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

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(54) **LASER TRACKER**

FOREIGN PATENT DOCUMENTS

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CN 1531659 A 9/2004
CN 101031817 A 9/2007

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(Continued)

OTHER PUBLICATIONS

Written Opinion of the International Searching Authority for Application No. PCT/US2012/033477; Date of Mailing Jul. 20, 2012.
(Continued)

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(57) **CLAIM**
We claim, the ornamental design for a laser tracker, as shown and described.

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

DESCRIPTION

(21) Appl. No.: **29/460,666**

(22) Filed: **Jul. 12, 2013**

Related U.S. Application Data

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(51) **LOC (10) Cl.** **10-04**

(52) **U.S. Cl.**
USPC **D10/66; D10/70**

(58) **Field of Classification Search**
USPC D10/66, 70; 33/276, 277, 281, 285, 33/286, 290, 291-299, DIG. 21; 340/539, 340/825.36, 825.46, 825.49; 356/5.15, 356/4.01, 5.01, 4.05, 5.05-5.09, 5.12, 28.5, 356/345, 375, 3.01, 128-155, 399-400; 385/83, 97-99, 134-139; 264/1.24-1.25

See application file for complete search history.

(56) **References Cited**

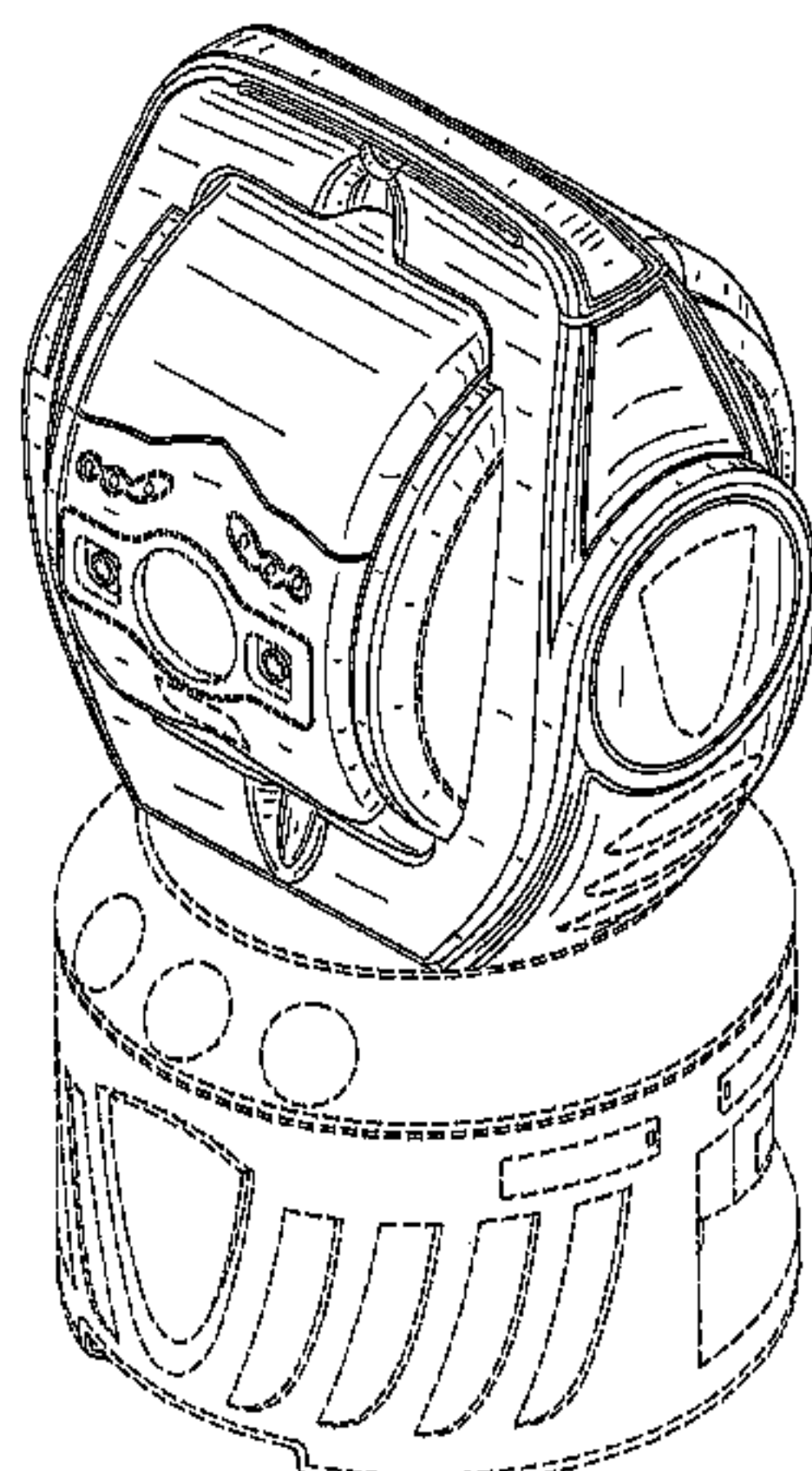
U.S. PATENT DOCUMENTS

2,682,804 A 7/1954 Clifford et al.
2,784,641 A 3/1957 Keuffel et al.

(Continued)

FIG. 1 is a first perspective view of the embodiment of the invention;
FIG. 2 is a second perspective view of the embodiment of FIG. 1;
FIG. 3 is a third perspective view of the embodiment of FIG. 1;
FIG. 4 is a front view of the embodiment of FIG. 1;
FIG. 5 is a rear view of the embodiment of FIG. 1;
FIG. 6 is a first side view of the embodiment of FIG. 1;
FIG. 7 is a second side view of the embodiment of FIG. 1; and,
FIG. 8 is a top view of the embodiment of FIG. 1.
The degree of transparency or opaqueness of the side cover member of the laser tracker forms no part of the claimed design. The side cover member of the claimed laser tracker may have facets, lenslets or other treatments.
The interior structure and details visible through the side cover member form no part of the claimed design.
The phantom lines shown in FIG. 1-FIG. 8 are environmental and not part of the claimed design.
The color and shading of the laser tracker forms no part of the claimed design, the laser tracker according to the claimed design may be any color or combination of colors.
The surface treatment of the laser tracker forms no part of the claimed design, the laser tracker of the claimed design may have any surface treatment.
References to “side”, “top”, “front”, “rear” and “bottom” in the figure descriptions are not meant to require certain in-use orientation; a laser tracker according to the claimed design may be used in any orientation.

1 Claim, 8 Drawing Sheets



(56)

References Cited

U.S. PATENT DOCUMENTS

3,339,457	A	9/1967	Pun	7,262,863	B2	8/2007	Schmidt et al.
3,365,717	A	1/1968	Holscher	7,286,246	B2	10/2007	Yoshida
3,464,770	A	9/1969	Schmidt	7,327,446	B2	2/2008	Cramer et al.
3,497,695	A	2/1970	Smith et al.	7,336,346	B2	2/2008	Aoki et al.
3,508,828	A	4/1970	Froome et al.	7,339,655	B2	3/2008	Nakamura et al.
3,619,058	A	11/1971	Hewlett et al.	7,352,446	B2	4/2008	Bridges et al.
3,627,429	A	12/1971	Jaenicke et al.	7,372,558	B2	5/2008	Kaufman et al.
3,658,426	A	4/1972	Vyce	7,453,554	B2	11/2008	Yang et al.
3,728,025	A	4/1973	Madigan et al.	7,466,401	B2	12/2008	Cramer et al.
3,740,141	A	6/1973	DeWitt, Jr.	7,471,377	B2	12/2008	Liu et al.
3,779,645	A	12/1973	Nakazawa et al.	7,474,388	B2	1/2009	Ohtomo et al.
3,813,165	A	5/1974	Hines et al.	7,480,037	B2	1/2009	Palmateer et al.
3,832,056	A	8/1974	Shipp et al.	7,492,444	B2	2/2009	Osada
3,900,260	A	8/1975	Wendt	7,511,824	B2	3/2009	Sebastian et al.
3,914,052	A	10/1975	Wiklund	7,518,709	B2	4/2009	Oishi et al.
4,113,381	A	9/1978	Epstein	7,535,555	B2	5/2009	Nishizawa et al.
4,297,030	A	10/1981	Chaborski	7,586,586	B2	9/2009	Constantikes
4,403,857	A	9/1983	Holscher	D605,959	S *	12/2009	Apotheloz D10/66
4,453,825	A	6/1984	Buck et al.	7,701,559	B2	4/2010	Bridges et al.
4,498,764	A	2/1985	Bolkow et al.	7,724,380	B2	5/2010	Horita et al.
4,531,833	A	7/1985	Ohtomo	7,738,083	B2	6/2010	Luo et al.
4,632,547	A	12/1986	Kaplan et al.	7,751,654	B2	7/2010	Lipson et al.
4,689,489	A	8/1987	Cole	7,800,758	B1	9/2010	Bridges et al.
4,692,023	A	9/1987	Ohtomo et al.	7,804,602	B2	9/2010	Raab
4,699,508	A	10/1987	Bolkow et al.	7,812,969	B2	10/2010	Morimoto et al.
4,707,129	A	11/1987	Hashimoto et al.	D629,314	S *	12/2010	Ogasawara D10/66
4,714,339	A	12/1987	Lau et al.	7,929,150	B1	4/2011	Schweiger
4,790,651	A	12/1988	Brown et al.	7,990,523	B2	8/2011	Schlierbach et al.
5,002,388	A	3/1991	Ohishi et al.	8,087,315	B2	1/2012	Goossen et al.
5,051,934	A	9/1991	Wiklund	2003/0133092	A1	7/2003	Rogers
5,082,364	A	1/1992	Russell	2004/0075823	A1	4/2004	Lewis et al.
5,162,862	A	11/1992	Bartram et al.	2005/0147477	A1	7/2005	Clark
5,319,434	A	6/1994	Croteau et al.	2006/0066836	A1	3/2006	Bridges et al.
5,400,130	A	3/1995	Tsujimoto et al.	2006/0103853	A1	5/2006	Palmateer
5,402,193	A	3/1995	Choate	2006/0132803	A1	6/2006	Clair et al.
5,416,321	A	5/1995	Sebastian et al.	2006/0145703	A1	7/2006	Steinbichler et al.
5,440,112	A	8/1995	Sakimura et al.	2006/0222237	A1	10/2006	Du et al.
5,455,670	A	10/1995	Payne et al.	2007/0016386	A1	1/2007	Husted
5,534,992	A	7/1996	Takeshima et al.	2007/0024842	A1	2/2007	Nishizawa et al.
5,737,068	A	4/1998	Kaneko et al.	2007/0121095	A1	5/2007	Lewis
5,742,379	A	4/1998	Reifer	2007/0130785	A1	6/2007	Bublitz et al.
5,754,284	A	5/1998	Leblanc et al.	2007/0247615	A1	10/2007	Bridges
RE35,816	E	6/1998	Schulz	2007/0285672	A1	12/2007	Mukai et al.
5,764,360	A	6/1998	Meier	2008/0002866	A1	1/2008	Fujiwara
5,771,623	A	6/1998	Pernstich et al.	2008/0024795	A1	1/2008	Yamamoto et al.
5,880,822	A	3/1999	Kubo	2008/0239281	A1	10/2008	Bridges
5,886,775	A	3/1999	Houser et al.	2008/0316497	A1	12/2008	Taketomi et al.
5,886,777	A	3/1999	Hirunuma	2008/0316503	A1	12/2008	Smarsh et al.
5,892,575	A	4/1999	Marino	2009/0009747	A1	1/2009	Wolf et al.
5,926,388	A	7/1999	Kimbrough et al.	2009/0046271	A1	2/2009	Constantikes
5,991,011	A	11/1999	Damm	2009/0066932	A1	3/2009	Bridges et al.
6,052,190	A	4/2000	Sekowski et al.	2010/0058252	A1	3/2010	Ko
D427,087	S *	6/2000	Kaneko et al. D10/66	2010/0128259	A1	5/2010	Bridges et al.
6,100,540	A	8/2000	Ducharme et al.	2010/0176270	A1	7/2010	Lau et al.
6,324,024	B1	11/2001	Shirai et al.	2010/0207938	A1	8/2010	Yau et al.
6,330,379	B1	12/2001	Hendriksen	2010/0245851	A1	9/2010	Teodorescu
6,351,483	B1	2/2002	Chen	2010/0250175	A1	9/2010	Briggs et al.
6,369,880	B1	4/2002	Steinlechner	2010/0277747	A1	11/2010	Rueb et al.
6,463,393	B1	10/2002	Giger	2011/0032509	A1	2/2011	Bridges
6,490,027	B1	12/2002	Rajchel et al.	2011/0069322	A1	3/2011	Hoffer, Jr.
6,563,569	B2	5/2003	Osawa et al.	2011/0166824	A1	7/2011	Haisty et al.
6,583,862	B1	6/2003	Perger	2011/0169924	A1	7/2011	Haisty et al.
6,633,367	B2	10/2003	Gogolla	2011/0173827	A1	7/2011	Bailey et al.
6,727,985	B2	4/2004	Giger	2011/0179281	A1	7/2011	Chevallier-Mames et al.
6,765,653	B2	7/2004	Shirai et al.	2012/0262728	A1 *	10/2012	Bridges et al. 356/614
6,847,436	B2	1/2005	Bridges				
6,859,744	B2	2/2005	Giger				
6,864,966	B2	3/2005	Giger				
7,023,531	B2	4/2006	Gogolla et al.				
7,095,490	B2	8/2006	Ohtomo et al.				
7,177,014	B2	2/2007	Mori et al.				
7,196,776	B2	3/2007	Ohtomo et al.				
7,224,444	B2	5/2007	Stierle et al.				
7,248,374	B2	7/2007	Bridges				
7,256,899	B1	8/2007	Faul et al.				

FOREIGN PATENT DOCUMENTS

DE	3827458	A1	2/1990
DE	202006020299	U1	5/2008
EP	0166106		1/1986
EP	1067363	A2	1/2001
EP	1607767	A1	12/2005
EP	2177868	A2	10/2009
EP	2259010	A1	12/2010
EP	2259013		12/2010
JP	57147800		9/1982
JP	5804881		3/1983
JP	2184788		7/1990

(56)

References Cited

FOREIGN PATENT DOCUMENTS

JP	5302976	11/1993
JP	6097288	4/1994
JP	11337642	12/1999
JP	2001272468	10/2001
JP	2002098762	4/2002
JP	2004527751	9/2004
JP	2008514967	5/2008
WO	0177613 A1	10/2001
WO	02084327	10/2002
WO	2003062744 A1	7/2003
WO	2008052348 A1	5/2008
WO	2008119073 A2	10/2008
WO	2010141120 A2	12/2010
WO	2010148525 A1	12/2010

OTHER PUBLICATIONS

Written Opinion of the International Searching Authority for Application No. PCT/US2012/033720; Date of Mailing Sep. 26, 2012.

Written Opinion of the International Searching Authority for Application No. PCT/US2012/034611; Date of Mailing Dec. 13, 2012.

Optical Circulator (3-Ports & 4-Ports); [on-line technical data sheet]; Alliance Fiber Optic Products, Inc. REV.D Jan. 15, 2004; Retrieved from www.afop.com.

Super-Nyquist Operation of the AD9912 Yields a High RF Output Signal; Analog Devices, Inc., AN-939 Application Note; www.analog.com; Copyright 2007.

Nanona High Speed & Low Loss Optical Switch; [on-line technical data sheet]; [Retrieved Oct. 14, 2010]; Retrieved from <http://www.bostonati.com/products/PI-FOS.pdf>.

Chen, Junewen, "Novel Laser Range Finding Algorithms", Proceedings of SPIE, vol. 6100, Jan. 1, 2006, pp. 61001Q-61001Q-8, XP55031002, ISSN: 0277-786X, DOI: 10.1117/12.645131, the whole document.

Making the Big Step from Electronics to Photonics by Modulating a Beam of Light with Electricity; May 18, 2005; [on-line]; [Retrieved May 7, 2009]; Cornell University News Service; Retrieved from <http://www.news.cornell.edu/stories/May05/LipsonElectroOptical.ws.html>.

EOspace—High-Speed Switches; [on-line technical brochure]; [Retrieved May 18, 2009]; Retrieved from <http://www.cospace.com/Switches.htm>.

FARO Laser Tracker ION; 2 pages; revised Apr. 23, 2010; FARO Technologies, Inc., www.lasertrackerfaro.com.

Great Britain Search Report for Application No. GB1013200.9 dated Nov. 22, 2010.

AO Modulator—M040-8J-FxS; [online—technical data sheet]; Gooch & Housego; Nov. 2006; Retrieved from <http://www.goochandhousego.com/>.

International Search Report of the International Searching Authority for Application No. PCT/US2012/032970; Date of Mailing Nov. 28, 2012.

International Search Report of the International Searching Authority for Application No. PCT/2012/030225; Date of Mailing Sep. 28, 2012.

International Search Report of the International Searching Authority for Application No. PCT/US2012/030835; Date of Mailing Jul. 23, 2012.

International Search Report of the International Searching Authority for Application No. PCT/US2012/031368; Date of Mailing Jul. 18, 2012.

International Search Report of the International Searching Authority for PCT/US2012/032715; Date of Mailing Jul. 5, 2012.

International Search Report of the International Searching Authority for Application No. PCT/US2012/032971; Date of Mailing Sep. 3, 2012.

International Search Report of the International Searching Authority for Application No. PCT/US2012/032972; Date of Mailing Nov. 28, 2012.

International Search Report of the International Searching Authority for Application No. PCT/US2012/032990; Date of Mailing Dec. 4, 2012.

International Search Report of the International Searching Authority for Application No. PCT/US2012/0033435; Date of Mailing Sep. 17, 2012.

International Search Report of the International Searching Authority for Application No. PCT/US2012/033477; Date of Mailing Jul. 20, 2012.

International Search Report of the International Searching Authority for Application No. PCT/YS2012/033720; Date of Mailing Sep. 26, 2012.

International Search Report of the International Searching Authority for Application No. PCT/US2012/034611; Date of Mailing Dec. 13, 2012.

2x2 High Speed Lithium Niobate Interferometric Switch; [on-line]; JDS Uniphase Corporation; 2007; Retrieved from www.jdsu.com.

Integrated Optical Amplitude Modulator; [on-line technical data sheet]; [Retrieved Oct. 14, 2010]; Jenoptik; Retrieved from [http://www.jenoptik.com/cms/products.nsf/0/A6DF20B50AEE7819C12576FE0074E8E6/\\$File/amplitudemodulators_en.pdf?Open](http://www.jenoptik.com/cms/products.nsf/0/A6DF20B50AEE7819C12576FE0074E8E6/$File/amplitudemodulators_en.pdf?Open).

Office Action for Japanese Patent Application No. 2010-176909 filed Aug. 6, 2010; issued on Oct. 23, 2012. All art cited within.

Office Action for Japanese Patent Application No. 2010-176909 filed Aug. 6, 2010; issued on Mar. 19, 2013. All art cited within.

Kester, Walt, Practical Analog Design Techniques, Analog Devices, Section 5, Undersampling Applications, Copyright 1995, pp. 5-1 to 5-34.

Optical Circulators Improve Bidirectional Fiber Systems; by Jay S. Van Delden; [online]; [Retrieved May 18, 2009]; Laser Focus World; Retrieved from http://www.laserfocusworld.com/display_article/28411/12/nonc/nonc/News/Optical-circulators-improve-bidirectional-fiber-systems.

Leica Absolute Tracker AT401-ASME B89.4.19/2006 Specifications; Hexagon Metrology; Leica Geosystems Metrology Products, Switzerland; 2 pages; www.leica-geosystems.com/metrology.

Leica Laser Tracker System, Leica Geosystems AG, Jan. 1, 1999, XP002678836, Retrieved from the Internet: URL:http://www.a-solution.com.au/pages/downloads/LTD500_Brochure_EN.pdf [retrieved on 2012] the whole document.

Lightvision—High Speed Variable Optical Attenuators (VOA); [on-line]; A publication of Lightwaves 2020, Feb. 1, 2008; Retrieved from <http://www.lightwaves2020.com/home/>.

Matsumaru, K., "Mobile Robot with Preliminary-Announcement and Display Function of Forthcoming Motion Using Projection Equipment," Robot and Human Interactive Communication, 2006. RO-MAN06. The 15th IEEE International Symposium, pp. 443-450, Sep. 6-8, 2006.

LaserTracer-measuring sub-micron in space; <http://www.etalon-ag.com/index.php/en/products/lasertracer>; 4 pages; Jun. 28, 2011; Etalon AG.

Computer Giants Embrace On-Chip Optics; Mar. 27, 2008; [on-line]; Optics.org; [Retrieved on Apr. 2, 2008]; Retrieved from <http://optics.org/cws/article/research/33521>.

Ou-Yang, Mang, et al., "High-Dynamic-Range Laser Range Finders Based on a Novel Multimodulated Frequency Method", Optical Engineering, vol. 45, No. 12, Jan. 1, 2006, p. 123603, XP55031001, ISSN: 0091-3286, DOI: 10.1117/1.2402517, the whole document.

MEMS Variable Optical Attenuators Single/Multi-Channel; [on-line]; Jan. 17, 2005; Retrieved from www.ozoptics.com.

PCMM System Specifications Leica Absolute Tracker and Leica T-Products; Hexagon Metrology; Leica Geosystems Metrology Products, Switzerland; 8 pages; www.leica-geosystems.com/metrology.

Poujouly, Stephane, et al., "A Twofold Modulation Frequency Laser Range Finder; A Twofold Modulation Frequency Laser Range Finder", Journal of Optics. A, Pure and Applied Optics, Institute of Physics Publishing, Bristol, GB, vol. 4, No. 6, Nov. 1, 2002, pp. S356-S363, XP020080997, ISSN: 1464-4258, DOI: 10.1088/1464-4258/4/6/380, the whole document.

Poujouly, Stephane, et al., Digital Laser Range Finder: Phase-Shift Estimation by Undersampling Technique; IEEE, Copyright 1999.

(56)

References Cited

OTHER PUBLICATIONS

RS Series Remote Controlled Optical Switch; [on-line technical data sheet]; Sercalo Microtechnology, Ltd. [Retrieved Oct. 14, 2010]; Retrieved from <http://www.sercalo.com/document/PDFs/DataSheets/RS%20datasheet.pdf>.

Tracker3; Ultra-Portable Laser Tracking System; 4 pages; 2010 Automated Precision Inc.; www.apisensor.com.

Written Opinion of the International Searching Authority for PCT/US2012/032715; Date of Mailing Jul. 5, 2012.

Written Opinion of the International Searching Authority for Application No. PCT/US2012/030225; Date of Mailing Sep. 28, 2012.

Written Opinion of the International Searching Authority for Application No. PCT/US2012/030835; Date of Mailing Jul. 23, 2012.

Written Opinion of the International Searching Authority for Application No. PCT/US2012/031368; Date of Mailing Jul. 18, 2012.

Written Opinion of the International Searching Authority for Application No. PCT/US2012/032970; Date of Mailing Nov. 28, 2012.

Written Opinion of the International Searching Authority for Application No. PCT/US2012/032971; Date of Mailing Sep. 3, 2012.

Written Opinion of the International Searching Authority for Application No. PCT/US2012/032972; Date of Mailing Nov. 28, 2012.

Written Opinion of the International Searching Authority for Application No. PCT/US2012/032990; Date of Mailing Dec. 4, 2012.

Written Opinion of the International Searching Authority for Application No. PCT/US2012/033435; Date of Mailing Sep. 17, 2012.

Chinese Office Action issued Sep. 22, 2013 for Patent Application No. 201010251189.3.

* cited by examiner

FIG 1

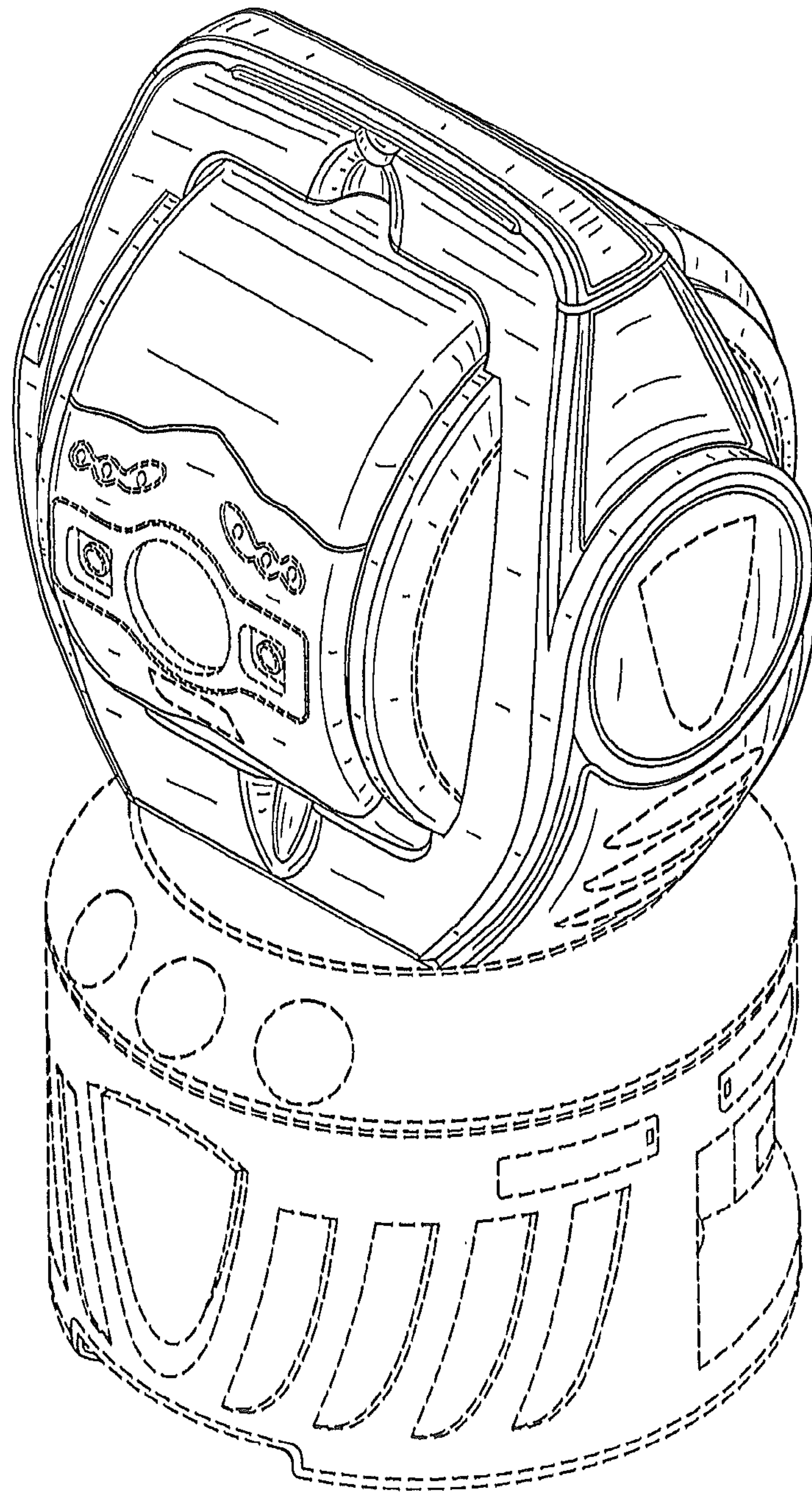


FIG 2

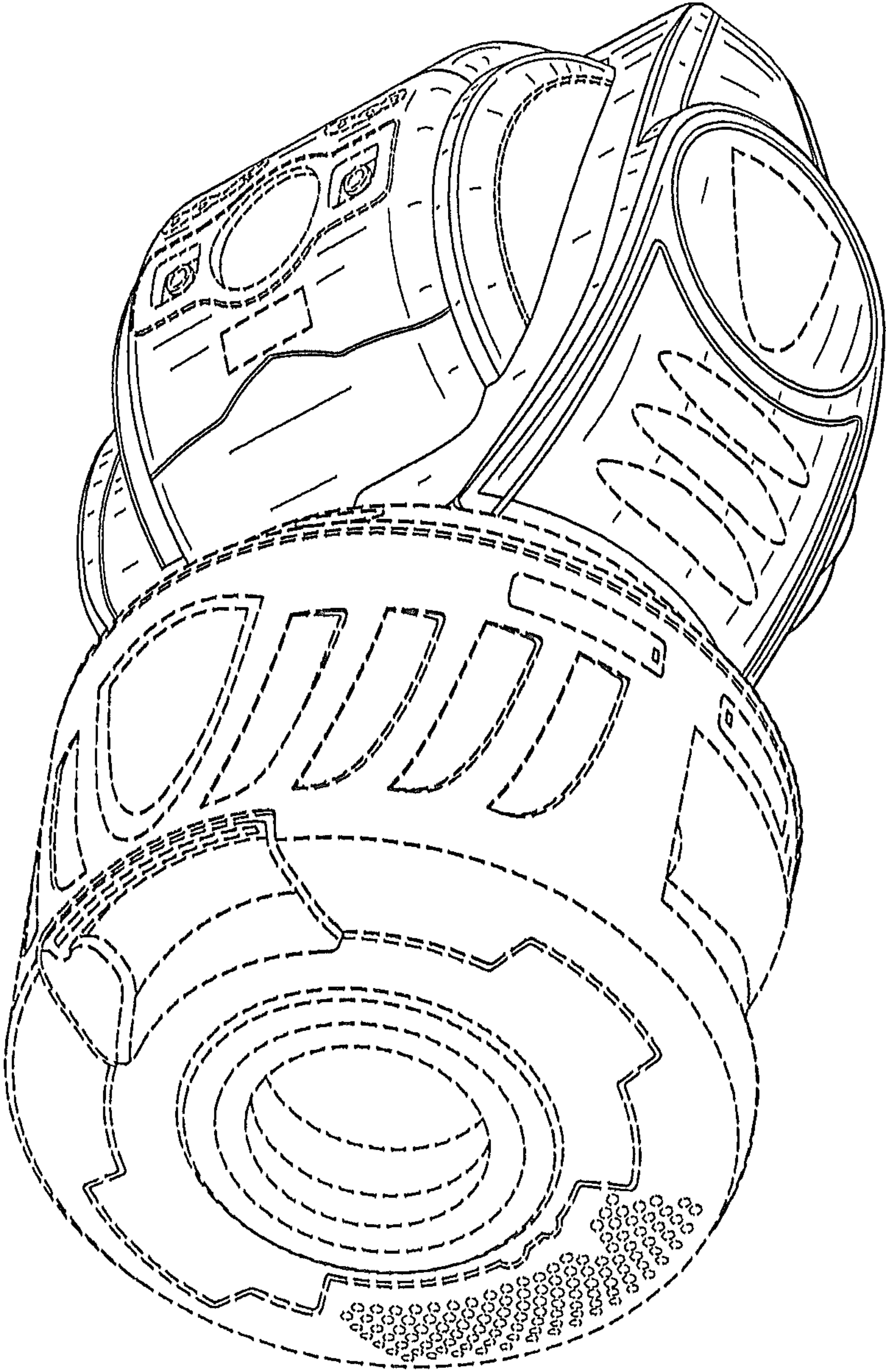


FIG 3

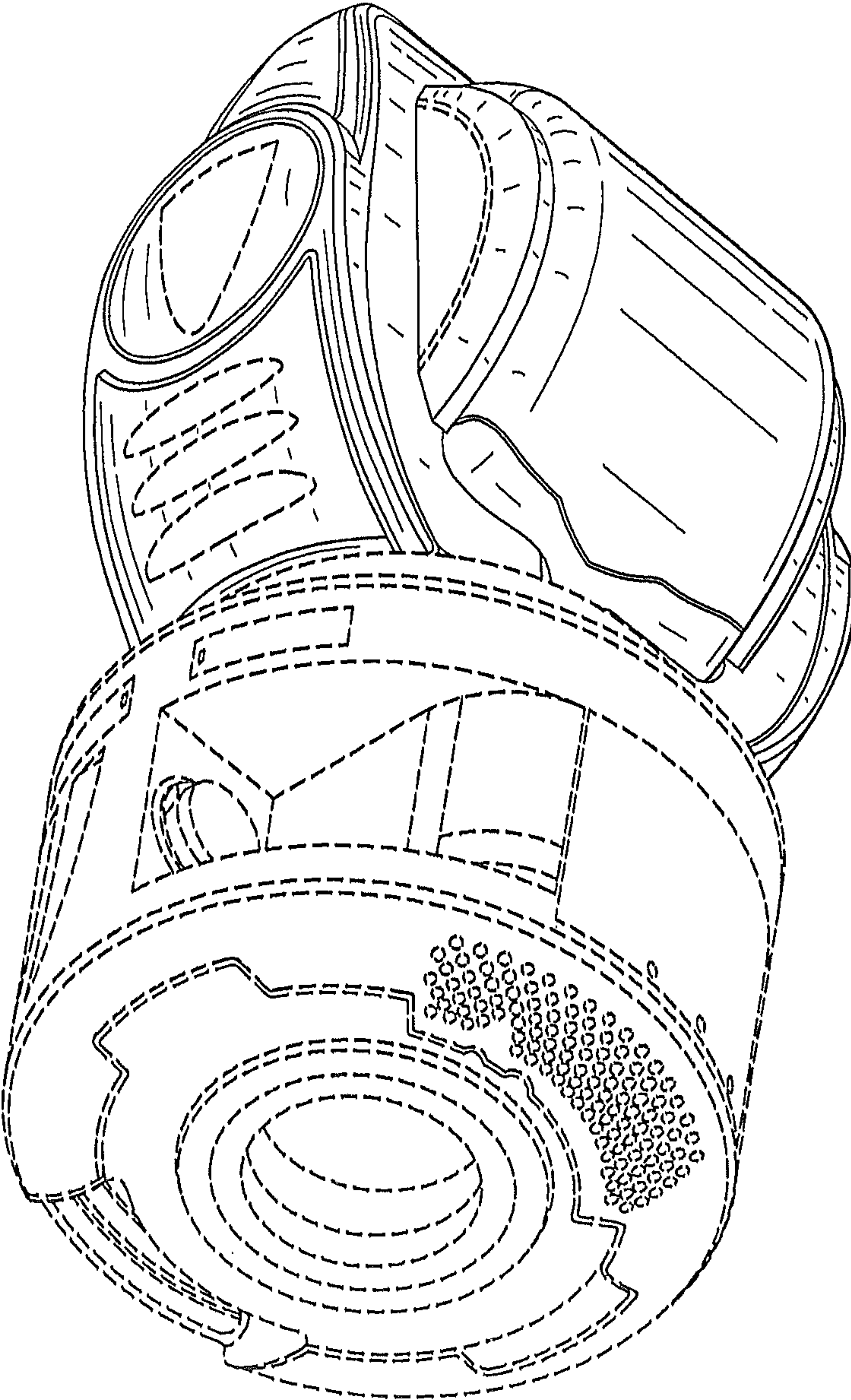


FIG 4

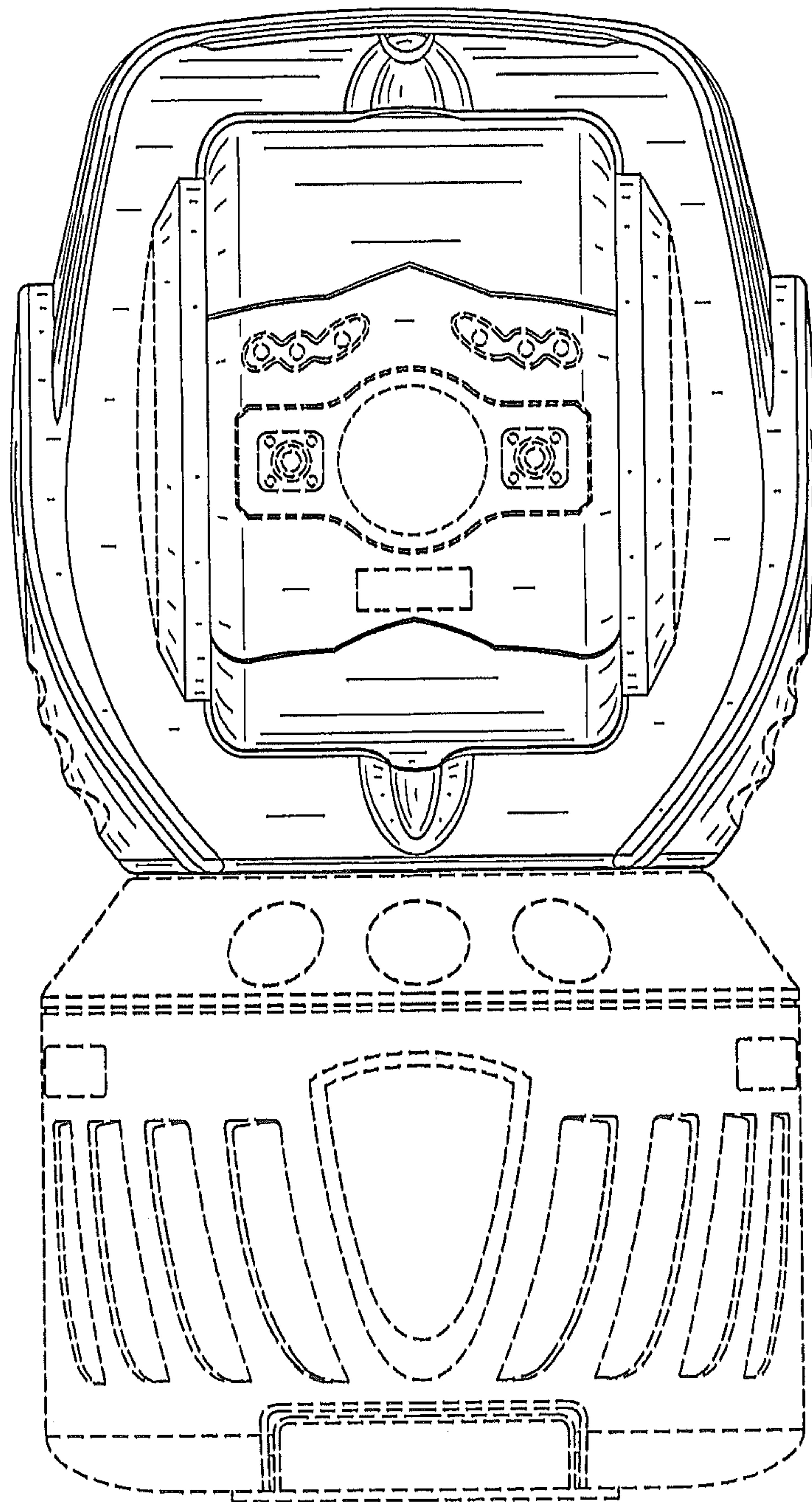


FIG 5

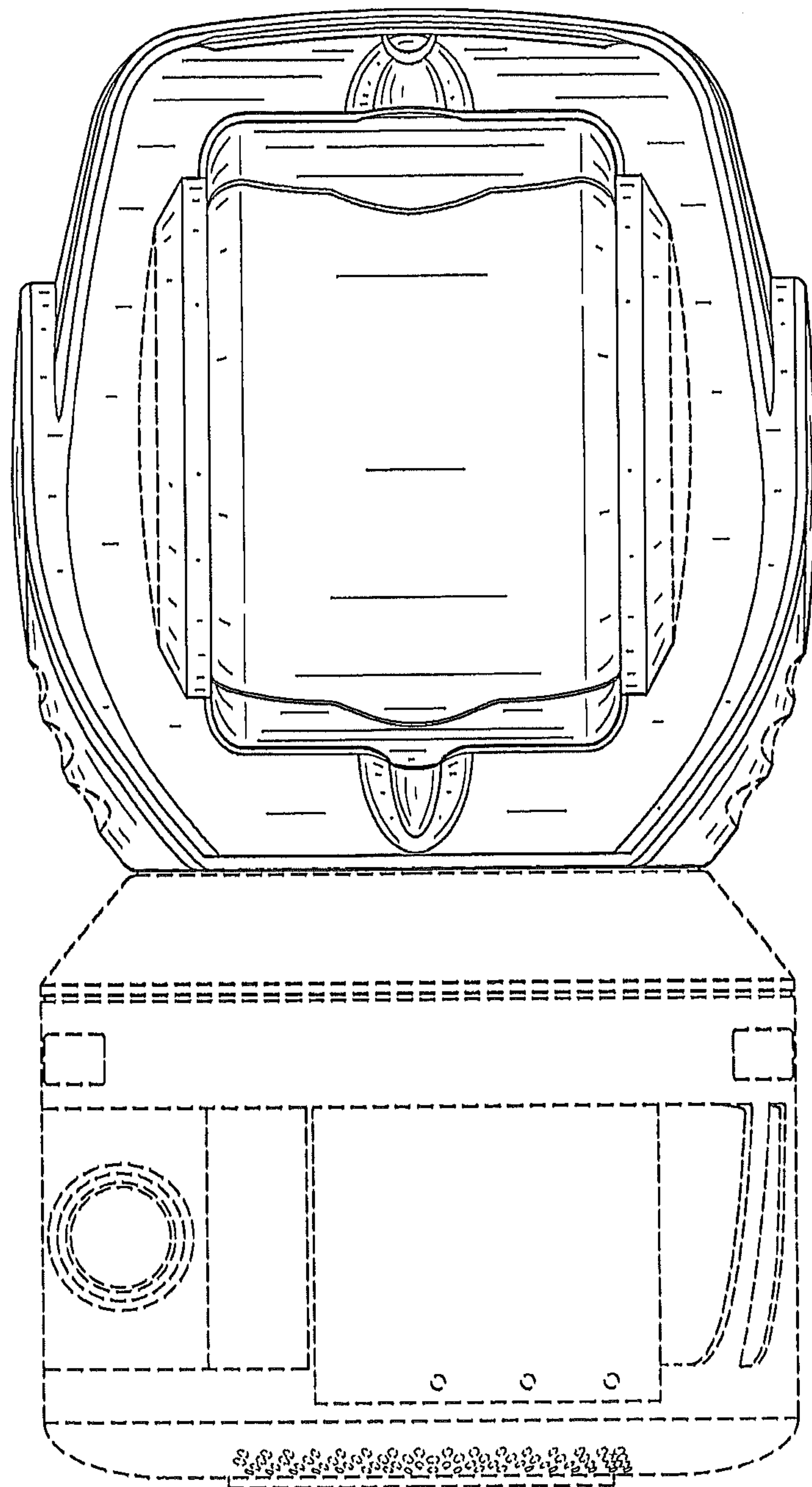


FIG 6

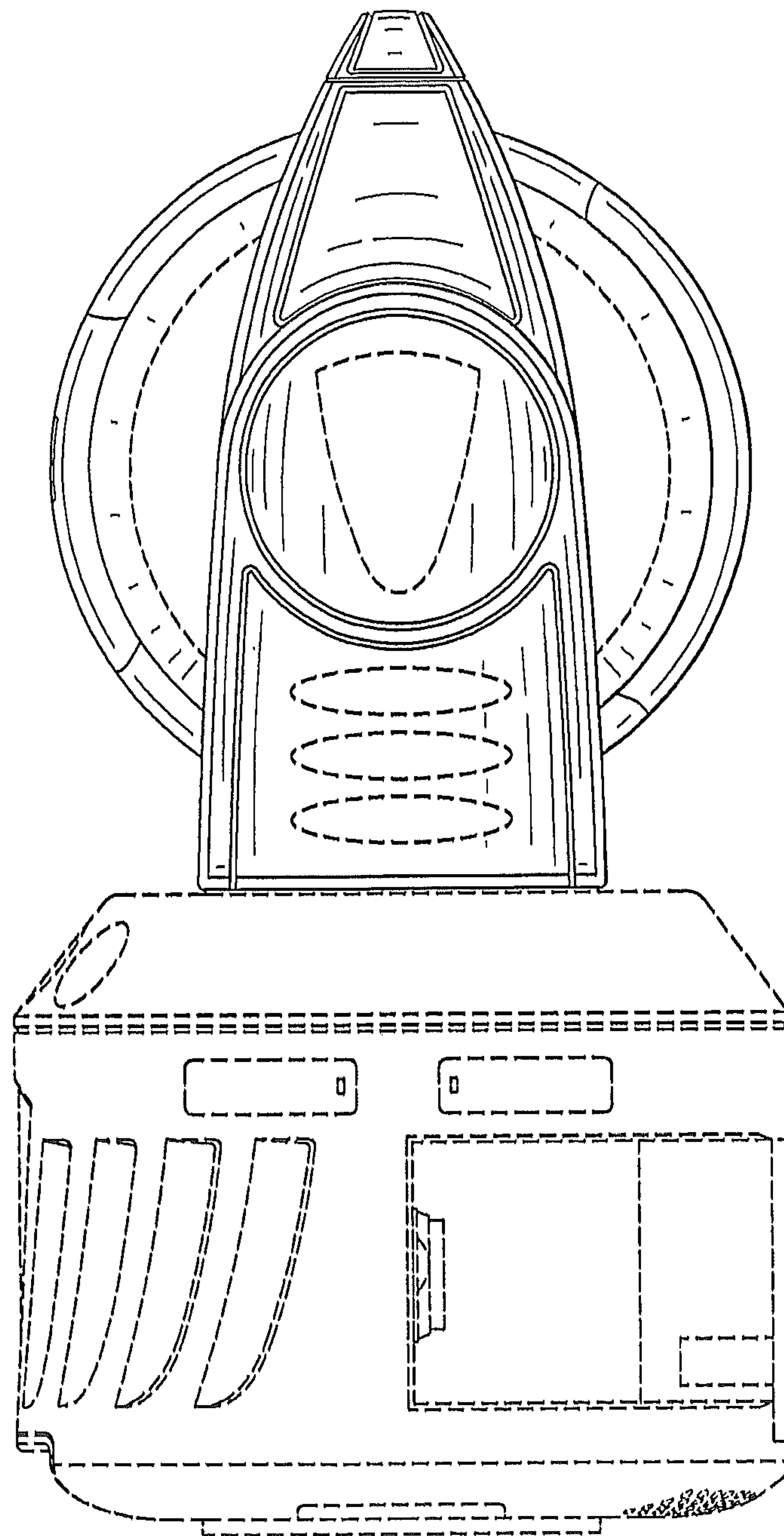


FIG 7

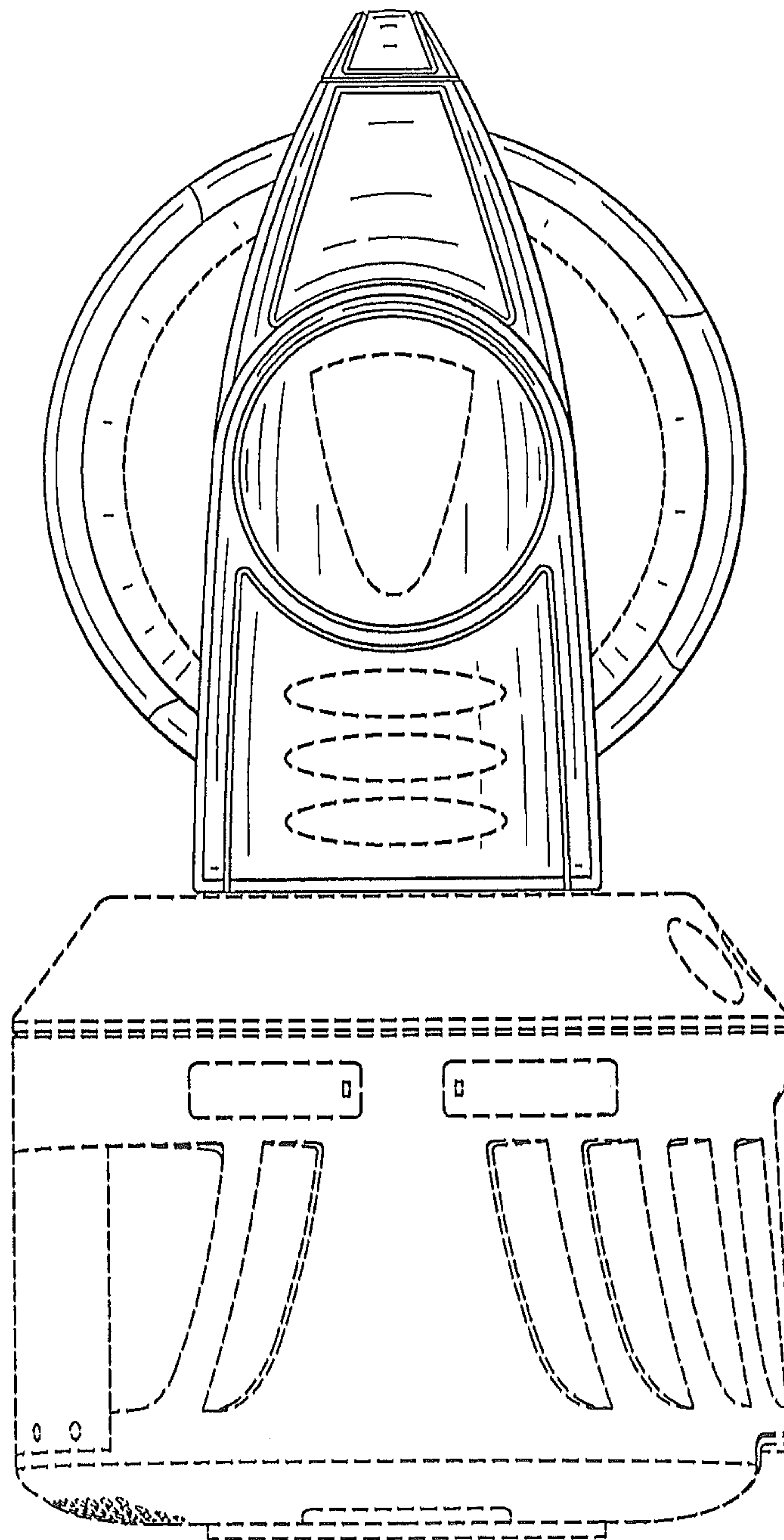


FIG 8

