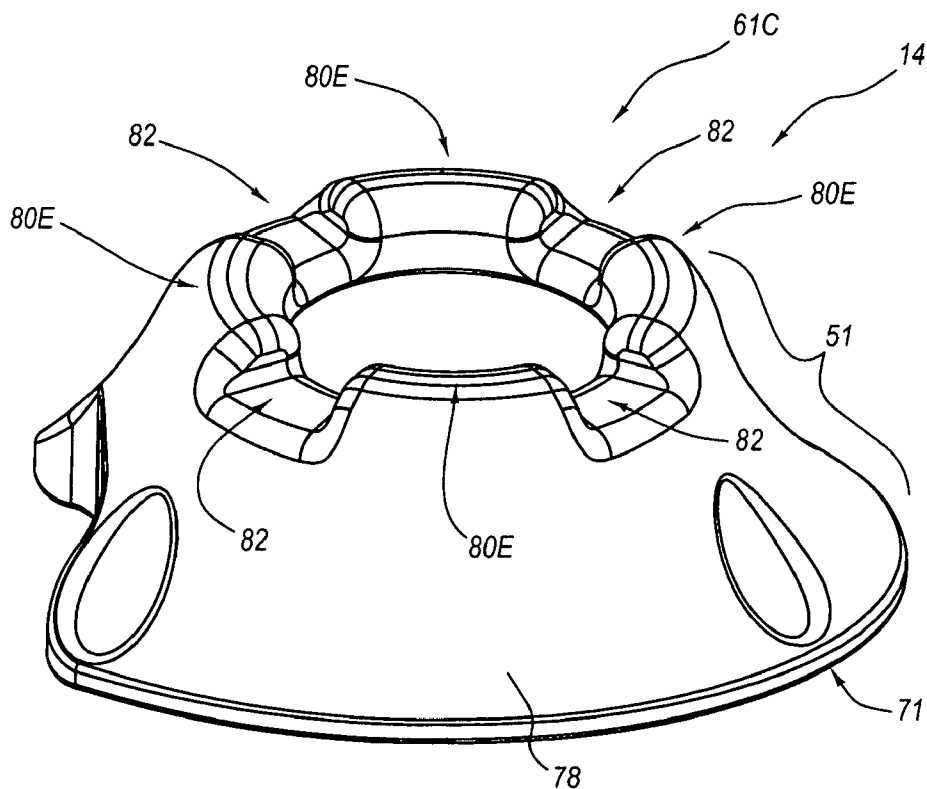


FIG. 10

U.S. Patent

May 24, 2011

Sheet 7 of 46

US 7,947,022 B2

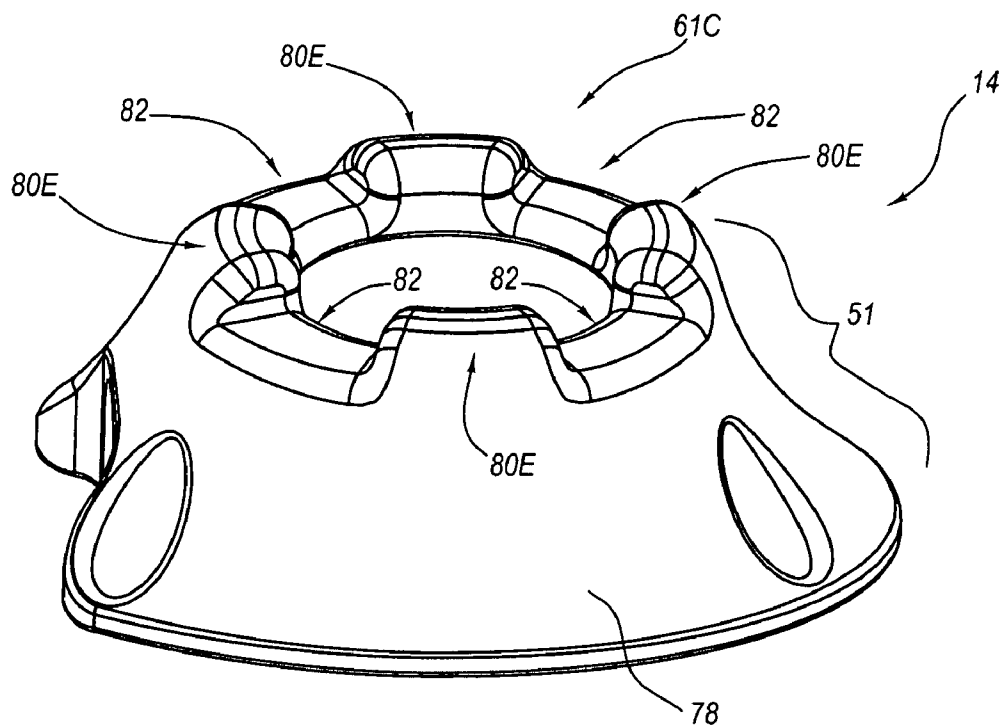


FIG. 11

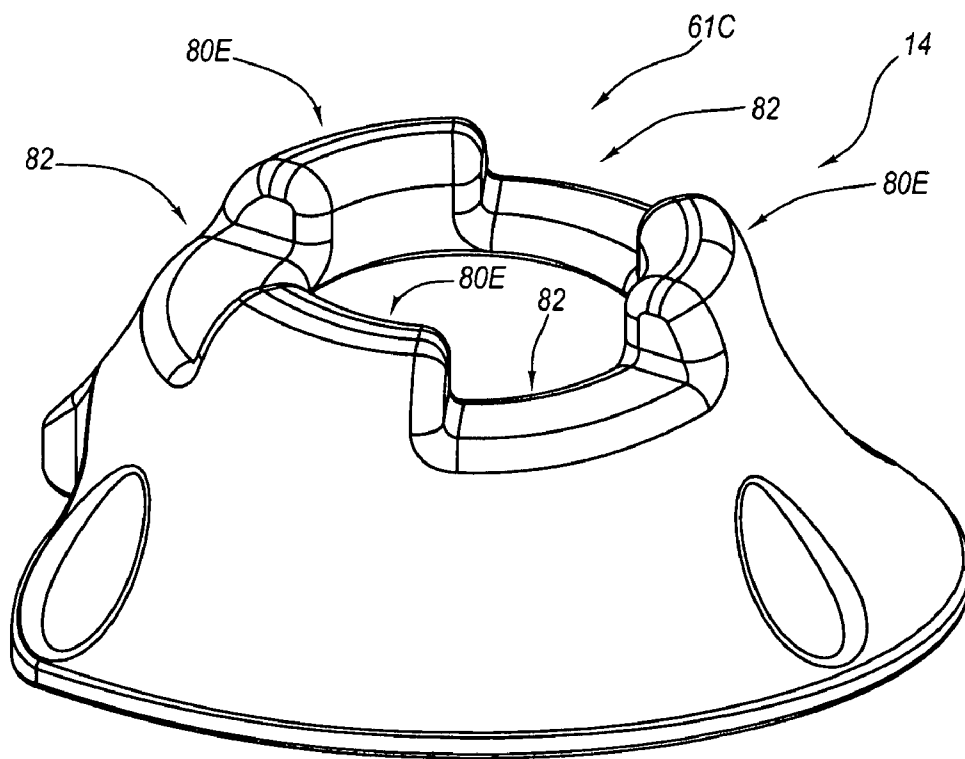


FIG. 12

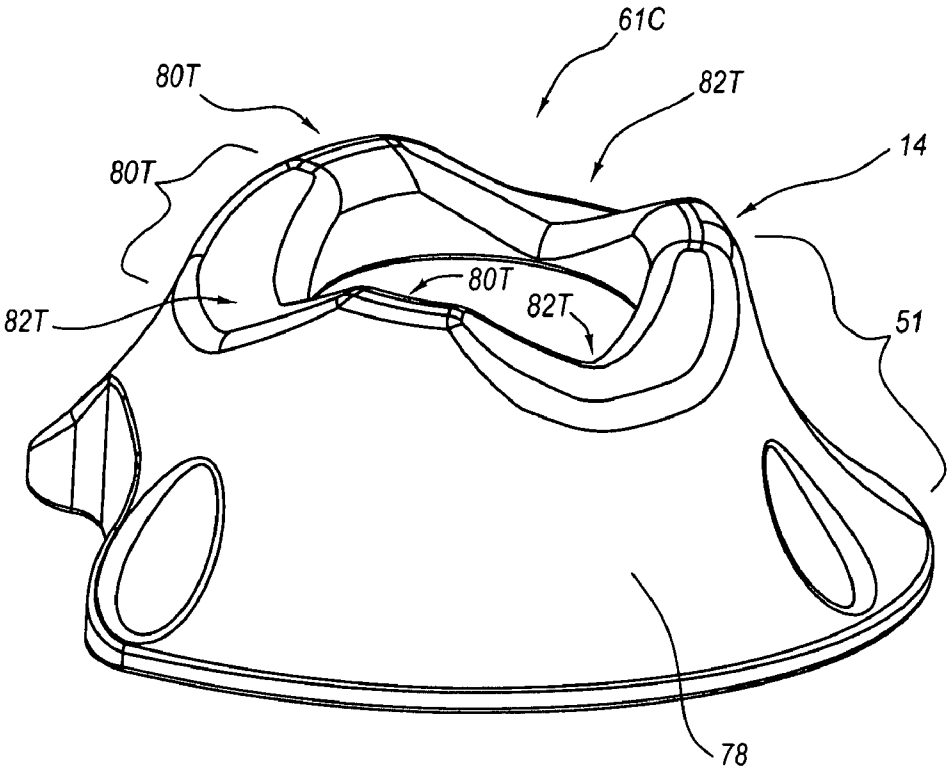


FIG. 13

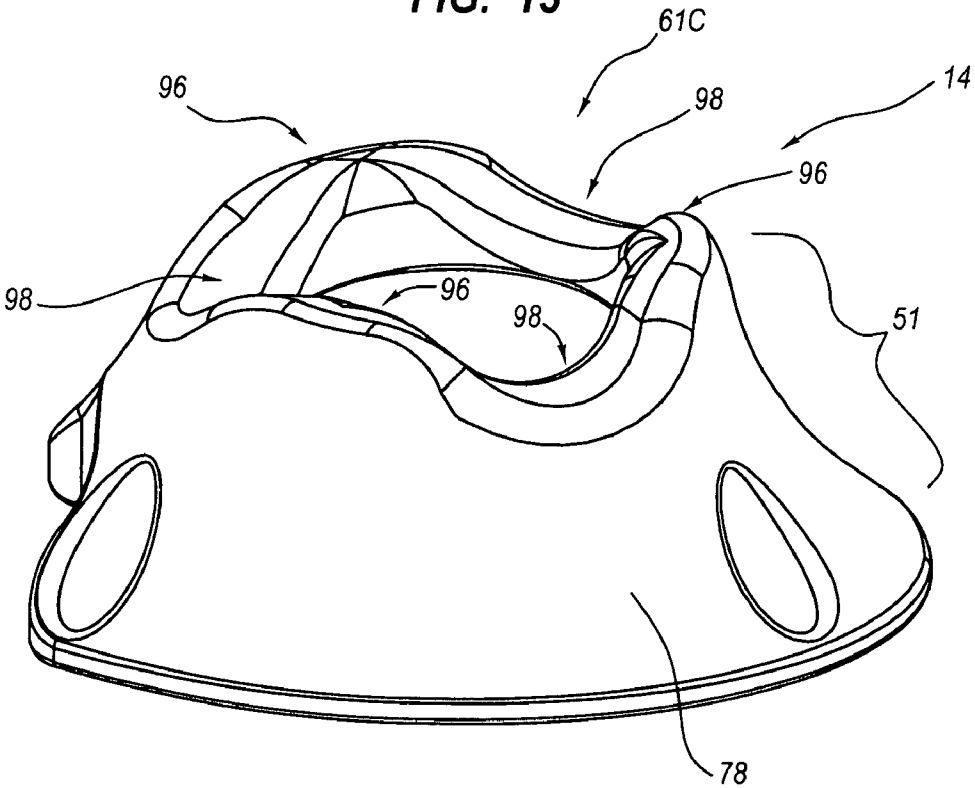


FIG. 14

U.S. Patent

May 24, 2011

Sheet 9 of 46

US 7,947,022 B2

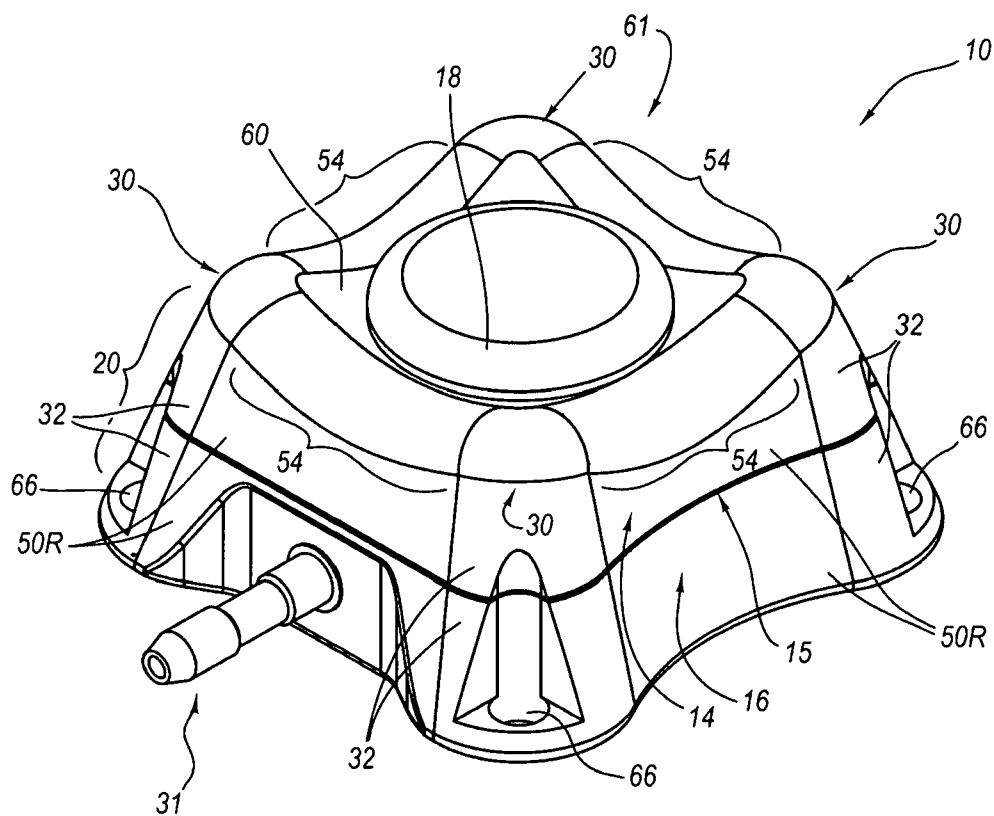


FIG. 15A

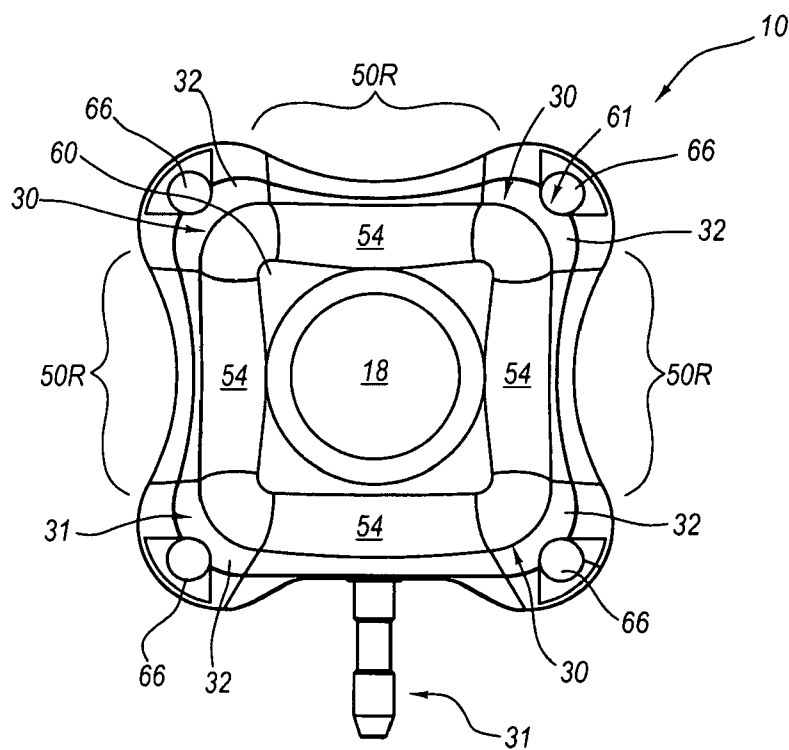


FIG. 15B

U.S. Patent

May 24, 2011

Sheet 10 of 46

US 7,947,022 B2

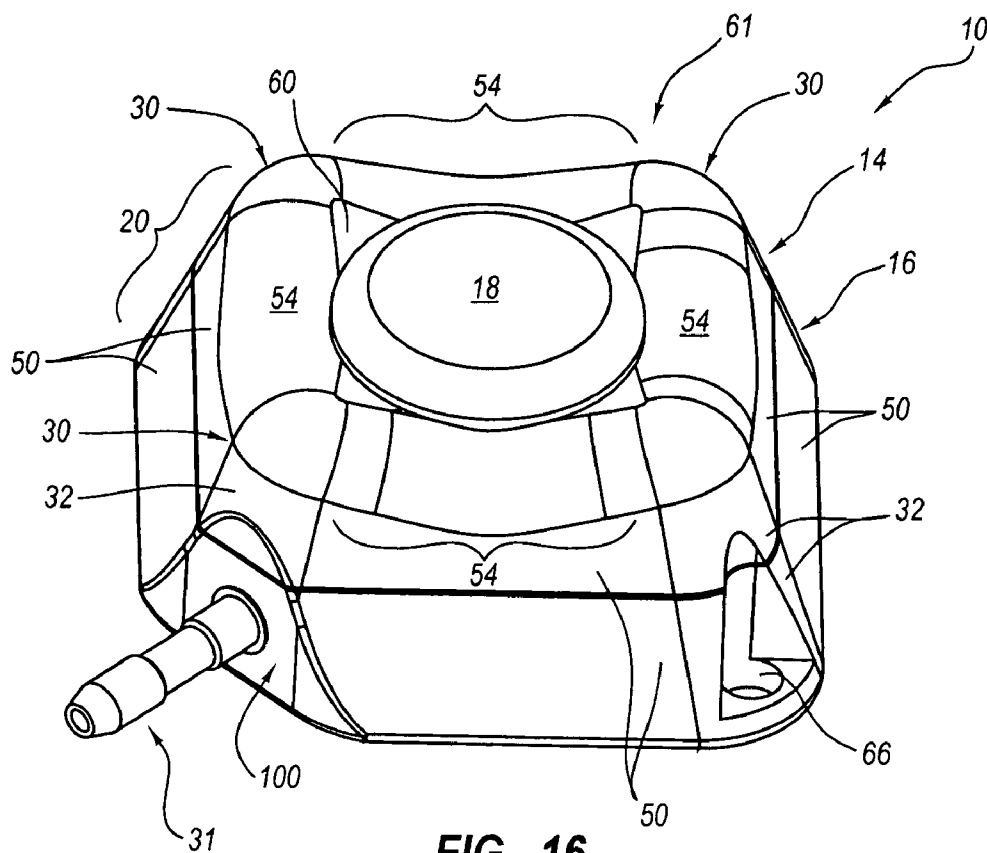


FIG. 16

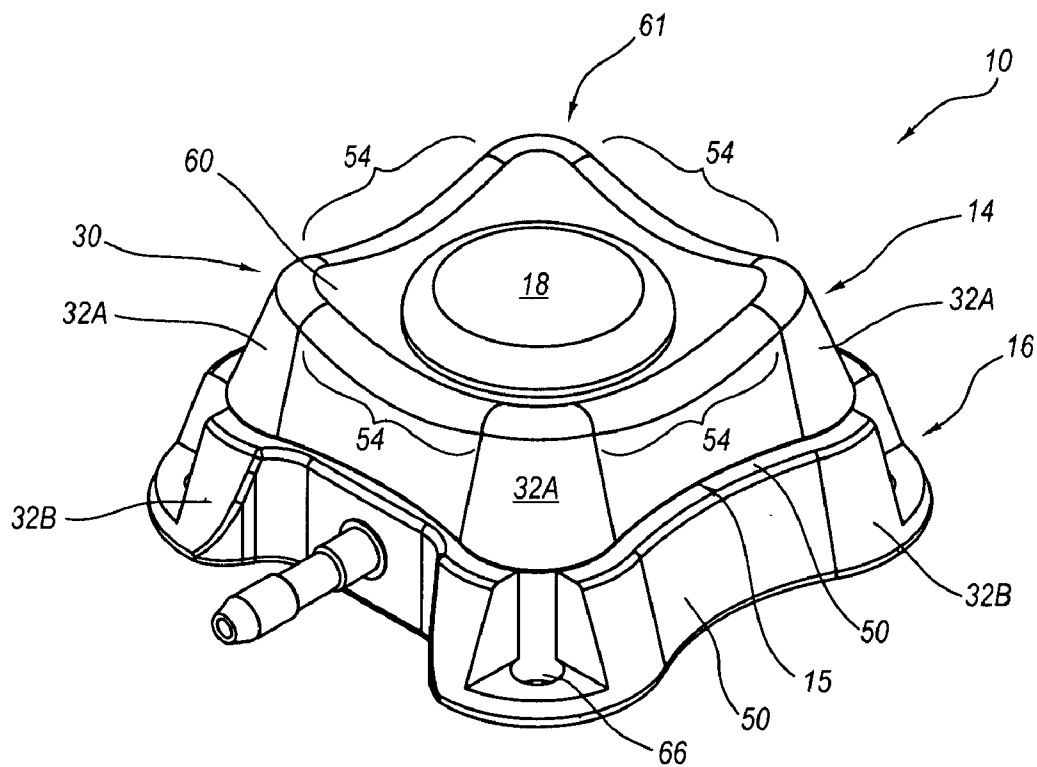


FIG. 17

U.S. Patent

May 24, 2011

Sheet 11 of 46

US 7,947,022 B2

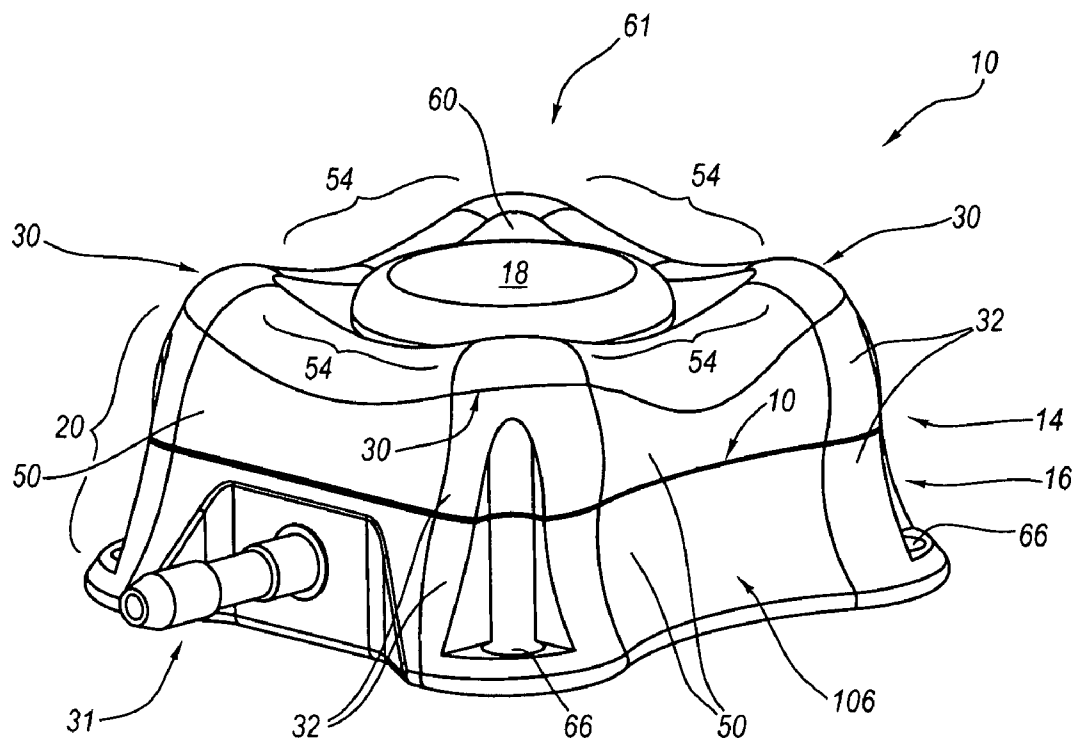


FIG. 18

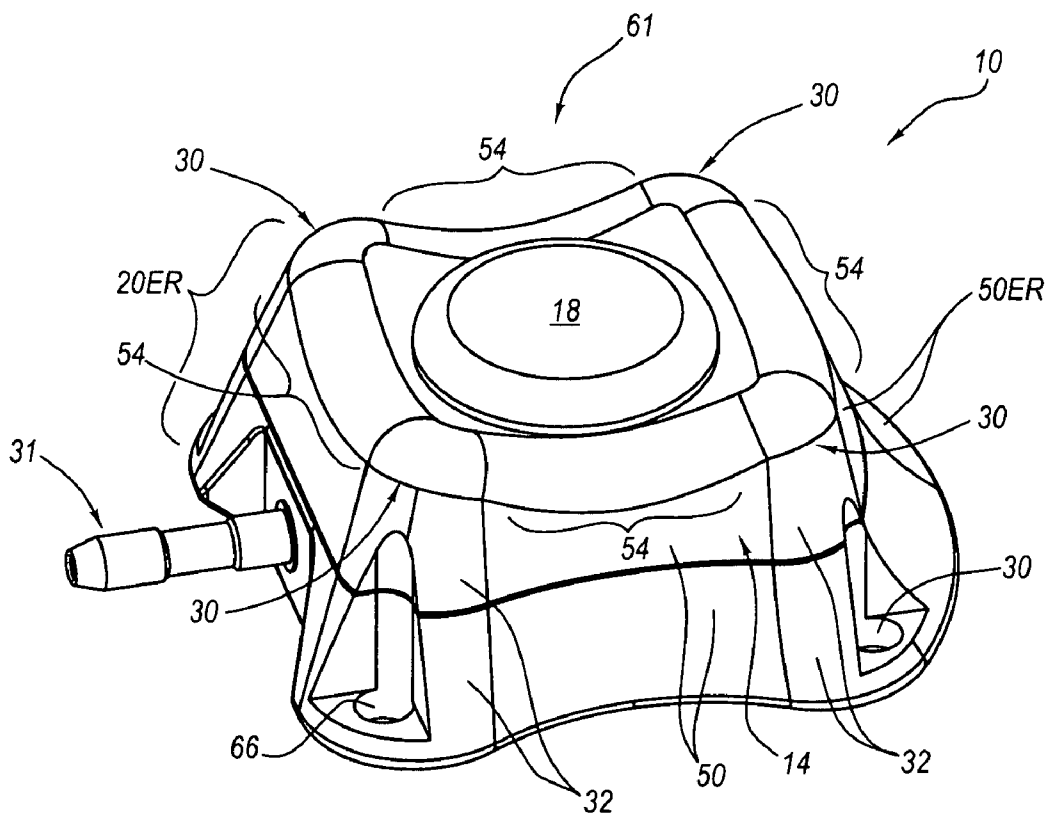


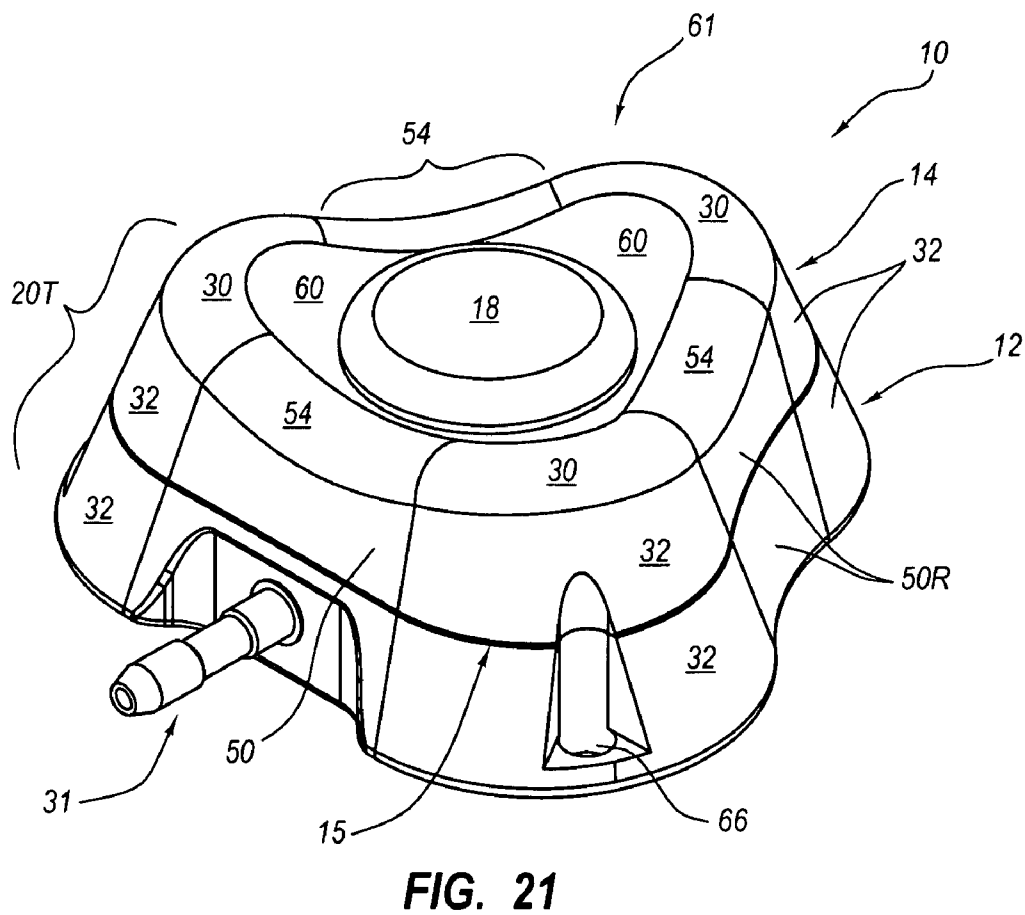
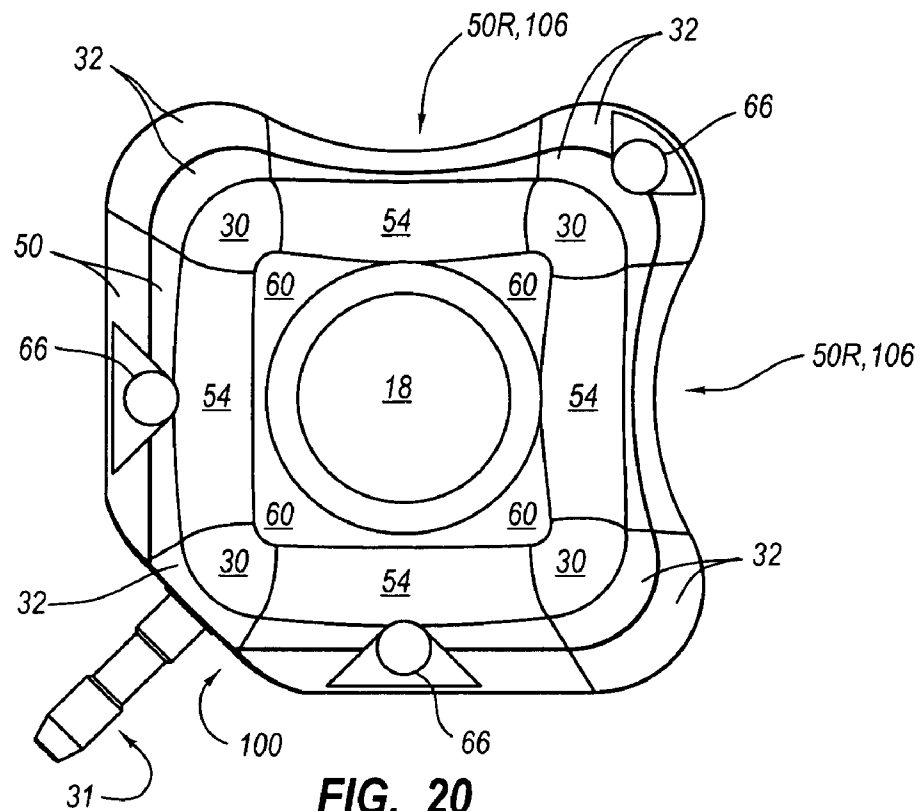
FIG. 19

U.S. Patent

May 24, 2011

Sheet 12 of 46

US 7,947,022 B2



U.S. Patent

May 24, 2011

Sheet 13 of 46

US 7,947,022 B2

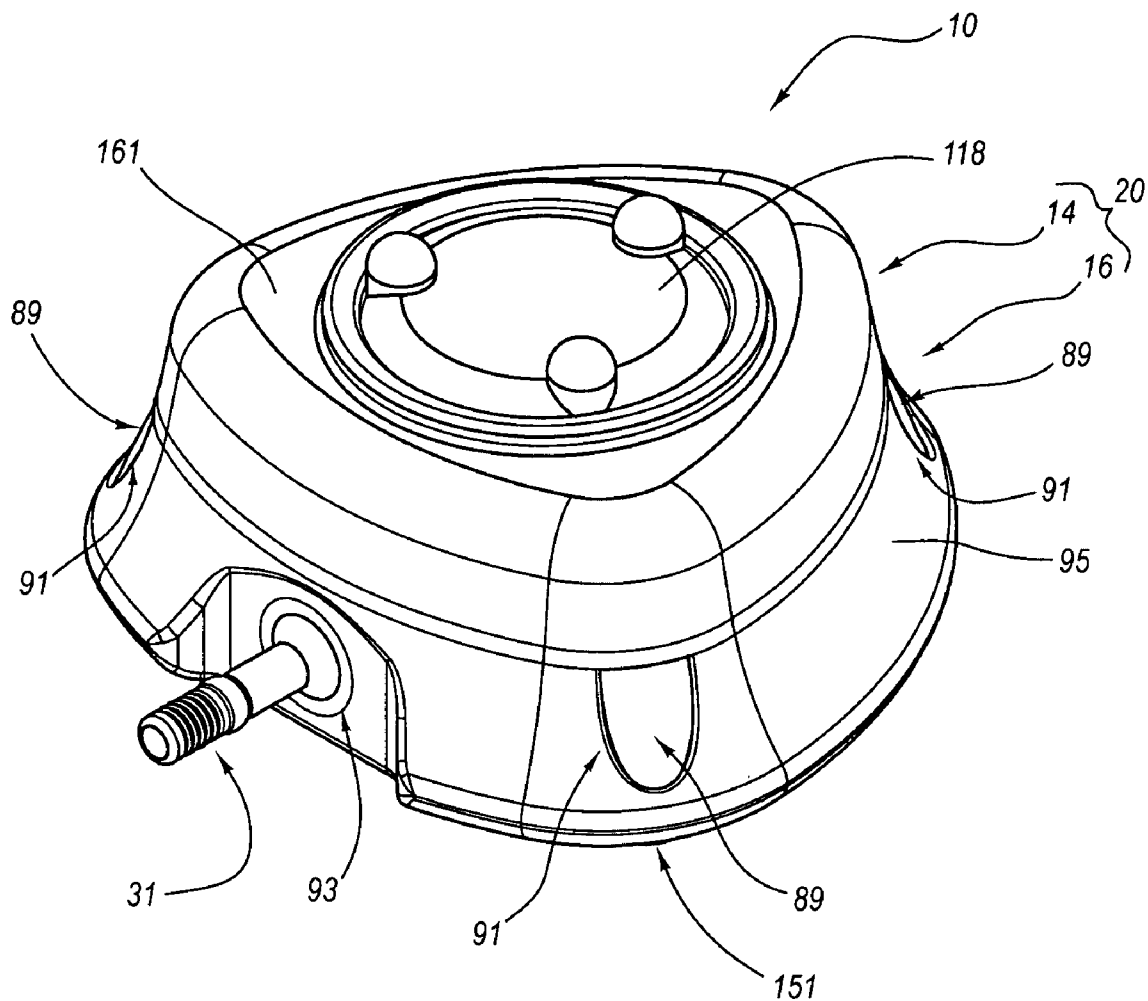


FIG. 22

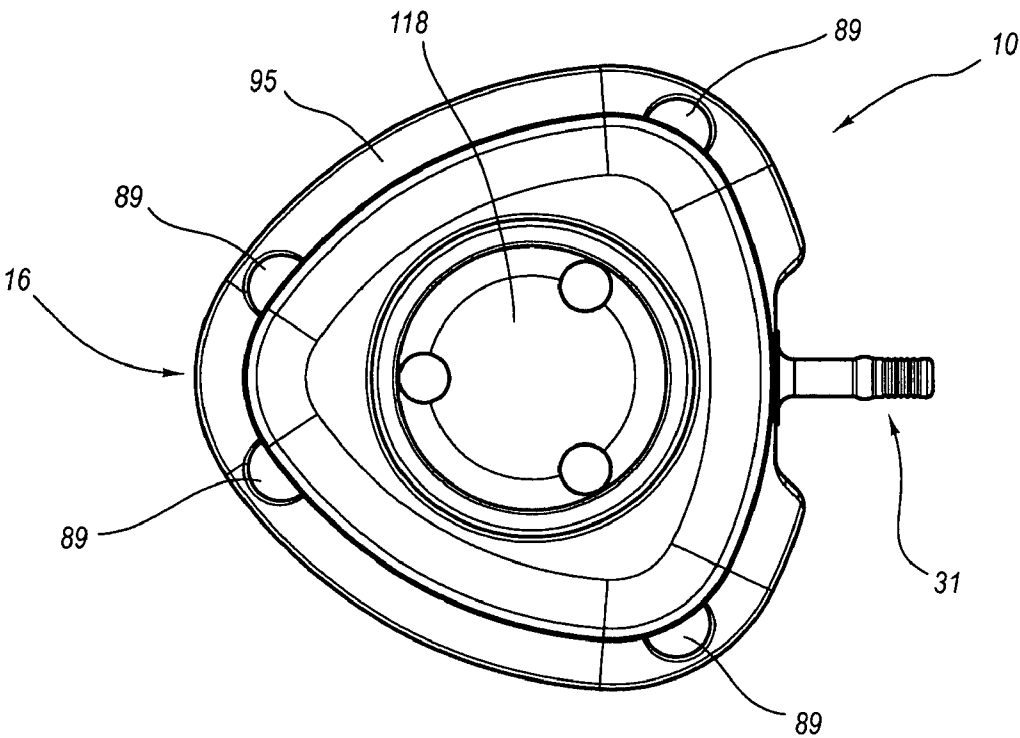


FIG. 23

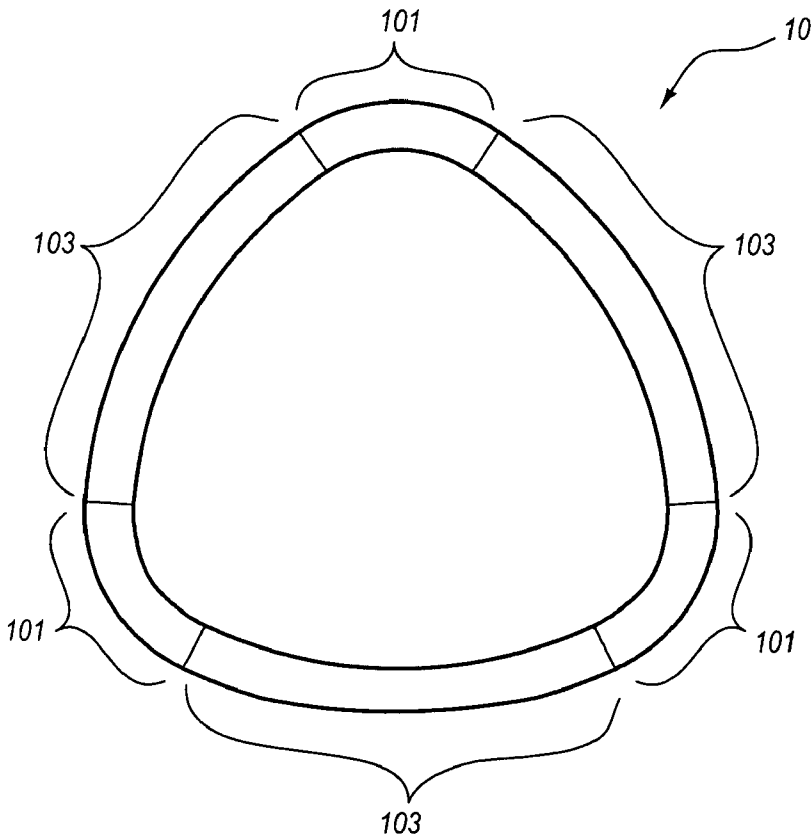


FIG. 24

U.S. Patent

May 24, 2011

Sheet 15 of 46

US 7,947,022 B2

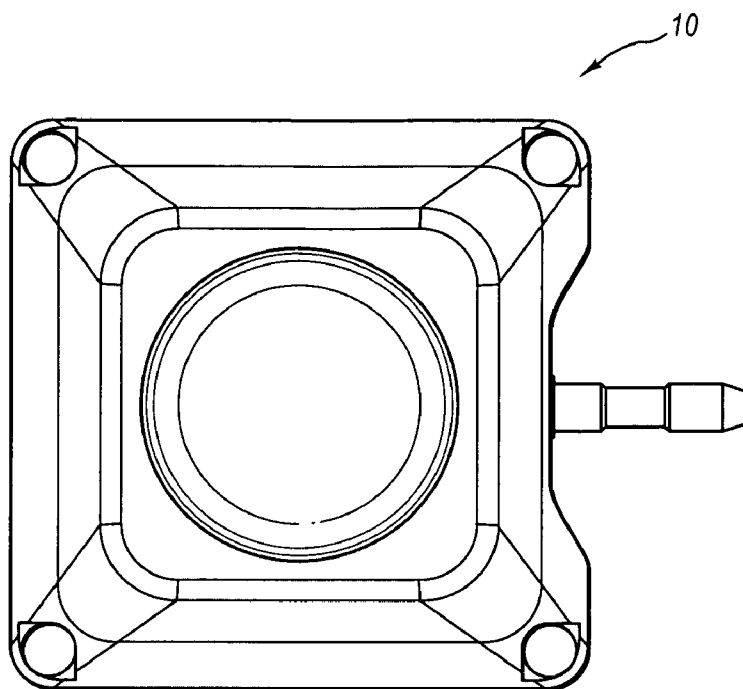


FIG. 25

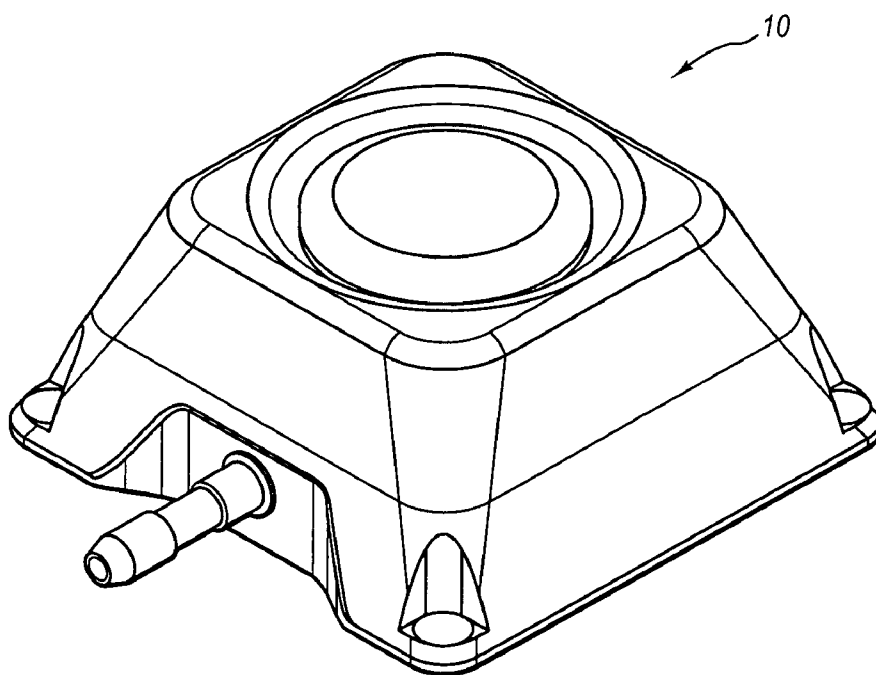


FIG. 26

U.S. Patent

May 24, 2011

Sheet 16 of 46

US 7,947,022 B2

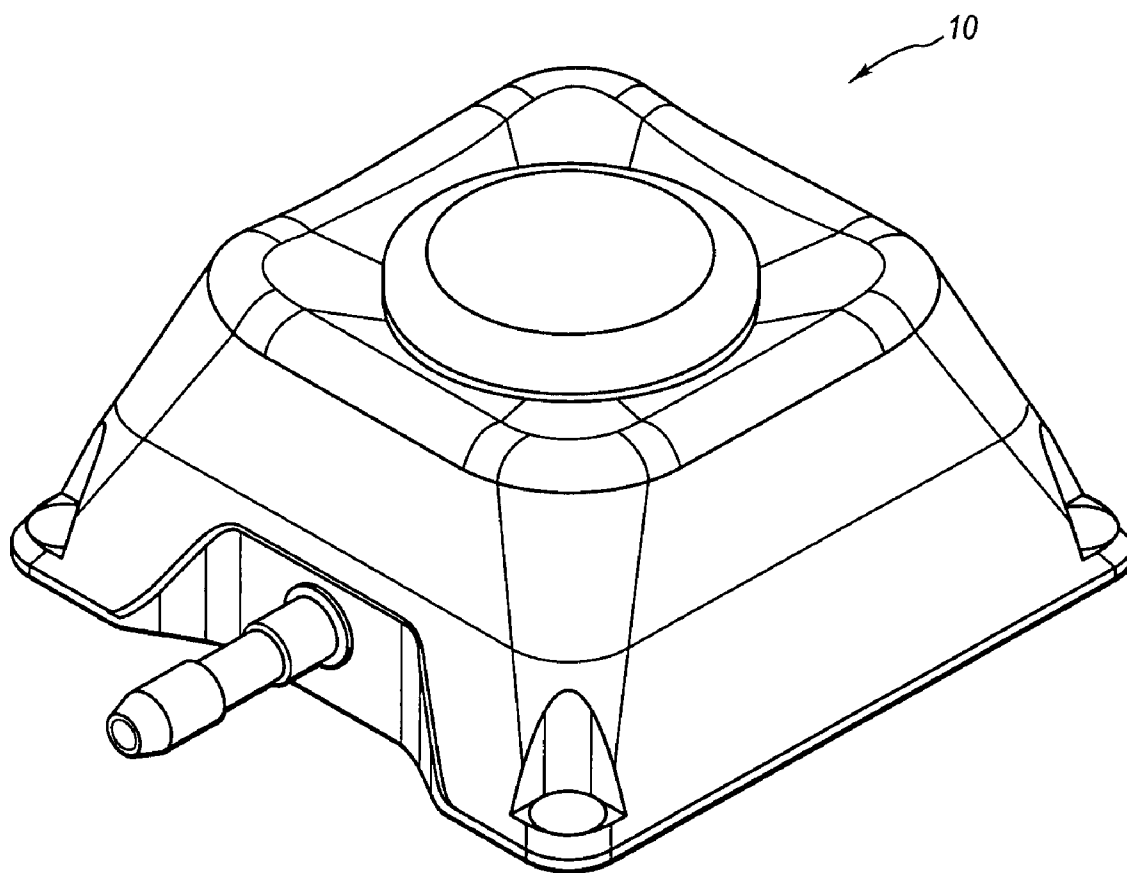


FIG. 27

U.S. Patent

May 24, 2011

Sheet 17 of 46

US 7,947,022 B2

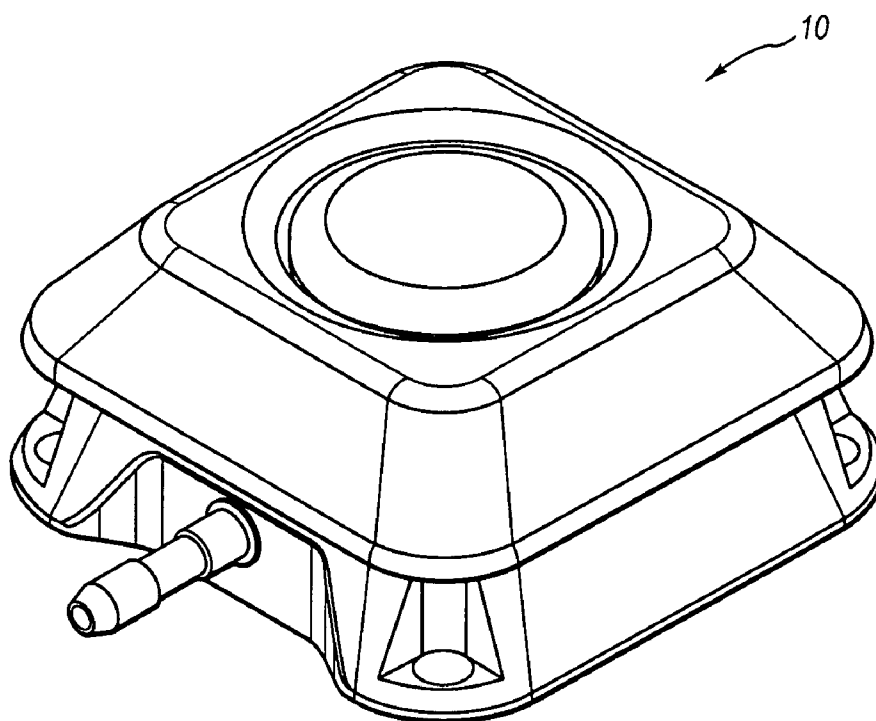


FIG. 28

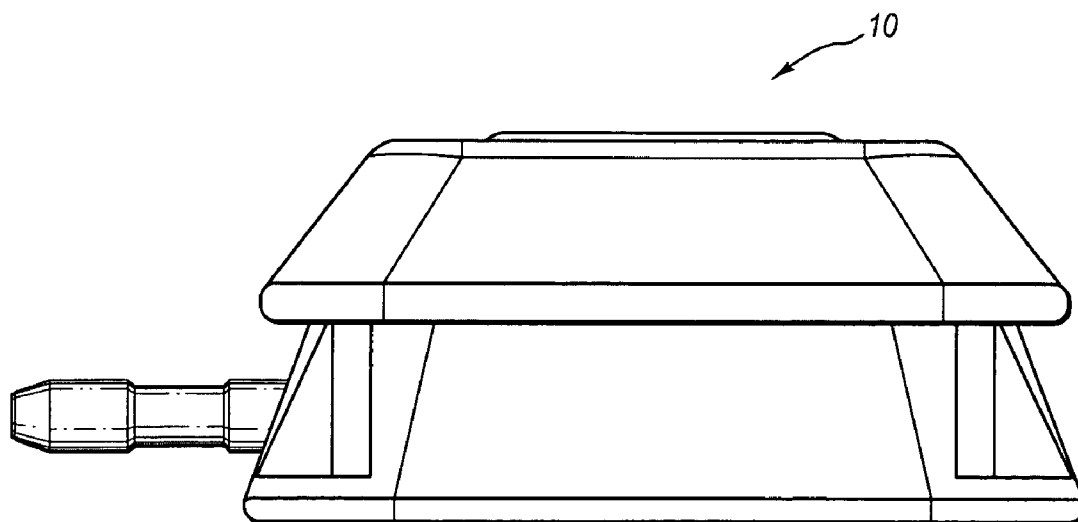


FIG. 29

U.S. Patent

May 24, 2011

Sheet 18 of 46

US 7,947,022 B2

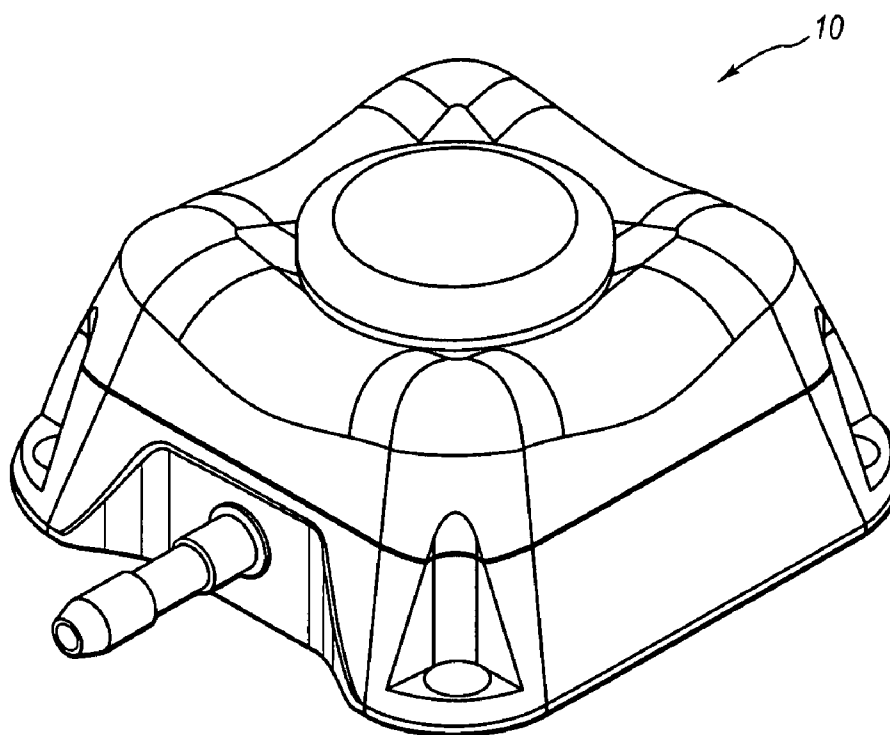


FIG. 30

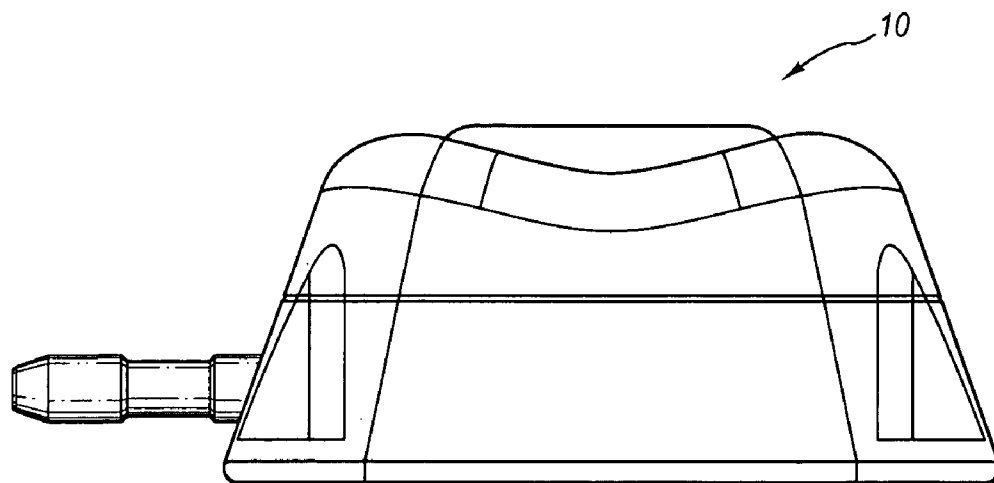


FIG. 31

U.S. Patent

May 24, 2011

Sheet 19 of 46

US 7,947,022 B2

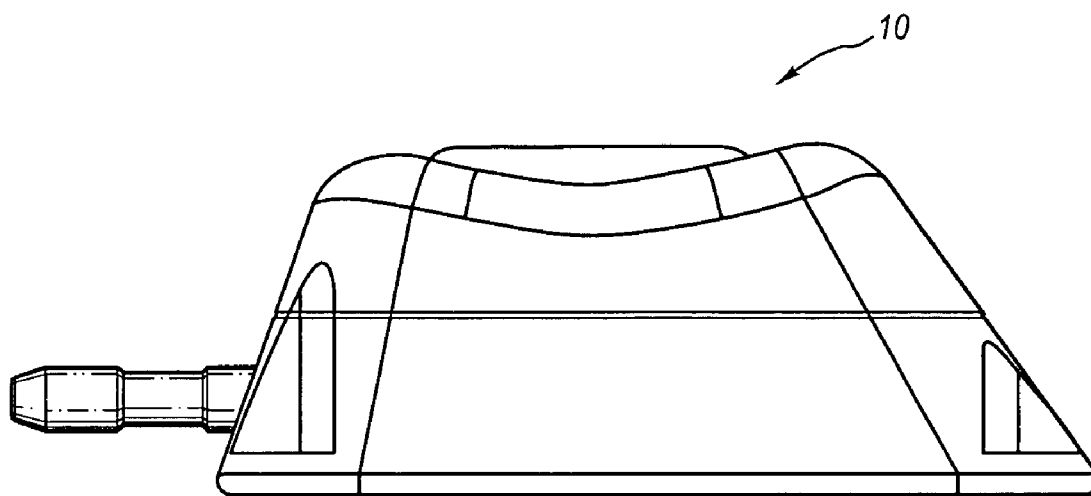


FIG. 32

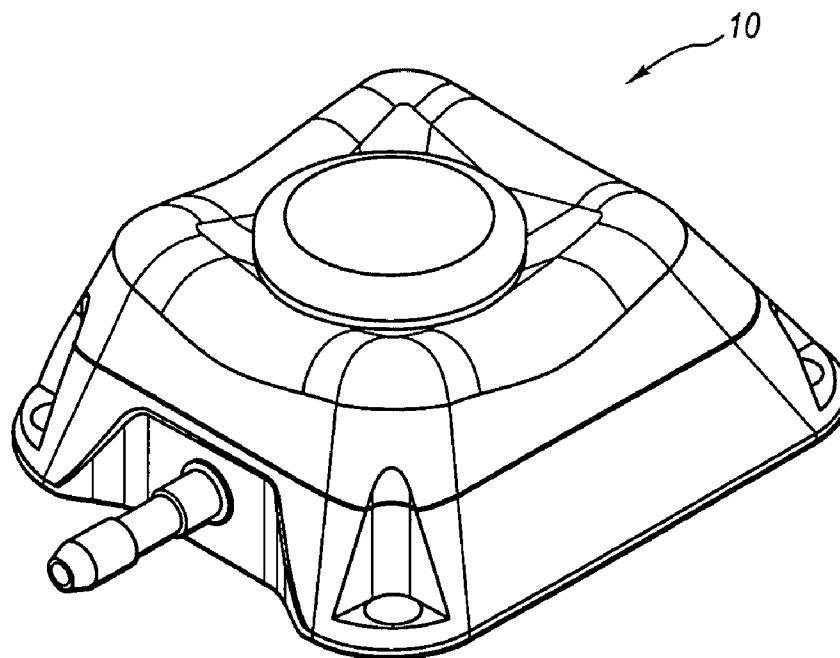


FIG. 33

U.S. Patent

May 24, 2011

Sheet 20 of 46

US 7,947,022 B2

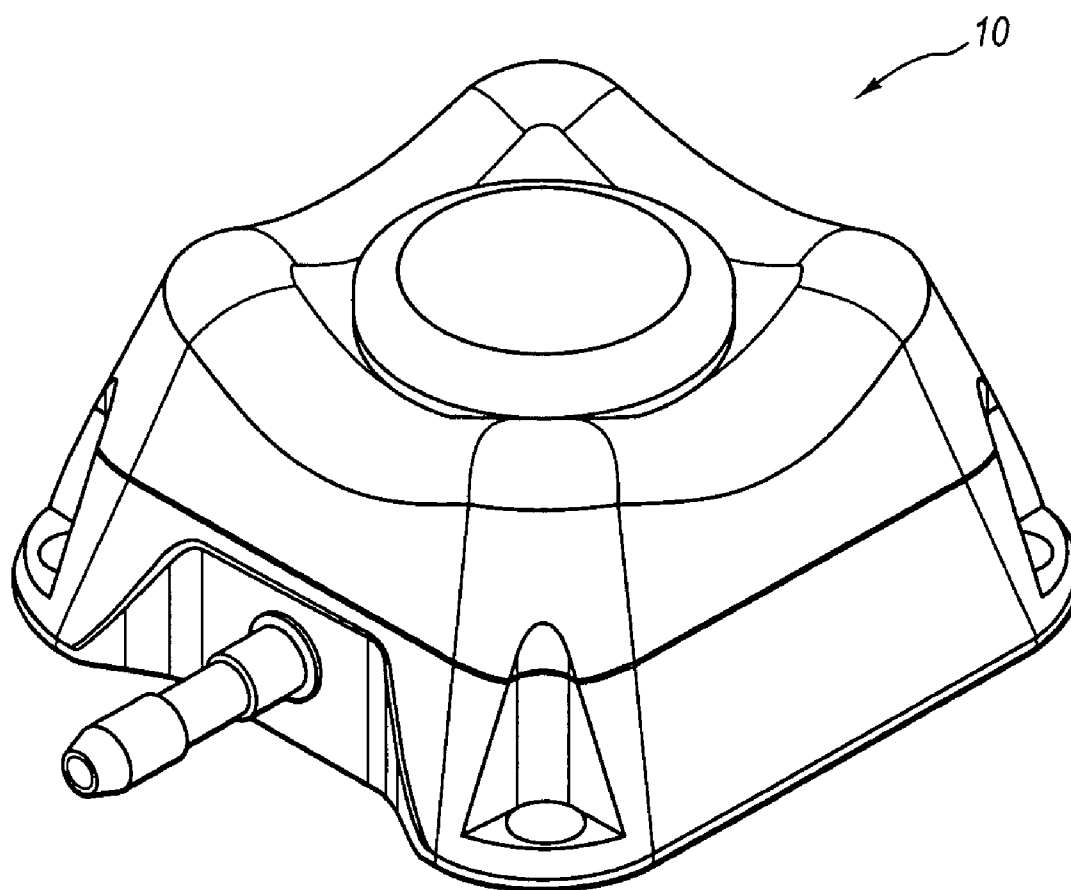


FIG. 34

U.S. Patent

May 24, 2011

Sheet 21 of 46

US 7,947,022 B2

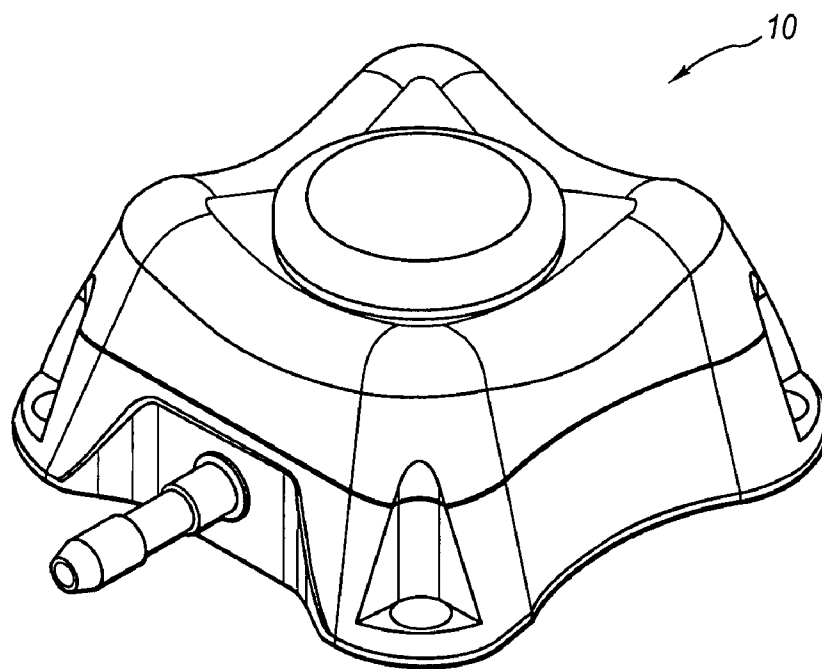


FIG. 35

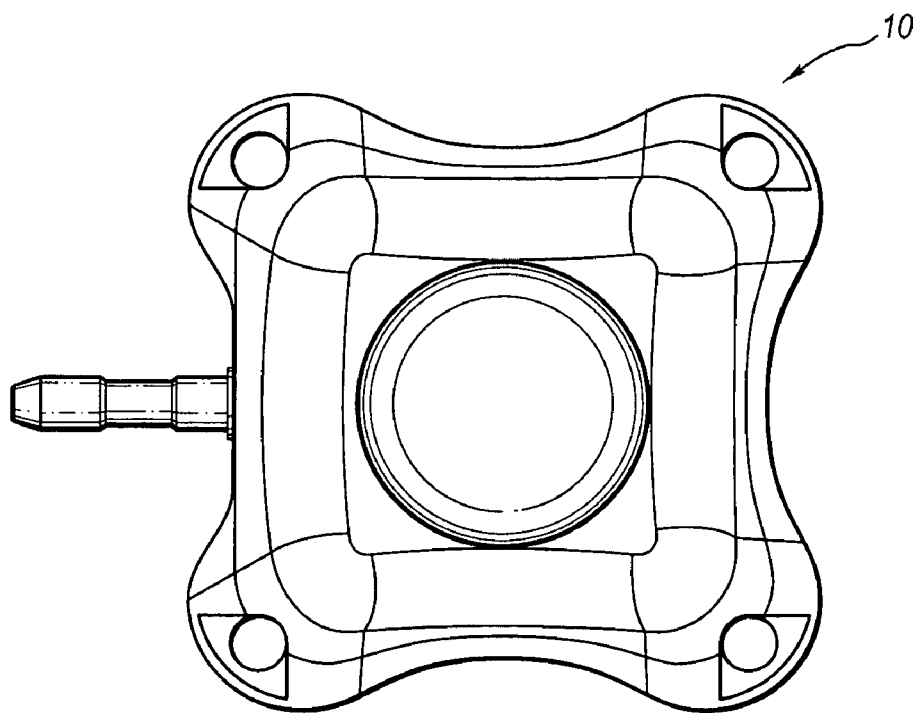


FIG. 36

U.S. Patent

May 24, 2011

Sheet 22 of 46

US 7,947,022 B2

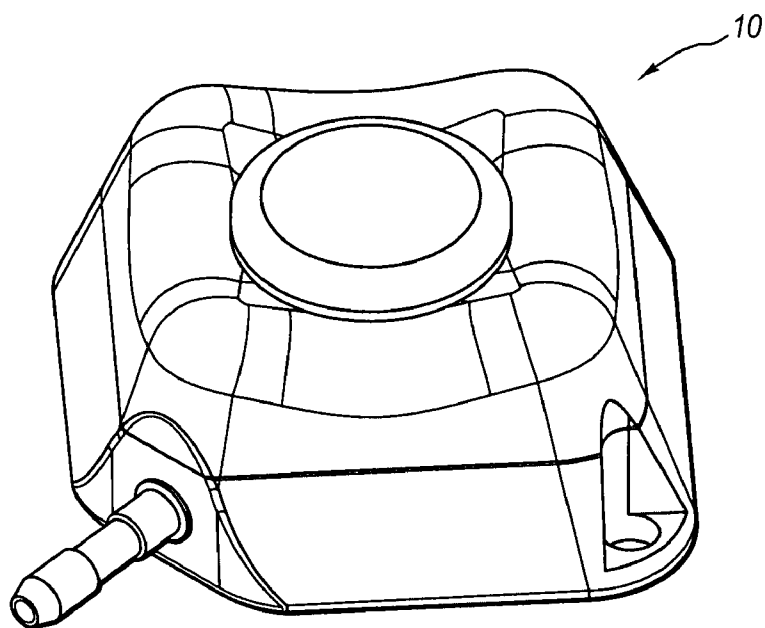


FIG. 37

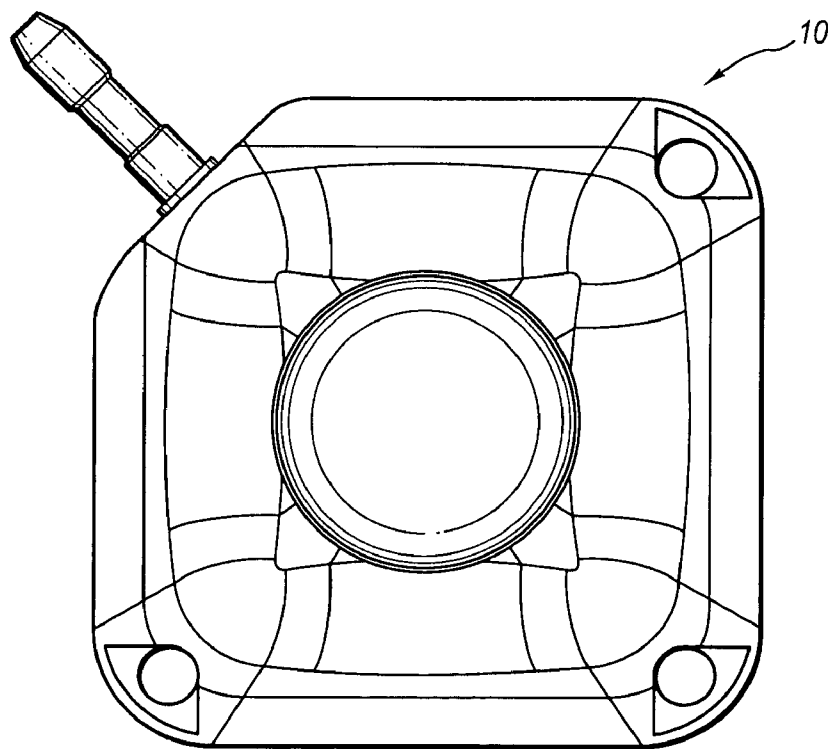


FIG. 38

U.S. Patent

May 24, 2011

Sheet 23 of 46

US 7,947,022 B2

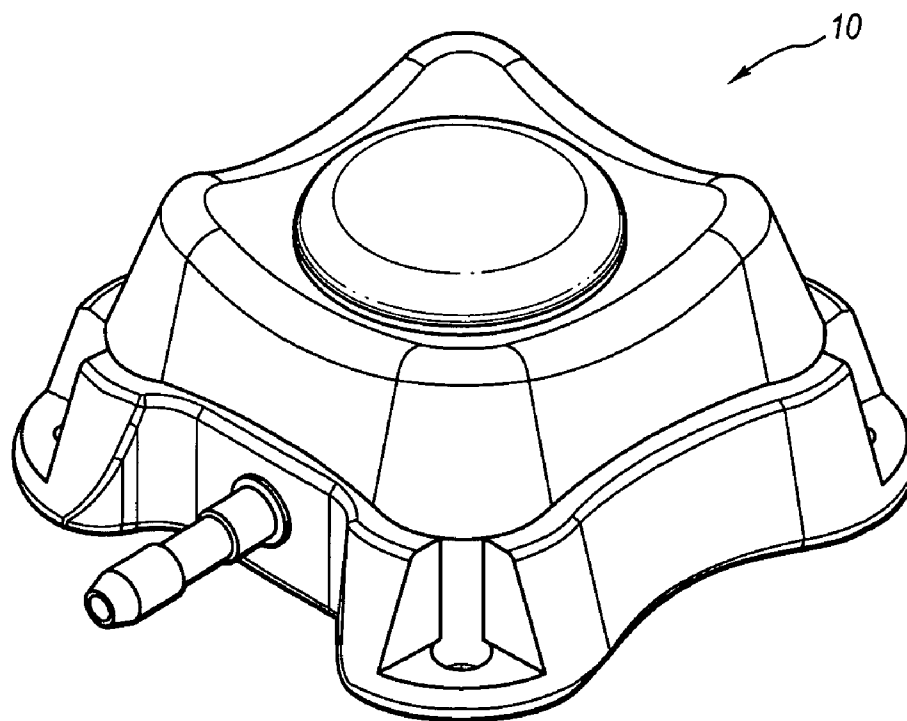


FIG. 39

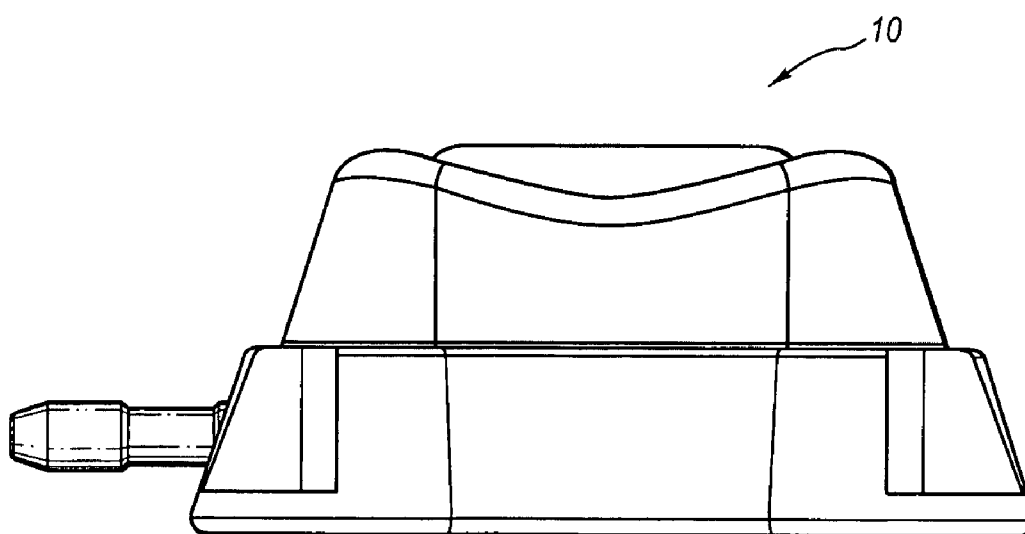


FIG. 40

U.S. Patent

May 24, 2011

Sheet 24 of 46

US 7,947,022 B2

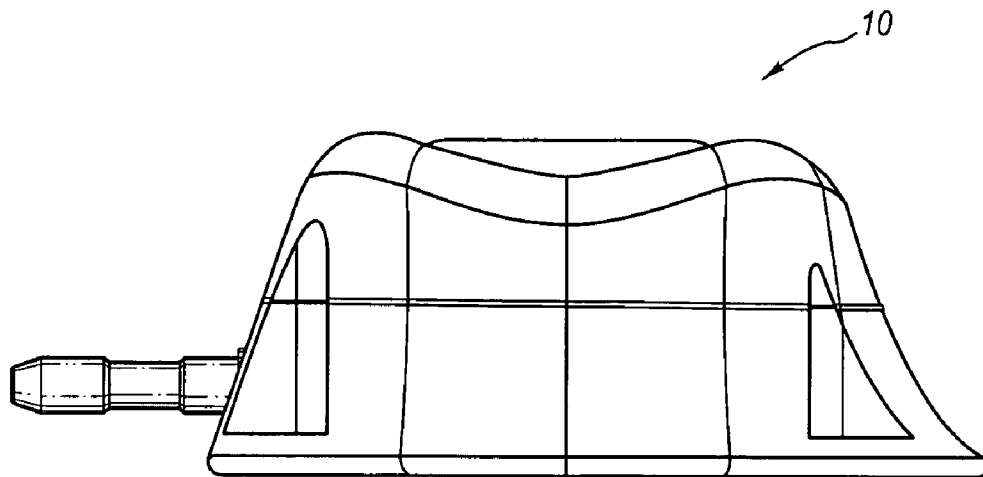


FIG. 41

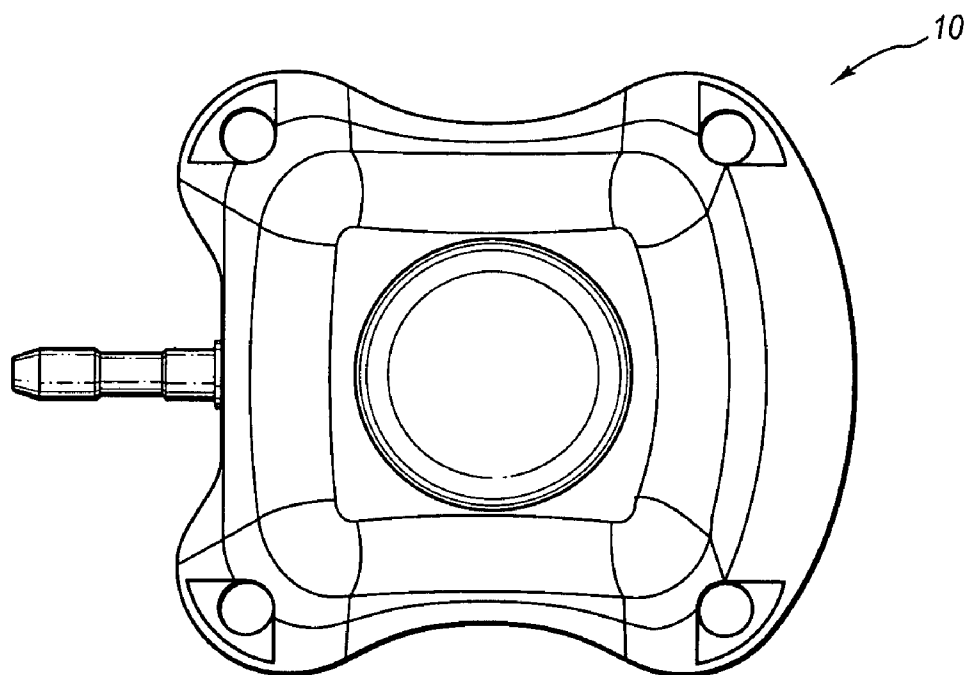


FIG. 42

U.S. Patent

May 24, 2011

Sheet 25 of 46

US 7,947,022 B2

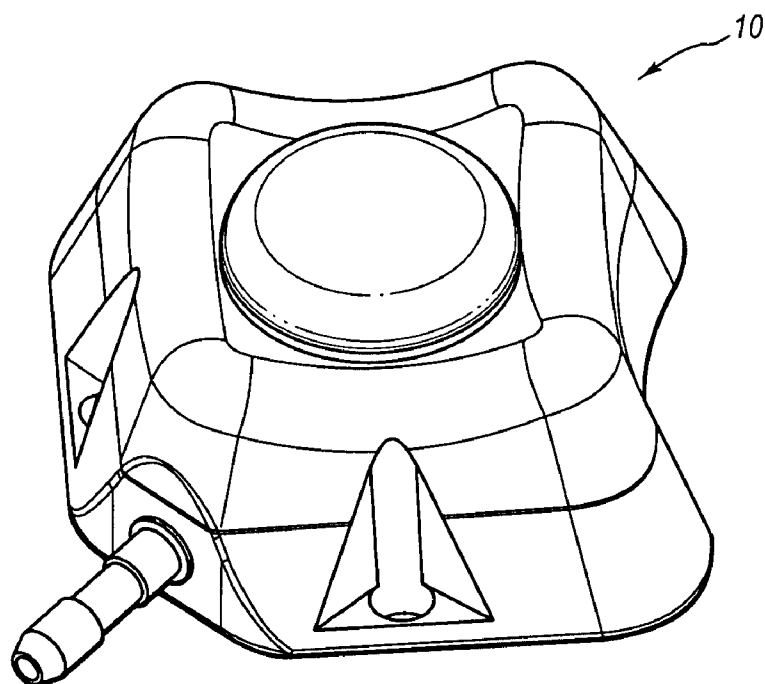


FIG. 43

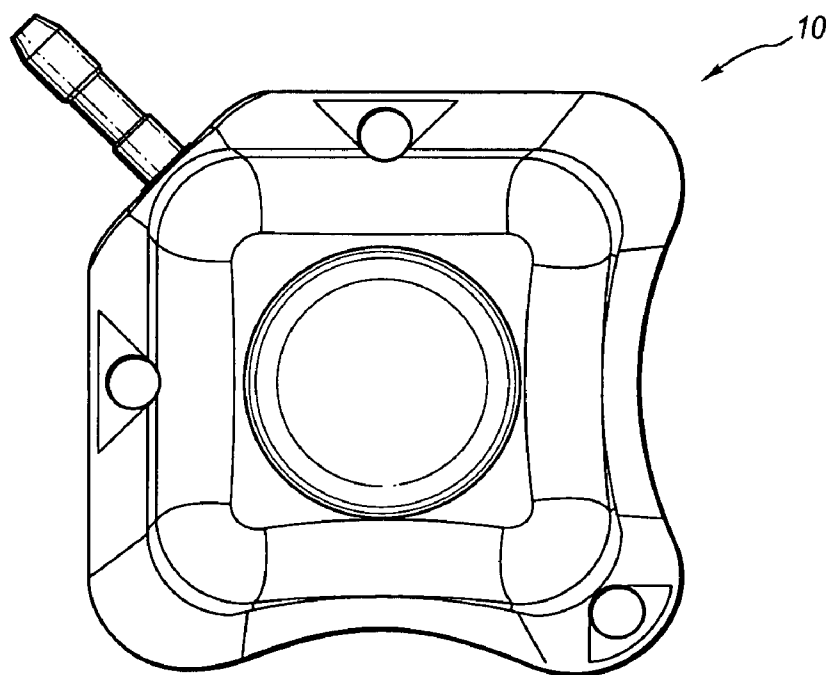


FIG. 44

U.S. Patent

May 24, 2011

Sheet 26 of 46

US 7,947,022 B2

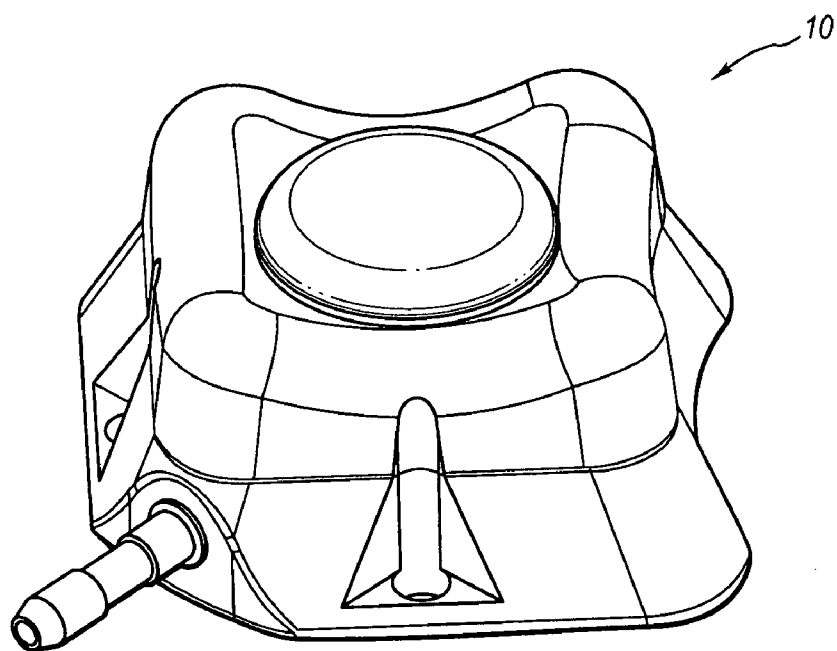


FIG. 45

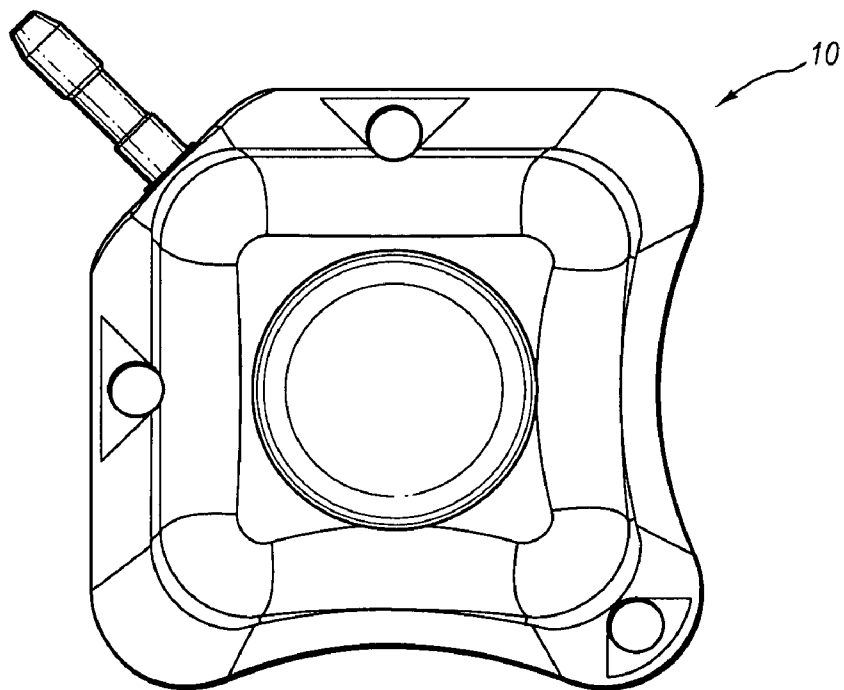


FIG. 46

U.S. Patent

May 24, 2011

Sheet 27 of 46

US 7,947,022 B2

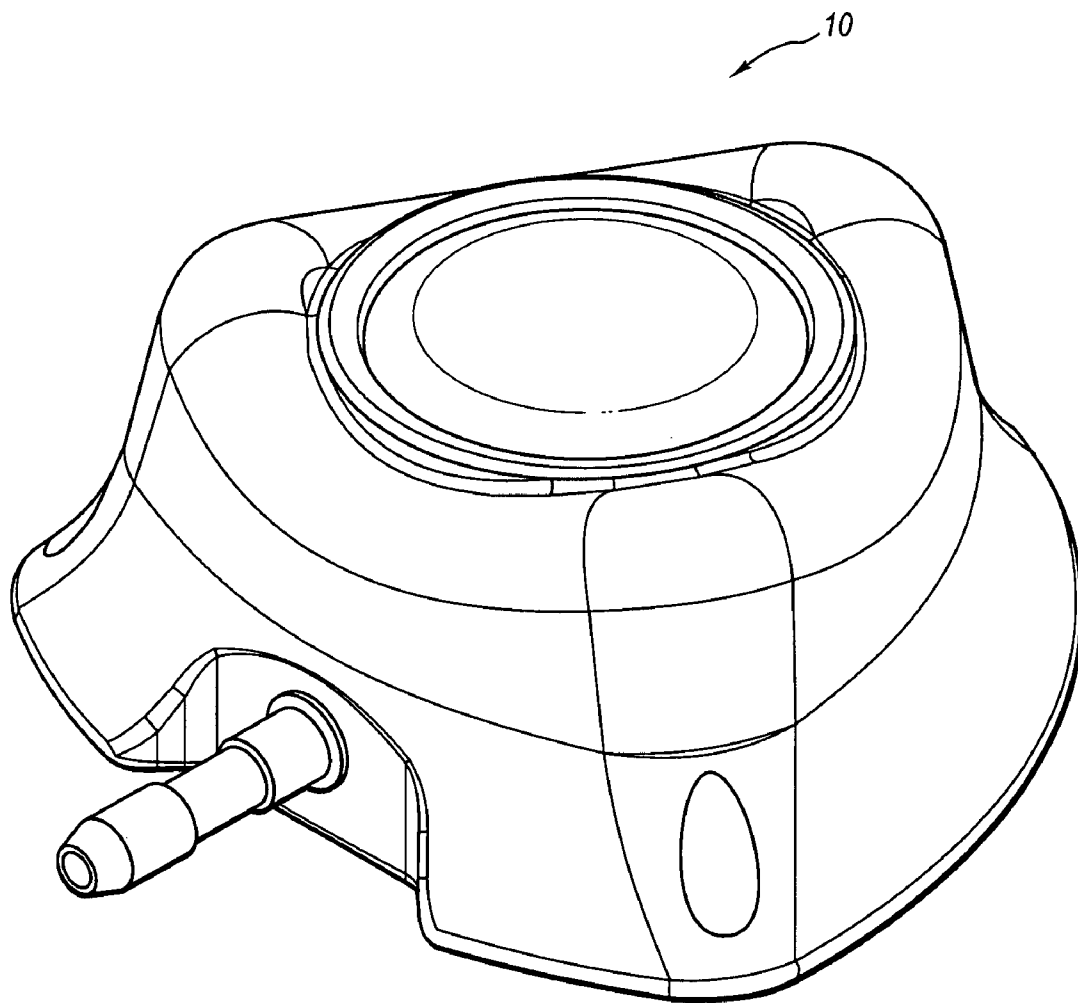


FIG. 47

U.S. Patent

May 24, 2011

Sheet 28 of 46

US 7,947,022 B2

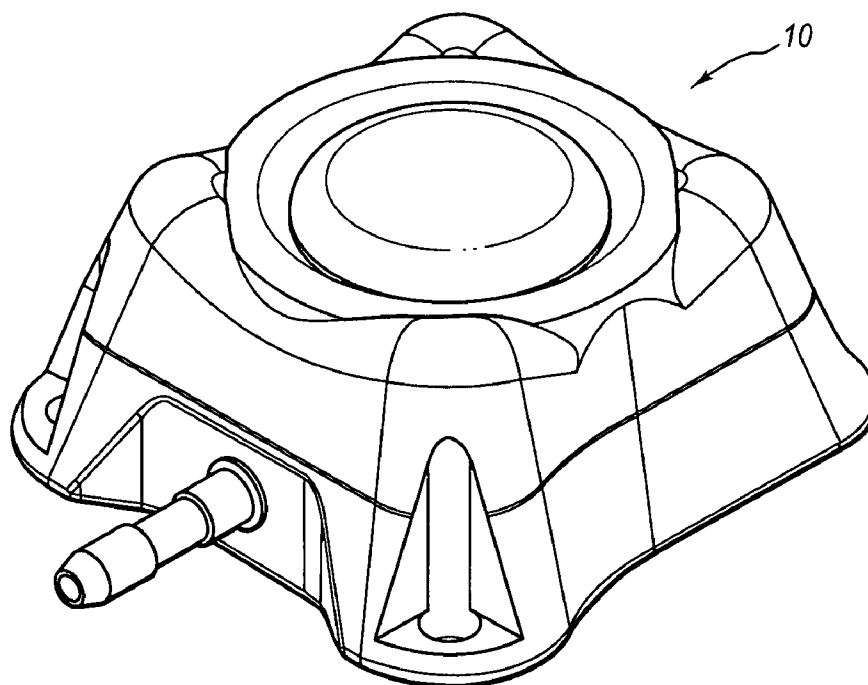


FIG. 48

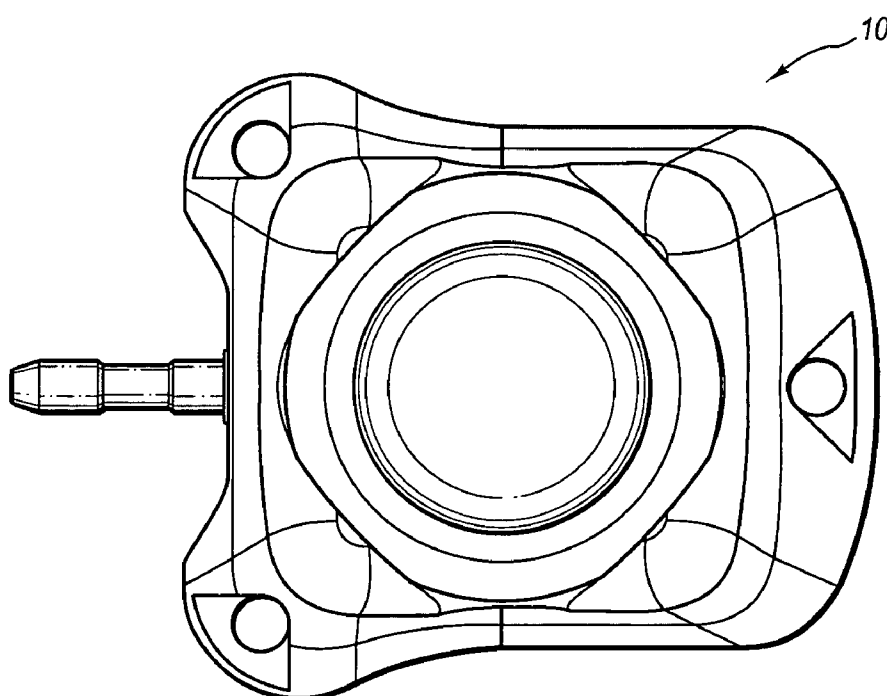


FIG. 49

U.S. Patent

May 24, 2011

Sheet 29 of 46

US 7,947,022 B2

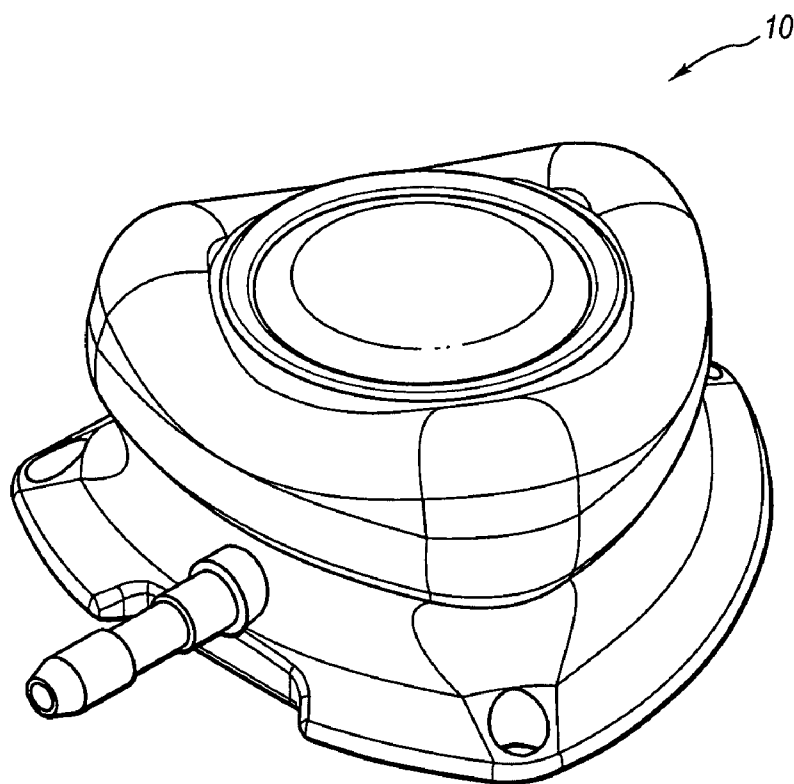


FIG. 50

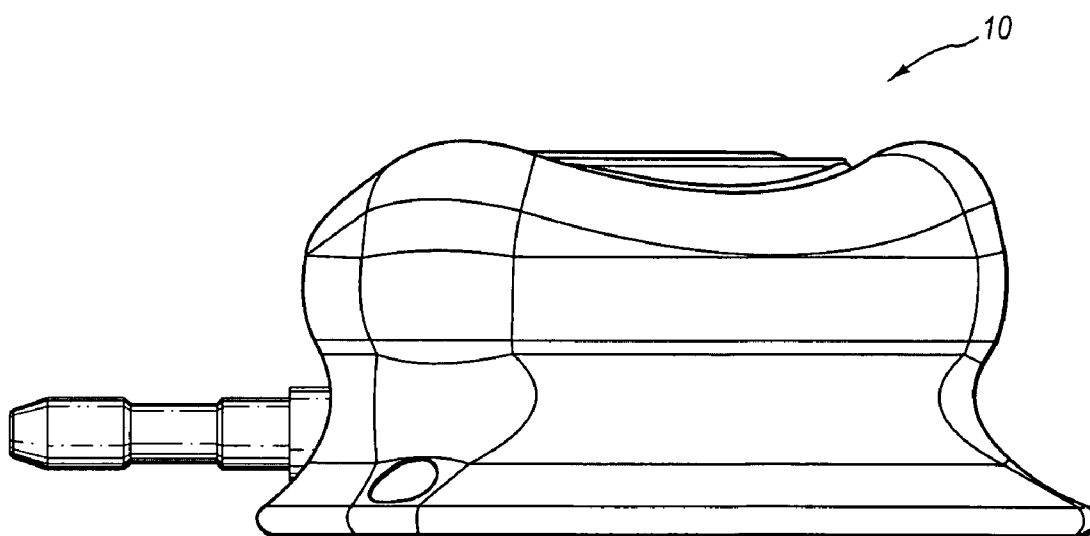


FIG. 51

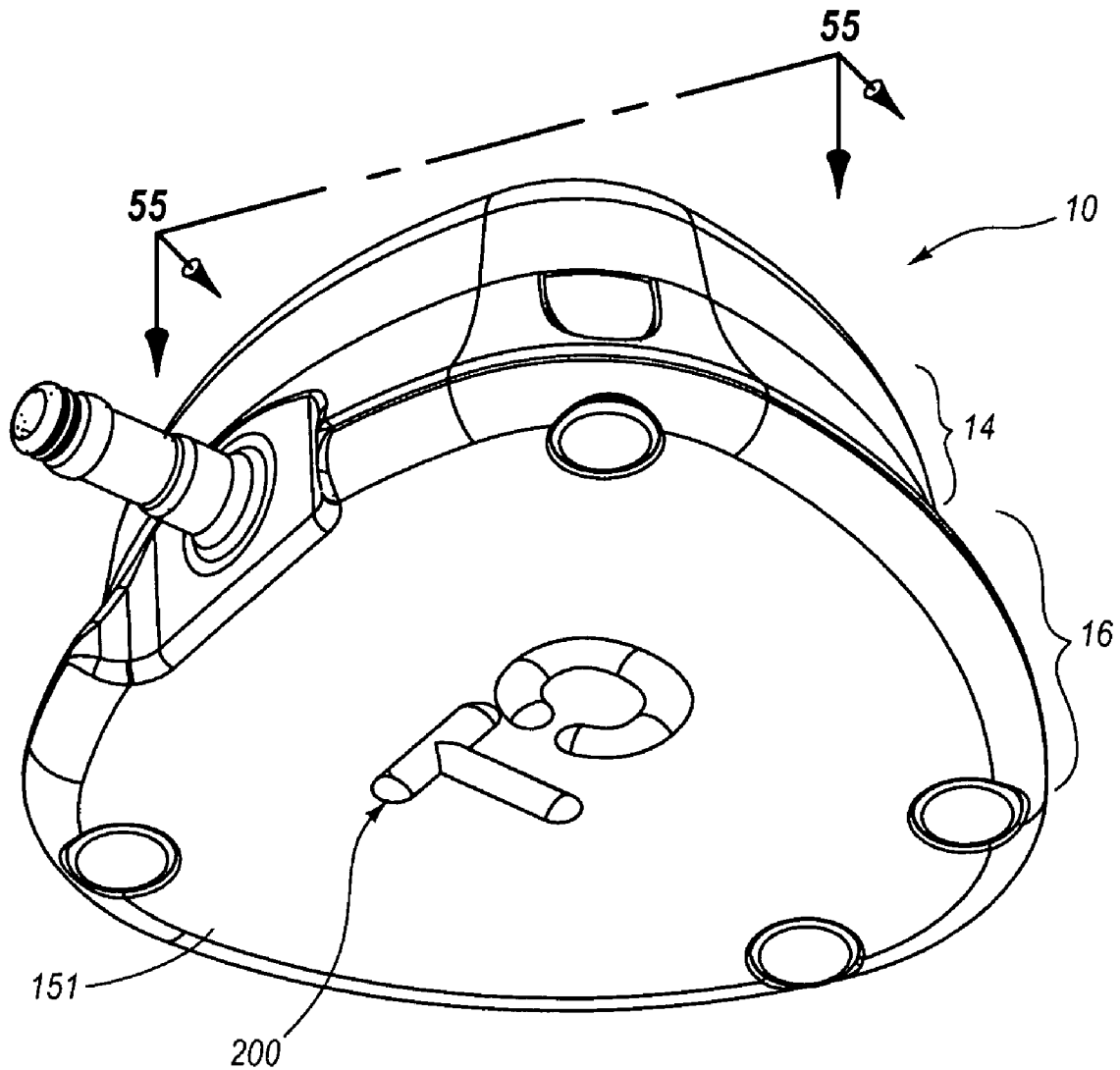


FIG. 52

U.S. Patent

May 24, 2011

Sheet 31 of 46

US 7,947,022 B2

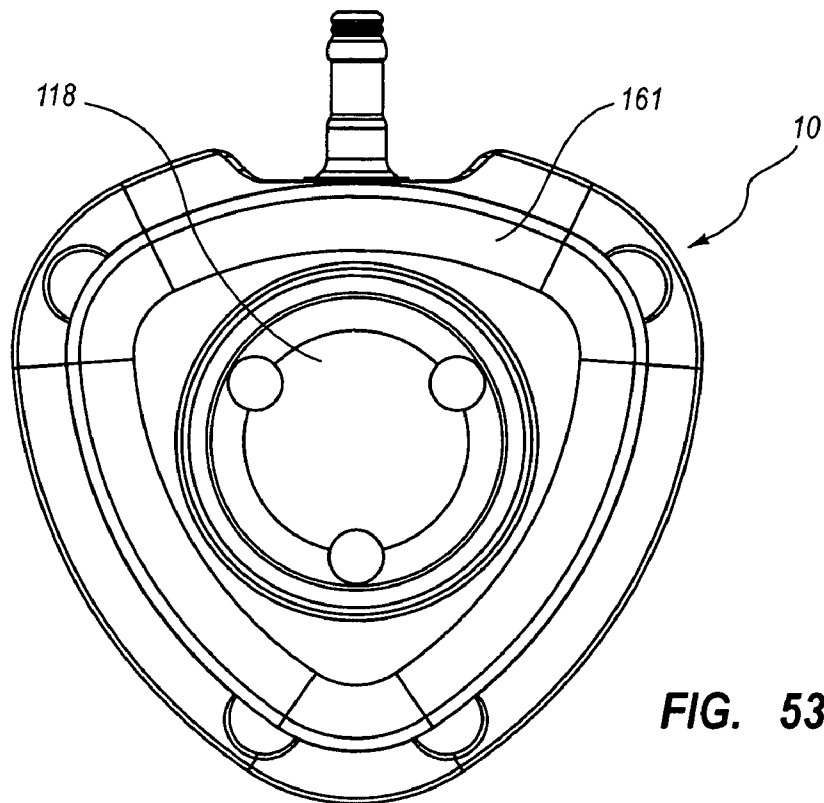


FIG. 53A

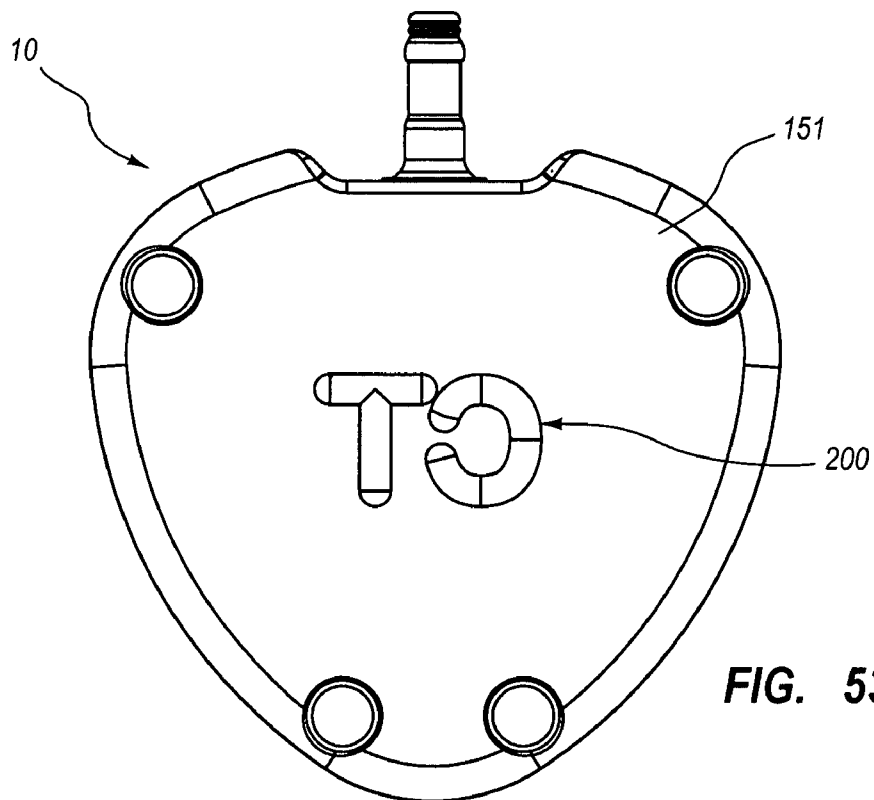


FIG. 53B

U.S. Patent

May 24, 2011

Sheet 32 of 46

US 7,947,022 B2

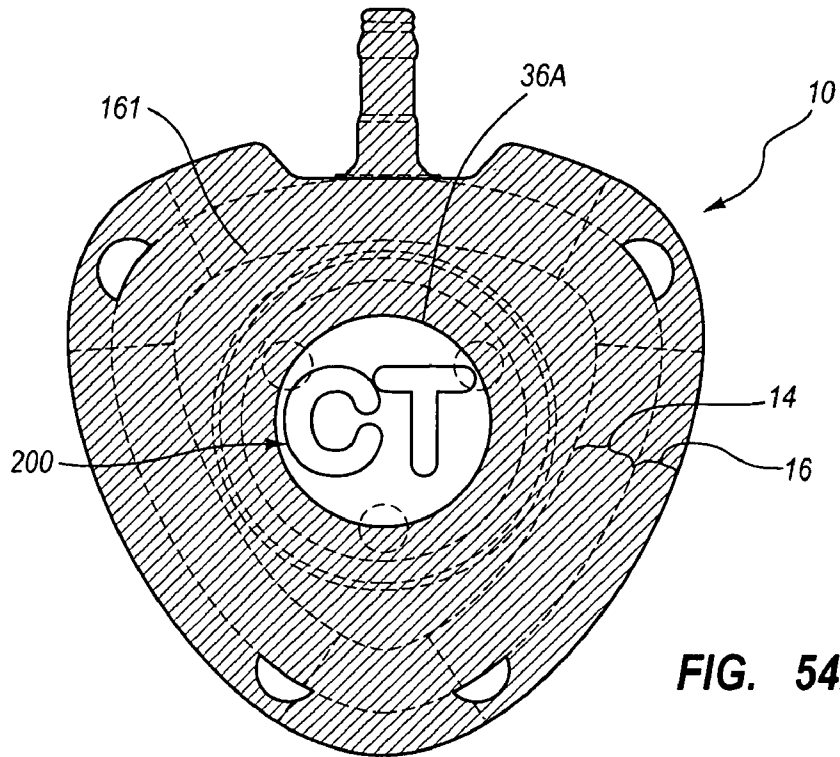


FIG. 54A

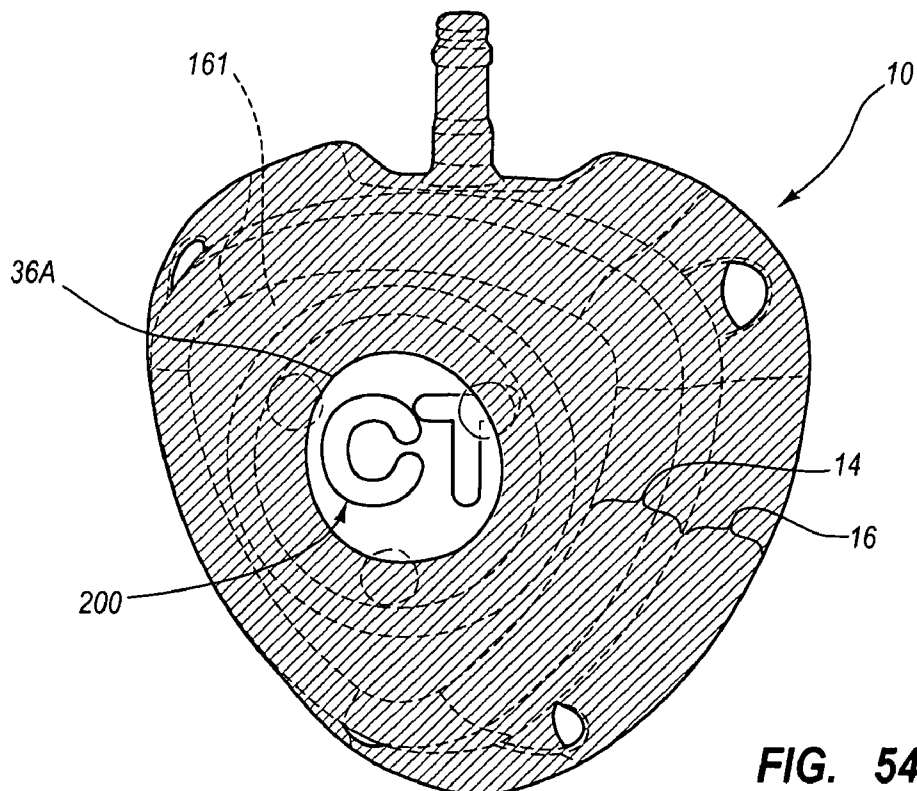


FIG. 54B

U.S. Patent

May 24, 2011

Sheet 33 of 46

US 7,947,022 B2

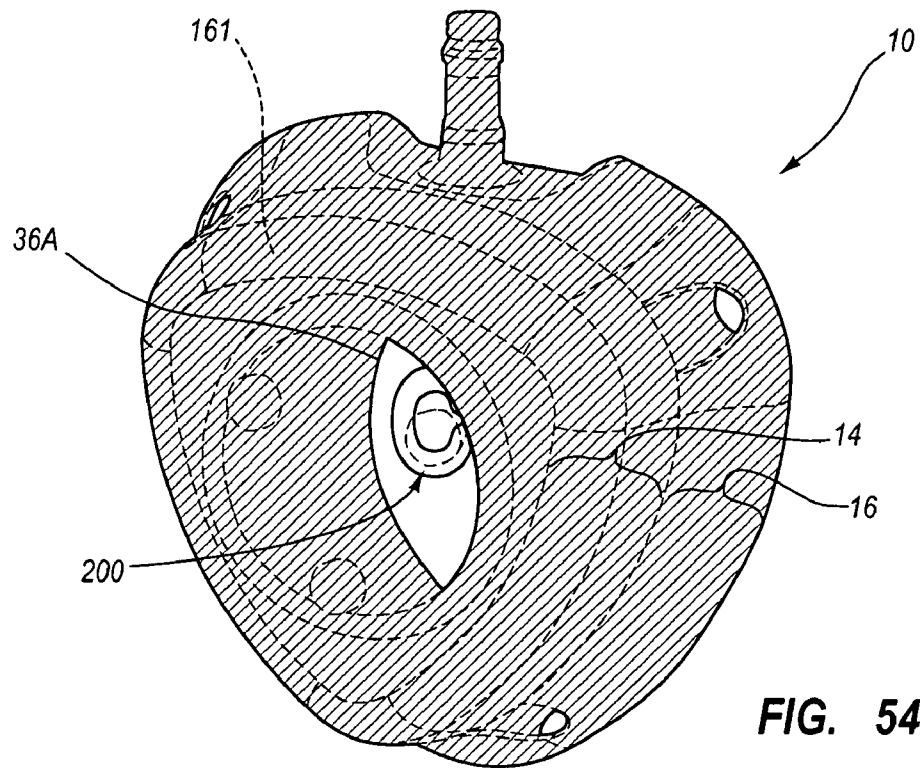


FIG. 54C

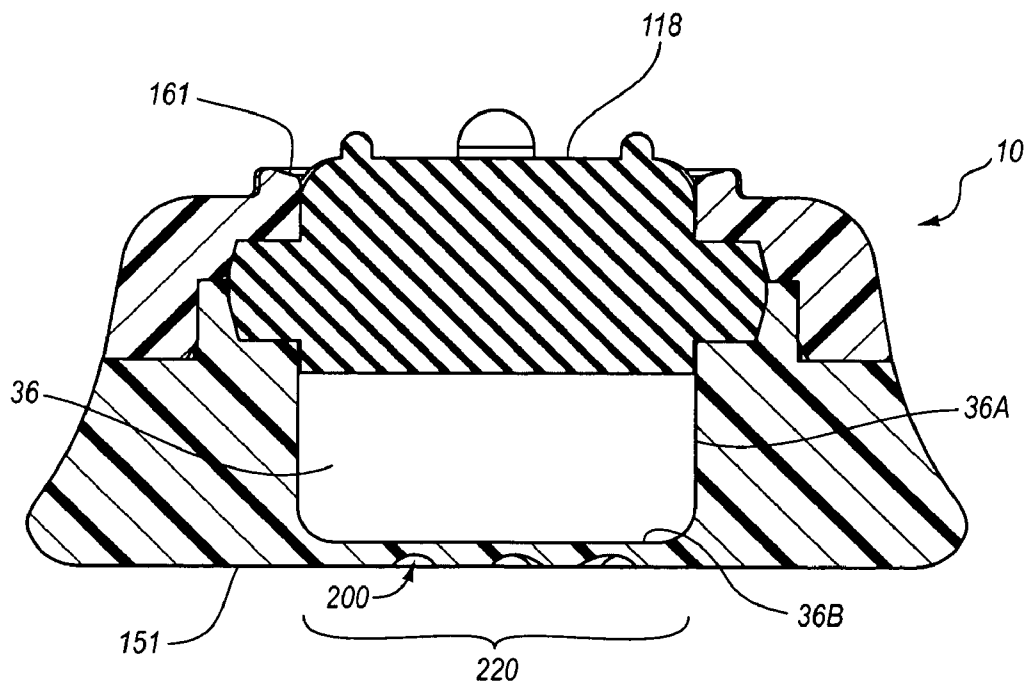


FIG. 55

U.S. Patent

May 24, 2011

Sheet 34 of 46

US 7,947,022 B2

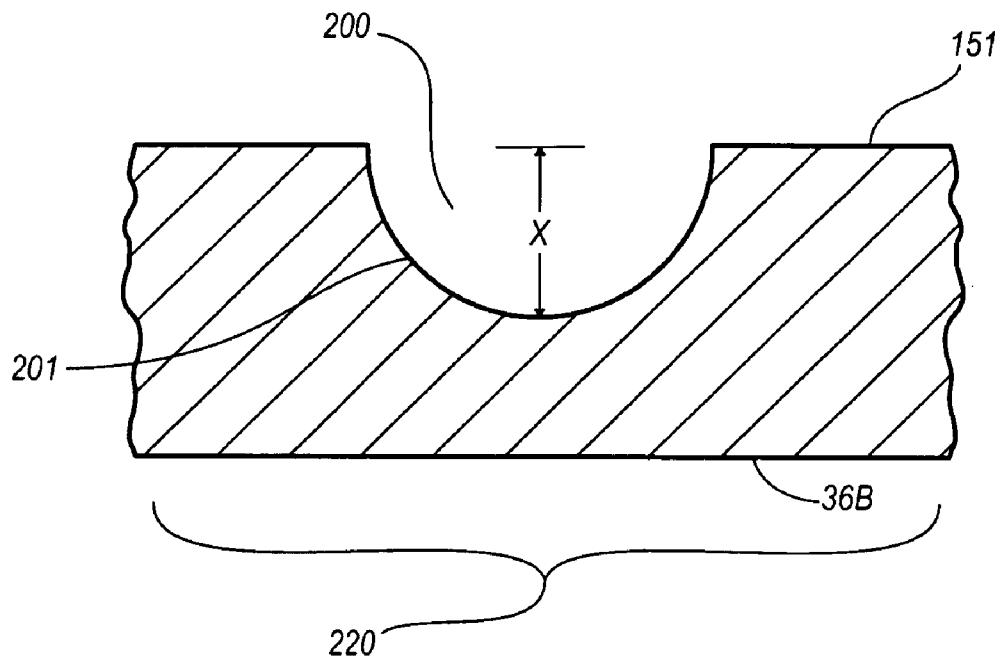


FIG. 56A

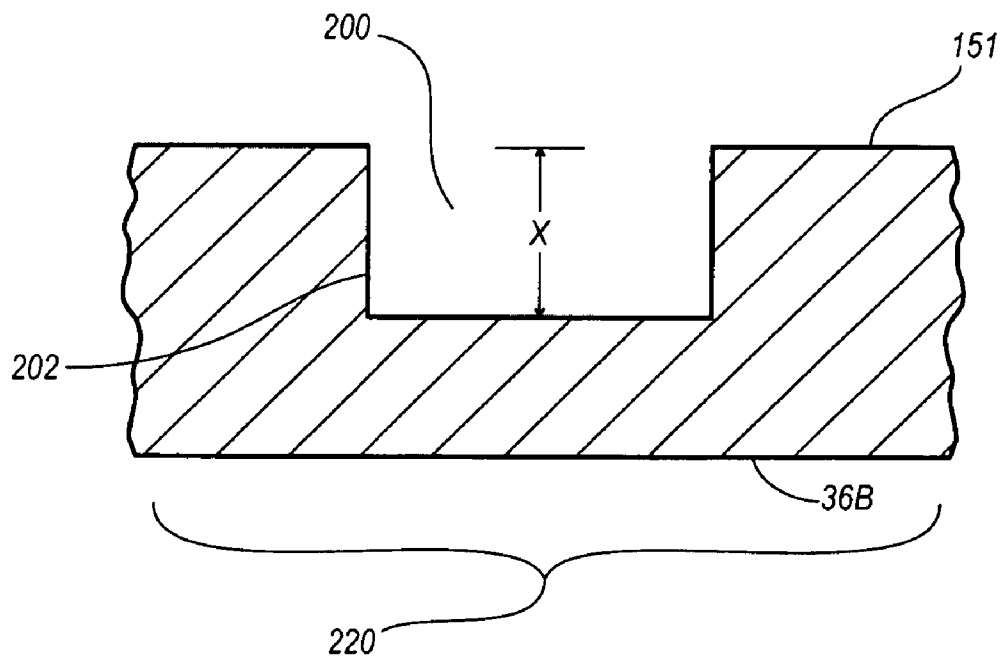


FIG. 56B

U.S. Patent

May 24, 2011

Sheet 35 of 46

US 7,947,022 B2

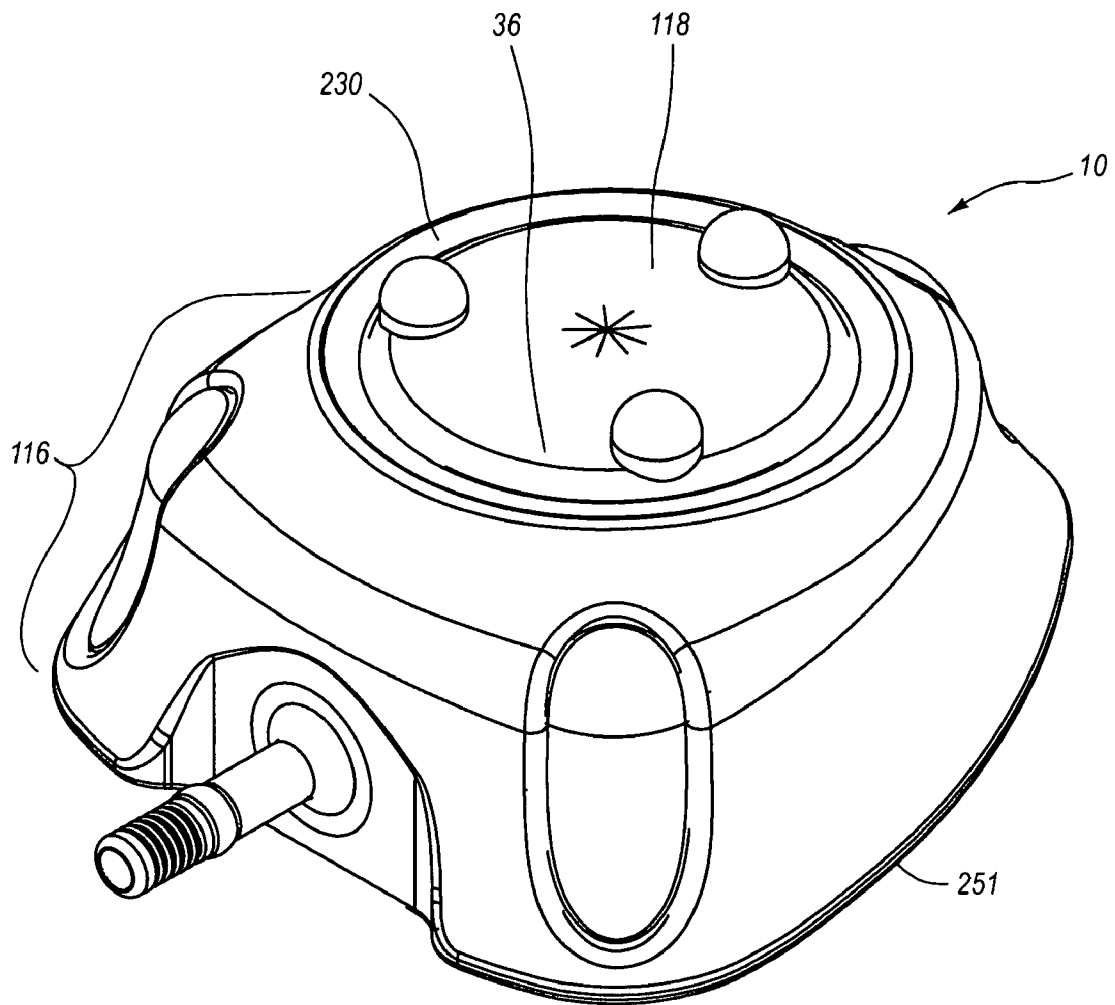


FIG. 57A

U.S. Patent

May 24, 2011

Sheet 36 of 46

US 7,947,022 B2

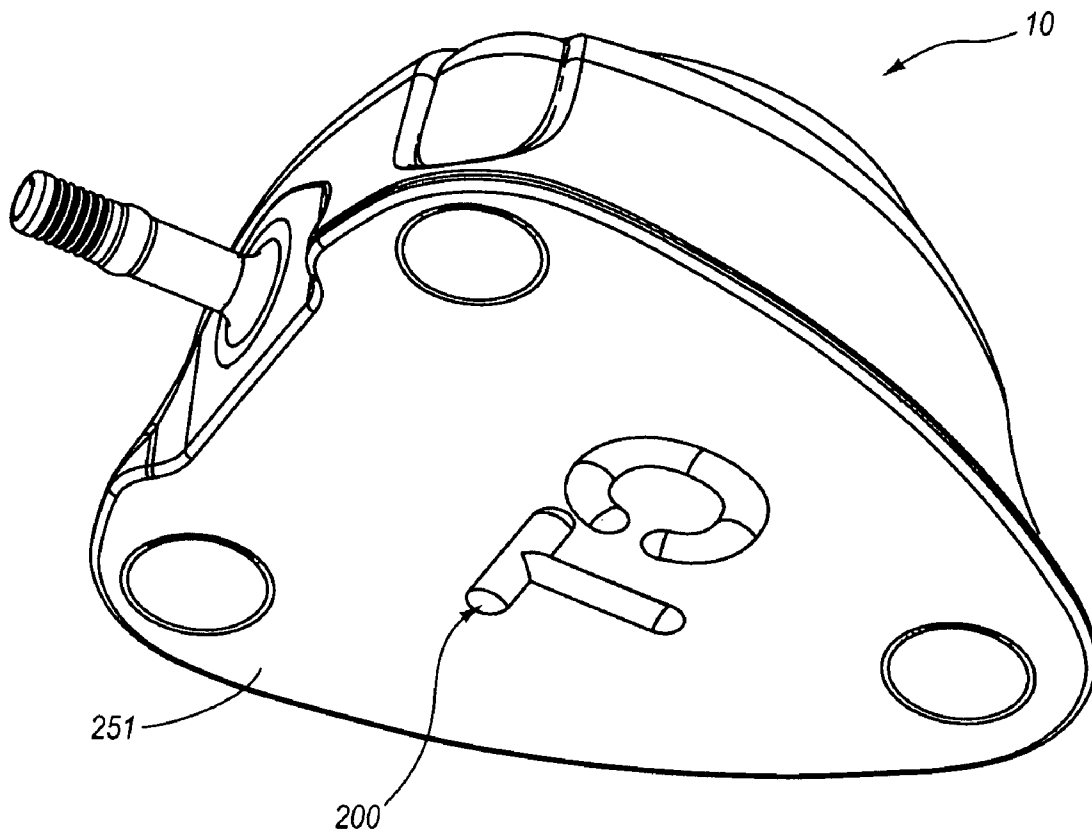


FIG. 57B

U.S. Patent

May 24, 2011

Sheet 37 of 46

US 7,947,022 B2

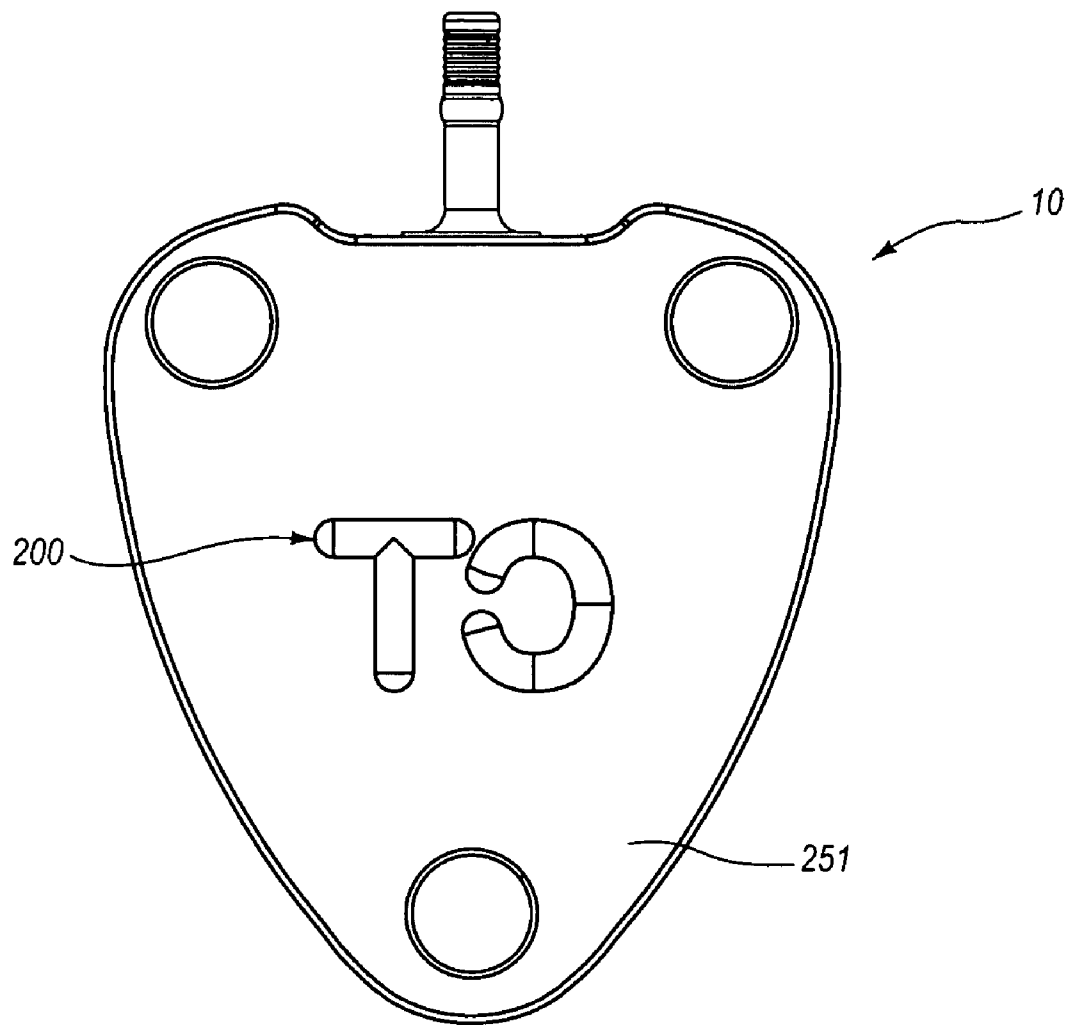


FIG. 57C

U.S. Patent

May 24, 2011

Sheet 38 of 46

US 7,947,022 B2

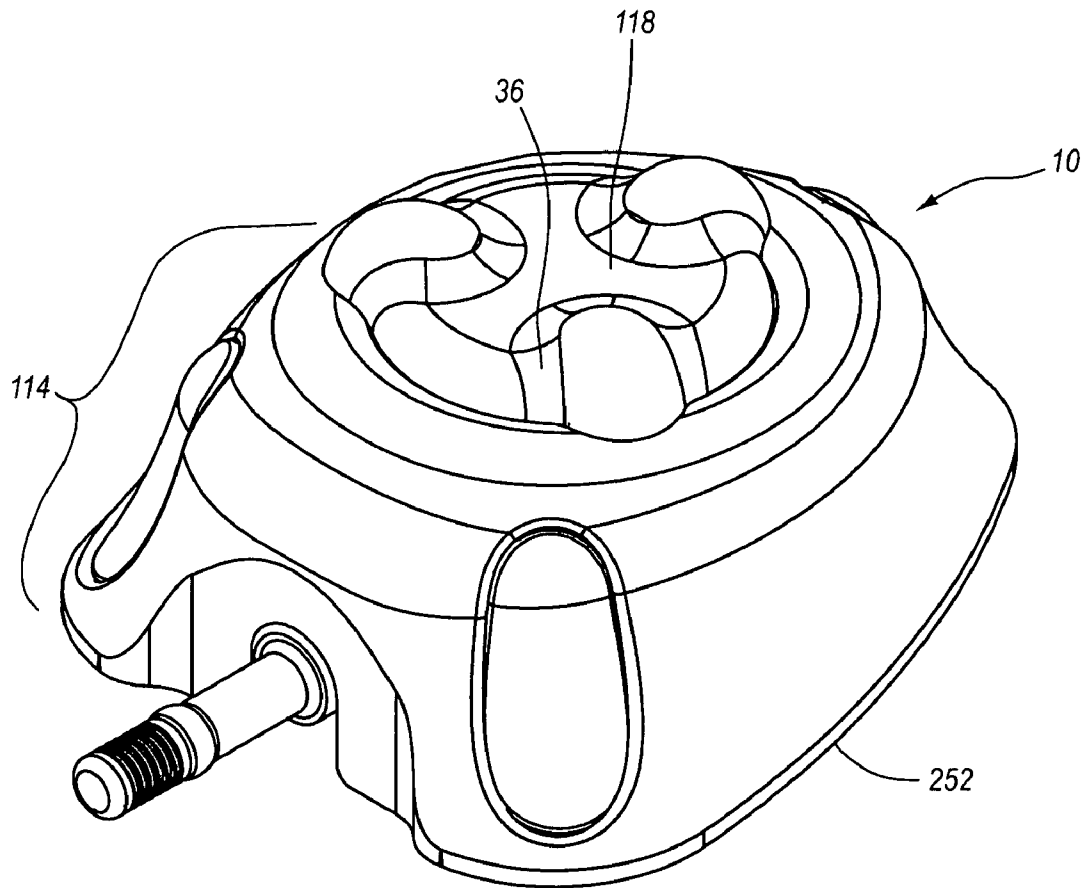


FIG. 58A

U.S. Patent

May 24, 2011

Sheet 39 of 46

US 7,947,022 B2

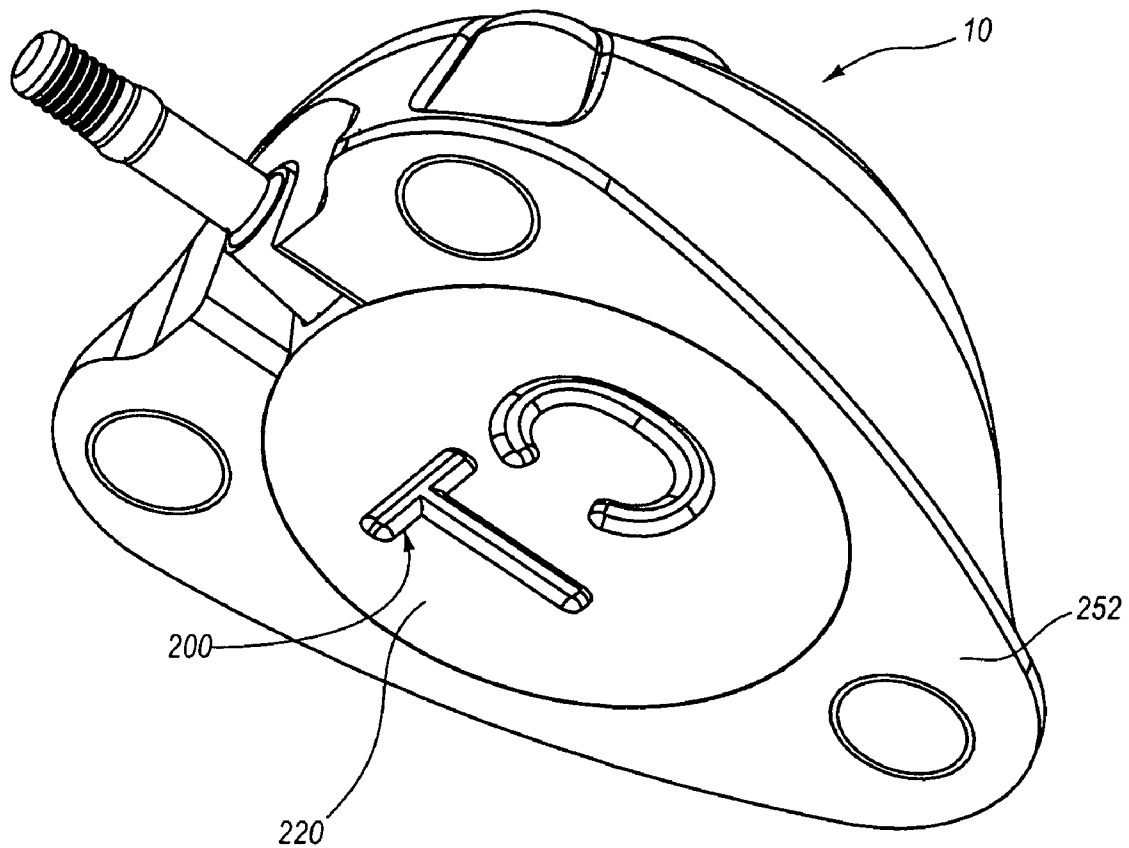


FIG. 58B

U.S. Patent

May 24, 2011

Sheet 40 of 46

US 7,947,022 B2

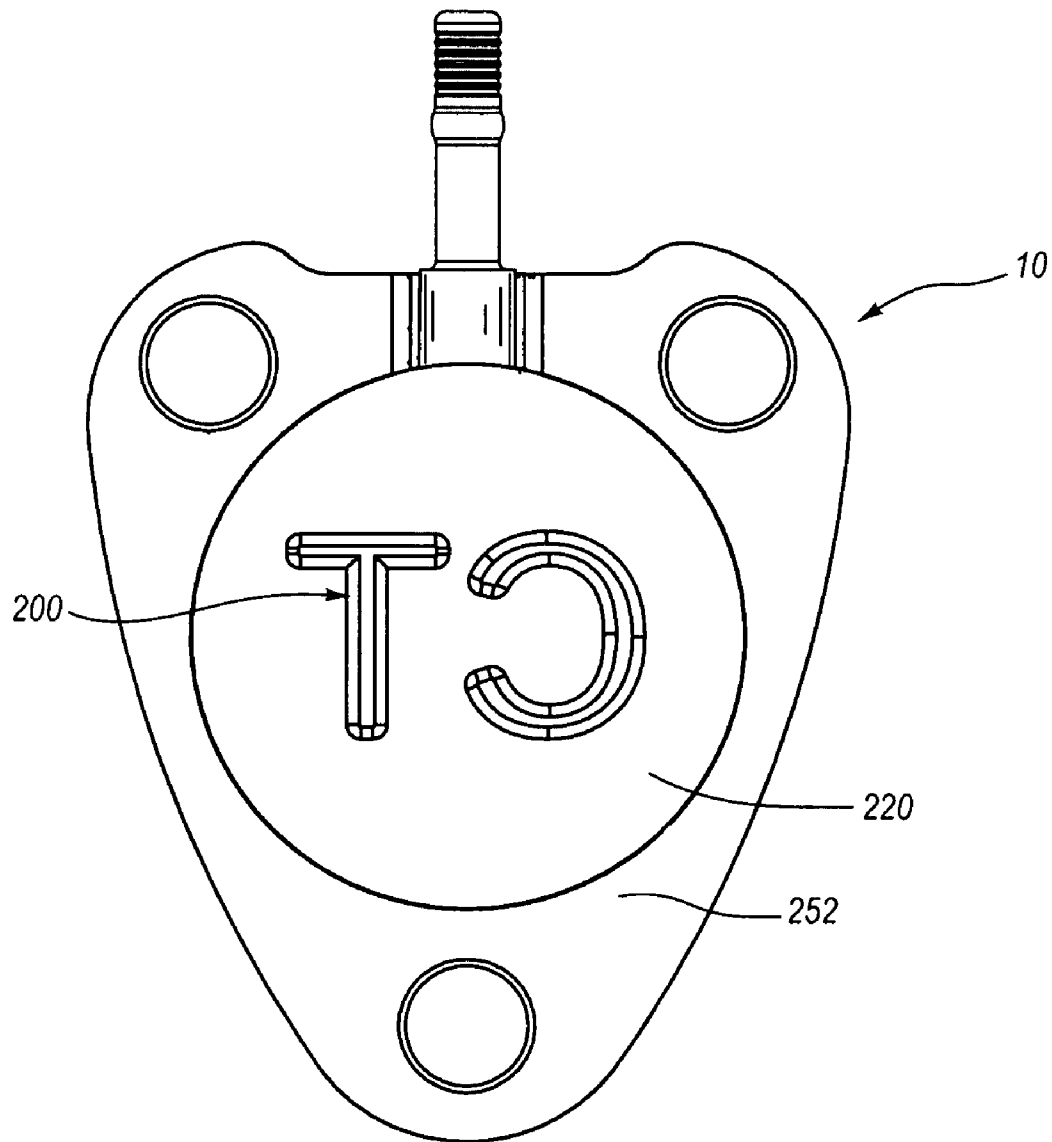


FIG. 58C

U.S. Patent

May 24, 2011

Sheet 41 of 46

US 7,947,022 B2

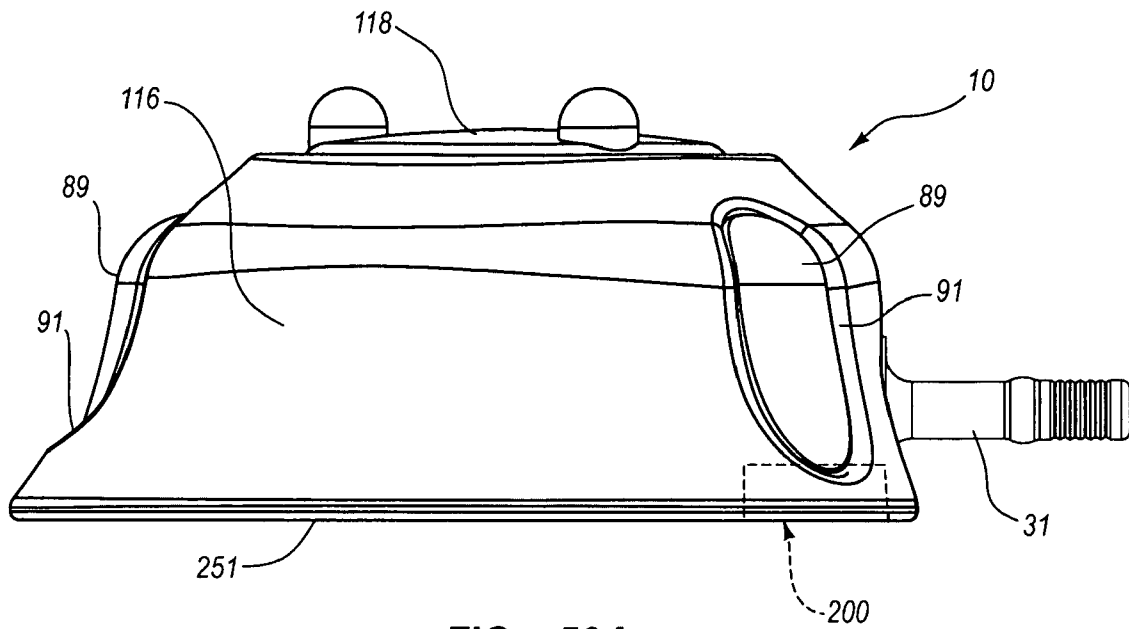


FIG. 59A

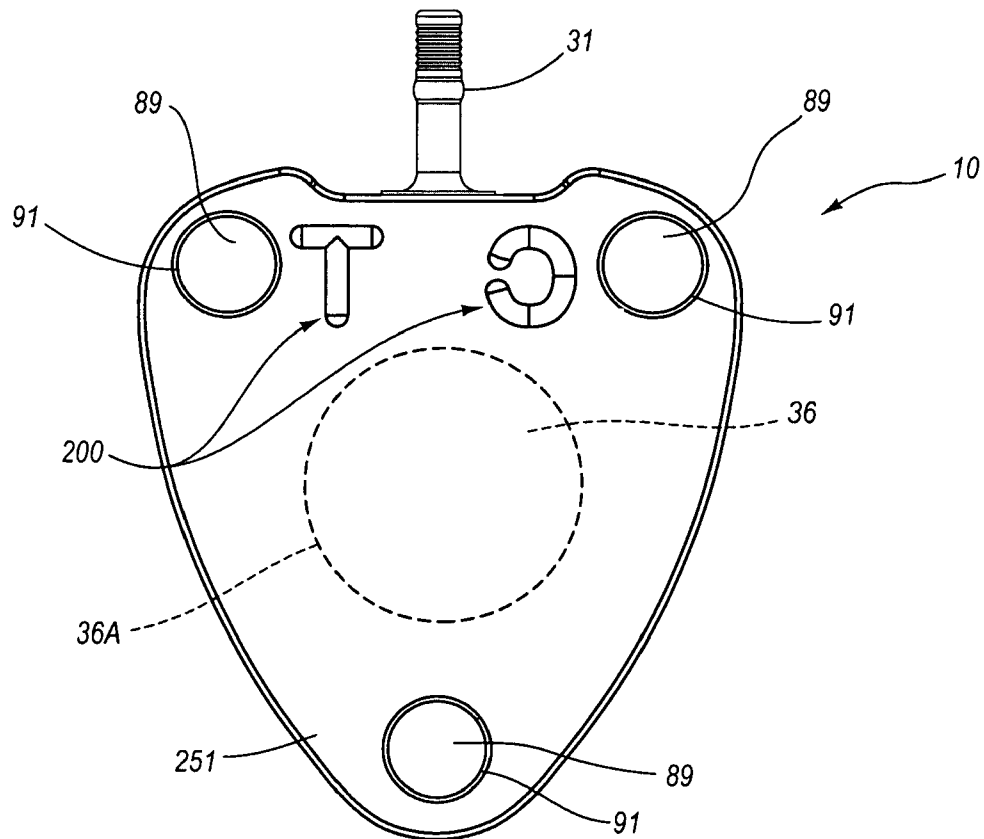


FIG. 59B

U.S. Patent

May 24, 2011

Sheet 42 of 46

US 7,947,022 B2

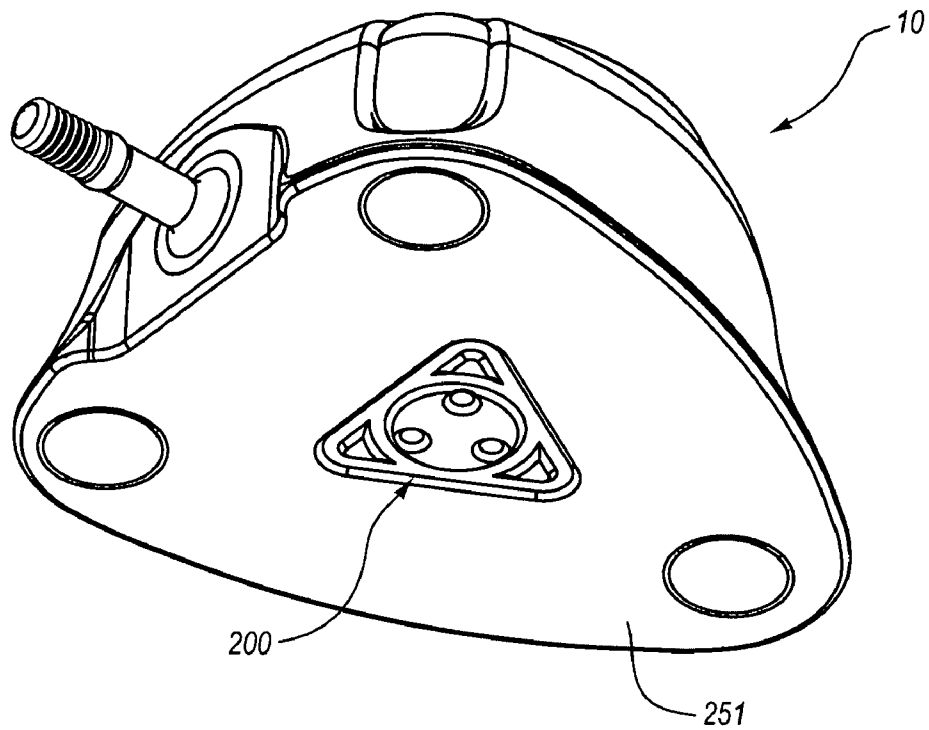


FIG. 60A

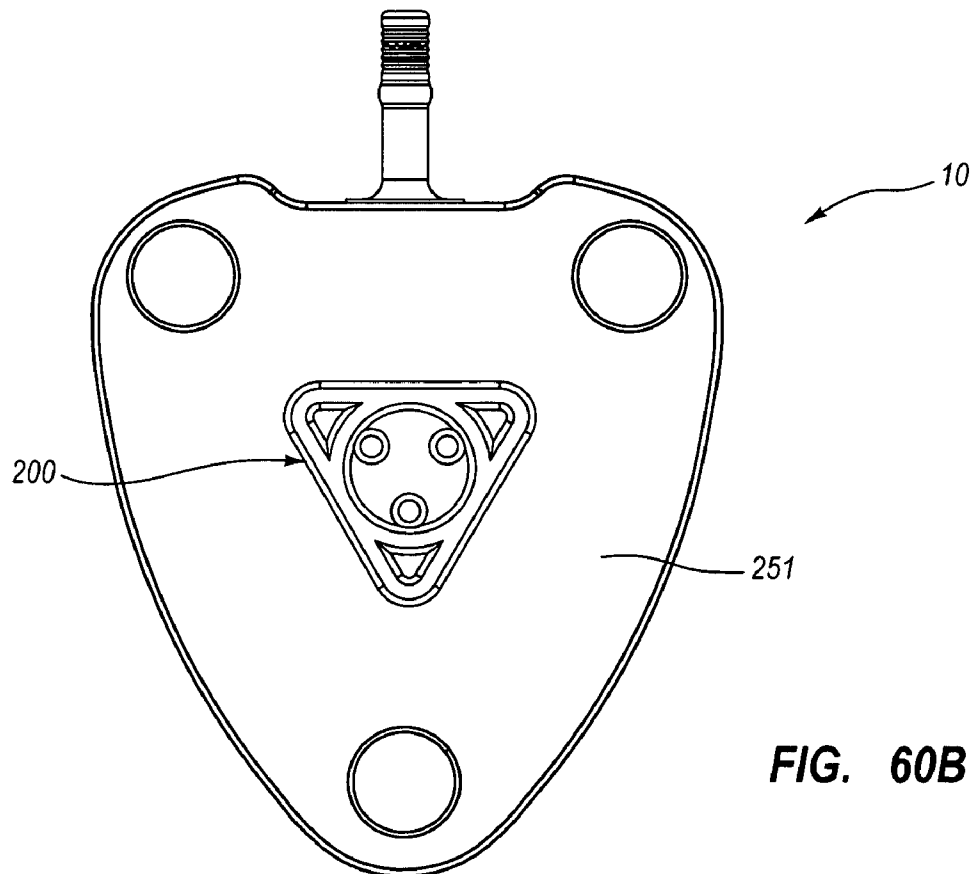


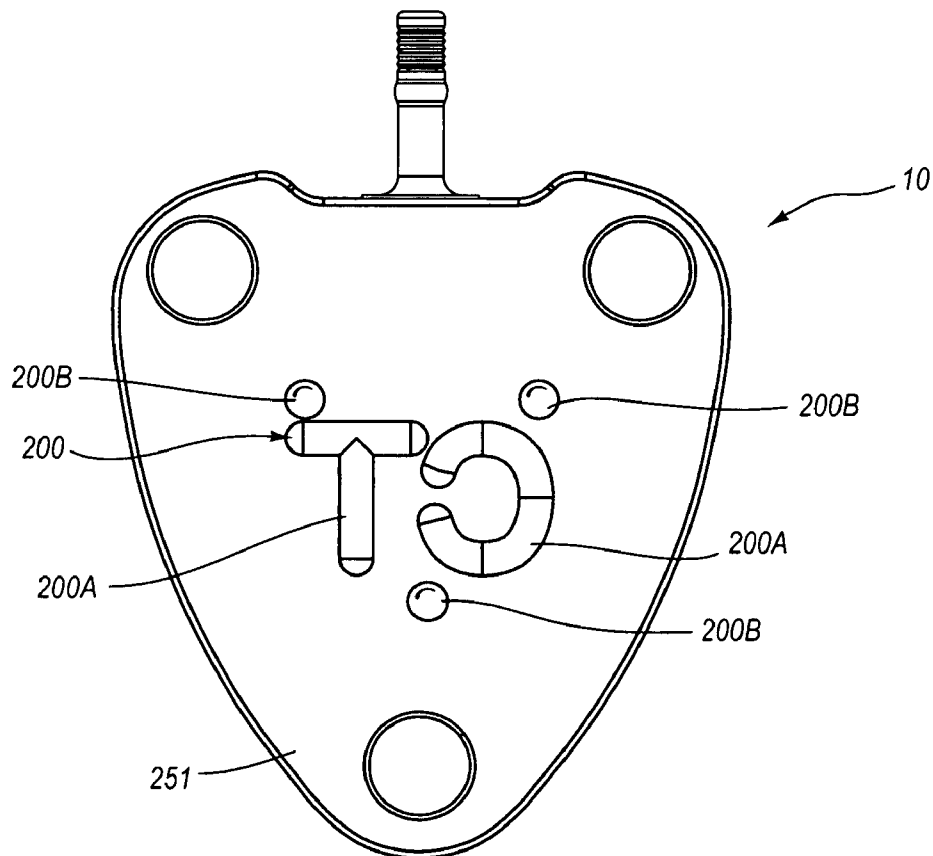
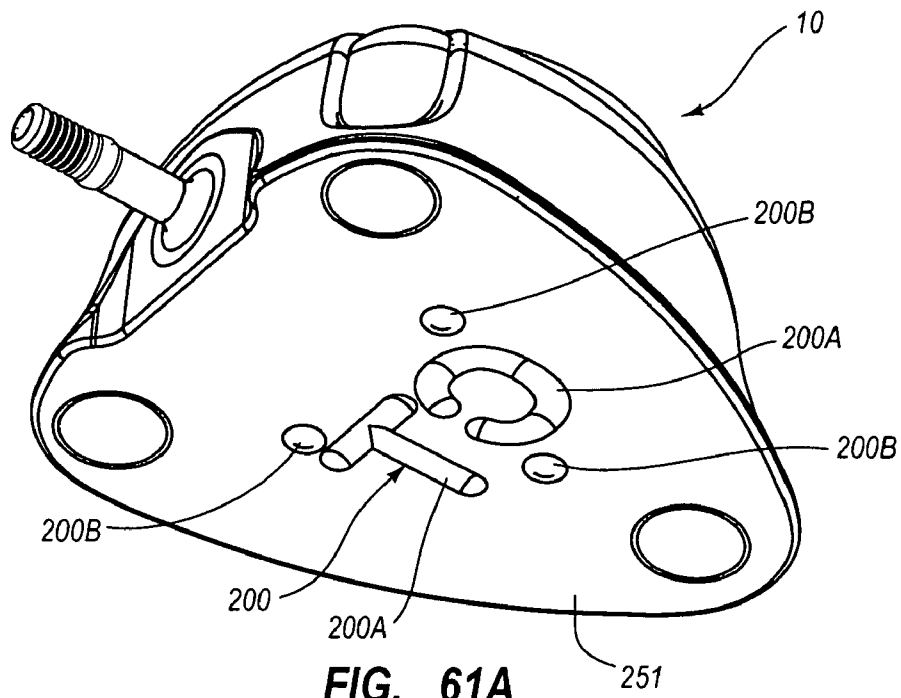
FIG. 60B

U.S. Patent

May 24, 2011

Sheet 43 of 46

US 7,947,022 B2



U.S. Patent

May 24, 2011

Sheet 44 of 46

US 7,947,022 B2

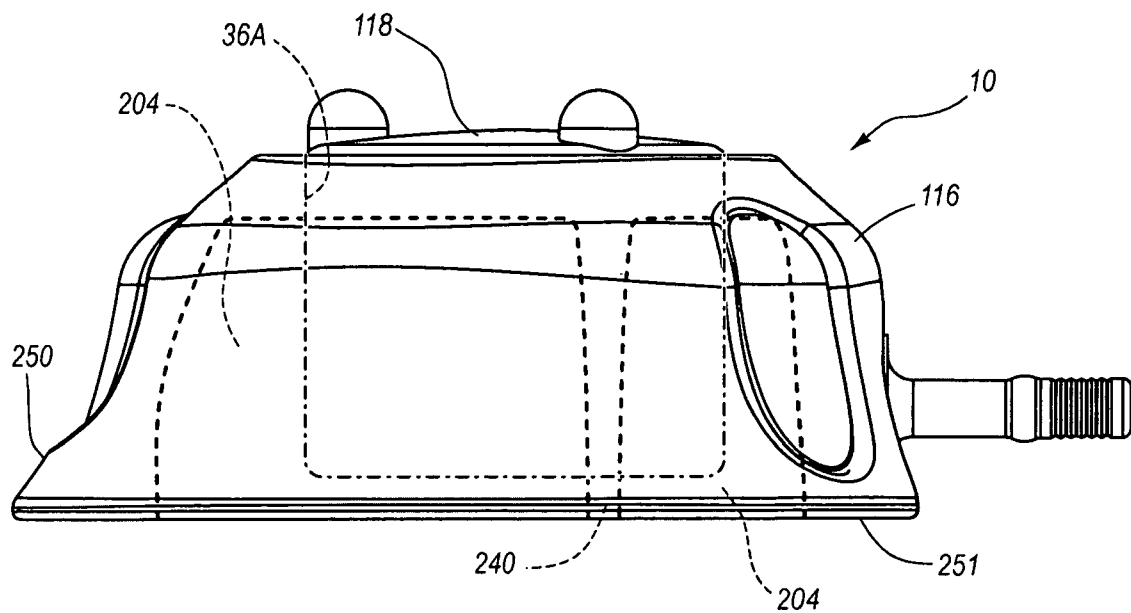
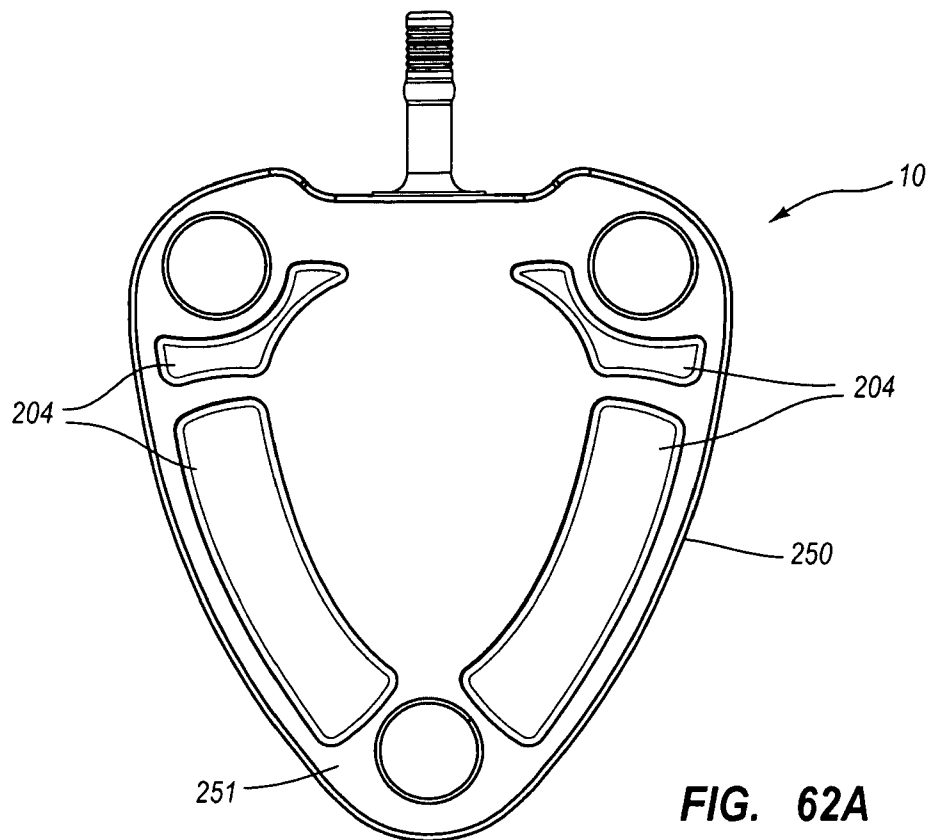


FIG. 62B

U.S. Patent

May 24, 2011

Sheet 45 of 46

US 7,947,022 B2

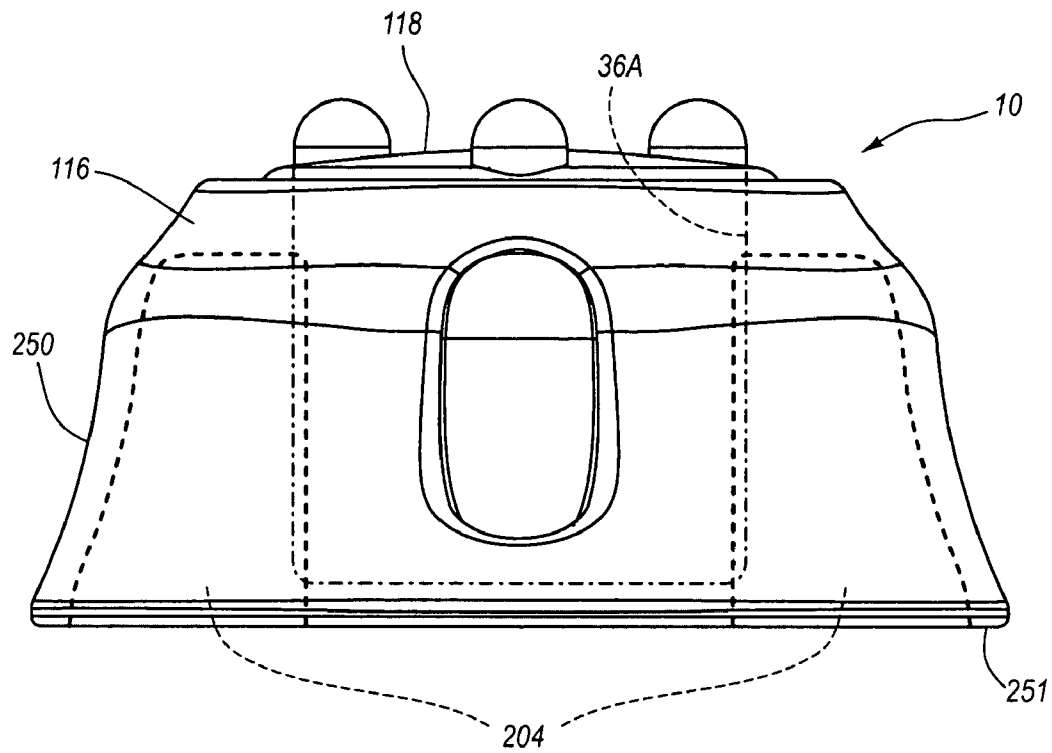


FIG. 62C

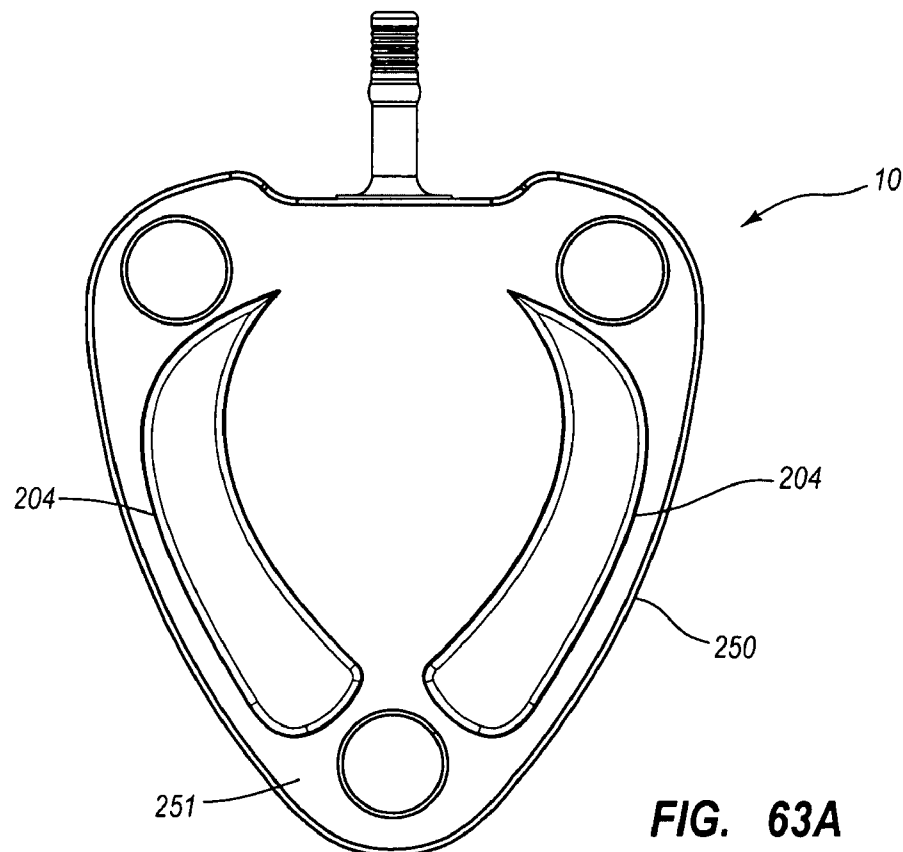


FIG. 63A

U.S. Patent

May 24, 2011

Sheet 46 of 46

US 7,947,022 B2

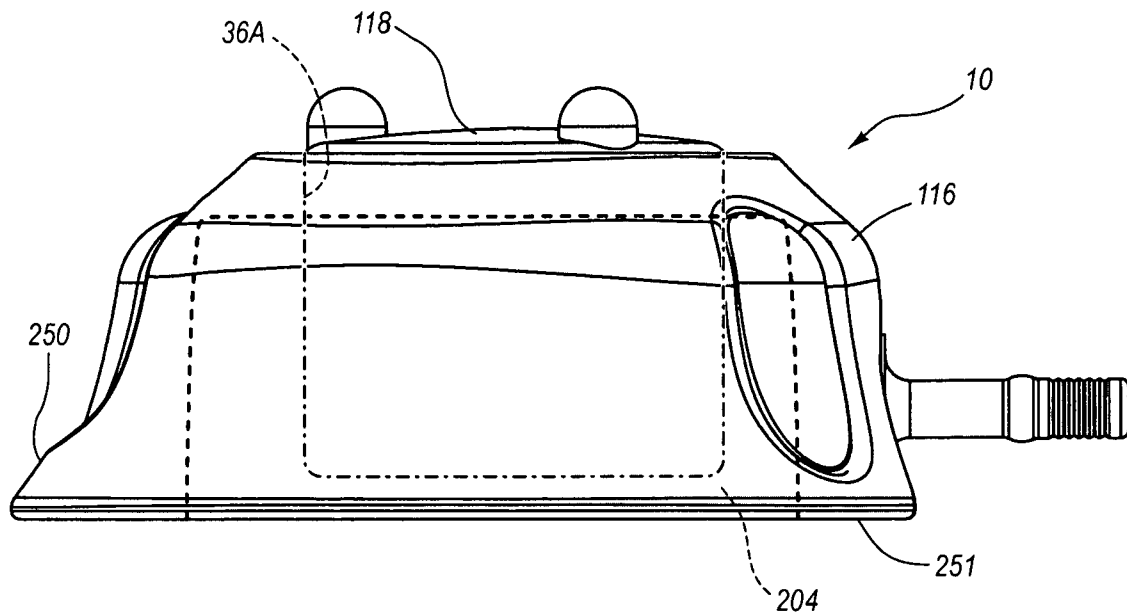


FIG. 63B

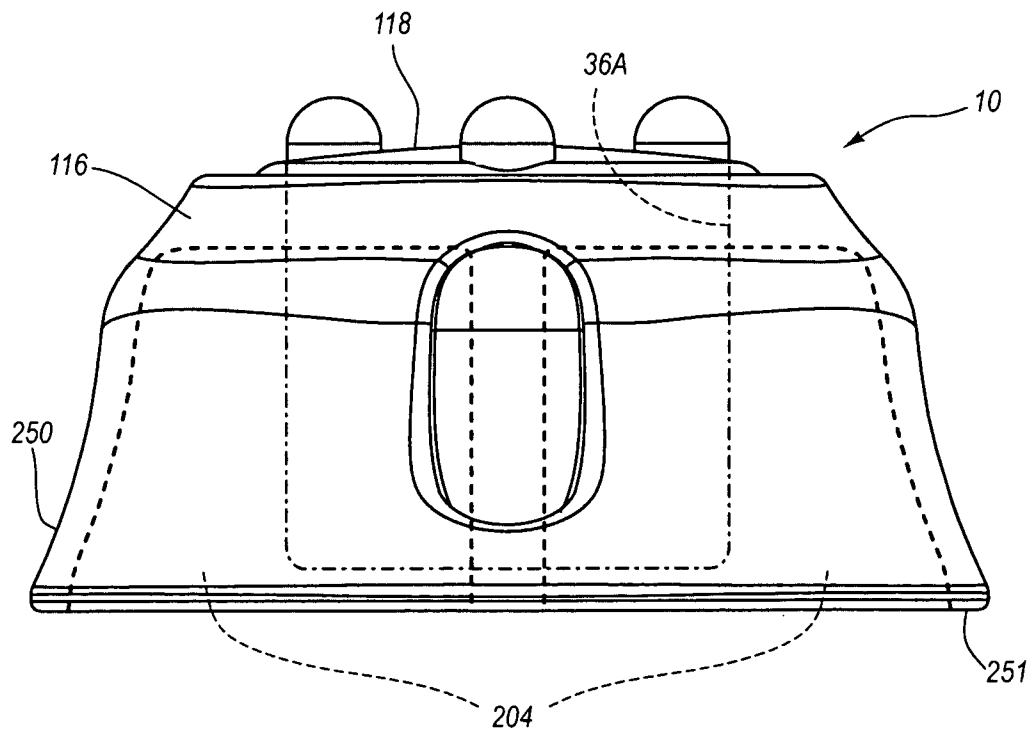


FIG. 63C

US 7,947,022 B2

1

**ACCESS PORT IDENTIFICATION SYSTEMS
AND METHODS****RELATED APPLICATIONS**

This application is a continuation-in-part of U.S. application Ser. No. 11/368,954, filed Mar. 6, 2006, and entitled "Access Port Identification Systems and Methods," now U.S. Pat. No. 7,785,302, which claims the benefit of U.S. Provisional U.S. Patent Application No. 60/658,518, filed Mar. 4, 2005, and entitled "Access Port Identification System." Each of the afore-referenced applications is incorporated, in its entirety, by this reference.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1A shows a perspective view of an embodiment of an access port according to the instant disclosure;

FIG. 1B shows a schematic side cross-sectional view the access port shown in FIG. 1A;

FIG. 2 shows a perspective view of an embodiment of an access port according to the instant disclosure;

FIG. 3 shows a perspective view of an access port according to the instant disclosure;

FIG. 4 shows a perspective view of an access port according to the instant disclosure;

FIG. 5 shows a perspective view of an access port according to the instant disclosure;

FIG. 6A shows a perspective view of an access port according to the instant disclosure;

FIG. 6B shows a side view of the access port shown in FIG. 6A;

FIG. 7 shows a perspective view of an access port according to the instant disclosure;

FIG. 8 shows a simplified perspective view of a cap for forming an access port according to the instant disclosure;

FIG. 9 shows a simplified perspective view of a cap for forming an access port according to the instant disclosure;

FIG. 10 shows a simplified perspective view of a cap for forming an access port according to the instant disclosure;

FIG. 11 shows a simplified perspective view of a cap for forming an access port according to the instant disclosure;

FIG. 12 shows a simplified perspective view of a cap for forming an access port according to the instant disclosure;

FIG. 13 shows a simplified perspective view of a cap for forming an access port according to the instant disclosure;

FIG. 14 shows a simplified perspective view of a cap for forming an access port according to the instant disclosure;

FIG. 15A shows a perspective view of an embodiment of an access port according to the instant disclosure;

FIG. 15B shows a top elevation view of the access port shown in FIG. 15A;

FIG. 16 shows a perspective view of an access port according to the instant disclosure;

FIG. 17 shows a perspective view of an access port according to the instant disclosure;

FIG. 18 shows a perspective view of an access port according to the instant disclosure;

FIG. 19 shows a perspective view of an access port according to the instant disclosure;

FIG. 20 shows a perspective view of an access port according to the instant disclosure;

FIG. 21 shows a perspective view of an access port according to the instant disclosure;

FIG. 22 shows a perspective view of another embodiment of an access port according to the instant disclosure;

2

FIG. 23 shows a top elevation view of the assembled access port shown in FIG. 22;

FIG. 24 shows a simplified representation of a transverse cross section of the access port shown in FIGS. 22 and 23;

FIGS. 25-51 show perspective views of additional embodiments of an access port.

FIG. 52 shows a bottom perspective view of an access port according to one embodiment;

FIG. 53A shows a top view of the access port shown in FIG. 52;

FIG. 53B shows a bottom view of the access port shown in FIG. 52;

FIG. 54A represents a radiographic image of the access port shown in FIG. 52 when viewed from above the access port;

FIG. 54B represents a radiographic image of the access port shown in FIG. 52 when viewed at an angle of approximately 20 degrees;

FIG. 54C represents a radiographic image of the access port shown in FIG. 52 when viewed at an angle of approximately 50 degrees;

FIG. 55 shows a cross-sectional view of the access port shown in FIG. 52;

FIGS. 56A and 56B show cross-sectional views of example embodiments of engraved features on an access port surface;

FIG. 57A shows a top perspective view of an access port according to one embodiment;

FIG. 57B shows a bottom perspective view of the access port shown in FIG. 57A;

FIG. 57C shows a bottom view of the access port shown in FIG. 57A;

FIG. 58A shows a top perspective view of another embodiment of an access port;

FIG. 58B shows a bottom perspective view of the access port shown in FIG. 58A;

FIG. 58C shows a bottom view of the access port shown in FIG. 58A;

FIG. 59A shows a side view of an embodiment of an access port;

FIG. 59B shows a bottom view of the access port shown in FIG. 59A;

FIG. 60A shows a bottom perspective view of an additional embodiment of an access port;

FIG. 60B shows a bottom view of the access port shown in FIG. 60A;

FIG. 61A shows a bottom perspective view of an additional embodiment of an access port;

FIG. 61B shows a bottom view of the access port shown in FIG. 61A;

FIG. 62A shows a bottom view of an additional embodiment of an access port;

FIG. 62B shows a side view of the access port shown in FIG. 62A;

FIG. 62C shows an end view of the access port shown in FIG. 62A;

FIG. 63A shows a bottom view of another embodiment of an access port;

FIG. 63B shows a side view of the access port shown in FIG. 63A; and

FIG. 63C shows an end view of the access port shown in FIG. 63A.

DETAILED DESCRIPTION

The instant disclosure relates generally to percutaneous access and, more specifically, to methods and devices associated with percutaneous access. Generally, the instant dis-

US 7,947,022 B2

3

closure relates to an access port for subcutaneous implantation. In one embodiment, an access port may allow a physician or other medical personnel to obtain long term percutaneous access to the interior of a patient's body. Employing an access port for percutaneous access may reduce the opportunity for infection by inhibiting fluid connections (that extend into the interior of a patient's body) from the patient's skin and from the external environment. The access device allows access to the interior of the patient without requiring a needle to pierce the skin. Further, internal components, such as a catheter or a valve, may be replaced without a surgical procedure. Features or aspects of the instant disclosure may apply to any such access ports for subcutaneous access to a patient, without limitation. The access port may be injected by hand (e.g., via a syringe including a needle) for example, or may be injected and pressurized by mechanical assistance (e.g., a so-called power injectable port).

Power injectable ports may be employed in, among other processes, for example, computed tomography ("CT") scanning processes. More particularly, a so-called "power injector" system may be employed for injecting contrast media into a peripherally inserted intravenous (IV) line. For example, such power injectors or injection systems may be commercially available from Medrad, Inc., a subsidiary of Schering AG, Germany and may be marketed under the trademark STELLANT®. Because fluid infusion procedures are often defined in terms of a desired flow rate of contrast media, such power injection systems are, in general, controllable by selecting a desired flow rate.

More specifically, the instant disclosure relates to an access port having at least one perceivable or identifiable feature for identifying the access port, wherein the identifiable feature is perceivable after the access port is implanted within a patient. For example, at least one or perhaps multiple identifiable feature(s) of an access port contemplated by the instant disclosure may be correlative to information (e.g., a manufacturer's model or design) pertaining to the access port. Thus, an identifiable feature from an access port of a particular model may be unique in relation to most if not all other identifiable features of another access port of a different models or design. Of course, the at least one identifiable feature of an access port contemplated by the instant disclosure may be further correlative with any information of interest, such as type of port, catheter type, date of manufacture, material lots, part numbers, etc. In one example, at least one identifiable feature of an access port may be correlative with the access port being power injectable. In this way, once at least one identifiable feature of an access port is observed or otherwise determined, correlation of such at least one feature of an access port may be accomplished, and information pertaining to the access port may be obtained.

In one embodiment, at least one feature may be perceived by palpation (i.e., to examine by touch), by way of other physical interaction, or by visual observation. Accordingly, a person of interest may touch or feel the access port through the skin to perceive at least one identifying characteristic thereof. In another embodiment, at least one identifiable feature may be perceived via x-ray or ultrasound imaging. In yet a further embodiment, at least one identifiable feature may be perceived through magnetic, light, or radio energy interaction or communication with the access port.

Turning to the embodiment wherein at least one feature may be perceived through palpation, other physical interaction, or visual observation, a topography or exterior surface feature of an access port contemplated by the instant disclosure may be configured for perception. For example, referring

4

to FIGS. 1A and 1B, an exemplary access port **10** contemplated by the instant disclosure is shown. FIGS. 1A and 1B show a perspective view and a schematic side cross-sectional view, respectively, of an access port **10** for allowing percutaneous or otherwise internal access to a patient's body. Access port **10** includes a housing or body **20** defined by a cap **14** and a base **16**. Cap **14** and base **16**, as known in the art, may be configured for capturing therebetween a septum **18**. As shown in FIG. 1A, cap **14** and base **16** may matingly engage one another along a mating line **15**. Cap **14** and base **16** may be secured or affixed to one another via mechanical fasteners such as screws or other fastening devices, may be adhesively affixed to one another, or may be affixed to one another as known in the art. Further, cap **14**, base **16**, and septum **18** may collectively define a cavity **36** in fluid communication with a lumen **29** of outlet stem **31**.

The body **20** may be implanted in a patient **7**, as shown in FIG. 1B, to dispose the cavity **36** subcutaneously within the patient **7**. Also, suture apertures **66** (FIG. 1A) may be used to affix the access port **10** within the patient **7**, if desired. After the body **20** is implanted in a patient **7**, the upper surface of the septum **18** may be substantially flush with the surface of the skin **6** of the patient **7** and may be repeatedly punctured for creating a percutaneous passageway from the exterior of the skin of the patient into the cavity **36**. The outlet stem **31** may create a fluid-communicative passageway from the cavity **36** through the outlet stem **31** and into the interior of the patient **7**. A catheter may be coupled to the outlet stem **31** for fluid communication with the cavity **36** and for transferring fluid from the cavity **36** to a desired remote location from the cavity **36** and within a patient **7**.

Body **20** of access port **10** may comprise a bio-compatible material such as polysulfone, titanium, or any other suitably bio-compatible material as known in the art. Accordingly, the body **20** may be formed from a bio-compatible plastic material. If desired, the body **20** may comprise a penetrable material for penetration by sutures or needles. In another embodiment, and as discussed further hereinbelow, body **20** may comprise an impenetrable material such as, for instance, a metal if desired. Body **20** may include a concave bottom or, in another embodiment, may include a flat bottom, without limitation.

According to the instant disclosure, access port **10** may comprise a body **20** exhibiting at least one identifiable feature. More particularly, as shown in FIG. 1A, body **20** may exhibit a partial generally pyramidal shape (i.e., a polygonal base having surfaces for each side of the polygon extending toward a common vertex otherwise known as a frustum). Generally, a body **20** of an access port **10** may exhibit a partial pyramidal shape extending between a generally quadrilateral shaped base positioned at reference plane **11** and a generally quadrilateral shaped upper base positioned at reference plane **9**. Reference planes **9** and **11** will not be shown in FIGS. 2-21, for clarity; however, reference to planes **9** or **11** with respect to FIGS. 2-21, as used herein, will refer to corresponding reference planes analogous to reference planes **9** and **11** as shown in FIGS. 1A and 1B.

As shown in FIG. 1A, the exterior of access port **10** is substantially defined by four substantially planar side surfaces **50** connected to one another by radiuses **32**. In addition, the upper topography **61** of access port **10** is defined by upper surface **60** in combination with chamfers **46A** and **46B** and may be further defined by the upper surface of septum **18**. Explaining further, the outer periphery of upper topography **61** may be described as a generally quadrilateral exterior formed by side regions **54** and having rounded corner regions

US 7,947,022 B2

5

30 adjacent side regions 54. Such a configuration may provide an access port having at least one feature that may be perceived by palpation.

It may be appreciated that there are many variations to the geometry of access port 10 as shown in FIG. 1A. For instance, while the body 20 of access port 10 may be described as a partially pyramidal shape or frustum, the instant disclosure is not so limited. Rather, one or more of side surfaces 50 may be oriented at as may be desired, without reference to any other side surfaces 50. Accordingly, for example, one of surfaces 50 may be substantially vertical while the remaining surfaces 50 may be oriented at respective, selected angles. Furthermore, it should be understood that FIG. 1A is merely exemplary and that the dimensions and shape as shown in FIG. 1A may vary substantially while still being encompassed by the instant disclosure.

FIG. 2 shows a perspective view of another embodiment of access port 10 according to the instant disclosure. As shown in FIG. 2, the exterior of access port 10 is substantially defined by a generally parallelogram-shaped base (positioned at reference plane 11 as shown in FIGS. 1A and 1B) extending generally pyramidally to a generally parallelogram-shaped upper surface (positioned at reference plane 9 as shown in FIGS. 1A and 1B). As shown in FIG. 2, radiuses 42 may be larger than radiuses 32 as shown in FIG. 1A. Furthermore, the upper topography 61 of access port 10 as shown in FIG. 2 may include rounded corner regions 40 which are larger than rounded corner regions 30 as shown in FIG. 1A. Thus, FIG. 2 shows an exemplary embodiment of an access port 10 that may be perceivably distinguishable from access port 10 as shown in FIGS. 1A and 1B. For example, a difference between one exterior of an access port contemplated by the instant disclosure and another exterior of a different access port contemplated by the instant disclosure may be determined by way of palpation.

In another embodiment, in another aspect contemplated by the instant disclosure, a template may be employed for perceiving at least one feature of an access port. For instance, a complementarily-shaped template may be positioned over and abutted against an access port contemplated by the instant disclosure so as to determine if the access port matches or substantially corresponds to the shape of the template. Such a process may reliably indicate or perceive at least one feature of an access port contemplated by the instant disclosure. Of course, a plurality of templates corresponding to different models of access ports may be serially engaged with an unknown access port so as to perceive at least one feature thereof. Such a process may allow for identification (e.g., of a model or manufacturer) of an access port contemplated by the instant disclosure.

In another aspect contemplated by the instant disclosure, an upper topography of an access port may include at least one feature for identifying the access port. For example, as shown in FIG. 3, upper surface 60 of access port 10 may be nonplanar. More specifically, upper surface 60 may be tapered or may arcuately extend downwardly (i.e., toward reference plane 11 as shown in FIGS. 1A and 1B) as it extends radially inwardly toward septum 18. Otherwise, access port 10, as shown in FIG. 3, may be configured substantially as described hereinabove with reference to FIGS. 1A and 1B. Thus, upper surface 60 is one exemplary example of at least one perceivable feature for identification of an access port contemplated by the instant disclosure.

In yet a further embodiment of an access port contemplated by the instant disclosure, side regions 54 extending between rounded corner regions 30 may exhibit at least one perceivable feature. For example, as shown in FIG. 4, access port 10

6

may include one or more side regions 54 that extend arcuately between adjacent rounded corner regions 30. Otherwise, access port 10, as shown in FIG. 4, may be configured substantially as described hereinabove with reference to FIGS. 1A and 1B. Side regions 54 may be congruent or symmetric with respect to one another or, in another embodiment, may be configured differently with respect to one another, without limitation.

FIG. 5 shows a further exemplary embodiment of an access port contemplated by the instant disclosure. More specifically, access port 10, as shown in FIG. 5, includes side regions 54 that form recessed regions 72 between adjacent rounded corner regions 30. Put another way, the upper topography 61 may include alternating recessed regions 72 and protruding regions 70 positioned generally about a periphery of septum 18. Otherwise, access port 10, as shown in FIG. 5, may be configured substantially as described hereinabove with reference to FIGS. 1A and 1B. Such a configuration may provide an access port having at least one identifiable feature.

In a further embodiment of an access port contemplated by the instant disclosure, FIGS. 6A and 6B show a perspective view and a side view, respectively, of an access port 10 generally configured as is described with reference to FIG. 5 but having an elongated body 20E. More specifically, elongated body 20E of access port 10, as shown in FIGS. 6A and 6B, includes a side surface 50E that extends generally from upper topography 61 downwardly (i.e., toward reference plane 11 as shown in FIGS. 1A and 1B) and having a slope (e.g., an angle with respect to a vertical axis normal to an upper surface of septum 18) which is different from the other side surfaces 50. Otherwise, access port 10, as shown in FIG. 6, may be configured substantially as described hereinabove with reference to FIGS. 1A and 1B. Such a configuration may provide an elongated body 20E of an access port 10 having an elongated side portion.

Of course, one or more side surfaces of an access port according to the instant disclosure may be configured for forming a body exhibiting a selected shape as may be desired. An elongated body portion of an access port contemplated by the instant disclosure may form, in combination with other features as described hereinabove or, in another embodiment, taken alone, at least one perceivable feature for identification of an access port according to the instant disclosure.

FIG. 7 shows a further embodiment of an access port encompassed by the instant disclosure. Particularly, as shown in FIG. 7, access port 10 may include an upper body portion 20a and a lower body portion 20b. Furthermore, each of upper body portion 20a and lower body portion 20b may exhibit a partial pyramidal shape (i.e., a frustum), wherein the body portions 20a and 20b are stacked vertically with respect to one another. Accordingly, upper body portion 20a may form an overhanging rim feature 76 extending along a periphery of access port 10. Explaining further, lower body portion 20b may have an exterior substantially defined by side surfaces 50b and rounded corner regions 30b, while upper body portion 20a may have an exterior substantially defined by side surfaces 50a, rounded corner regions 30a, and upper topography 61. It may be appreciated that overhanging rim feature 76 may be sized and configured for perception via palpation. Such a configuration may provide a suitable access port for delivery of a beneficial or medicinal substance, the access port being identifiable (e.g., by model number, manufacturer, etc.) after implantation.

It should be understood that the instant disclosure contemplates access ports having an exterior geometry that is not quadrilateral in nature. Rather, the instant disclosure contemplates that an access port may have an exterior which is

US 7,947,022 B2

7

generally cylindrical, generally conical, generally elliptical, generally oval, or an exterior that is otherwise arcuate in nature. Specifically, the instant disclosure contemplates that an access port having a substantially rounded or arcuate exterior may include at least one feature configured for identification of the access port after implantation. For example, as shown in FIG. 8, shows a cap 14 that exhibits an exterior surface 78 that is substantially conical. Cap 14 may be assembled to a suitable base (not shown) for capturing a septum (not shown) as described hereinabove to form an access port 10 as generally described with reference to FIGS. 1-7.

The instant disclosure further contemplates that at least one protrusion, protruding region, recess, recessed region, undulation, or adjacent features of different elevation may comprise a feature for identifying an access port contemplated by the instant disclosure. More specifically, upper topography 61C, as shown in FIG. 8, may include a plurality of protrusions 80. Protrusions 80 may exhibit partially spherical upper surfaces that transition into a lower portion of cap 14. In further detail, protrusions 80 may be circumferentially spaced about the periphery of septum (not shown) as may be desired. In one embodiment, a plurality of protrusions 80 may be symmetrically circumferentially spaced about the periphery of septum (not shown). More generally, at least one protrusion 80 may be sized, configured, and positioned for forming at least one identifiable feature of an access port. Of course, at least one protrusion 80 may be structured for facilitating comfort of a patient within which the access port is implanted. As may be appreciated, at least one protrusion 80 or more than one protrusion 80 may be included in an upper topography 61C of an access port (not shown) contemplated by the instant disclosure.

FIG. 9 shows another embodiment of a cap 14 including at least one protrusion 80E for forming and identifying an access port contemplated by the instant disclosure after implantation thereof within a patient. Protrusions 80E may extend circumferentially about a center of revolution. Thus, protrusions 80E may exhibit a body 87 portion circumferentially extending between rounded ends 83. Further, cap 14 may have an exterior surface 78 that is substantially symmetric about an axis of revolution. More generally, body 20 may extend from a generally circular, generally elliptical, or generally oval base positioned at a lower extent 71 of the cap 14 to an upper generally circular, generally elliptical, or generally oval cross section that is smaller than a cross section of the base and is positioned at an upper extent 73 (without considering protrusions 80E) of the cap 14. In addition, side surface 51, as shown in FIG. 9, extends arcuately between the base and the upper topography 61 of cap 14. Side surface 51 may extend in a generally tapered or conical fashion, may exhibit a radius or other arcuate shape, or may otherwise transition between a cross section of the base of the access port to a cross section proximate the upper topography 61C thereof.

Further, FIG. 10 shows an embodiment of a cap 14 for forming an access port contemplated by the instant disclosure having an upper topography 61C thereof comprising alternating circumferentially extending protrusions 80E and circumferentially extending recesses 82, wherein the circumferentially extending protrusions 80E are circumferentially larger than the circumferentially extending recesses 80E. In another embodiment of an access port contemplated by the instant disclosure, FIG. 11 shows a perspective view of a cap 14 having an upper topography 61C thereof comprising alternating circumferentially extending protrusions 80E and circumferentially extending recesses 82, wherein the circumferen-

8

tially extending protrusions 80E and the circumferentially extending recesses 82 are substantially equal in (circumferential) sized or extension. In yet a further embodiment of a cap 14 for forming an access port contemplated by the instant disclosure, FIG. 12 shows a perspective view of a cap 14 having an upper topography 61C thereof comprising three circumferentially extending protrusions 80E and three circumferentially extending recesses 82, arranged so as to alternate circumferentially, wherein the circumferentially extending protrusions 80E and the circumferentially extending recesses 82 are substantially equal in (circumferential) size.

FIG. 13 shows a perspective view of an additional embodiment of an cap 14 for forming an access port contemplated by the instant disclosure including an upper topography 61C including circumferentially extending protrusions 80T and circumferentially extending recesses 82T, wherein transition regions 81 are provided between circumferentially extending protrusions 80T and circumferentially extending recesses 82T. Such transition regions 81, as shown in FIG. 13, may taper or generally smoothly transition between a circumferentially extending protrusion 80T and a circumferentially extending recess 82T. Also, FIG. 14 shows a perspective view of an additional embodiment of a cap 14 for forming an access port contemplated by the instant disclosure including an upper topography 61C including protrusion regions 96 and recessed regions 98 that transition between one another and alternate circumferentially so as to form an undulating topography comprising upper topography 61C. Such an undulating topography, as shown in FIG. 14, generally smoothly transitions between circumferentially adjacent protrusion regions 96 and recessed regions 98.

In a further embodiment of an access port contemplated by the instant disclosure, FIGS. 15A and 15B show a perspective view and a top elevation view, respectively, of an access port 10 generally configured as is described with reference to FIG. 5 but may include at least one nonplanar side surface. In another embodiment, access port 10 as shown in FIG. 15 may be configured as shown in FIGS. 1-4 or FIGS. 6-7, or any embodiments described hereinbelow, without limitation. More specifically, elongated body 20 of access port 10, as shown in FIGS. 15A and 15B, includes three side surfaces 50R that extend arcuately (as shown in FIG. 15B). Such a configuration may provide an access port 10 that is identifiable subsequent to implantation. In yet another embodiment of an access port contemplated by the instant disclosure, FIG. 16 shows a perspective view of an access port 10 including a side wall 100 that truncates a portion of a radius 32 formed between side surfaces 50 of access port 10. It may also be noted that such an access port 10 may include three suture apertures 66, which may, taken alone or in combination with at least one other feature, comprise at least one identifiable feature of an access port contemplated by the instant disclosure. In addition, as shown in FIG. 16, outlet stem 31 may extend from side wall 100.

In a further embodiment of an access port contemplated by the instant disclosure, FIG. 17 shows a perspective view of an access port 10 wherein cap 14 and base 16, when assembled to one another along mating line 15, form a flange feature or lip feature 102 that extends about at least a portion of the periphery of the access port 10. As shown in FIG. 17, lip feature 102 extends substantially about the periphery of the access port 10, proximate to the mating line 15 between cap 14 and base 16. Such a feature may comprise at least one identifiable feature of an access port contemplated by the instant disclosure. Thus, it may be appreciated that a peripheral discontinuity between the cap 14 and base 16 may be formed generally along the mating line 15 therebetween. In

US 7,947,022 B2

9

the embodiment of an access port as shown in FIG. 7, an overhanging rim feature 76 may comprise a peripheral discontinuity or, in the embodiment of an access port as shown in FIG. 17, a lip feature 102 may comprise a peripheral discontinuity.

In a further embodiment of an access port contemplated by the instant disclosure, FIG. 18 shows a perspective view of an access port 10 wherein at least a portion of at least one side surface 50 is concave. As shown in FIG. 18, concave region 106 of side surface 50 is concave. Concavity (i.e., a concave region 106) may be exhibited over at least a portion of a side surface of an access port of any of the embodiments as shown herein, without limitation. Thus, at least one side surface 50 of an access port contemplated by the instant disclosure having at least a portion thereof that is concave is one exemplary example of at least one perceivable feature for identification of an access port contemplated by the instant disclosure.

In a further embodiment of an access port contemplated by the instant disclosure, FIG. 18 shows a perspective view of an access port 10 wherein at least a portion of at least one side surface 50 is concave. As shown in FIG. 18, region 106 of side surface 50 is concave. Concavity may be exhibited over at least a portion of a side surface of an access port of any of the embodiments as shown herein, without limitation. Thus, at least one side surface 50 of an access port contemplated by the instant disclosure having at least a portion thereof that is concave is one exemplary example of at least one perceivable feature for identification of an access port contemplated by the instant disclosure.

In a further embodiment of an access port contemplated by the instant disclosure, FIG. 19 shows a perspective view of an access port 10 generally configured as is described with reference to FIGS. 6A and 6B. More specifically, elongated body 20ER, as shown in FIG. 19 includes a side surface 50ER that extends arcuately from upper topography 61 of access port 10 downwardly (i.e., toward reference plane 11 as shown in FIGS. 1A and 1B). Such a configuration may provide an elongated body 20E of an access port 10 having an elongated side portion.

It should be understood from the above-described various embodiments of an access port contemplated by the instant disclosure that many variations, additions, or different features may be encompassed by the instant disclosure. Thus, the instant disclosure is not limited to the several above-described exemplary embodiments.

For example, as shown in FIG. 20, which shows a top elevation view of an access port 10 contemplated by the instant disclosure, an access port 10 may include a side wall 100 that at least partially truncates a radius 32 between side surfaces 50, outlet stem 31 extending from side wall 100, and at least one of a concave region 106 and an arcuate surface 50R. Further, as shown in FIG. 20, suture apertures 66 may be positioned so as to identify the access port 10 after subcutaneous implantation.

Additionally, the instant disclosure contemplates access ports having an exterior geometry that is polygonal in nature. Specifically, the instant disclosure contemplates that an access port contemplated by the instant disclosure may exhibit a generally triangular exterior. Thus, as shown in FIG. 21, body 20 may exhibit a generally pyramidal or tapered shape (i.e., a polygonal base having surfaces for each side of the polygon extending toward a common vertex). Generally, a body 20T of an access port 10 may extend between a generally triangularly-shaped base and a relatively smaller, generally triangularly-shaped upper base. Accordingly, the exterior of access port 10 may be substantially defined by

10

three side surfaces (e.g., 50, 50R, 102, 50E) having radiuses 32 extending therebetween. In addition, the upper topography 61 of access port 10 may be defined by upper surface 60 in combination with side regions 54 and rounded corner regions 30. Such a configuration may provide an access port having at least one feature that may be perceived by palpation.

FIGS. 22 and 23 show a perspective view and a top elevation view of another embodiment of an access port including a generally triangular exterior geometry. More particularly, as shown in FIGS. 22 and 23, a cap 14 and base 16 (collectively forming a housing) may capture a septum 118 to form an access port 10. Further, outlet stem 31 may include a stem base that may be positioned within and sealed to an outlet recess 93 formed within base 16. The outlet stem 31 may be in fluid communication with a cavity formed within the access port 10. Optionally, suture plugs 89 may be positioned within suture cavities 91 formed in base 16. Suture plugs 89 may comprise a pliant material (e.g., silicone, rubber, etc.) that may provide some resilience between sutures coupling the access port 10 (i.e., the base 16) to a patient. In further detail, a side periphery 95 (e.g., one or more side walls) of access port 10 may be generally triangular. Thus, cap 14 and base 16 may collectively form a generally triangular housing or body of access port 10. Also, the instant disclosure contemplates that side periphery 95 may increase or decrease in cross-sectional size (e.g., by tapering or arcuately transforming) between upper surface 161 of cap 14 and lower surface 151 of base 16. As shown in FIGS. 22 and 23, a transverse cross section (taken in a selected plane substantially parallel to lower surface 151 of base 16) of access port 10 may be larger proximate to lower surface 151 of base 16 and may be relatively smaller proximate upper surface 161 of cap 14.

Additionally, FIG. 24 shows a simplified representation of a transverse cross section of access port 10. As shown in FIG. 24, side periphery 95 of access port 10 may define three side regions 103 that extend between associated vertex regions 101. In addition, in one embodiment and as shown in FIG. 24, side periphery 95 may define a substantially equilateral generally triangular shape. As one of ordinary skill in the art will appreciate, side regions 103 may arcuately extend between associated vertex regions 101; thus, side regions 103 may form "sides" of a generally triangular shape. Further, although vertex regions 101 are rounded, it may be appreciated that such vertex regions 101 form an intersection between adjacent side regions 103. Accordingly, one of ordinary skill in the art will appreciate that the phrase "generally triangular," as used herein, encompasses any generally three-sided geometry wherein adjacent sides intersect, without limitation. For example, the phrase "generally triangular" encompasses three sided polygons, circular triangles, equilateral triangles, etc., without limitation.

The instant disclosure also contemplates that at least one feature of an access port contemplated by the instant disclosure may not be observable visually or by palpation but, rather, may be otherwise observable. For example, the instant disclosure contemplates that at least one feature of an access port may be observable through interaction with an imaging technology such as x-ray or ultrasound. For example, in one embodiment, a metal feature (e.g., a plate or other metal geometry) may be included by an access port contemplated by the instant disclosure. As may be appreciated, such a metal feature may be represented on an x-ray generated by exposure of the access port to x-ray energy while simultaneously exposing x-ray sensitive film to x-ray energy passing through the access port. Further, the instant disclosure contemplates that a size, shape, or both size and shape of a metal feature of an access port may be configured for enhancing identification

US 7,947,022 B2

11

of an access port. For example, assuming that a metal feature comprises a metal plate, a size, shape, or both may be selectively tailored for identification of an access port. Similarly, a feature of an access port contemplated by the instant disclosure may be tailored for detection via ultrasound interaction. Such a feature may comprise an exterior topographical feature. In another embodiment, such a feature may comprise a composite structure including two or more materials that form an interface surface that may be identified by ultrasound imaging.

One example embodiment of a feature observable through interaction with imaging technology contemplated by the instant disclosure is shown in FIGS. 52, 53A, and 53B. FIG. 52 depicts a bottom perspective view of an access port 10. FIG. 53A shows a top view of the access port 10, while FIG. 53B shows a bottom view of the access port. The access port 10 of FIGS. 52, 53A, and 53B is similar in some respects to the access port 10 as seen in FIGS. 22 and 23, including a cap 14 and a base 16 that cooperate to define a body. In the present example embodiment, however, the lower surface 151 of the base 16 includes an identification feature 200, as seen in FIGS. 52 and 53B. It is contemplated that the identification feature 200 can be one or more alphanumeric characters, such as the "CT" depicted. Additionally, the instant disclosure contemplates the use of other markings, such as one or more symbols, patterns, characters, designs, a combination thereof, etc. The identification feature 200 can be of any size, shape, or both in order to tailor the identification feature for the specific identification of one or more of a variety of characteristics of the access port. Specifically, in one embodiment the identification feature 200 can convey information to a practitioner regarding the power-injectability of the implanted access port. Note that in the present embodiment, the identification feature 200 is defined as a recessed feature, whereas in other embodiments the identification feature may be defined in other ways, as discussed hereafter.

As mentioned above, FIG. 53A depicts a top view of the access port 10. Note that the identification feature 200 is not observable through the upper surface 161 of the cap 14 or through the septum 118 without the interaction of imaging technology. As seen in FIG. 53B, the alphanumeric characters of the identification feature 200, "CT," are engraved mirror-reversed on the lower surface 151 of the base 16. The "CT" is engraved mirror-reversed so that when imaging technology, such as x-ray imaging, is used to identify a subcutaneously implanted access port, the "CT" will be visible in the proper orientation. By engraving a desired identification feature mirror-reversed on the bottom surface of an access port, a practitioner will be able to determine if there is a problem with the port after implantation, such as if the access port has flipped or otherwise become mis-oriented while in the body of the patient. Thus, if the identification feature is seen mirror-reversed or askew in an x-ray image, the practitioner can correct the problem before attempts are made to use the access port.

Although also useful in access ports where only a portion of a port includes a metallic material, e.g., a metal plate, the engraving technique is well-suited in one embodiment for access ports that are composed of solid metal, such as titanium, stainless steel, or other materials that are typically radiopaque, i.e., non-transmissive to x-rays in sufficient thickness. FIGS. 54A-54C are representative images of the access port 10 of FIG. 52, which includes titanium or other metallic material, as seen via x-ray imaging after implantation into the patient. The access port 10 includes the identification feature 200 as seen in FIGS. 52 and 53B. Due to the relative thickness of the access port 10, the material of the base 16 and cap 14 surrounding a cavity periphery 36A of the

12

cavity 36, which is a fluid cavity, is substantially non-transmissive to x-rays and therefore appears relatively dark in the x-ray image of FIG. 54A. However, the material of the access port 10 within the cavity periphery 36A is relatively thinner through a cavity base 220 (as seen in FIG. 55) than through the material of the cap 14 and base 16. Thus, additional thinning of the material when creating the identification feature 200 enables the identification feature to appear relatively more radiographically transmissive than the surrounding material of the cavity base under x-ray imaging. Note that the identification feature 200 in FIG. 54A is visible in the proper orientation, indicating that the access port is not flipped.

FIGS. 54B and 54C are additional representative x-ray images of the identification feature 200 of the access port 10, wherein the access port is tilted at angles of approximately 20 and 50 degrees, respectively. Thus, the identification feature 200 is also useful for determining relative orientation of the access port 10 after implantation.

FIG. 55 shows a cross-sectional view taken at line 55-55 of the access port 10 in FIG. 52. In this example embodiment, the identification feature 200 is disposed beneath the septum 118 and the cavity 36. FIGS. 56A and 56B further depict enlarged cross-sectional views of potential cut profiles of the recessed identification feature 200. FIG. 56A shows a rounded engraving profile 201, engraved on the lower surface 151 of the base 16 and used for purposes of aesthetics and ease of manufacturing. For a relatively more defined contrast under imaging technology, however, a sharp-edged engraving profile 202 may be used, as seen in FIG. 56B. Note that a variety of cross-sectional recessed profiles may be employed. This disclosure further contemplates that although engraving is discussed here, other methods of marking the identification feature may be used, such as milling, machining, chemical or laser etching, molding, stamping, etc.

Regardless of the cut profile used, better contrast is achieved generally with greater engraving depth X. The optimal engraving depth X will depend, however, on the thickness of the overall cavity base 220, which is the portion of the base directly below the cavity 36, as shown in FIG. 55. For example, in an embodiment of an access port including titanium, if the overall thickness of the cavity base 220 is approximately 0.020" then sufficient contrast for x-ray imaging purposes can be obtained in one embodiment by engraving the identification feature 200 to a depth X (FIGS. 56A, 56B) of between about 0.009" and about 0.011". In another example embodiment of an access port including titanium, where the overall thickness of the cavity base 220 is approximately 0.030", sufficient contrast can be obtained by engraving the identification feature 200 to a depth X of between about 0.015" and about 0.021". One of ordinary skill in the art will appreciate that the depth of an engraved identification feature can be varied substantially in order to comply with a product's safety requirements and still remain within the scope contemplated by this disclosure. In addition, the depth X of the identification feature can vary according to the position of the feature on the access port, the thickness of material to be penetrated by the imaging technology, the type of material included in the access port, etc.

It is also contemplated by this disclosure that the use of an identification feature in a metallic or other radiopaque access port can be applied to access ports having a variety of possible configurations, such as is seen in FIGS. 57A-58C, for example. FIGS. 57A-57C depict one embodiment, wherein the access port 10 includes an identification feature 200 on a lower surface 251 of a base or body 116. The access port 10 in FIGS. 57A-57C includes a retaining ring 230, which seals the septum 118 to the base or body 116, over the cavity 36. In one

US 7,947,022 B2

13

embodiment, the retaining ring **230** is press fit into the base or body **116** to hold the septum **118** in place. FIGS. **58A-58C** show yet another embodiment, wherein the access port **10** includes an identification feature **200** on the cavity base **220** and wherein the cavity base is mated to and flush with a lower surface **252** of a cap **114** to define a body. In a particular embodiment, the cavity base **220** is press fit into the cap **114**, though other mating configurations can also be employed.

In another embodiment contemplated by the instant disclosure, FIGS. **59A** and **59B** show that the location of the identification feature **200** can vary as well. Rather than placing the identification feature **200** under the cavity **36**, it is possible to place the identification feature under another portion of the access port **10**, such as under the outlet stem **31** and between the septum plugs **89**, i.e., proximate the outer periphery of the access port bottom surface. Though the overall thickness of the access port structure above the identification feature **200** is greater in this location than if engraved under the cavity **36**, the change in location allows for a relatively deeper engraving, which will increase contrast without risk of excessive thinning of the cavity base **220**. Additionally, in one embodiment, it is possible to define the identification feature compositely by engraving into both the bottom and top surfaces, such that the engravings are vertically aligned. This enables the remaining material thickness to be substantially reduced in order to provide relatively greater radiographic transmission through the identification feature.

Additionally, the instant disclosure contemplates access ports having any variety or combination of desired identification features for indicating power-injectability or other aspect or characteristic of an access port. Specifically, FIGS. **60A-61B** depict different types of identification features **200**, according to example embodiments. FIGS. **60A-60B** depict a symbolic identification feature **200**. FIGS. **61A-61B** depict an exemplary embodiment of an access port **10** including a combination of identification features **200**, namely an alphanumeric identification feature **200A** and a patterned identification feature **200B**. A patterned or symbolic identification feature can also be used to help indicate the orientation of the port or for any other desired reason. It is understood by the instant disclosure that other symbols, patterns, marks, and alphanumeric characters can be used both alone and in any combination with each other on a variety of access port configurations.

In additional embodiments, the identification feature can be defined on an inside bottom surface **36B** of the cavity **36** of an access port **10**, or in addition to the identification feature **200** provided on the bottom surface **251**. In another embodiment, the material surrounding the defining edges of the desired radiopaque alphanumeric character, symbol, pattern, etc., can be removed instead of removing the desired feature shape itself so as to define a "positive" relief image of the identification feature. Such a positive relief identification feature can be defined on a lower surface of an access port body or on the inside bottom surface of the cavity, for example.

In addition to the various types of symbols, patterns, marks, and alphanumeric characters that are contemplated by the instant disclosure, FIGS. **62A-63C** disclose additional example embodiments of identifying features on access ports that are observable via x-ray or other suitable imaging technology. Specifically, the instant disclosure contemplates the use of shelled-out cavities **204**, wherein portions of the access port **10** are hollowed out. This results in shelled-out cavities **204** extending inward from the lower surface **251** of the base or body **116** or corresponding port lower surfaces of the other embodiments described herein, including the lower surface **151** of the base **16**, as in FIG. **151**, and the lower surface **252**

14

of a cap **114**, as in FIGS. **58A-58C**. This is done by removing the material surrounding the cavity **36** without disrupting the cavity periphery **36A** or the outer side surfaces **250** of the access port **10**. As seen in FIG. **62B**, ribs **240** may be left to support the remaining "shelled" frame of the access port **10**. The definition of such cavities **204** provides a relative difference in radiopacity of the access port **10** that can be identified via x-ray imaging. As such, the cavities **204** can be arranged to define a pattern or to form an indicia for identification of an aspect or characteristic of the access port **10**. Note that in other embodiments, the cavities can be defined so as to extend from other surfaces of the access port, including the top and sides thereof.

In a further aspect contemplated by the instant disclosure, it is contemplated that a communicative technology may be utilized wherein information is encompassed by an access port contemplated by the instant disclosure. Generally, a communication device (e.g., a radio beacon, a light-emitting element, an ultrasound emitting transducer, etc.), may be imbedded or otherwise affixed to an access port contemplated by the instant disclosure. Such a communication device may be configured for transmitting information in response to a given impetus. More specifically, the instant disclosure contemplates that an access port contemplated by the instant disclosure may be exposed to a request signal (e.g., a sound, an impact or an acceleration, light, radio waves, etc.). Such a request signal may cause the communication device to transmit information therefrom via sound, light, radio waves, or as otherwise known in the art. Such information may be employed for identifying an access port contemplated by the instant disclosure.

In one exemplary example, it is contemplated that radio frequency identification technology may be employed for identification of an access port contemplated by the instant disclosure. Particularly, so-called active RFID tags are powered by an internal battery and are typically read/write devices. Currently, a suitable cell coupled to suitable low power circuitry can ensure functionality for as long as ten or more years, depending upon the operating temperatures and read/write cycles and usage. So-called passive RFID tags operate without a separate external power source and obtain operating power generated from the reader. Passive RFID tags are typically programmed with a unique set of data (usually 32 to 128 bits) that cannot be modified. Read-only tags may operate as an identifier comparable to linear barcodes which may contain selected product-specific information. Thus, passive RFID tags may be much lighter than active RFID tags, less expensive, and may offer a virtually unlimited operational lifetime. The tradeoff is that they have shorter read ranges than active tags and require a higher-powered reader.

One advantage of RFID approach is the noncontact, non-line-of-sight nature of the technology. Tags can be read through a variety of substances such as snow, fog, ice, paint, crusted grime, and other visually and environmentally challenging conditions, where other optically read technologies may be less effective. RFID tags can also be read in challenging circumstances at rapid speeds, in most cases responding in less than about 100 milliseconds.

While certain representative embodiments and details have been shown for purposes of illustrating aspects contemplated by the instant disclosure, it will be apparent to those skilled in the art that various changes in the methods and apparatus disclosed herein may be made without departing from the scope contemplated by the instant disclosure, which is defined in the appended claims. For example, other access port sizes and shapes may be employed; and various other

US 7,947,022 B2

15

embodiments and structures may be employed for forming at least one identifiable feature of an access port contemplated by the instant disclosure. In particular, FIGS. 25-51 illustrate a number of additional exemplary embodiments of access port 10. As is apparent from these figures, access port 10 may be formed in any number of shapes and sizes, such that any number of modifications and changes are possible to any of the embodiments described and illustrated herein without departing from the spirit and scope of the instant disclosure.

What is claimed is:

1. An access port for providing subcutaneous access to a patient, comprising:

a body defining a fluid cavity accessible by inserting a needle through a septum; and

at least one radiopaque identification feature of the access port observable via imaging technology subsequent to subcutaneous implantation of the access port, the at least one radiopaque identification feature including one or more alphanumeric characters identifying the access port as a power-injectable port.

2. The access port according to claim 1, wherein the imaging technology includes x-ray imaging technology.

3. The access port according to claim 1, wherein the radiopaque identification feature is defined on a bottom surface of the access port.

4. The access port according to claim 1, wherein the radiopaque identification feature is defined as a recessed feature in the body of the access port.

5. The access port according to claim 1, wherein the access port includes a metallic portion and the radiopaque identification feature is disposed on the metallic portion.

6. The access port according to claim 1, wherein the at least radiopaque identification feature includes at least one of the following: a symbol, a pattern, a mark, or any combination thereof.

7. The access port according to claim 1, wherein the at least one radiopaque identification feature includes at least one cavity extending inward from a bottom surface of the body.

8. The access port according to claim 1, wherein the at least one radiopaque identification feature indicates an orientation of the access port when the access port is imaged by x-ray imaging technology.

9. The access port according to claim 1, wherein the one or more alphanumeric characters includes the letters "C" and "T."

16

10. An access port for providing subcutaneous access to a patient, comprising:

a metallic body defining a fluid cavity; and
an radiopaque identification feature included on a bottom surface of the access port, the feature being an alphanumeric message observable via imaging technology subsequent to subcutaneous implantation of the access port, the alphanumeric message identifying the access port as a power-injectable port.

11. The access port according to claim 10, wherein the alphanumeric message is recessed in the bottom surface of the access port.

12. The access port according to claim 10, wherein the alphanumeric message is disposed below the port fluid cavity.

13. The access port according to claim 10, wherein the alphanumeric message is proximate a periphery of the bottom surface of the access port.

14. The access port according to claim 10, wherein the body includes titanium and includes a base, the base defining at least a portion of the bottom surface of the access port.

15. The access port according to claim 10, wherein the alphanumeric message is disposed on an inside bottom surface of the fluid cavity.

16. An access port for providing subcutaneous access to a patient, comprising:

a body including a metallic material and defining a fluid cavity, the fluid cavity covered by a septum; and

at least one recessed identification feature defined by the body, observable via x-ray imaging technology subsequent to subcutaneous implantation of the access port, the at least one identification feature identifying the access port as a power-injectable access port.

17. The access port according to claim 16, wherein the at least one recessed identification feature is included on an inside surface of the fluid cavity.

18. The access port according to claim 16, wherein the at least one recessed identification feature includes an engraved feature and is relatively more x-ray transmissive with respect to other portions of the access port body.

19. The access port according to claim 16, wherein the at least one recessed identification feature includes one or more alphanumeric characters.

20. The access port according to claim 19, wherein the one or more alphanumeric characters includes the letters "C" and "T."

* * * * *