



US0D1060608S

(12) **United States Design Patent** (10) **Patent No.: US D1,060,608 S**
Collins (45) **Date of Patent: ** Feb. 4, 2025**

(54) **DEVICE TO CONTROL FLUID FLOW THROUGH A TUBE**

(71) Applicant: **DEKA Products Limited Partnership**,
Manchester, NH (US)

(72) Inventor: **David E. Collins**, Amesbury, MA (US)

(73) Assignee: **DEKA Products Limited Partnership**,
Manchester, NH (US)

(**) Term: **15 Years**

(21) Appl. No.: **29/861,477**

(22) Filed: **Nov. 30, 2022**

Related U.S. Application Data

(60) Continuation of application No. 29/691,259, filed on
May 15, 2019, now Pat. No. Des. 972,125, which is
(Continued)

(51) **LOC (15) Cl.** **29-02**

(52) **U.S. Cl.**
USPC **D24/111**

(58) **Field of Classification Search**
USPC D24/107, 108, 111, 127, 169, 185, 186
(Continued)

(56) **References Cited**

U.S. PATENT DOCUMENTS

774,645 A 11/1904 Brooks
789,516 A 5/1905 Williams
(Continued)

FOREIGN PATENT DOCUMENTS

CN 213749 11/1986
CN 1986008 6/2007
(Continued)

OTHER PUBLICATIONS

Jetley et al., "Safety Requirements Based Analysis of Infusion Pump Software", Proceedings of the IEEE Real Time Systems Symposium, Tuscon, Dec. 2007 pp. 1-4.

(Continued)

Primary Examiner — Omeed Agilee

Assistant Examiner — Michael Hoffman

(74) *Attorney, Agent, or Firm* — Ira Stickler

(57) **CLAIM**

The ornamental design for a device to control fluid flow through a tube, as shown and described.

DESCRIPTION

FIG. 1 is a perspective view of a first embodiment of a device to control fluid flow through a tube, showing my new design;

FIG. 2 is a front side elevational view thereof;

FIG. 3 is a back side elevational view thereof;

FIG. 4 is a left side elevational view thereof;

FIG. 5 is a right side elevational view thereof;

FIG. 6 is a top plan view thereof;

FIG. 7 is a bottom plan view thereof;

FIG. 8 is a perspective view of a second embodiment of a device to control fluid flow through a tube, showing my new design;

FIG. 9 is a front side elevational view thereof;

FIG. 10 is a back side elevational view thereof;

FIG. 11 is a left side elevational view thereof;

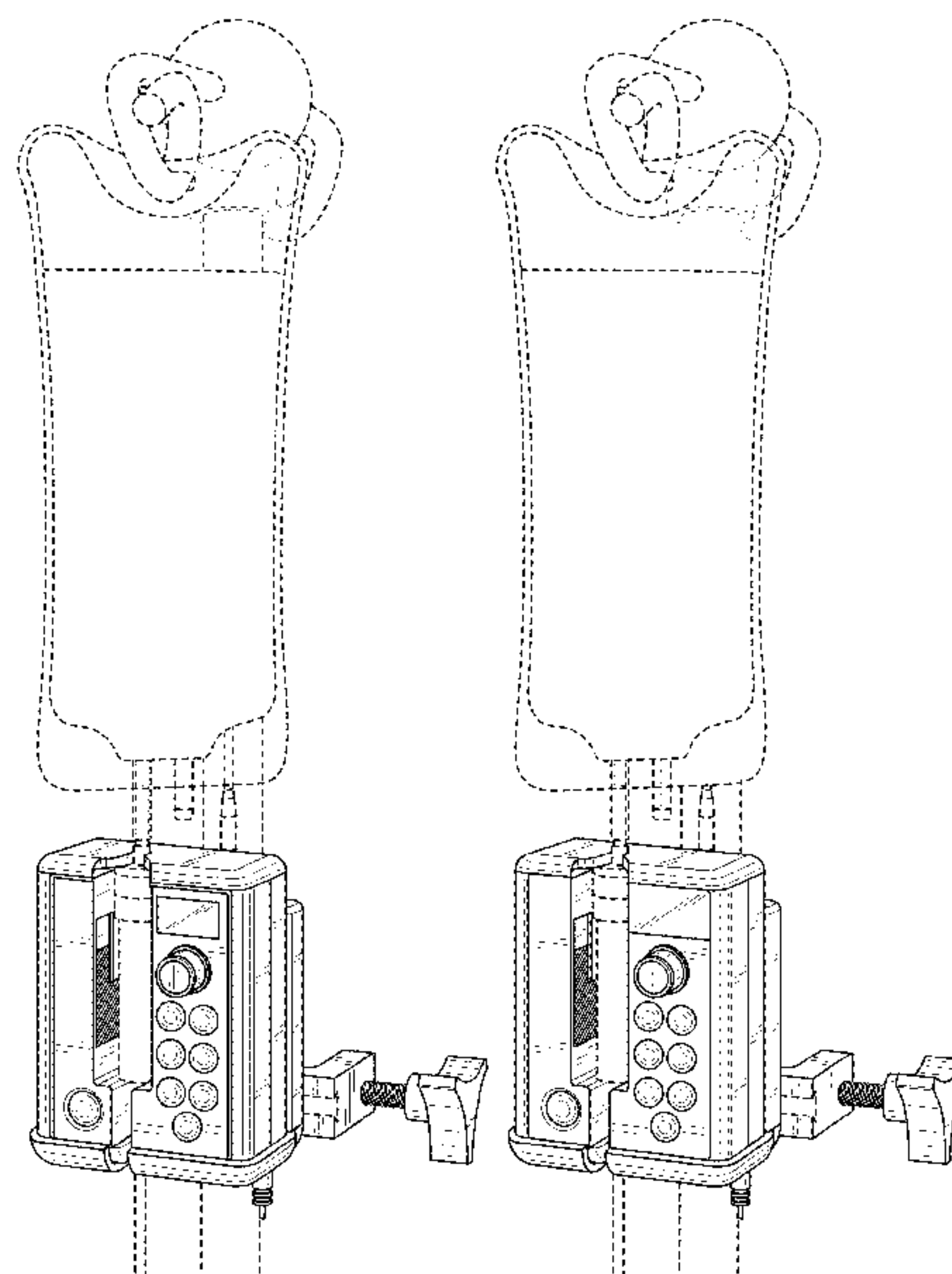
FIG. 12 is a right side elevational view thereof;

FIG. 13 is a top plan view thereof; and,

FIG. 14 is a bottom plan view thereof.

The broken lines shown in the drawings depict portions of the device to control fluid flow through a tube, that form no part of the claimed design.

1 Claim, 14 Drawing Sheets



Related U.S. Application Data

a division of application No. 29/565,908, filed on May 25, 2016, now Pat. No. Des. 854,145.

(58) Field of Classification Search

CPC A61M 5/142; A61M 5/1452; A61M 5/168; A61M 5/16886; A61M 2205/502; A61M 2205/505; A61M 2205/3331; A61M 2205/3334; A61M 2205/8206

See application file for complete search history.

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

792,963 A	6/1905	Bullard	4,920,336 A	4/1990	Meier
795,424 A	7/1905	Bailey	4,936,828 A	6/1990	Chiang
795,805 A	8/1905	Wakefield	4,959,050 A	9/1990	Bobo, Jr.
799,025 A	9/1905	Price	4,979,940 A	12/1990	Bobo, Jr.
974,430 A	11/1910	Peter	4,981,467 A	1/1991	Bobo
2,880,764 A	4/1959	Pelavin	5,002,539 A	3/1991	Coble
2,888,877 A	6/1959	Shellman	5,045,069 A	9/1991	Imparato
3,173,372 A	3/1965	Baldwin	5,047,014 A	9/1991	Mosebach et al.
3,384,336 A	5/1968	Pulman	5,057,090 A	10/1991	Bessman
3,609,379 A	9/1971	Hildebrandt	5,083,741 A	1/1992	Sancoff
3,640,311 A	2/1972	Gotzenberger	5,154,693 A	10/1992	East et al.
3,685,787 A	8/1972	Adelberg	5,154,704 A	10/1992	Archibald
3,724,807 A	4/1973	Jackson	5,181,910 A	1/1993	Scanlon
3,733,149 A	5/1973	Jacobson	5,186,057 A	2/1993	Everhart
3,790,042 A	2/1974	McCormickj	RE34,413 E	10/1993	McCullough
3,831,600 A	8/1974	Buckles	5,267,980 A	12/1993	Dirr, Jr.
4,038,982 A	8/1977	Burke	5,271,432 A	12/1993	Gueret
4,105,028 A	8/1978	Sadlier	5,278,626 A	1/1994	Poole
4,155,362 A	5/1979	Jess	5,279,558 A	1/1994	Kriesel
4,191,184 A	3/1980	Carlisle	D347,472 S *	5/1994	Sunderland D24/111
4,247,077 A	1/1981	Banick et al.	5,314,316 A	5/1994	Shibamoto
4,303,376 A	12/1981	Siekmann	D348,730 S	7/1994	Walker et al.
4,321,461 A	3/1982	Walter	5,328,341 A	7/1994	Forni
4,328,800 A	5/1982	Marx	5,331,309 A	7/1994	Sakai
4,328,801 A	5/1982	Marx	D353,667 S	12/1994	Tsubota et al.
4,383,252 A	5/1983	Purcell	D355,716 S	2/1995	Nash et al.
4,397,642 A	8/1983	Lamadrid	5,411,052 A	5/1995	Murray
4,421,506 A	12/1983	Danby	5,415,641 A	5/1995	Yerlikaya
4,449,534 A	5/1984	Leibinsohn Saul	D361,617 S	8/1995	Sancoff et al.
4,469,480 A	9/1984	Figler	5,439,442 A	8/1995	Bellifemine
4,490,140 A	12/1984	Carr	D362,721 S	9/1995	Peeler et al.
4,496,351 A	1/1985	Hillel et al.	5,482,446 A	1/1996	Williamson
4,504,263 A	3/1985	Steuer	D367,527 S *	2/1996	Marston D24/111
4,525,163 A	6/1985	Slavik	5,489,265 A	2/1996	Montalvo et al.
4,553,958 A	11/1985	Lecocq	5,526,285 A	6/1996	Campo
4,577,197 A	3/1986	Crean	5,562,615 A	10/1996	Nassif
4,583,975 A	4/1986	Pekkarinen	5,588,963 A	12/1996	Roelofs
RE32,294 E	11/1986	Knute	5,601,980 A	2/1997	Gordon
4,634,426 A	1/1987	Kamendeanl	5,707,588 A	1/1998	Tsukishima
4,635,281 A	1/1987	Jones	5,718,562 A	2/1998	Lawless
4,648,869 A	3/1987	Bobo, Jr.	5,753,820 A	5/1998	Reed
4,662,829 A	5/1987	Nehring	5,782,805 A	7/1998	Meinzer
4,668,216 A	5/1987	Martin	5,800,140 A	9/1998	Forni
4,673,161 A	6/1987	Flynn et al.	5,800,386 A	9/1998	Bellifemine
4,673,616 A	6/1987	Goodwin	5,814,015 A	9/1998	Gargano et al.
4,673,820 A	6/1987	Kamen	5,843,045 A	12/1998	DuPont
4,680,977 A	7/1987	Conero	5,896,195 A	4/1999	Juvinall
4,703,314 A	10/1987	Spani	5,899,665 A	5/1999	Makino
4,718,896 A	1/1988	Arndt	5,920,361 A	7/1999	Gibeau
4,720,636 A	1/1988	Benner, Jr.	D416,999 S	11/1999	Miyamoto
4,722,224 A	2/1988	Scheller et al.	6,015,083 A	1/2000	Hayes
4,775,368 A	10/1988	Iwatschenki	6,049,381 A	4/2000	Reintjes
4,778,451 A	10/1988	Kamen	6,050,713 A	4/2000	O'Donnell
4,787,406 A	11/1988	Edwards et al.	6,083,206 A	7/2000	Molko
4,812,904 A	3/1989	Maring	6,091,483 A	7/2000	Guirguis
4,820,268 A	4/1989	Kawamura	6,091,492 A	7/2000	Strickland
4,820,281 A	4/1989	Lawler	6,110,153 A	8/2000	Davis
4,821,904 A	4/1989	Bhargava et al.	D434,150 S	11/2000	Tumey et al.
4,834,744 A	5/1989	Ritson	6,142,979 A	11/2000	McNally et al.
4,837,708 A	6/1989	Wright	6,144,453 A	11/2000	Hallerman
4,846,792 A	7/1989	Bobo, Jr.	6,149,631 A	11/2000	Haydel, Jr.
4,909,786 A	3/1990	Gijsselhart	6,159,186 A	12/2000	Wickham
			6,213,354 B1	4/2001	Kay
			6,213,739 B1	4/2001	Phallen et al.
			6,228,047 B1	5/2001	Dadson
			D446,860 S	8/2001	Meziere
			6,270,478 B1	8/2001	Mern
			6,305,908 B1	10/2001	Hermann
			6,328,712 B1	12/2001	Cartledge
			6,362,887 B1	3/2002	Meisberger
			D461,891 S	8/2002	Moberg
			6,491,659 B1	12/2002	Miyamoto
			6,500,151 B1	12/2002	Cobb
			6,503,221 B1	1/2003	Briggs
			6,523,414 B1	2/2003	Malmstrom
			D471,274 S	3/2003	Diaz et al.
			6,549,639 B1	4/2003	Genest
			6,554,791 B1	4/2003	Cartledge et al.
			6,562,012 B1	5/2003	Brown

(56)

References Cited

U.S. PATENT DOCUMENTS

6,574,050 B1	6/2003	Lin et al.	8,638,358 B2	1/2014	Dabiri et al.
6,599,282 B2	7/2003	Burka	8,647,074 B2	2/2014	Moberg et al.
6,641,556 B1	11/2003	Shigezawa	8,692,678 B2	4/2014	Warner et al.
6,657,545 B1	12/2003	Lin	8,733,178 B2	5/2014	Bivans et al.
6,736,801 B1	5/2004	Gallagher	D709,183 S	7/2014	Kemlein
6,776,152 B2	8/2004	Gray et al.	8,777,897 B2	7/2014	Butterfield
6,810,290 B2	10/2004	Lebel et al.	D712,043 S	8/2014	Sliger
6,814,547 B2	11/2004	Childers et al.	D714,452 S	9/2014	Koski et al.
6,947,073 B1	9/2005	Seal	8,834,429 B2 *	9/2014	Grant A61M 5/1723
6,975,898 B2	12/2005	Seibel			604/218
6,984,052 B1	1/2006	Del Castillo	D720,449 S	12/2014	Galbraith et al.
7,001,365 B2	2/2006	Makkink	D728,779 S	5/2015	Sabin et al.
7,068,831 B2	6/2006	Florent	D735,319 S	7/2015	Sabin et al.
7,070,121 B2	7/2006	Schramm	D736,370 S	8/2015	Sabin et al.
7,092,796 B2	8/2006	Vanderveen	9,095,652 B2	8/2015	Dewey
7,118,549 B2	10/2006	Chan	9,128,051 B2	9/2015	Bui
7,147,448 B2	12/2006	Slaughter et al.	9,134,735 B2	9/2015	Lowery et al.
7,163,740 B2	1/2007	Rosati	9,134,736 B2	9/2015	Lowery et al.
7,190,275 B2	3/2007	Goldberg	9,144,644 B2	9/2015	Hungerford
7,255,680 B1	8/2007	Gharib	9,151,646 B2	10/2015	Kamen et al.
D564,087 S	3/2008	Yodfat et al.	D745,661 S	12/2015	Collins et al.
7,338,475 B2	3/2008	Brown	D745,662 S	12/2015	Chen
7,420,151 B2	9/2008	Fengler et al.	D746,441 S	12/2015	Harr et al.
7,448,706 B2	11/2008	Yamanobe	9,216,279 B2	12/2015	Travis et al.
7,467,055 B2	12/2008	Seshimo et al.	D746,975 S	1/2016	Schenck et al.
D585,543 S	1/2009	Yodfat et al.	D746,976 S	1/2016	Chen et al.
D586,463 S	2/2009	Evans et al.	9,234,850 B2	1/2016	Hammond et al.
7,498,563 B2	3/2009	Mandro	D749,206 S	2/2016	Johnson et al.
7,499,581 B2	3/2009	Tribble	D751,689 S	3/2016	Peret et al.
7,540,859 B2	6/2009	Claude	D751,690 S	3/2016	Peret et al.
7,677,689 B2	3/2010	Kim	D752,209 S	3/2016	Peret et al.
D614,587 S *	4/2010	Yodfat D13/168	D752,758 S	3/2016	Chung
7,695,448 B2	4/2010	Cassidy	9,295,778 B2	3/2016	Kamen et al.
7,767,991 B2	8/2010	Sacchetti	D754,065 S	4/2016	Gray et al.
7,776,927 B2	8/2010	Chu	D756,386 S	5/2016	Kendler et al.
7,782,366 B2	8/2010	Imai et al.	D756,505 S	5/2016	Park
7,783,107 B2	8/2010	Zandifar	D758,399 S	6/2016	Kendler et al.
D629,503 S	12/2010	Caffey et al.	D760,288 S	6/2016	Kendler et al.
7,892,201 B1	2/2011	Laguna	D760,289 S	6/2016	Kendler et al.
7,892,204 B2	2/2011	Kraus	9,364,394 B2	6/2016	Demers et al.
7,905,859 B2	3/2011	Bynum	9,372,486 B2	6/2016	Peret et al.
7,914,483 B2	3/2011	Simmons	D760,782 S	7/2016	Kendler et al.
7,918,834 B2	4/2011	Mernoe	D760,888 S	7/2016	Gill et al.
7,924,424 B2	4/2011	Erickson et al.	9,400,873 B2	7/2016	Kamen et al.
7,933,780 B2	4/2011	De La Hueraga	9,408,966 B2	8/2016	Kamen
7,952,698 B2	5/2011	Friedrich	D767,756 S	9/2016	Sabin
8,004,683 B2	8/2011	Tokhtuev et al.	9,435,455 B2	9/2016	Peret et al.
8,025,634 B1	9/2011	Moubayed	D768,716 S	10/2016	Kendler et al.
8,038,657 B2	10/2011	Davis	9,465,919 B2	10/2016	Kamen et al.
8,038,663 B2	10/2011	Miner	9,468,716 B2	10/2016	Hariharesan et al.
8,051,853 B2	11/2011	Berthon-Jones	9,488,200 B2	11/2016	Kamen et al.
8,103,461 B2	1/2012	Glaser et al.	D774,645 S	12/2016	Gill et al.
8,112,814 B2	2/2012	Shimizu	9,518,958 B2	12/2016	Wilt et al.
8,137,083 B2	3/2012	Zhou	9,636,455 B2	5/2017	Kamen et al.
8,147,447 B2	4/2012	Sundar et al.	D789,516 S	6/2017	Gill et al.
8,147,448 B2	4/2012	Sundar	9,675,756 B2	6/2017	Kamen et al.
8,147,464 B2	4/2012	Spohn	9,677,555 B2	6/2017	Kamen et al.
8,184,848 B2	5/2012	Wu	9,687,417 B2	6/2017	Demers et al.
8,256,984 B2	9/2012	Fathallah	D791,306 S	7/2017	Clemente et al.
8,257,779 B2	9/2012	Abernathy	D792,963 S	7/2017	Gill
8,282,894 B2	10/2012	Lee	D795,424 S	8/2017	Sloss
D674,083 S	1/2013	Boaz	D795,805 S	8/2017	Gray et al.
D676,551 S	2/2013	Desai et al.	9,719,964 B2	8/2017	Blumberg
D677,784 S	3/2013	Marguerie	9,724,465 B2	8/2017	Peret et al.
8,394,062 B2	3/2013	Powers	9,724,466 B2	8/2017	Peret et al.
8,439,880 B2	5/2013	Rondeau	9,724,467 B2	8/2017	Peret et al.
8,447,069 B2	5/2013	Huang et al.	9,730,731 B2	8/2017	Langenfeld et al.
8,471,231 B2	6/2013	Paz	9,744,300 B2	8/2017	Kamen et al.
8,523,797 B2	9/2013	Lowery et al.	9,746,093 B2	8/2017	Peret et al.
8,523,829 B2	9/2013	Miner et al.	9,746,094 B2	8/2017	Peret et al.
8,523,839 B2	9/2013	Siefert	9,759,343 B2	9/2017	Peret et al.
8,529,511 B2	9/2013	Boulanger	9,759,369 B2	9/2017	Gray et al.
8,531,517 B2	9/2013	Tao	9,772,044 B2	9/2017	Peret et al.
8,552,361 B2	10/2013	Mandro	D799,025 S	10/2017	Johnson et al.
8,622,979 B2	1/2014	Hungerford	D801,519 S	10/2017	Sabin et al.
			9,789,247 B2	10/2017	Kamen et al.
			D802,118 S	11/2017	Peret et al.
			D802,747 S	11/2017	Au et al.
			D803,386 S	11/2017	Sabin et al.

(56)

References Cited

U.S. PATENT DOCUMENTS

D803,387 S	11/2017	Bodwell et al.	11,227,687 B2	1/2022	Kamen et al.
D804,017 S	11/2017	Sabin	D943,736 S	2/2022	Sloss et al.
9,808,572 B2	11/2017	Kamen et al.	11,244,745 B2	2/2022	Kamen et al.
D805,183 S	12/2017	Sabin et al.	11,295,846 B2	4/2022	Kamen et al.
9,856,990 B2	1/2018	Peret et al.	11,328,803 B2	5/2022	Kamen et al.
D813,376 S	3/2018	Peret et al.	11,339,887 B2	5/2022	Peret et al.
D814,021 S	3/2018	Sabin	11,339,918 B2	5/2022	Gray et al.
D815,730 S	4/2018	Collins et al.	11,348,674 B2	5/2022	Kamen et al.
D816,685 S	5/2018	Kendler et al.	11,486,722 B2	11/2022	Chen et al.
D816,829 S	5/2018	Peret et al.	11,516,304 B2	11/2022	Sutherland
D817,479 S	5/2018	Sabin et al.	2001/0026292 A1	10/2001	Ishizaki
D817,480 S	5/2018	Sabin et al.	2001/0055462 A1	12/2001	Seibel
9,968,730 B2	5/2018	Blumberg, Jr. et al.	2002/0050293 A1	5/2002	Knowles et al.
9,976,665 B2	5/2018	Peret et al.	2002/0194933 A1	12/2002	Roelofs
10,044,791 B2	8/2018	Kamen et al.	2003/0045840 A1	3/2003	Burka
10,082,241 B2	9/2018	Janway et al.	2003/0055406 A1	3/2003	Lebel
10,088,346 B2	10/2018	Kane et al.	2003/0107819 A1	6/2003	Lin et al.
10,108,785 B2	10/2018	Kamen et al.	2003/0217962 A1	11/2003	Childers
10,113,660 B2	10/2018	Peret et al.	2004/0044306 A1	3/2004	Lynch et al.
10,126,267 B2	11/2018	Blumberg, Jr.	2004/0044309 A1	3/2004	Owens et al.
10,185,812 B2	1/2019	Kamen et al.	2004/0171994 A1	9/2004	Goldberg
10,202,970 B2	2/2019	Kamen et al.	2005/0096581 A1	5/2005	Chan
10,202,971 B2	2/2019	Kamen et al.	2005/0171491 A1	8/2005	Minh Miner et al.
10,220,135 B2	3/2019	Kamen et al.	2005/0171791 A1	8/2005	Chimenti et al.
10,228,683 B2	3/2019	Peret et al.	2006/0096660 A1	5/2006	Diaz
10,242,159 B2	3/2019	Kamen et al.	2006/0140466 A1	6/2006	Seshimo
10,245,374 B2	4/2019	Kamen et al.	2006/0140798 A1*	6/2006	Kutsuzawa A61M 5/16831
10,265,463 B2	4/2019	Biasi et al.			417/474
10,288,057 B2	5/2019	Kamen et al.	2006/0146077 A1	7/2006	Song
10,316,834 B2	6/2019	Kamen et al.	2006/0175414 A1	8/2006	Nakamura
D854,145 S	7/2019	Collins	2006/0211981 A1	9/2006	Sparks et al.
10,380,321 B2	8/2019	Kamen et al.	2006/0291211 A1	12/2006	Rodriguez
10,391,241 B2	8/2019	Desch et al.	2007/0088269 A1	4/2007	Valego et al.
D860,437 S	9/2019	Collins	2007/0102623 A1	5/2007	Fengler
10,426,517 B2	10/2019	Langenfeld et al.	2007/0228071 A1	10/2007	Kamen et al.
10,436,342 B2	10/2019	Peret et al.	2007/0270648 A1	11/2007	Smith et al.
10,453,157 B2	10/2019	Kamen et al.	2007/0272755 A1	11/2007	Chang et al.
10,468,132 B2	11/2019	Kamen et al.	2007/0293817 A1	12/2007	Feng
10,471,402 B2	11/2019	Demers et al.	2008/0000457 A1	1/2008	Dyar
10,478,261 B2	11/2019	Demers et al.	2008/0051732 A1	2/2008	Chen
10,488,848 B2	11/2019	Peret et al.	2008/0147008 A1	6/2008	Lewis
10,561,787 B2	2/2020	Kamen et al.	2008/0147016 A1	6/2008	Faries
10,563,681 B2	2/2020	Kamen et al.	2008/0154214 A1	6/2008	Spohn
10,571,070 B2	2/2020	Gray et al.	2008/0200866 A1	8/2008	Prisco et al.
10,655,779 B2	5/2020	Janway et al.	2008/0235765 A1	9/2008	Shimizu
10,670,182 B2	6/2020	Janway et al.	2008/0237502 A1	10/2008	Fago
10,718,445 B2	7/2020	Yoo	2008/0252472 A1	10/2008	Su et al.
10,722,645 B2	7/2020	Kamen et al.	2009/0003678 A1	1/2009	Cutler
10,739,759 B2	8/2020	Peret et al.	2009/0097029 A1	4/2009	Tokhtuev
10,753,353 B2	8/2020	Kamen et al.	2009/0112115 A1	4/2009	Huang
10,758,669 B2 *	9/2020	Slaby A61M 5/16831	2009/0180106 A1	7/2009	Friedrich
10,761,061 B2	9/2020	Wilt et al.	2009/0224638 A1	9/2009	Weber
10,839,953 B2	11/2020	Kamen et al.	2009/0254025 A1	10/2009	Simmons
10,844,970 B2	11/2020	Peret et al.	2009/0262351 A1	10/2009	Erickson
D905,848 S	12/2020	Sloss et al.	2009/0276167 A1	11/2009	Glaser
10,857,293 B2	12/2020	Kamen et al.	2009/0281460 A1	11/2009	Lowery
10,872,685 B2	12/2020	Blumberg, Jr. et al.	2010/0021933 A1	1/2010	Okano
10,876,868 B2	12/2020	Kane et al.	2010/0036363 A1	2/2010	Watanabe et al.
10,894,638 B2	1/2021	Peret et al.	2010/0097451 A1	4/2010	Bruce
10,911,515 B2	2/2021	Biasi et al.	2010/0114027 A1	5/2010	Jacobson
D914,195 S	3/2021	Gray et al.	2010/0120601 A1	5/2010	Hayamizu
D914,196 S	3/2021	Gray et al.	2010/0168671 A1	7/2010	Faries, Jr.
D914,197 S	3/2021	Gray et al.	2010/0204650 A1	8/2010	Hungerford et al.
D917,045 S	4/2021	Gray	2010/0211003 A1	8/2010	Sundar
D918,396 S	5/2021	Gray et al.	2010/0217229 A1	8/2010	Miner
10,994,074 B2	5/2021	Blumberg, Jr. et al.	2010/0229978 A1	9/2010	Zhou
11,024,409 B2	6/2021	Kamen et al.	2010/0232712 A1	9/2010	Tomita et al.
11,024,419 B2	6/2021	Kamen et al.	2010/0292635 A1	11/2010	Sundar
11,109,934 B2	9/2021	Demers et al.	2010/0309005 A1	12/2010	Warner
11,129,933 B2	9/2021	Kamen et al.	2011/0000560 A1	1/2011	Miller et al.
D937,413 S	11/2021	Gray	2011/0004186 A1	1/2011	Butterfield
11,164,672 B2	11/2021	Kamen et al.	2011/0019630 A1	1/2011	Harris
11,179,688 B2	11/2021	Demers et al.	2011/0025826 A1	2/2011	Dabiri
11,210,611 B2	12/2021	Kamen et al.	2011/0046899 A1	2/2011	Paz
11,217,340 B2	1/2022	Desch et al.	2011/0060284 A1	3/2011	Harr
			2011/0125103 A1	5/2011	Rondeau
			2011/0137239 A1	6/2011	DeBelser et al.
			2011/0142283 A1	6/2011	Huang
			2011/0144595 A1	6/2011	Cheng

(56)

References Cited

U.S. PATENT DOCUMENTS

2011/0166511 A1	7/2011	Sharvit	2014/0267709 A1	9/2014	Hammond
2011/0178476 A1	7/2011	Lin	2014/0276457 A1	9/2014	Munro
2011/0190146 A1	8/2011	Boehm	2014/0309612 A1	10/2014	Smisson, III
2011/0190637 A1	8/2011	Knobel	2014/0313120 A1	10/2014	Kamhi
2011/0196304 A1	8/2011	Kramer et al.	2014/0318639 A1	10/2014	Peret
2011/0196306 A1	8/2011	De La Huerga	2014/0327759 A1	11/2014	Tao
2011/0206247 A1	8/2011	Dachille	2014/0340512 A1	11/2014	Tao
2011/0208123 A1	8/2011	Gray	2014/0343492 A1	11/2014	Kamen
2011/0231204 A1	9/2011	De La Huerga	2015/0002667 A1	1/2015	Peret et al.
2011/0251557 A1	10/2011	Powers	2015/0002668 A1	1/2015	Peret
2011/0275063 A1	11/2011	Weitz	2015/0002677 A1	1/2015	Peret et al.
2011/0306931 A1	12/2011	Kamen et al.	2015/0023808 A1	1/2015	Zhu
2011/0313351 A1	12/2011	Kamen et al.	2015/0033823 A1	2/2015	Blumberg, Jr.
2011/0313789 A1	12/2011	Kamen et al.	2015/0314083 A1	4/2015	Blumberg, Jr. et al.
2011/0316919 A1	12/2011	Baldy, Jr.	2015/0122260 A1 *	5/2015	Daly A61M 16/0875 128/204.23
2011/0317004 A1	12/2011	Tao	2015/0154364 A1	6/2015	Biasi et al.
2012/0013735 A1	1/2012	Tao	2015/0157791 A1	6/2015	Desch et al.
2012/0035581 A1	2/2012	Travis	2015/0219881 A1	8/2015	Munro
2012/0039507 A1	2/2012	Ikenoue	2015/0238228 A1	8/2015	Langenfeld et al.
2012/0059318 A1	3/2012	Dewey	2015/0257974 A1	9/2015	Demers et al.
2012/0059350 A1	3/2012	Siefert	2015/0332009 A1	11/2015	Kane et al.
2012/0095415 A1	4/2012	Sharvit	2015/0361974 A1	12/2015	Hungerford et al.
2012/0095433 A1	4/2012	Hungerford	2016/0025641 A1	1/2016	Hammond et al.
2012/0185267 A1	7/2012	Kamen et al.	2016/0055397 A1	2/2016	Peret et al.
2012/0197185 A1	8/2012	Tao	2016/0055649 A1	2/2016	Peret et al.
2012/0238997 A1	9/2012	Dewey	2016/0058967 A1 *	3/2016	McCormick A61M 16/0883 128/205.24
2012/0265166 A1	10/2012	Yodfat	2016/0061641 A1	3/2016	Peret et al.
2012/0274765 A1	11/2012	Ung et al.	2016/0063353 A1	3/2016	Peret et al.
2012/0310153 A1	12/2012	Moberg	2016/0073063 A1	3/2016	Peret et al.
2012/0310205 A1	12/2012	Lee et al.	2016/0084434 A1	3/2016	Janway et al.
2013/0035659 A1	2/2013	Hungerford	2016/0097382 A1	4/2016	Kamen et al.
2013/0044951 A1	2/2013	Cherng et al.	2016/0131272 A1	5/2016	Yoo
2013/0083191 A1	4/2013	Lowery et al.	2016/0151564 A1	6/2016	Magers et al.
2013/0085443 A1	4/2013	Lowery	2016/0158437 A1	6/2016	Biasi et al.
2013/0110046 A1	5/2013	Nowak et al.	2016/0179086 A1	6/2016	Peret et al.
2013/0131508 A1	5/2013	Thomas	2016/0184510 A1	6/2016	Kamen et al.
2013/0177455 A1	7/2013	Kamen	2016/0203292 A1	7/2016	Kamen et al.
2013/0182381 A1	7/2013	Gray	2016/0262977 A1	9/2016	Demers et al.
2013/0184676 A1	7/2013	Kamen	2016/0287780 A1	10/2016	Lee et al.
2013/0188040 A1	7/2013	Kamen et al.	2016/0319850 A1	11/2016	Kamen et al.
2013/0191513 A1	7/2013	Kamen et al.	2016/0346056 A1	12/2016	Demers et al.
2013/0192380 A1 *	8/2013	Bivans A61M 5/14228 73/781	2016/0362234 A1	12/2016	Peret et al.
2013/0197693 A1	8/2013	Kamen	2017/0011202 A1	1/2017	Kamen et al.
2013/0201471 A1	8/2013	Bui et al.	2017/0045478 A1	2/2017	Wilt et al.
2013/0201482 A1	8/2013	Munro	2017/0047022 A1	2/2017	Ikeda et al.
2013/0204188 A1	8/2013	Kamen et al.	2017/0216516 A1	8/2017	Dale et al.
2013/0253442 A1	9/2013	Travis	2017/0224909 A1	8/2017	Kamen et al.
2013/0272773 A1	10/2013	Kamen	2017/0259230 A1	9/2017	Demers et al.
2013/0281965 A1	10/2013	Kamen	2017/0266378 A1	9/2017	Kamen et al.
2013/0297330 A1	11/2013	Kamen	2017/0268497 A1	9/2017	Kamen et al.
2013/0310990 A1	11/2013	Peret et al.	2017/0284968 A1	10/2017	Blumberg, Jr.
2013/0317753 A1	11/2013	Kamen	2017/0296745 A1	10/2017	Kamen et al.
2013/0317837 A1	11/2013	Ballantyne et al.	2017/0303969 A1	10/2017	Langenfeld et al.
2013/0336814 A1	12/2013	Kamen et al.	2017/0321841 A1	11/2017	Gray et al.
2013/0339049 A1	12/2013	Blumberg, Jr. et al.	2017/0333623 A1	11/2017	Kamen et al.
2013/0346108 A1	12/2013	Kamen	2017/0335988 A1	11/2017	Peret et al.
2014/0043469 A1	2/2014	Engel	2018/0028745 A1	2/2018	Amon et al.
2014/0066880 A1	3/2014	Prince et al.	2018/0038501 A1	2/2018	Peret et al.
2014/0081233 A1	3/2014	Hungerford	2018/0066648 A1	3/2018	Kamen et al.
2014/0094753 A1	4/2014	Mernoe	2018/0080605 A1	3/2018	Janway et al.
2014/0100526 A1 *	4/2014	Ueda A61M 5/142 604/151	2018/0106246 A1	4/2018	Kamen et al.
2014/0121601 A1	5/2014	Hoenninger, III	2018/0128259 A1	5/2018	Kamen et al.
2014/0135695 A1	5/2014	Grant	2018/0224012 A1	8/2018	Peret et al.
2014/0148757 A1	5/2014	Ambrosina	2018/0228964 A1	8/2018	Blumberg, Jr. et al.
2014/0165703 A1	6/2014	Wilt et al.	2018/0252359 A1	9/2018	Janway et al.
2014/0180711 A1	6/2014	Kamen	2018/0278676 A1	9/2018	Kamen et al.
2014/0188076 A1	7/2014	Kamen	2019/0009018 A1	1/2019	Kamen et al.
2014/0188516 A1	7/2014	Kamen	2019/0033104 A1	1/2019	Kane et al.
2014/0194818 A1	7/2014	Yodfat	2019/0041362 A1	2/2019	Blumberg, Jr.
2014/0195639 A1	7/2014	Kamen	2019/0049029 A1	2/2019	Peret et al.
2014/0227021 A1	8/2014	Kamen et al.	2019/0134298 A1	5/2019	Kamen et al.
2014/0228758 A1	8/2014	Chi et al.	2019/0139640 A1	5/2019	Kamen et al.
2014/0257178 A1	9/2014	Sang et al.	2019/0154026 A1	5/2019	Kamen et al.
			2019/0170134 A1	6/2019	Kamen et al.
			2019/0175821 A1	6/2019	Kamen et al.
			2019/0179289 A1	6/2019	Peret et al.
			2019/0189272 A1	6/2019	Kamen et al.

(56)

References Cited**U.S. PATENT DOCUMENTS**

2019/0219047 A1 7/2019 Kamen et al.
 2019/0249657 A1 8/2019 Kamen et al.
 2019/0298913 A1 10/2019 Biasi et al.
 2019/0316948 A1 10/2019 Karol et al.
 2019/0328964 A1 10/2019 Desch et al.
 2019/0341146 A1 11/2019 Kamen et al.
 2019/0348160 A1* 11/2019 Heavelyn G16H 40/67
 2019/0365421 A1 12/2019 Langenfeld et al.
 2020/0025305 A1 1/2020 Peret et al.
 2020/0051190 A1 2/2020 Kamen et al.
 2020/0054823 A1 2/2020 Baier et al.
 2020/0066388 A1 2/2020 Kamen et al.
 2020/0070113 A1 3/2020 Demers et al.
 2020/0078127 A1 3/2020 Demers et al.
 2020/0139044 A1* 5/2020 Kono A61M 5/14232
 2020/0171241 A1 6/2020 Kamen et al.
 2020/0173469 A1 6/2020 Kamen et al.
 2020/0182400 A1 6/2020 Gray et al.
 2020/0278078 A1 9/2020 Janway et al.
 2020/0292127 A1 9/2020 Janway et al.
 2020/0347949 A1 11/2020 Yoo
 2020/0353157 A1* 11/2020 Slaby A61M 5/14212
 2020/0371497 A1 11/2020 Peret et al.
 2020/0386220 A1 12/2020 Kamen et al.
 2020/0393414 A1 12/2020 Wilt et al.
 2021/0023296 A1 1/2021 Langenfeld et al.
 2021/0062929 A1 3/2021 Peret et al.
 2021/0065867 A1 3/2021 Kamen et al.
 2021/0085858 A1 3/2021 Kamen et al.
 2021/0098102 A1 4/2021 Blumberg, Jr. et al.
 2021/0116271 A1 4/2021 Kane et al.
 2021/0125719 A1 4/2021 Peret et al.
 2021/0252211 A1 8/2021 Blumberg, Jr. et al.
 2021/0287790 A1 9/2021 Kamen et al.
 2021/0304864 A1 9/2021 Kamen et al.
 2021/0308366 A1 10/2021 Kamen et al.
 2021/0365849 A1 11/2021 Kamen et al.
 2021/0378777 A1 12/2021 Demers et al.
 2022/0008649 A1 1/2022 Kamen et al.
 2022/0044796 A1 2/2022 Kamen et al.
 2022/0062541 A1 3/2022 Kamen et al.
 2022/0122002 A1 4/2022 Kamen et al.
 2022/0122710 A1 4/2022 Desch et al.
 2022/0130536 A1 4/2022 Kamen et al.
 2022/0143564 A1 5/2022 Demers et al.

FOREIGN PATENT DOCUMENTS

CN 2922921 7/2007
 CN 201 I 10955 9/2008
 DE 2023027 11/1970
 DE 2631951 1/1978
 DE 3617723 12/1987
 DE 3643276 6/1988
 DE 3822057 1/1989
 DE 69229832 2/2000
 EP 112699 7/1984
 EP 441323 8/1991
 EP 819495 1/1998
 EP 1722310 11/2006
 EP 2319551 5/2011
 EP 2793977 11/2015
 FR 2042606 2/1971
 FR 2273264 12/1975
 FR 2458804 1/1981
 FR 2617593 1/1989
 GB 1301033 12/1972
 GB 2020735 11/1979
 GB 2207239 1/1989
 GB 2328982 3/1999
 JP 58163843 9/1983
 JP 04-280582 10/1992
 JP 07 I 36250 5/1995
 JP 3I 10458 11/2000
 JP 2007229928 9/2007

JP 2009298012 12/2009
 JP 2011062371 3/2011
 KR I 020050039780 4/2005
 KR 10200601 I 1424 10/2006
 KR 1020100037914 4/2010
 NL 7006908 11/1970
 NL 8801680 2/1989
 NL 9101825 5/1993
 SE 376843 6/1975
 WO 1981002770 10/1981
 WO 1993009407 5/1993
 WO 2000072181 11/2000
 WO 2002040084 5/2002
 WO 2002100262 12/2002
 WO 2004035116 4/2004
 WO 2005094919 10/2005
 WO 2006086723 8/2006
 WO 2008022880 2/2008
 WO 2008079023 7/2008
 WO 2009039203 3/2009
 WO 2009039214 3/2009
 WO 2009055639 4/2009
 WO 2010020397 4/2010
 WO 2010129720 11/2010
 WO 2011021098 2/2011
 WO 2011080193 7/2011
 WO 2011136667 11/2011
 WO 2012104779 8/2012
 WO 2013017949 2/2013
 WO 2013070337 5/2013
 WO 2013095459 6/2013
 WO 2013096713 6/2013
 WO 2013096718 6/2013
 WO 2013096722 6/2013
 WO 2013096909 6/2013
 WO 2013176770 11/2013
 WO 2013177357 11/2013
 WO 2014100557 6/2014
 WO 2014100571 6/2014
 WO 2014100658 6/2014
 WO 2014100687 6/2014
 WO 2014100736 6/2014
 WO 2014100744 6/2014
 WO 2014144557 9/2014
 WO 2014025736 10/2014
 WO 2014160058 10/2014
 WO 2014160249 10/2014
 WO 2014160307 10/2014
 WO 2015017275 2/2015
 WO 2015116557 8/2015
 WO 2017137421 8/2017
 WO 2019142125 7/2019

OTHER PUBLICATIONS

King et al. Prototyping closed loop physiologic control with the medical device coordination framework. In SEHC 2010: Proceedings of the 2010 ICSE Workshop on Software Engineering in Health Care (pp. 1-11). New York, NY: ACM. (2010).
 Leor et al., "A System for the Measurement of Drop Volume of Intravenous Solutions", Proceedings Computers in Cardiology 1990, pp. 405-406, Los Alamitos, California.
 Luerkens, David W. "Theory and Application of Morphological Analysis: Fine Particles and Surfaces". Boca Raton: CRC, 1991.5-7.
 Matas et al., 'Progressive Probabilistic Hough Transform', University of Surrey, Czech Technical University, 1998, pp. 1-10.
 National Patient Safety Agency, Design for Patient Safety: A Guide to the Design of Electronic Infusion Devices, booklet, 2010, pp. 1-96, Edition 1, National Patient Safety Agency, London.
 Notice of Acceptance from IP Australia for Patent Application 2012358397, mailed on Jan. 5, 2017, 3 pgs.
 Notice of Acceptance from IP Australia for Patent Application 2016225879, mailed on Oct. 26, 2016, 3 pgs.
 Notice of Acceptance from the New Zealand Intellectual Property Office for Patent Application 715098, mailed on Sep. 9, 2016, 3 pgs.

(56)

References Cited

OTHER PUBLICATIONS

Notice of Acceptance from the New Zealand Intellectual Property Office for Patent Application 723930, mailed on Nov. 16, 2016, 3 pgs.

Notice of Acceptance from the New Zealand Intellectual Property Office for Patent Application 626382, mailed on Feb. 9, 2016, 1 pg.

Notice of Allowance from Korean Intellectual Property Office for Patent Application 10-2014-7019883, mailed on Jun. 28, 2016, 3 pgs.

Notice Of Eligibility For Grant from The Intellectual Property Office of Singapore for Application 11201507504S, mailed on Jun. 6, 2016, 12 pgs.

Notice of Preliminary Rejection (Non-Final) from the Korean Intellectual Property Office (“KIPO”) for Korean Patent Application No. 10-2014-7019883, mailed on Dec. 15, 2015.

Notification from The Eurasian Patent Organization for Application 201491218, mailed on Apr. 27, 2015, 2 pgs.

Notification from The Eurasian Patent Organization for Application 201491218/32, date Apr. 19, 2017, 1 pg.

Notification of Non-Compliance With Substantive Requirements and Invitation to Submit Observations and/or Amended Application from The African Regional Intellectual Property Organization (ARIPO) for Application AP/P/2014/007721, mailed on Apr. 25, 2017.

Patent Application 14155193, mailed on Nov. 19, 2015.

Report of substantive examination from Superintendent of Industry and Commerce of Colombia for.

Results of Substantive Examination from IMPI for Application MX/a/2014/007751, mailed on Mar. 31, 2017.

Rule 161 Communication from the European Patent Office for Patent Application 14720397.0-1662, mailed on Oct. 28, 2015, 2 pgs.

Search Report from the European Patent Office for EPO Application No. 16 167 576.4-1662, mailed on Sep. 19, 2016, 4 pgs. . . .

Second Office Action and Search Report dated Jun. 27, 2016, received in Republic of China patent application No. 201280069373.3, 6 pgs.

Second Report of substantive examination from Superintendent of Industry and Commerce of Colombia for Patent Application 14.155.193, mailed on Sep. 8, 2016, 18 pgs.

“AutoClamp”, Ace Medical, Mar. 18, 2016 (retrieved). 2 pgs., http://ace-medical.com/2014/en/product/product/view.asp?po_no=31.

“DripAssist Product Brochure”, Shift Labs, Mar. 18, 2016 (retrieved). 1 pg., <http://www.shiftlabs.com/sites/default/files/DripAssistOnesheet.pdf>.

“DripAssist Product Overview”, Shift Labs, Mar. 18, 2016 (retrieved). 2 pgs, <http://www.shiftlabs.com/products/dripassist/overview>.

“DripAssist Specification”, Shift Labs, Mar. 18, 2016 (retrieved). 2 pgs, <http://www.shiftlabs.com/products/dripassist/specifications>.

“Feature Detection”, OpenCV Wiki, Oct. 31, 2011 (retrieved), 7 pgs, http://opencv.willowgarage.com/documentation/cpp/imgproc_feature_detection.html.

“IV Drip monitor”, Allison Lipper, Mar. 18, 2016 (retrieved). 3 pgs., <http://cnx.org/contents/WmaFki2-@3/IV-Drip-Monitor>.

“Microcomputer Intravenous Infusion Drip Controller”, Longfian Scitech Co., Ltd., Mar. 18, 2016 (retrieved). Advertisement listed as having a valid price starting at Mar. 10, 2016, 2 pgs, <http://marina.en.made-in-china.com/productimage/bKvQTtJcJEhs-2fljOOFZetfTSdnhcU/China-Microcomputer-Intravenous-Infusion-Drip-Controller.html>.

“Miscellaneous Image Transformations”, OpenCV Wiki, 2011, 9 pgs., http://opencv.willowgarage.com/documentation/cpp/miscellaneous_image_transformations.

“Object Detection”, OpenCV Wiki, 2011, 2 pgs., http://opencv.willowgarage.com/documentation/cpp/object_detection.html.

“The OpenCV Reference Manual Release 2.3”, May 10, 2011, pp. 1-263.

“Vista Basic: Instructions for Use: Software IFVB”, manual, 2002, pp. 3, B. Braun Medical Inc.

AAMI and FDA, Infusing Patients Safely: Priority Issues from the AAMI/FDA Infusion Device Summit, Symposium, Oct. 5-6, 2010, pp. 1-48, AAMI, Arlington, VA, USA.

Application 715098, mailed on Jun. 13, 2016, 2 pgs.

Application No. PCT/US201 I/066588, 9 pgs.

Background Extraction and Update Algorithm Based on Frame-difference, Fan Xio-liang, et al., China Academic Journal Electronic Publishing House, dated Nov. 2011, 3 pgs.

Butterfield, “Alaris SE Pump, Monitoring and Detection of IV Line Occlusions.”, CareFusion Corporation, 2010, 4 pgs.

Conway, “Analytical Analysis of Tip Travel in a Bourdon Tube”, Master’s Thesis, Naval Postgraduate School Monterey, Dec. 1995, pp. 1-89.

Darzynkiewicz, ‘Cytometry’, Methods in Cell Biology, 2011, Third Edition Part A, vol. 63, pp. 44-48, Academic Press, San Diego, 2001. And please see whole document generally.

Decision to Grant from the European Patent Office for Patent Application 15192051.9-1664/3006010, mailed on Jan. 19, 2017, 3 pgs.

English Search Report from The People’s Republic of China for Patent Application 201280069373.3, mailed on Jul. 12, 2016, 2 pgs.

European Community Design Registration 002381669/0001-0005, Filed Jan. 8, 2014 and published on May 12, 2016, 42 pgs.

Examination Report from the European Patent Office for EPO Application No. 16 167 576.4-1662, mailed on Jun. 1, 2017, 4 pgs.

Examination Report from the European Patent Office for EPO Application No. 16 167 576.4-1662, mailed on Oct. 11, 2016, 6 pgs.

Extended European Search Report dated Mar. 3, 2016, received in European patent application No. 15192051.9, 7 pgs.

FDA US Food and Drug Administration, “SEDASYS® Computer-Assisted Personalized Sedation System PS000”, Jul. 16, 2013, pp. 1-2, www.fda.gov/MedicalDevices/ProductsandMedicalProcedures/DeviceApprovalsandClearances/Recently-ApprovedDevices/ucm353950.htm.

First Examination Report from IP Australia for Patent Application 2012358397, mailed on Jul. 28, 2016, 3 pgs.

First Examination Report from Mexican Patent Office for Patent Application MX/a/2014/007751, mailed on Sep. 8, 2016, 5 pgs.

First Examination Report from The Intellectual Property Office of New Zealand for Application 626382, mailed on Apr. 1, 2015.

First Examination report from the New Zealand Intellectual Property Office for New Zealand IP No. 715098, mailed on Jan. 12, 2016.

First Examination Report from the New Zealand Intellectual Property Office for Patent Application 725469, mailed on Nov. 8, 2016, 2 pgs.

First Office Action dated Oct. 20, 2015, received in Republic of China patent application No. 201280069373.3, 4 pgs.

First Office Action dated Jul. 28, 2016, received in Australian patent application No. 2012358397, 3 pgs.

First Office Action for Chinese Patent Application 201610248658.3, mailed on Feb. 13, 2017.

Further Examination Report from the New Zealand Intellectual Property Office for Patent.

Further Examination Report from the New Zealand Intellectual Property Office for Patent Application 626382, mailed on Jan. 12, 2016, 2 pgs.

Galambos et al., “Progressive Probabilistic Hough Transform for Line Detection”, IEEE, 10 pgs, 1999.

Hofmann, “Modeling Medical Devices for Plug-and-Play Interoperability”, MIT Department of Electrical Engineering and Computer Science, Jun. 2007, 1-187 pgs.

Hugli et al., “Drop volume measurement by vision.” Proceedings of SPIE Electronic Imaging Conference, San Diego, Jan. 2000. SPIE vol. 3866-11, pp. 60-66.

International Preliminary Report on Patentability and Written Opinion, dated Sep. 15, 2015, received in International patent application No. PCT/US2014/029020, 11 pgs.

International Preliminary Report on Patentability dated Jul. 3, 2014, received in International patent application No. PCT/US2012/071142, 9 pgs.

(56)

References Cited

OTHER PUBLICATIONS

International Search Report & Written Opinion dated Nov. 7, 2013, received in International patent application No. PCT/US2013/042350, 18 pgs.

International Search Report & Written Opinion dated Oct. 1, 2013, received in International patent application No. PCT/US2012/071490, 19 pgs.

International Search Report & Written Opinion dated May 14, 2012, received in International patent.

International Search Report & Written Opinion dated Jun. 18, 2013, received in International patent application No. PCT/US2012/071142, 14 pgs.

International Search Report & Written Opinion dated Dec. 4, 2013, received in International patent application No. PCT/US2013/032445, 20 pgs.

International Search Report & Written Opinion dated Jul. 6, 2017, received in International patent application No. PCT/US2017/015382, 21 pgs.

International Search Report dated Feb. 5, 2015, received in International patent application No. PCT/US2014/029020, 7 pgs.

Invitation to Pay Additional Fees and, Where Applicable, Protest Fee dated Sep. 9, 2013, received in International patent application No. PCT/US2013/032445, 10 pgs.

Invitation to Pay Additional Fees and, Where Applicable, Protest Fee dated Sep. 26, 2013, received in International patent application No. PCT/US2013/042350, 7 pgs.

Invitation To Respond to Written Opinion from the Intellectual Property Office of Singapore for Application | 1201507504S, mailed on Nov. 23, 2015.

* cited by examiner

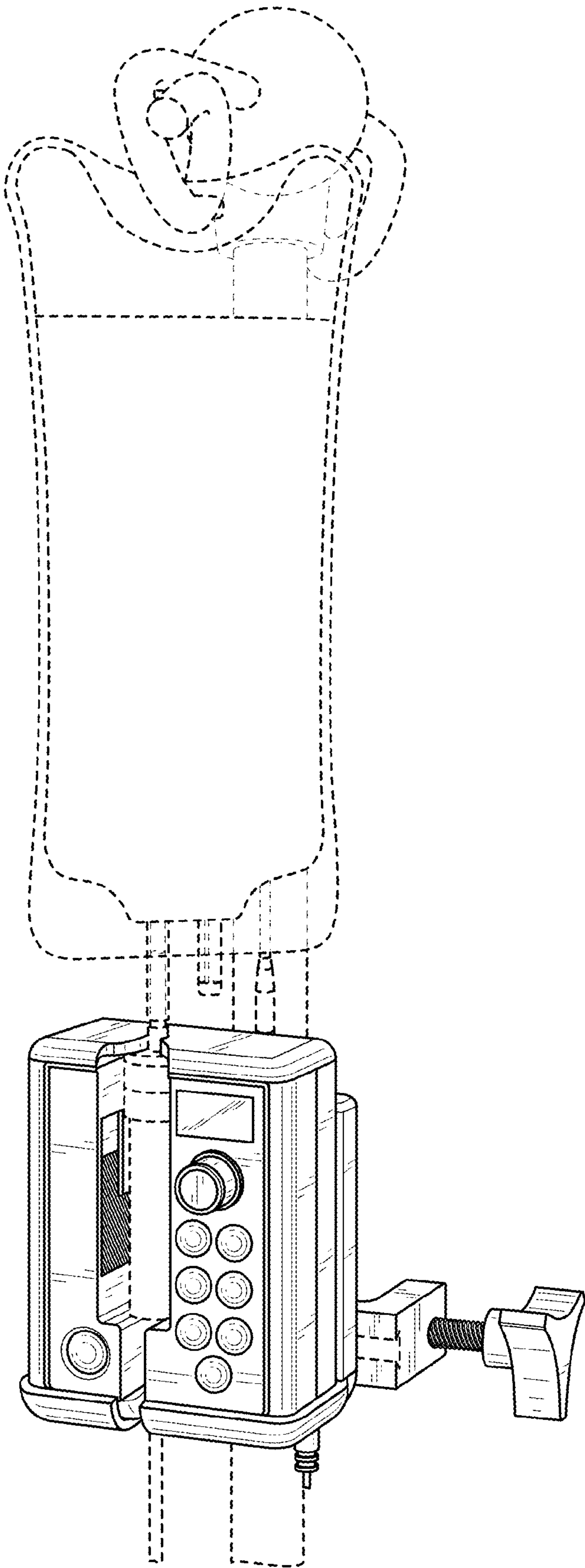


FIG. 1

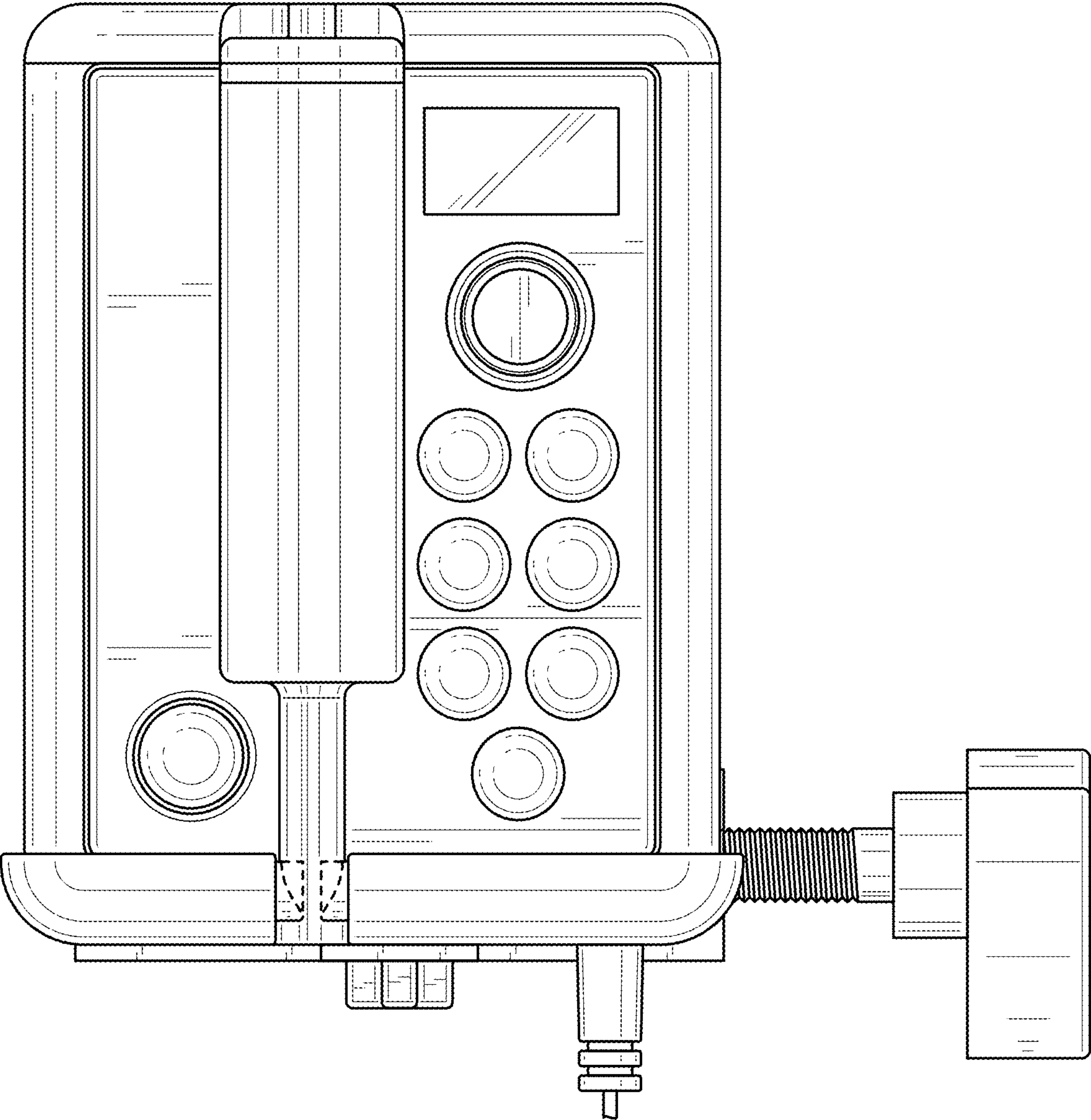


FIG. 2

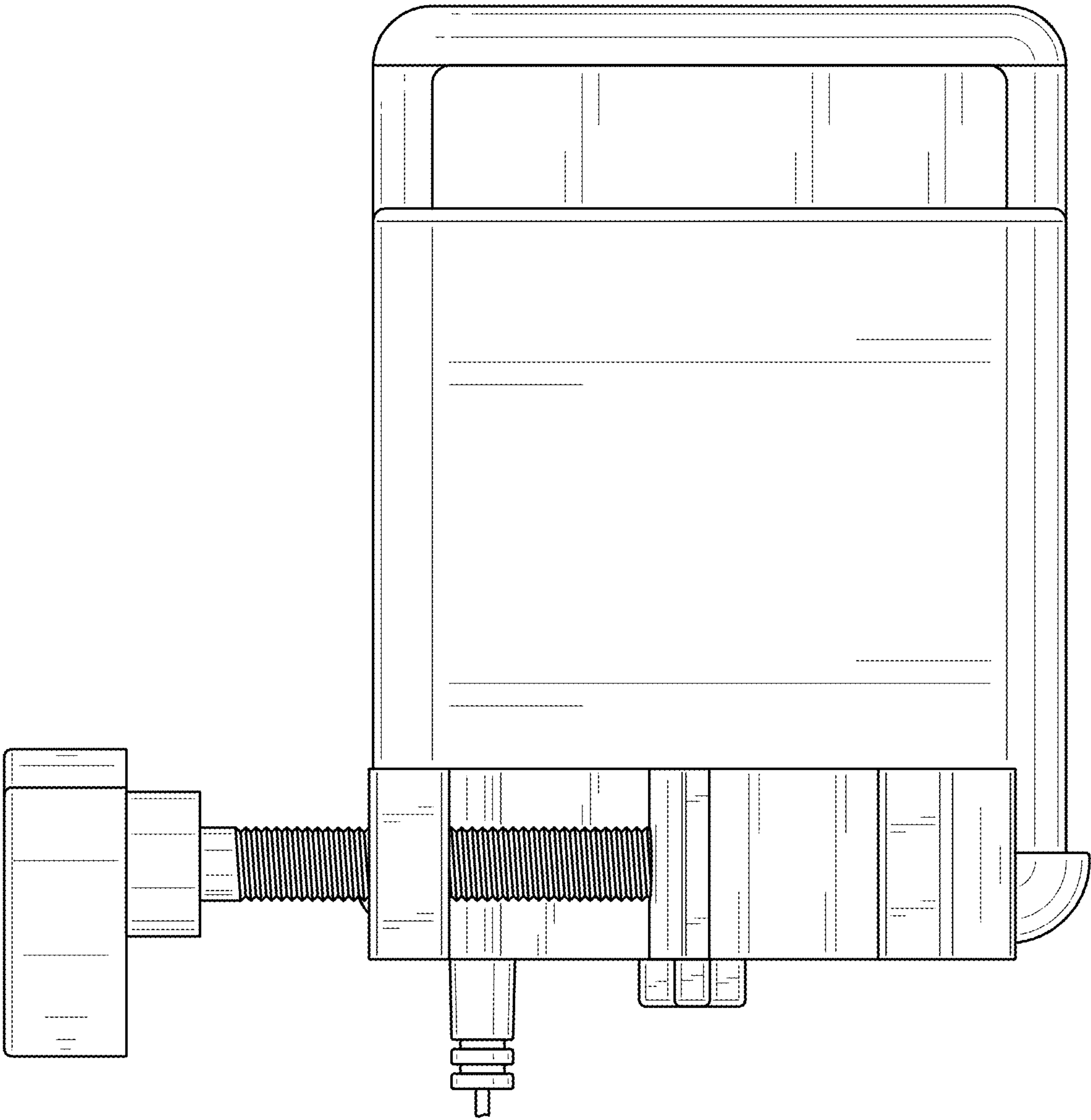


FIG. 3

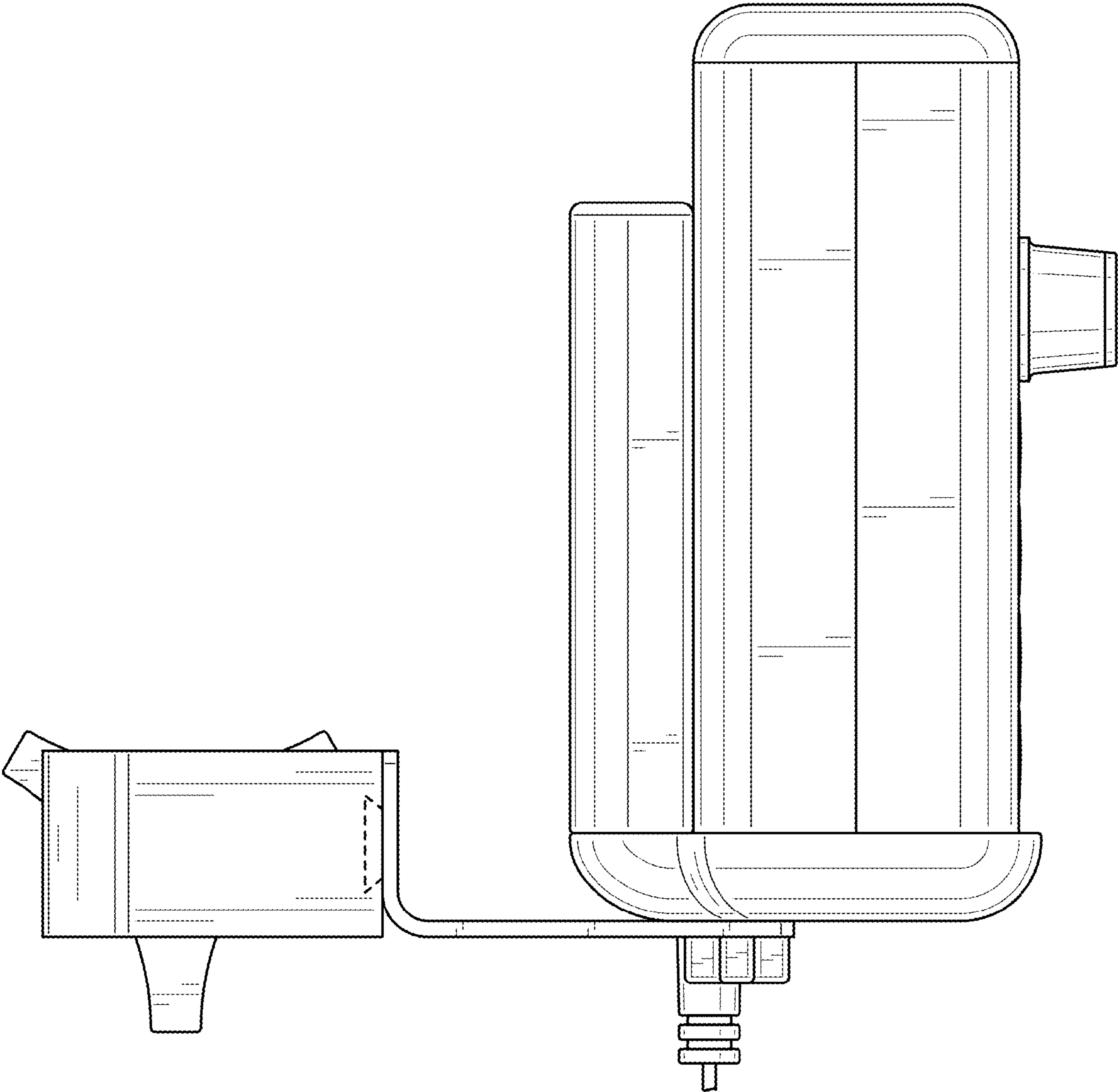


FIG. 4

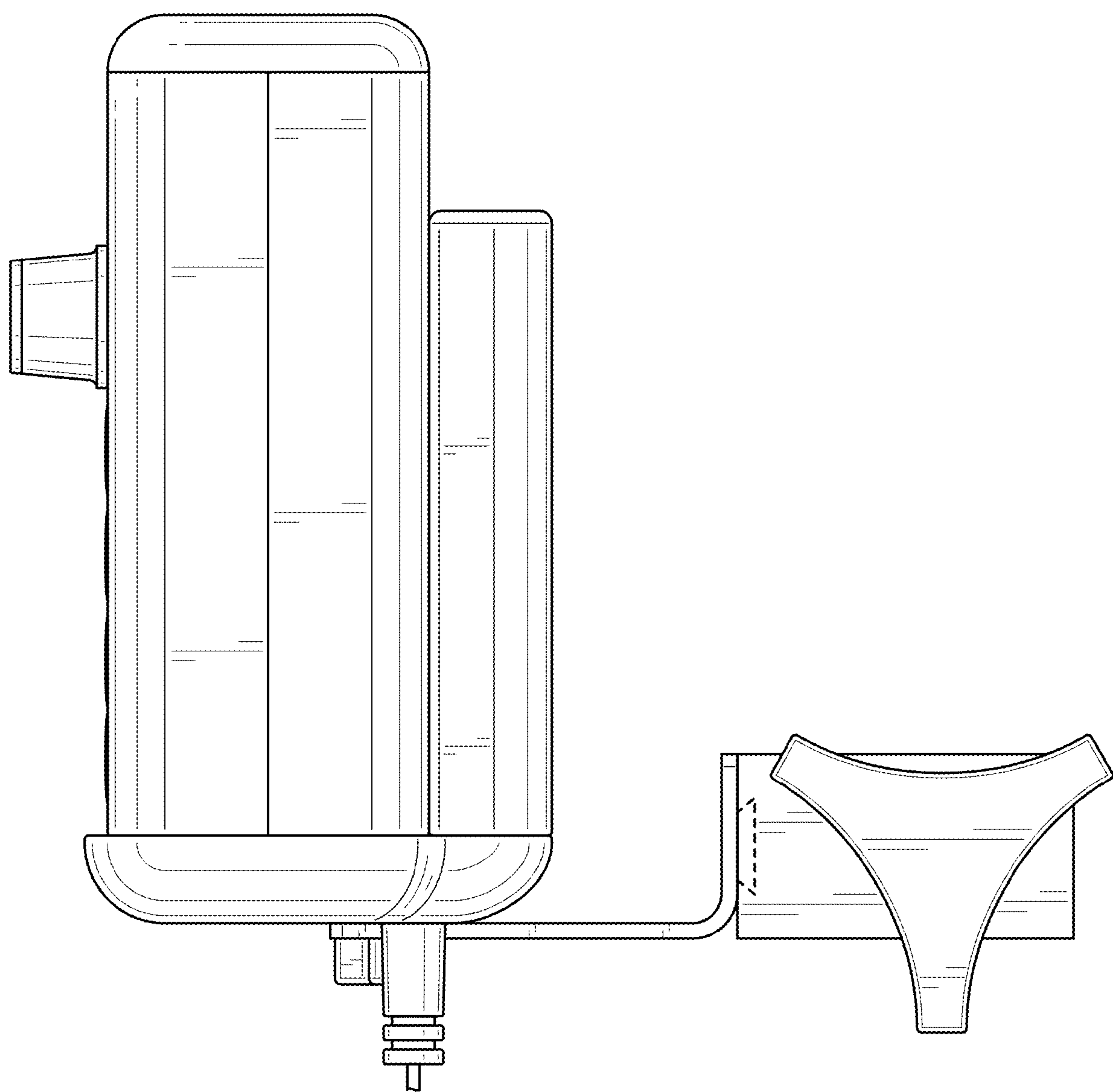


FIG. 5

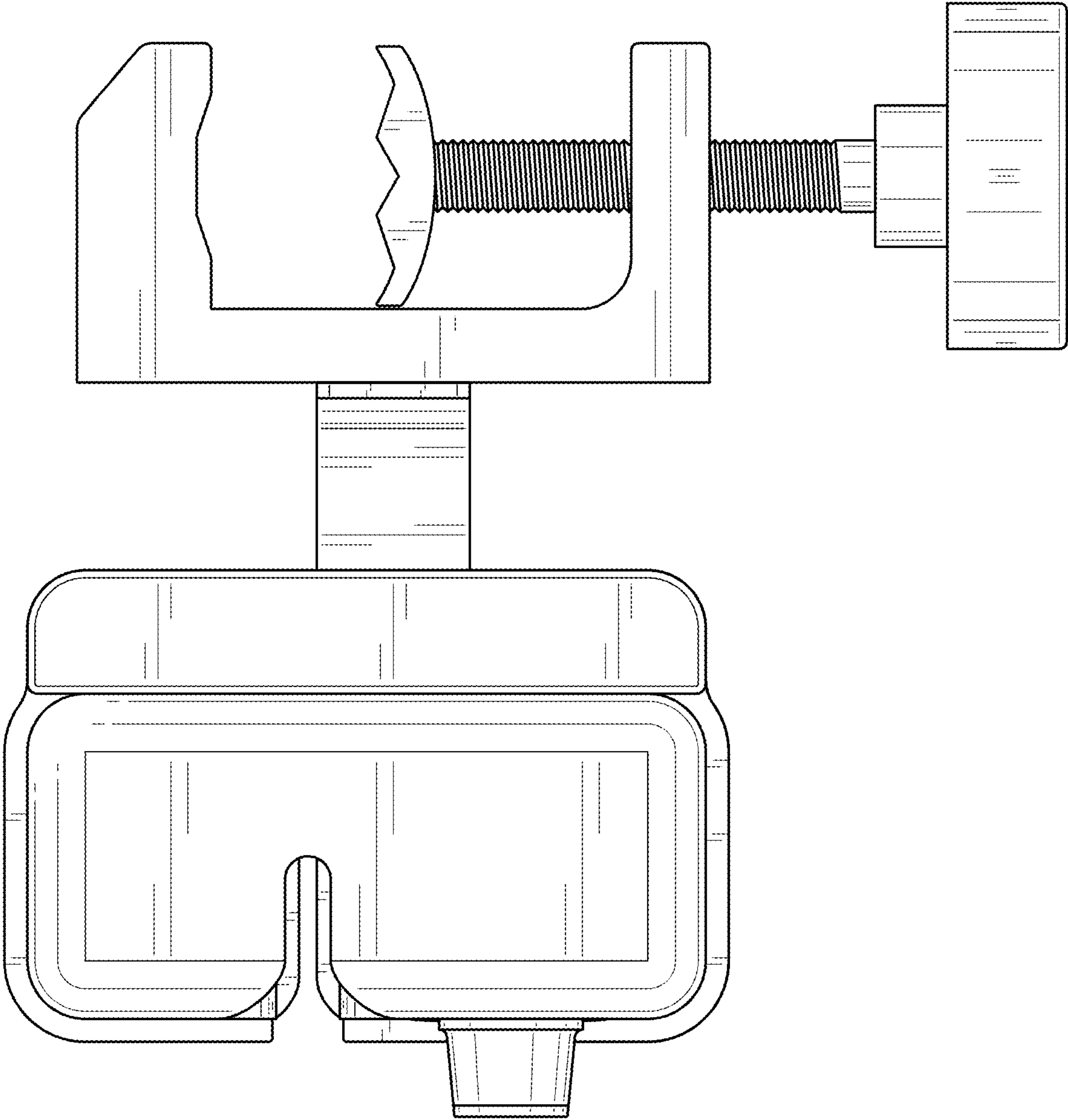


FIG. 6

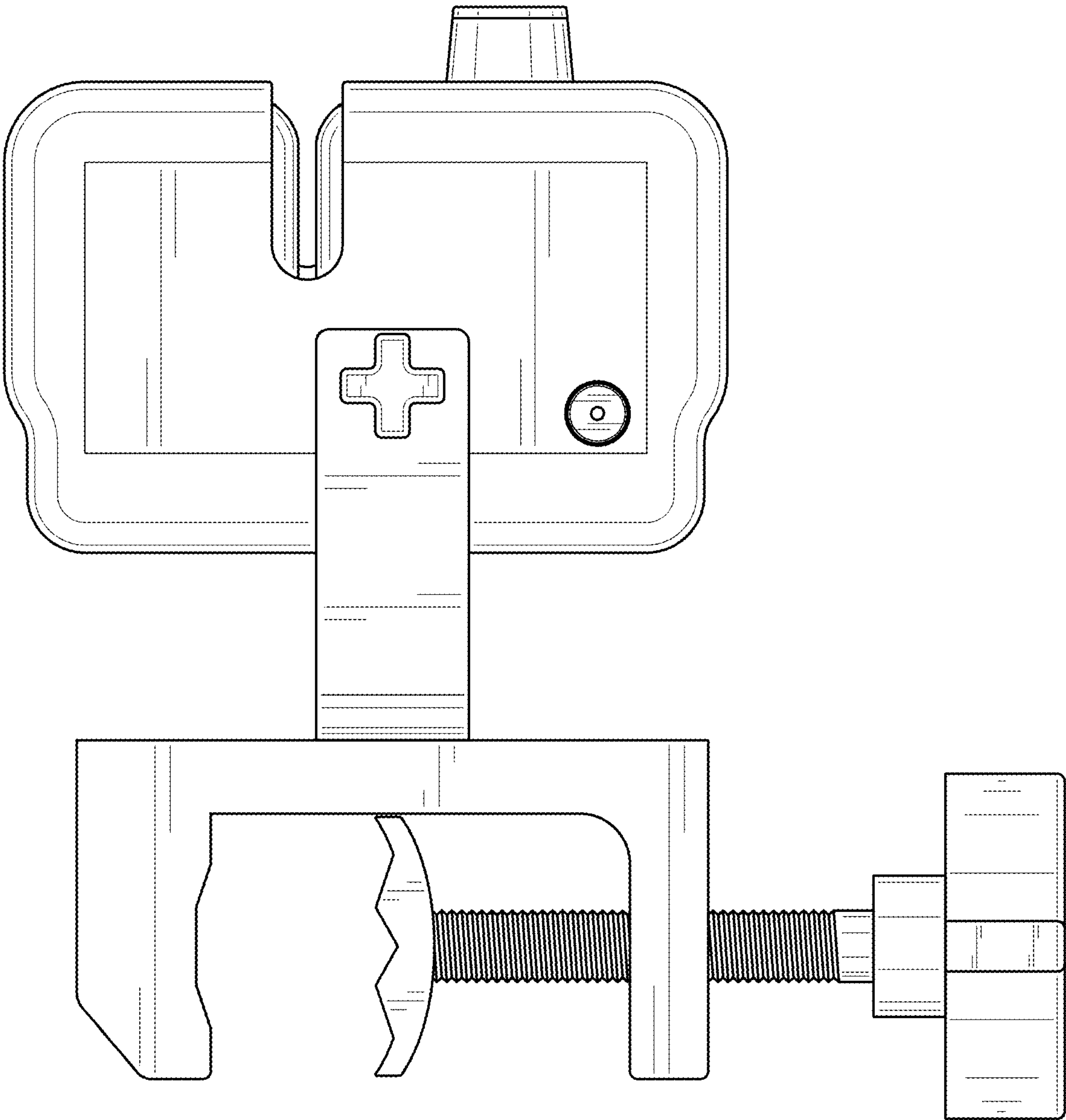


FIG. 7

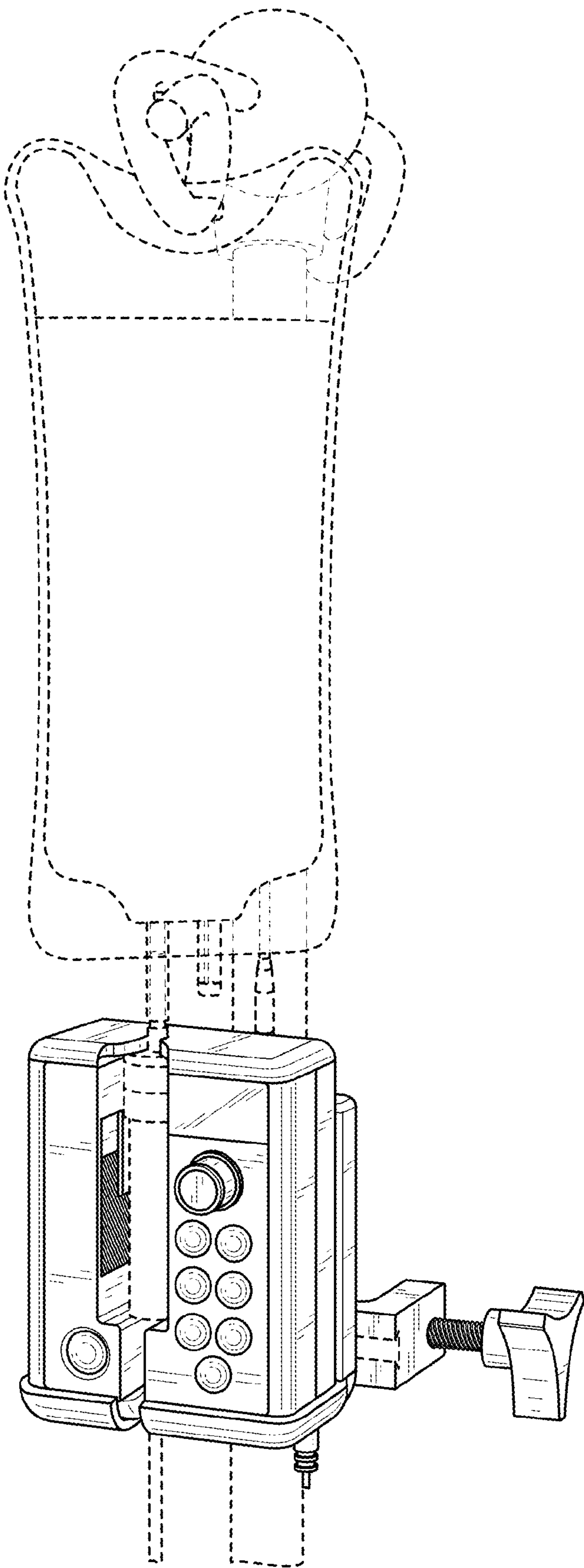


FIG. 8

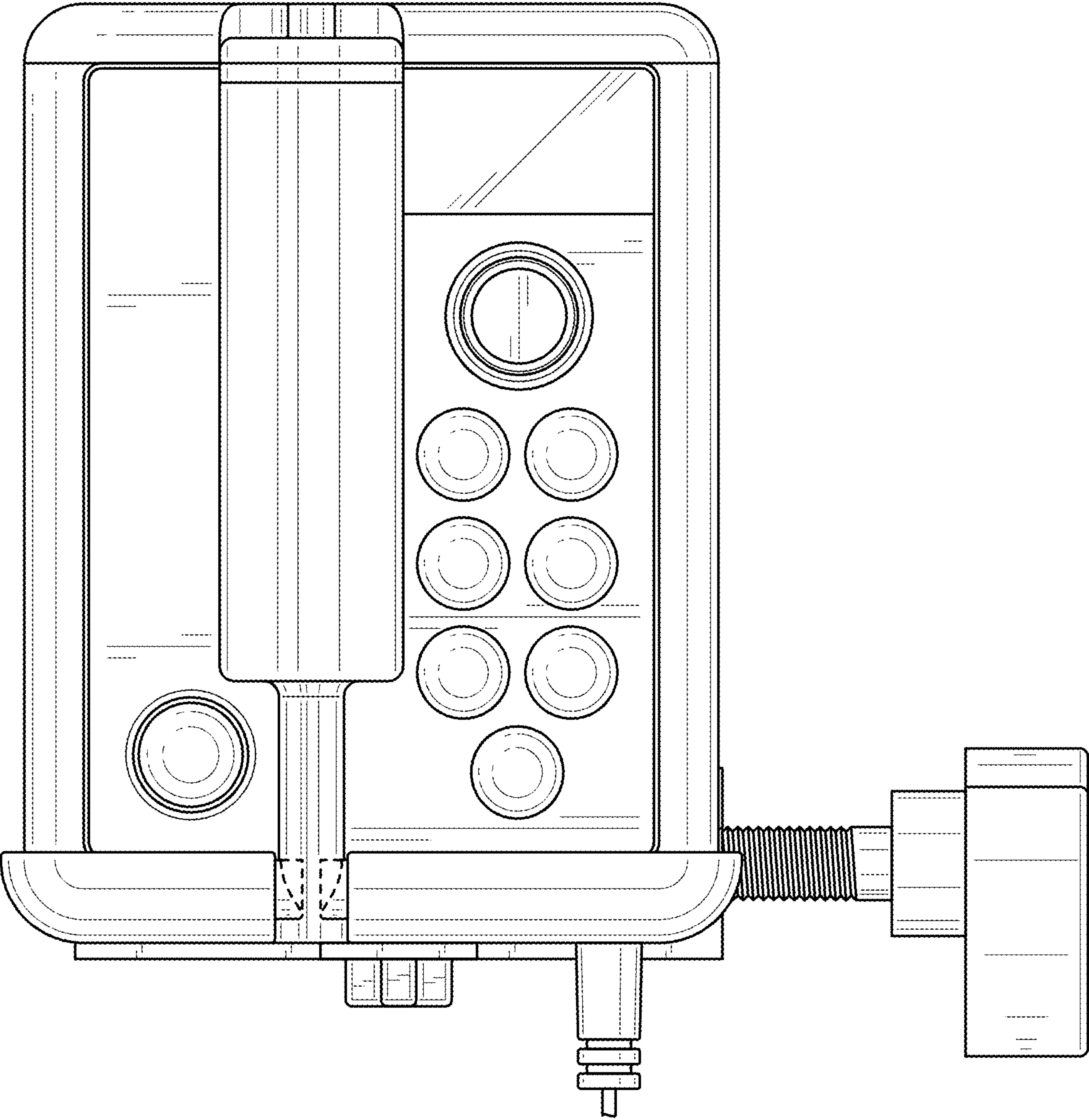


FIG. 9

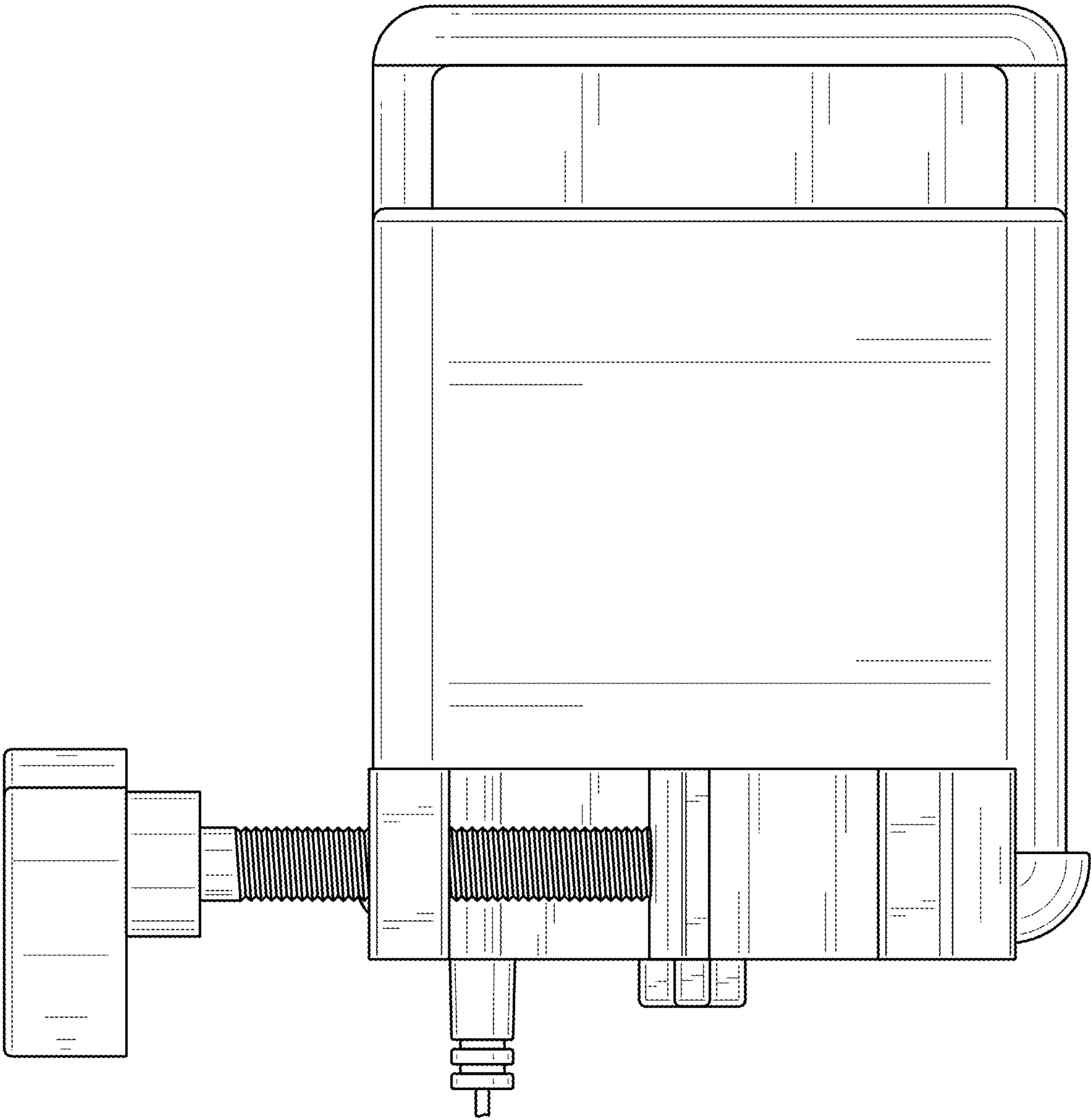


FIG. 10

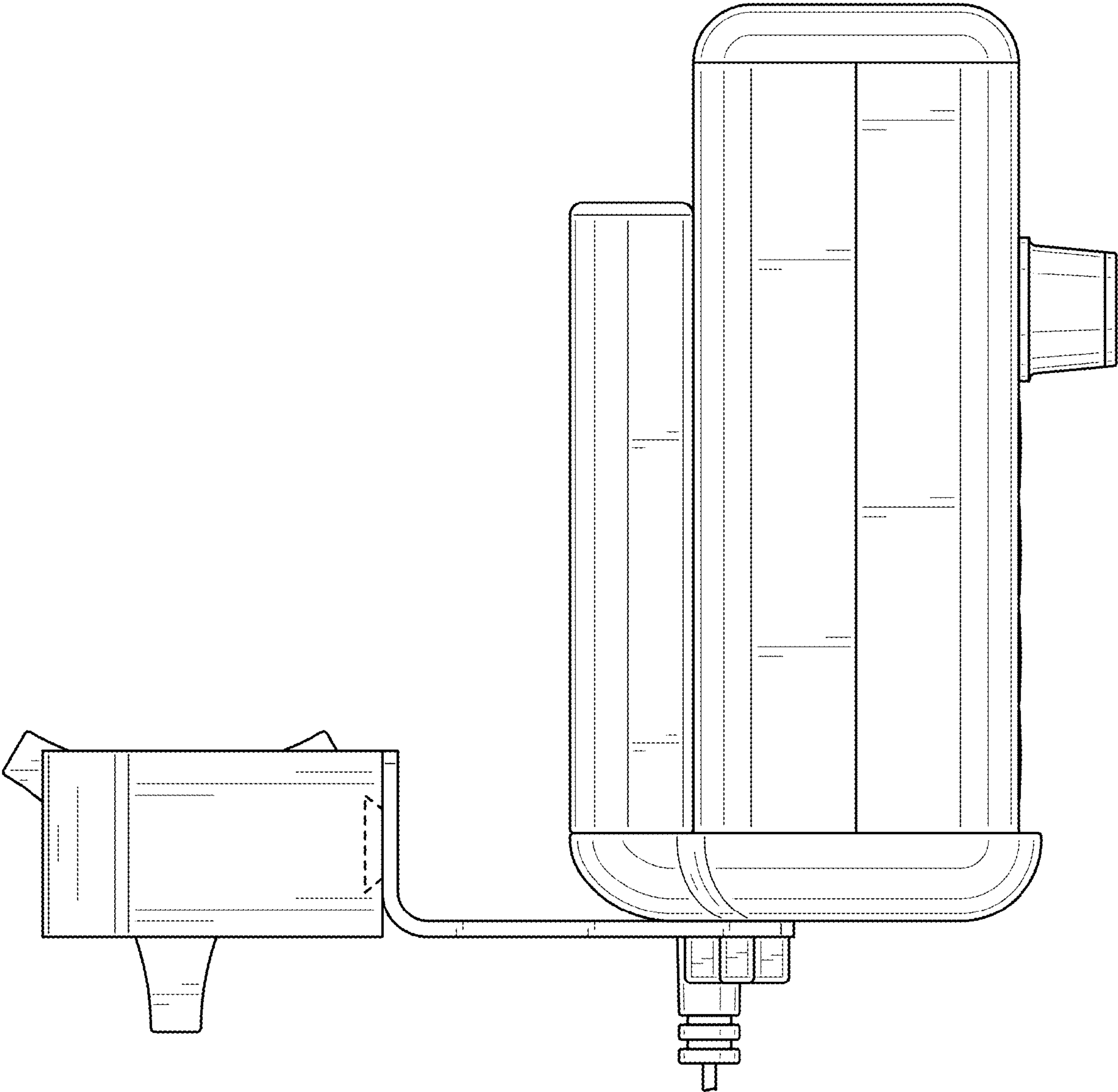


FIG.11

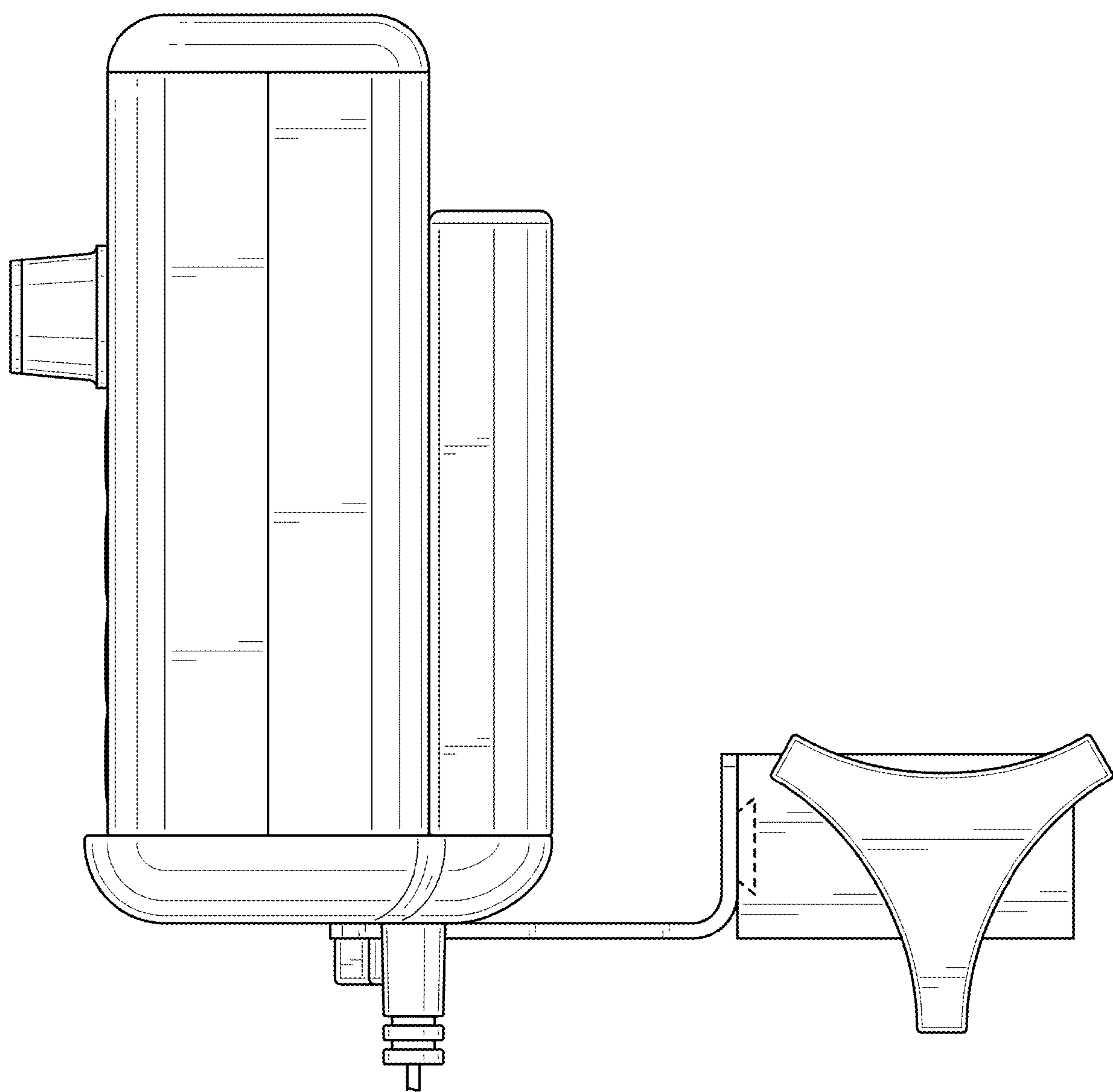


FIG. 12

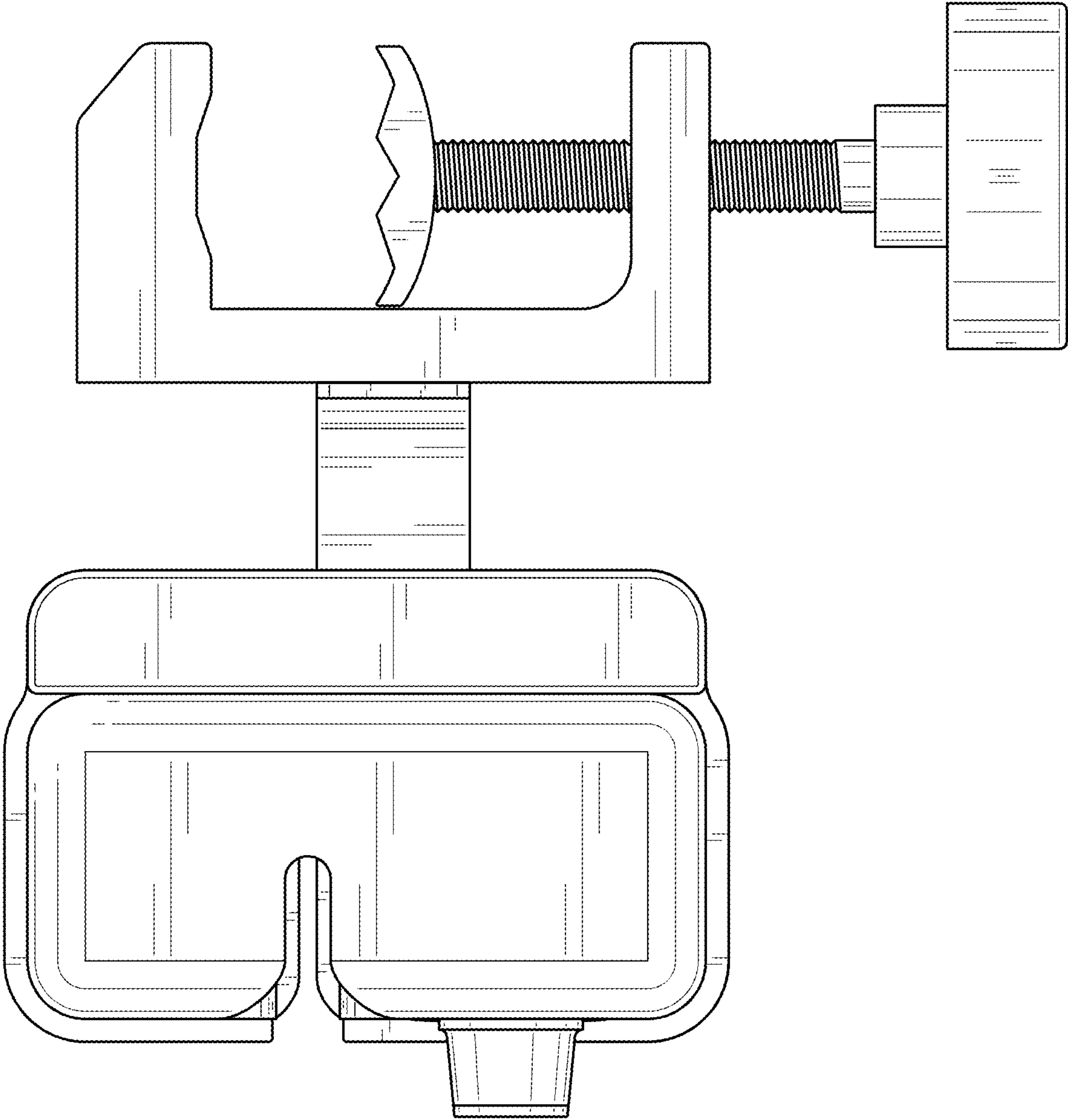


FIG. 13

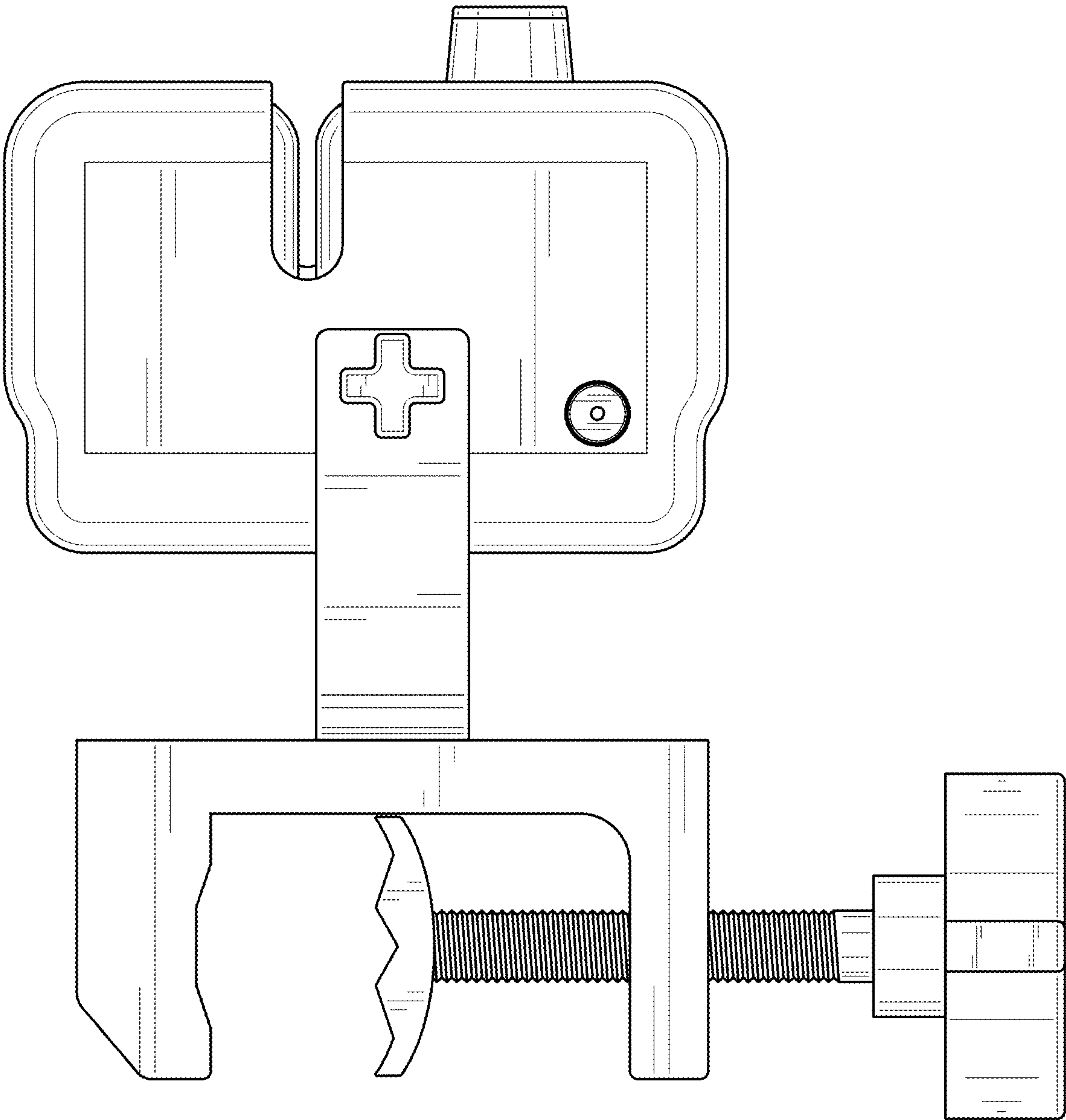


FIG. 14