US00D752209S

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

(10) **Patent No.: US D752,209 S**
(45) **Date of Patent: ** Mar. 22, 2016**

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

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

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

(21) Appl. No.: **29/471,864**

(22) Filed: **Nov. 6, 2013**

(51) **LOC (10) Cl.** **24-02**

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

(58) **Field of Classification Search**
USPC D24/111, 107, 112, 169; 604/7–9, 19, 604/67, 123–125, 143, 151–152, 154–156, 604/218, 246, 256, 253, 250–251, 108, 604/169; 417/234; D9/526, 529, 668
CPC A61M 5/14232; A61M 5/16831; A61M 5/172; A61M 5/14228; A61M 2205/3365; A61M 2205/3313; A61M 5/145; A61M 5/1689; A61M 5/1413; A61M 5/1415; A61M 2205/3569; G01D 5/2451; G01D 5/3473; Y10S 128/13
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

2,888,877 A 6/1959 Shellman et al.
3,173,372 A 3/1965 Baldwin
(Continued)

FOREIGN PATENT DOCUMENTS

AU 2247783 A 6/1985
CA 1213749 A1 11/1986
(Continued)

OTHER PUBLICATIONS

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.
(Continued)

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Assistant Examiner — Mark Booker
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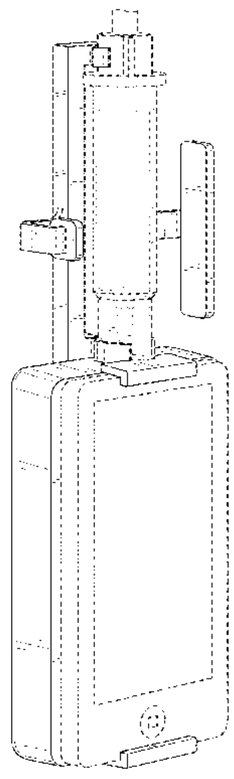
(57) **CLAIM**

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

DESCRIPTION

FIG. **1** is a front, top, and left side perspective view of the apparatus to control fluid flow through a tube, showing my new design;
FIG. **2** is a back, right side perspective view thereof;
FIG. **3** is a first side elevational view thereof;
FIG. **4** is a back side elevational view thereof;
FIG. **5** is a left side elevational view thereof;
FIG. **6** is a right side elevational view thereof;
FIG. **7** is a top plan view thereof; and,
FIG. **8** is bottom plan view thereof.
The ornamental design which is claimed is shown in solid lines in the drawings.
The broken lines shown in the figures represent portions of the apparatus to control fluid flow through a tube that form no part of the claimed design.

1 Claim, 7 Drawing Sheets



(56) **References Cited**

U.S. PATENT DOCUMENTS

3,384,336	A		5/1968	Pulman
3,609,379	A		9/1971	Hildebrandt
3,685,787	A		8/1972	Adelberg
3,733,149	A		5/1973	Jacobson
3,790,042	A		2/1974	McCormick et al.
3,831,600	A		8/1974	Yum et al.
4,038,982	A		8/1977	Burke et al.
4,105,028	A		8/1978	Sadlier et al.
4,155,362	A		5/1979	Jess
4,303,376	A		12/1981	Siekmann
4,321,461	A		3/1982	Walter, Jr. et al.
4,328,800	A		5/1982	Marx et al.
4,328,801	A		5/1982	Marx et al.
4,397,642	A		8/1983	Lamadrid
4,421,506	A		12/1983	Danby et al.
4,449,534	A		5/1984	Leibinsohn Saul
4,469,480	A		9/1984	Figler et al.
4,504,263	A		3/1985	Steuer et al.
4,525,163	A		6/1985	Slavik et al.
4,583,975	A		4/1986	Pekkarinen et al.
RE32,294	E		11/1986	Knute
4,634,426	A		1/1987	Kamen
4,648,869	A		3/1987	Bobo, Jr.
4,662,829	A		5/1987	Nehring
4,668,216	A		5/1987	Martin et al.
4,673,820	A		6/1987	Kamen
4,680,977	A		7/1987	Conero et al.
4,703,314	A		10/1987	Spani
4,718,896	A		1/1988	Arndt et al.
4,720,636	A		1/1988	Benner, Jr.
4,820,281	A		4/1989	Lawler, Jr.
4,834,744	A		5/1989	Ritson
4,837,708	A		6/1989	Wright
4,846,792	A		7/1989	Bobo, Jr. et al.
4,909,786	A		3/1990	Gijselhart et al.
4,920,336	A		4/1990	Meijer
4,936,828	A		6/1990	Chiang
4,959,050	A		9/1990	Bobo, Jr.
4,979,940	A		12/1990	Bobo, Jr. et al.
4,981,467	A		1/1991	Bobo, Jr. et al.
5,002,539	A		3/1991	Coble et al.
5,045,069	A		9/1991	Imparato
5,057,090	A		10/1991	Bessman
5,154,704	A		10/1992	Archibald
5,181,910	A	*	1/1993	Scanlon 604/67
5,186,057	A		2/1993	Everhart
RE34,413	E		10/1993	McCullough
5,267,980	A		12/1993	Dirr, Jr. et al.
5,314,316	A		5/1994	Shibamoto et al.
5,328,341	A		7/1994	Forni
5,331,309	A		7/1994	Sakai
5,415,641	A		5/1995	Yerlikaya et al.
5,482,446	A		1/1996	Williamson et al.
5,562,615	A		10/1996	Nassif
5,588,963	A		12/1996	Roelofs
5,718,562	A	*	2/1998	Lawless et al. 417/1
5,753,820	A		5/1998	Reed et al.
5,782,805	A	*	7/1998	Meinzer et al. 604/131
5,800,140	A		9/1998	Forni
5,899,665	A		5/1999	Makino et al.
6,049,381	A		4/2000	Reintjes et al.
6,050,713	A		4/2000	O'Donnell et al.
6,083,206	A		7/2000	Molko
6,110,153	A		8/2000	Davis et al.
6,149,631	A		11/2000	Haydel, Jr.
6,159,186	A		12/2000	Wickham et al.
6,213,354	B1		4/2001	Kay
6,228,047	B1		5/2001	Dadson
D446,860	S	*	8/2001	Meziere et al. D24/169
6,305,908	B1	*	10/2001	Hermann et al. 417/234
6,328,712	B1		12/2001	Cartledge
6,362,887	B1		3/2002	Meisberger
6,500,151	B1		12/2002	Cobb et al.
6,503,221	B1	*	1/2003	Briggs et al. 604/67
6,523,414	B1		2/2003	Malmstrom et al.
6,562,012	B1		5/2003	Brown et al.
6,599,282	B2		7/2003	Burko
6,641,556	B1		11/2003	Shigezawa
6,657,545	B1		12/2003	Lin et al.
6,736,801	B1		5/2004	Gallagher
6,984,052	B1		1/2006	Del Castillo
7,001,365	B2		2/2006	Makkink
7,190,275	B2		3/2007	Goldberg et al.
7,338,475	B2		3/2008	Brown
7,498,563	B2		3/2009	Mandro et al.
7,499,581	B2		3/2009	Tribble et al.
7,540,859	B2		6/2009	Claude et al.
7,695,448	B2		4/2010	Cassidy et al.
7,767,991	B2		8/2010	Sacchetti
7,892,204	B2		2/2011	Kraus
7,905,859	B2	*	3/2011	Bynum et al. 604/131
7,918,834	B2		4/2011	Mernoe et al.
7,933,780	B2		4/2011	De La Huerga
8,025,634	B1		9/2011	Moubayed et al.
8,038,657	B2		10/2011	Davis et al.
8,147,448	B2		4/2012	Sundar et al.
8,147,464	B2		4/2012	Spohn et al.
8,256,984	B2	*	9/2012	Fathallah et al. 403/380
8,529,511	B2	*	9/2013	Boulanger et al. 604/151
8,531,517	B2		9/2013	Tao
8,552,361	B2	*	10/2013	Mandro et al. 250/231.13
8,622,979	B2		1/2014	Hungerford et al.
8,834,429	B2	*	9/2014	Grant et al. 604/218
2002/0194933	A1		12/2002	Roelofs
2003/0045840	A1		3/2003	Burko
2003/0055406	A1	*	3/2003	Lebel et al. 604/891.1
2003/0217962	A1		11/2003	Childers et al.
2004/0171994	A1		9/2004	Goldberg et al.
2005/0171491	A1		8/2005	Minh Miner et al.
2006/0140466	A1		6/2006	Seshimo et al.
2006/0291211	A1		12/2006	Rodriguez et al.
2008/0004574	A1		1/2008	Dyar et al.
2008/0051732	A1		2/2008	Chen
2008/0147008	A1		6/2008	Lewis et al.
2008/0147016	A1		6/2008	Faries et al.
2008/0154214	A1	*	6/2008	Spohn et al. 604/247
2008/0235765	A1		9/2008	Shimizu
2009/0112115	A1		4/2009	Huang et al.
2009/0224638	A1		9/2009	Weber
2009/0254025	A1	*	10/2009	Simmons 604/67
2009/0276167	A1		11/2009	Glaser et al.
2009/0281460	A1		11/2009	Lowery et al.
2010/0097451	A1		4/2010	Bruce et al.
2010/0114027	A1		5/2010	Jacobson et al.
2010/0168671	A1		7/2010	Faries, Jr. et al.
2010/0211003	A1		8/2010	Sundar et al.
2010/0292635	A1		11/2010	Sundar
2010/0309005	A1		12/2010	Warner et al.
2011/0004186	A1		1/2011	Butterfield
2011/0125103	A1		5/2011	Rondeau
2011/0166511	A1		7/2011	Sharvit et al.
2011/0196306	A1		8/2011	De La Huerga
2011/0208123	A1	*	8/2011	Gray et al. 604/151
2011/0231204	A1		9/2011	De La Huerga
2011/0251557	A1	*	10/2011	Powers 604/151
2011/0313789	A1		12/2011	Kamen et al.
2012/0013735	A1		1/2012	Tao
2012/0059318	A1		3/2012	Dewey
2012/0059350	A1		3/2012	Siefert
2012/0095415	A1		4/2012	Sharvit et al.
2012/0095433	A1		4/2012	Hungerford et al.
2012/0185267	A1		7/2012	Kamen et al.
2012/0197185	A1		8/2012	Tao
2012/0238997	A1		9/2012	Dewey
2012/0265166	A1	*	10/2012	Yodfat 604/506
2012/0310153	A1	*	12/2012	Moberg et al. 604/67
2013/0035659	A1		2/2013	Hungerford et al.
2013/0177455	A1		7/2013	Kamen et al.
2013/0182381	A1		7/2013	Gray et al.
2013/0184676	A1		7/2013	Kamen et al.
2013/0188040	A1		7/2013	Kamen et al.
2013/0191513	A1		7/2013	Kamen et al.
2013/0197693	A1		8/2013	Kamen et al.
2013/0201482	A1		8/2013	Munro

(56) **References Cited**

U.S. PATENT DOCUMENTS

2013/0204188	A1	8/2013	Kamen et al.	
2013/0253442	A1 *	9/2013	Travis et al.	604/250
2013/0272773	A1	10/2013	Kamen et al.	
2013/0281965	A1	10/2013	Kamen et al.	
2013/0297330	A1	11/2013	Kamen et al.	
2013/0310990	A1	11/2013	Peret et al.	
2013/0317753	A1	11/2013	Kamen et al.	
2013/0317837	A1	11/2013	Ballantyne et al.	
2013/0336814	A1	12/2013	Kamen et al.	
2013/0339049	A1	12/2013	Blumberg, Jr. et al.	
2013/0346108	A1	12/2013	Kamen et al.	
2014/0081233	A1	3/2014	Hungerford et al.	
2014/0135695	A1 *	5/2014	Grant et al.	604/111
2014/0148757	A1 *	5/2014	Ambrosina et al.	604/67
2014/0165703	A1	6/2014	Wilt et al.	
2014/0180711	A1	6/2014	Kamen et al.	
2014/0188076	A1	7/2014	Kamen et al.	
2014/0188516	A1	7/2014	Kamen et al.	
2014/0194818	A1 *	7/2014	Yodfat et al.	604/151
2014/0195639	A1	7/2014	Kamen et al.	
2014/0227021	A1	8/2014	Kamen et al.	
2014/0309612	A1 *	10/2014	Smisson et al.	604/500
2014/0318639	A1	10/2014	Peret et al.	
2015/0002667	A1	1/2015	Peret et al.	
2015/0002668	A1	1/2015	Peret et al.	
2015/0002677	A1	1/2015	Peret et al.	

FOREIGN PATENT DOCUMENTS

DE	2023027		11/1970
DE	3617723	A1	12/1987
DE	3822057	C2	1/1989
DE	69229832	T2	2/2000
EP	0112699	A2	7/1984
EP	1722310	A1	4/2005
EP	2319551	A2	10/2008
FR	2042606	A1	2/1971
FR	2458804		1/1981
FR	2617593		1/1989
GB	1301033	A	12/1972
GB	2020735	A	11/1979
GB	2207239	B	1/1989
GB	2328982	B	3/1999
JP	S58163843		9/1983
JP	3110458	B2	11/2000
JP	2011 062371	A	3/2011
NL	7006908		11/1970
NL	8801680		2/1989
NL	9101825	A	5/1993
SE	376843		6/1975
WO	WO 81/02770	A1	10/1981
WO	WO 1993/009407	A1	5/1993
WO	WO 00/72181	A2	11/2000
WO	WO 02/40084	A2	5/2002
WO	WO 02/0100262	A1	12/2002
WO	WO 2004/035116	A1	4/2004
WO	WO 2005/094919	A1	10/2005
WO	WO 2006/086723	A2	8/2006
WO	WO 2008/022880	A1	2/2008
WO	WO 2008/079023	A1	7/2008
WO	WO 2009/039203	A2	3/2009
WO	WO 2009/039214	A2	3/2009
WO	WO 2009/055639	A2	4/2009
WO	WO 2010/129720	A2	11/2010
WO	WO 2011/021098	A1	2/2011
WO	WO 2011/136667	A1	11/2011
WO	WO 2013/095459	A9	6/2013
WO	WO 2013/096713	A2	6/2013
WO	WO 2013/096718	A2	6/2013
WO	WO 2013/096722	A2	6/2013
WO	WO 2013/096909	A2	6/2013
WO	WO 2013/176770	A2	11/2013
WO	WO 2013/177357	A1	11/2013
WO	WO 2014/100557	A2	6/2014
WO	WO 2014/100571	A2	6/2014
WO	WO 2014/100658	A1	6/2014
WO	WO 2014/100687	A2	6/2014
WO	WO 2014/100736	A2	6/2014
WO	WO 2014/100744	A2	6/2014
WO	WO 2014/144557	A2	9/2014

OTHER PUBLICATIONS

Conway, "*Analytical Analysis of Tip Travel in a Bourdon Tube*", Master's Thesis, Naval Postgraduate School Monterey, Dec. 1995, pp. i-89.

"*Principles of Flow Cytometry: Aan Overview.*" Methods in Cell Biology: Cytometry. Ed. Zbigniew Darzynkiewicz. 3rd ed. vol. 63. Academic, 2000. 44-48.

"Feature Detection", *OpenCV Wiki,* 2010, 7 pgs, http://opencv.willowgarage.com/documentation/cpp/imgproc_feature_detection.html.

Galambos et al., "*Progressive Probabilistic Hough Transform for Line Detection*", IEEE, 7 pgs, 1999.

International Search Report & Written Opinion dated May 14, 2012, received in International patent application No. PCT/US2011/066588 (I97WO), 9 pgs.

International Search Report & Written Opinion dated Jun. 18, 2013, received in International patent application No. PCT/US2012/071142 (J79WO), 14 pgs.

International Search Report & Written Opinion dated Oct. 1, 2013, received in International patent application No. PCT/US2012/071490 (J76WO), 19 pgs.

International Search Report & Written Opinion dated Dec. 4, 2013, received in International patent application No. PCT/US2013/032445 (K14WO), 20 pgs.

International Search Report & Written Opinion dated Nov. 7, 2013, received in International patent application No. PCT/US2013/042350 (K66WO), 18 pgs.

Invitation to Pay Additional Fees and, Where Applicable, Protest Fee dated Sep. 9, 2013, received in International patent application No. PCT/US2013/032445 (K14WO), 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 (K66WO), 7 pgs.

Hofmann, "*Modeling Medical Devices for Plug-and-Play Interoperability*", MIT Department of Electrical Engineering and Computer Science, Jun. 2007, pp. 1-187.

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).

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.

FDA US Food and Drug Administration, "*SEDASYS® Computer-Assisted Personalized Sedation System—P08000*", Jul. 16, 2013, pp. 1-2, www.fda.gov/MedicalDevices/ProductsandMedicalProcedures/DeviceApprovalsandClearances/Recently-Approved-Devices/ucm353950.htm.

Luerkens, David W. "*Theory and Application of Morphological Analysis: Fine Particles and Surfaces*". Boca Raton: CRC, 1991. 5-7.

"*Miscellaneous Image Transformations*", OpenCV Wild, 2011, 9 pgs., http://opencv.willowgarage.com/documentation/cpp/miscellaneous_image_transformations.

National Patient Safety Agency, *Design for Patient Safety: A Guide to the Design of Electronic Infusion Devices,* booklet, 2010, pgs. 1-96, Edition 1, National Patient Safety Agency, London.

"Object Detection", OpenCV Wild, 2011, 2 pgs., http://opencv.willowgarage.com/documentation/cpp/object_detection.html.

"*The OpenCV Reference Manual Release 2.4.6.0*", Jul. 1, 2013, pp. 1-813.

Leor at al., "*A System for the Measurement of Drop Volume of Intravenous* Solutions", Proceedings Computers in Cardiology 1990, pp. 405-406, Los Alamitos, California.

(56) **References Cited**

OTHER PUBLICATIONS

Butterfield, "*Alaris SE Pump, Monitoring and Detection of IV Line Occlusions.",* CareFusion Corporation, 2010, 4 pgs.
"*Vista Basic: Instructions for Use: Software IFVB",* manual, 2002, pp. 3, B. Braun Medical Inc.

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.
Matas et al., "Progressive Probabilistic Hough Transform" BMVC98 (1998).

* cited by examiner

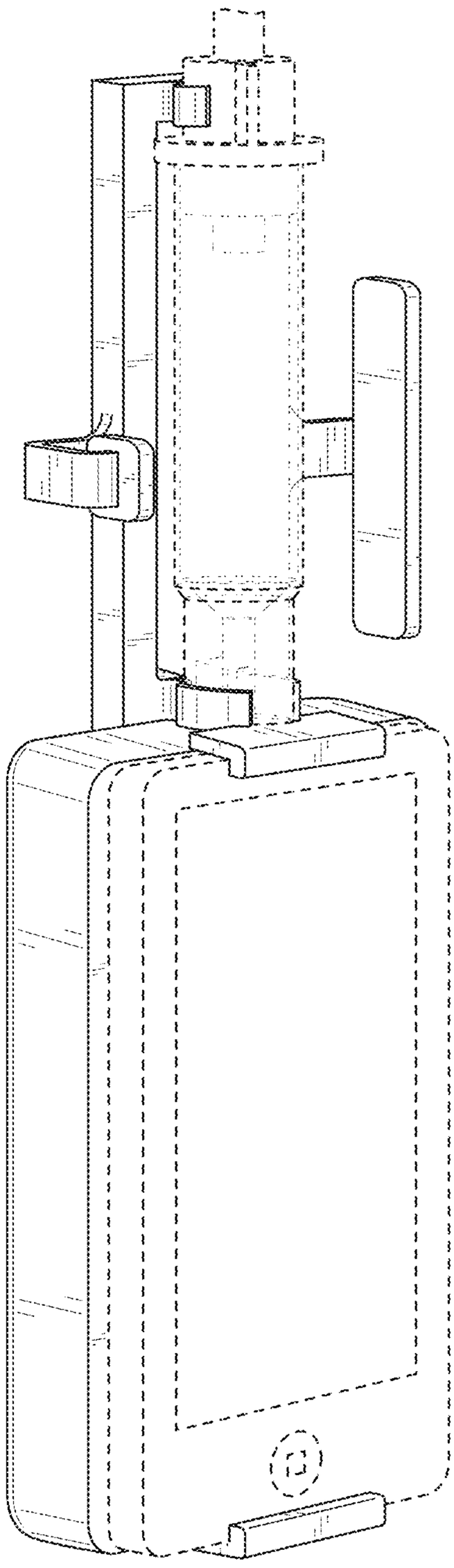


FIG. 1

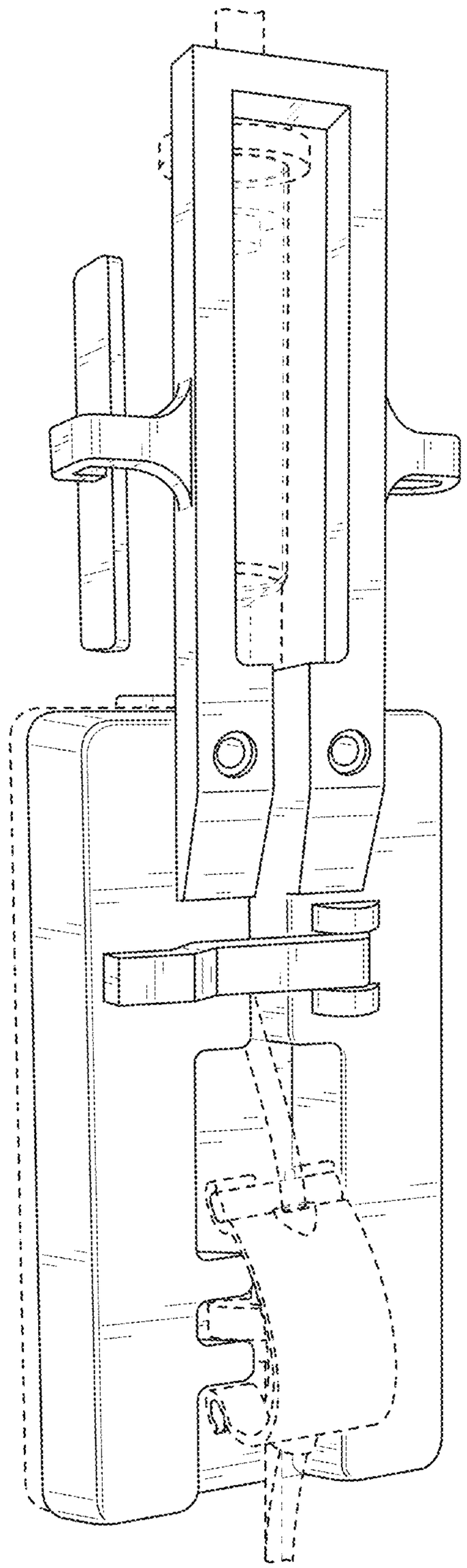


FIG. 2

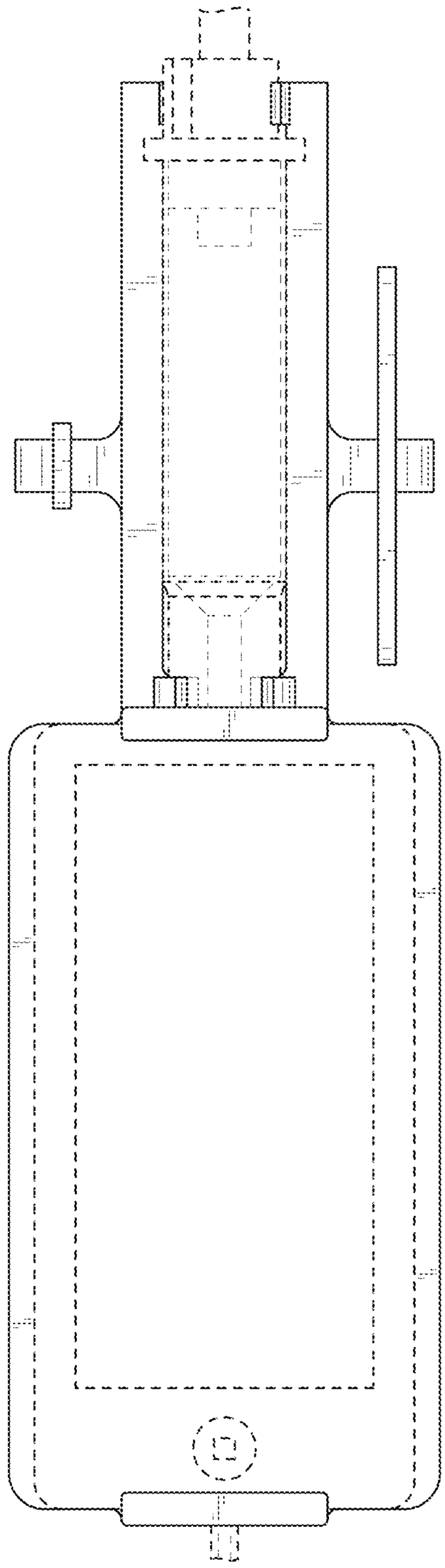


FIG. 3

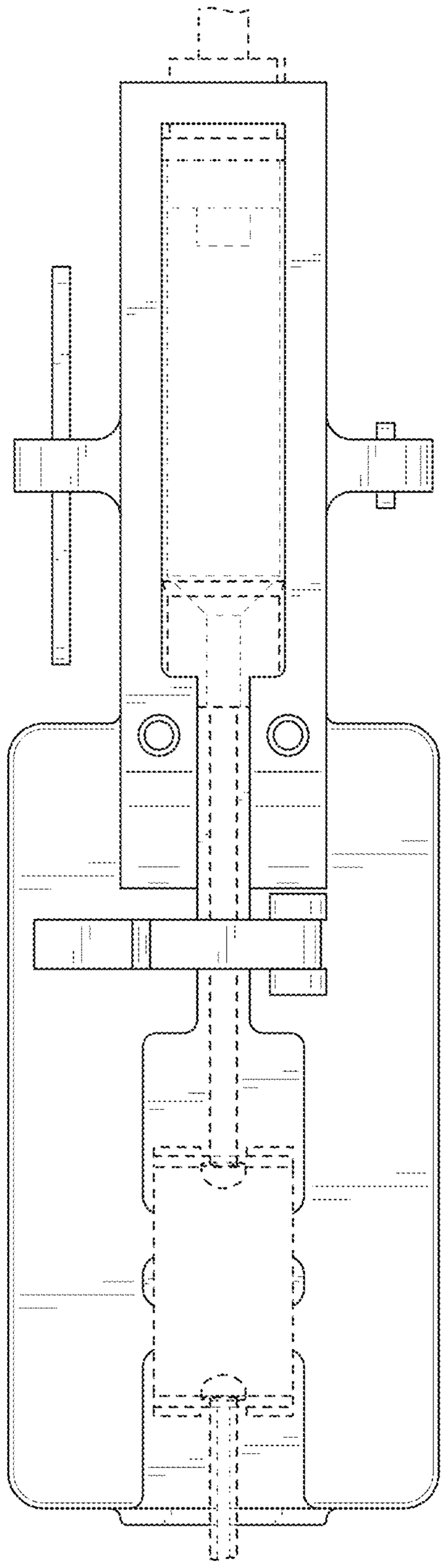


FIG. 4

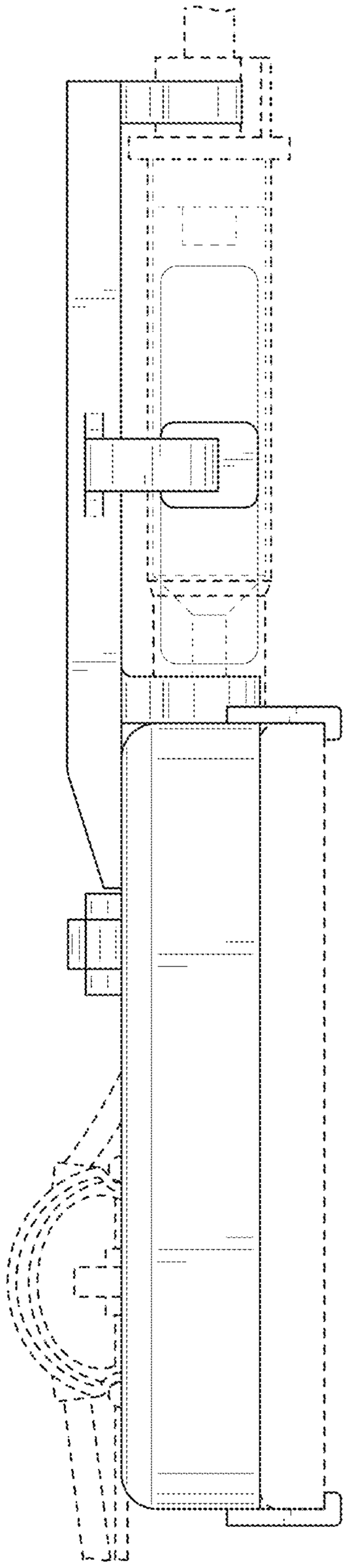


FIG. 5

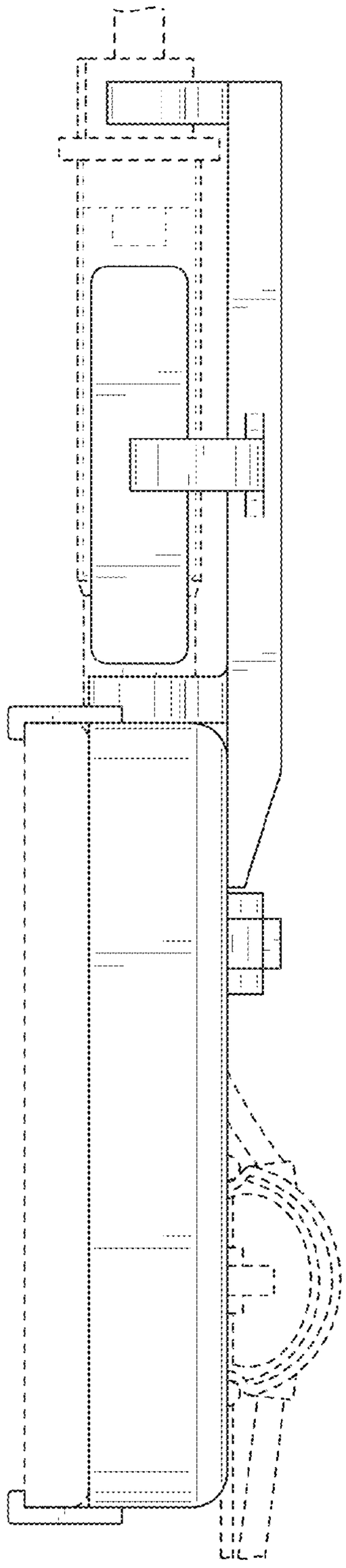


FIG. 6

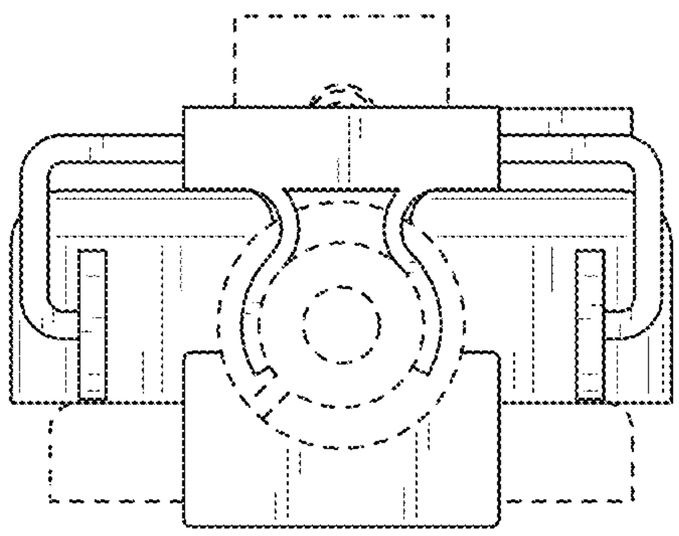


FIG. 7

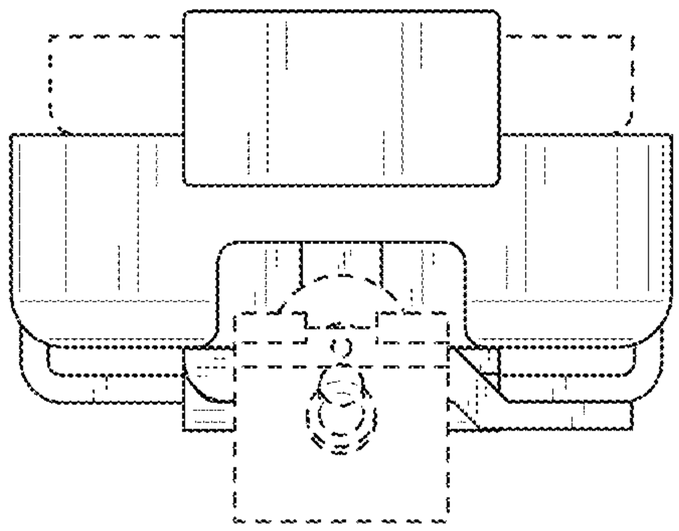


FIG. 8