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

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(54) **HUMERAL IMPLANT**

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(52) **U.S. Cl.**  
USPC ..... **D24/155**

(58) **Field of Classification Search**  
USPC ..... D2/617; D3/201, 203.1, 203.6, 203.7,  
D3/304, 306, 314; D8/382; D14/205,  
(Continued)

(56) **References Cited**

**U.S. PATENT DOCUMENTS**

448,126 A 3/1891 Craig  
1,065,456 A 6/1913 Lowrey  
(Continued)

**FOREIGN PATENT DOCUMENTS**

DE 4220217 12/1993  
DE 10233204 1/2004  
(Continued)

**OTHER PUBLICATIONS**

Med Gadget, "Tornier Announces First Implant in U.S. Trial of Its  
Simpliciti Stemless Shoulder Joint Replacement System", first

available Aug. 5, 2011. (<https://www.medgadget.com/2011/08/tornier-announces-first-implant-in-u-s-trial-of-its-simpliciti-stemless-shoulder-joint-replacement-system.html>) (Year: 2011).\*

(Continued)

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(57) **CLAIM**

The ornamental design for a humeral implant, as shown and described.

**DESCRIPTION**

FIG. 1 is a top perspective view of an embodiment of a humeral implant of our design;

FIG. 2 is a bottom perspective view thereof;

FIGS. 3-6 are side views thereof;

FIG. 7 is a top view thereof; and

FIG. 8 is a bottom view thereof.

FIG. 9 is a top perspective view of another embodiment of a humeral implant of our design;

FIG. 10 is a bottom perspective view of the design of FIG. 9;

FIGS. 11-14 are side views of the design of FIG. 9;

FIG. 15 is a top view of the design of FIG. 9; and

FIG. 16 is a bottom view of the design of FIG. 9.

FIG. 17 is a top perspective view of another embodiment of a humeral implant of our design;

FIG. 18 is a bottom perspective view of the design of FIG. 17;

FIGS. 19-22 are side views of the design of FIG. 17;

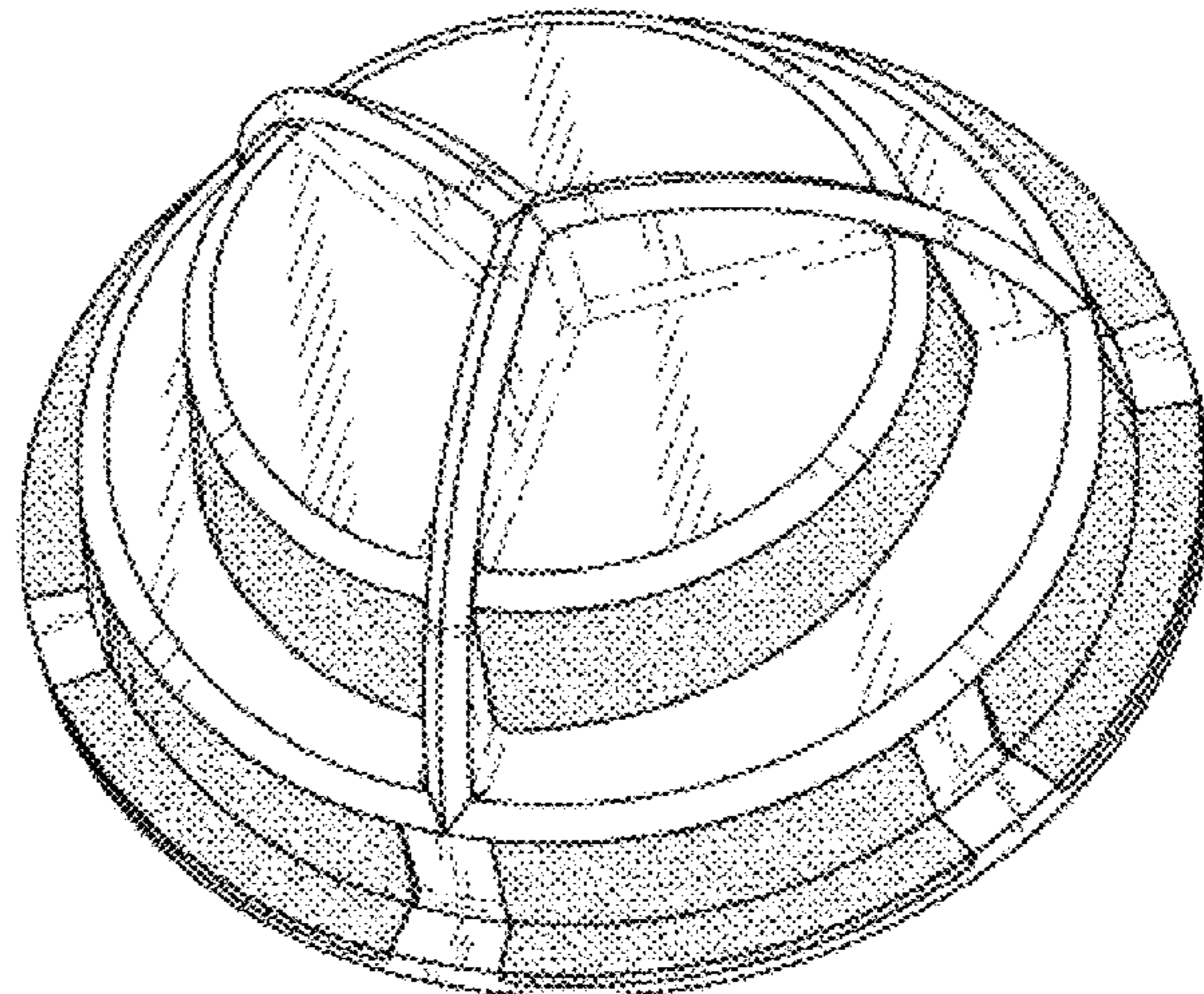
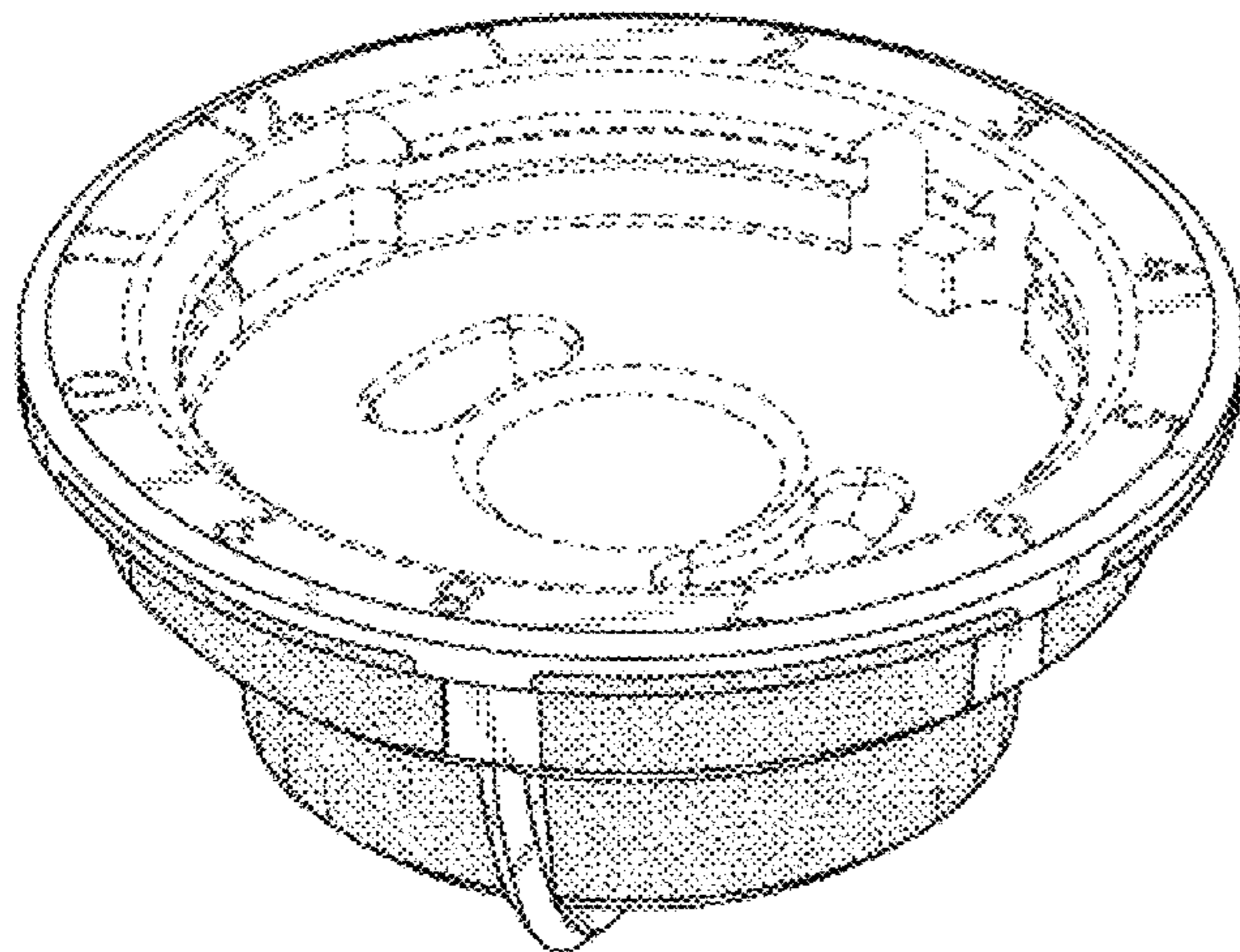
FIG. 23 is a top view of the design of FIG. 17; and

FIG. 24 is a bottom view of the design of FIG. 17.

The broken lines immediately adjacent to the shaded areas depict the bounds of the claimed design, while all other broken lines are directed to environment. The broken lines form no part of the claimed design.

The stipple shading as used in this application is a drafting convention used to show contrast with adjacent surfaces.

**1 Claim, 15 Drawing Sheets**



(58) **Field of Classification Search**

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 2017/00292; A61B 2017/00796; A61B  
 2017/00969; A61B 50/30; A61B 50/33;  
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 A61F 2/30; A61F 2/50; A61F 2002/5038;  
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 2/604; A61F 2/66; A61F 2002/6614;  
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 2/885; A61F 2/4014; A61F 2002/4018;  
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 2002/4033; A61F 2002/4037; A61F  
 2002/4044; A61F 2002/4051; A61F  
 2/4059; A61F 2002/4062; A61F  
 2002/4066; A61F 2002/407; A61F  
 2002/4074; A61F 2002/4077; A61F  
 2/4081; A61F 2002/4085; A61N 1/05;  
 A61N 1/0551; A61N 1/20; A61M 16/04

See application file for complete search history.

5,810,524 A 9/1998 Wirth, Jr. et al.  
 5,820,315 A 10/1998 Collard  
 5,830,215 A 11/1998 Incavo et al.  
 5,954,727 A 9/1999 Collazo  
 5,976,148 A 11/1999 Charpenet et al.  
 6,045,582 A 4/2000 Prybyla  
 6,063,124 A 5/2000 Amstutz  
 6,099,214 A 8/2000 Lee et al.  
 D433,130 S \* 10/2000 Cude ..... D24/121  
 6,132,469 A 10/2000 Schroeder  
 6,139,551 A 10/2000 Michelson et al.  
 6,146,423 A 11/2000 Cohen et al.  
 6,174,335 B1 1/2001 Varieur et al.  
 6,187,012 B1 2/2001 Masini  
 6,197,063 B1 3/2001 Dews  
 6,264,299 B1 7/2001 Noda  
 6,264,657 B1 7/2001 Urbahns et al.  
 6,306,171 B1 10/2001 Conzemius  
 6,364,910 B1 4/2002 Shultz et al.  
 6,368,271 B1 4/2002 Sharratt  
 6,368,353 B1 4/2002 Arcand  
 6,379,917 B1 4/2002 Okun et al.  
 6,409,730 B1 6/2002 Green et al.  
 6,508,840 B1 1/2003 Rockwood, Jr. et al.  
 6,520,994 B2 2/2003 Nogarin  
 6,537,278 B1 3/2003 Johnson  
 6,666,874 B2 12/2003 Heitzmann et al.  
 6,736,851 B2 5/2004 Maroney et al.  
 6,746,452 B2 6/2004 Tuke et al.  
 6,783,549 B1 8/2004 Stone et al.  
 6,786,684 B1 9/2004 Ecker  
 6,797,006 B2 9/2004 Hodorek et al.  
 7,044,973 B2 5/2006 Rockwood, Jr. et al.  
 7,097,663 B1 8/2006 Nicol et al.  
 7,140,087 B1 11/2006 Giltner  
 7,160,328 B2 1/2007 Rockwood, Jr. et al.  
 7,169,184 B2 1/2007 Dalla Pria  
 7,175,663 B1 2/2007 Stone  
 7,179,084 B1 2/2007 Kometas  
 7,189,036 B1 3/2007 Watson  
 7,189,261 B2 3/2007 Dews et al.  
 7,204,854 B2 4/2007 Guederian et al.  
 7,344,565 B2 3/2008 Seyer et al.  
 7,465,319 B2 12/2008 Tornier  
 7,476,228 B2 1/2009 Abou  
 7,476,253 B1 1/2009 Craig et al.  
 7,585,327 B2 9/2009 Winslow  
 7,615,080 B2 11/2009 Ondrla  
 7,637,703 B2 12/2009 Khangar et al.  
 7,648,530 B2 1/2010 Habermeyer et al.  
 7,670,382 B2 3/2010 Parrott et al.  
 7,678,150 B2 3/2010 Tornier et al.  
 D617,459 S \* 6/2010 Bogue ..... D24/155  
 7,744,602 B2 6/2010 Teeny et al.  
 7,758,650 B2 7/2010 Dews et al.  
 7,887,544 B2 2/2011 Tornier et al.  
 7,927,376 B2 4/2011 Leisinger et al.  
 D643,926 S 8/2011 Collins  
 8,021,370 B2 9/2011 Fenton et al.  
 8,114,089 B2 2/2012 Divoux et al.  
 8,162,947 B2 4/2012 Dreyfuss  
 8,182,541 B2 5/2012 Long et al.  
 8,187,282 B2 5/2012 Tornier et al.  
 8,192,497 B2 6/2012 Ondrla  
 8,202,275 B2 6/2012 Wozencroft  
 8,221,037 B2 7/2012 Neitzell  
 8,231,682 B2 7/2012 LaFosse  
 8,246,687 B2 8/2012 Katrana et al.  
 8,277,512 B2 10/2012 Parrott et al.  
 8,317,871 B2 11/2012 Stone et al.  
 8,409,798 B2 4/2013 Luy et al.  
 8,419,798 B2 4/2013 Ondrla et al.  
 D685,474 S 7/2013 Courtney  
 8,500,744 B2 8/2013 Wozencroft et al.  
 8,506,638 B2 8/2013 Vanasse et al.  
 8,512,410 B2 8/2013 Metcalfe et al.  
 8,591,592 B2 11/2013 Dreyfuss  
 8,641,773 B2 2/2014 Bergin et al.  
 8,647,387 B2 2/2014 Winslow

(56) **References Cited**

U.S. PATENT DOCUMENTS

1,123,730 A 1/1915 Greenfield  
 2,444,099 A 6/1948 Hennessey, Jr.  
 2,886,081 A 5/1959 Cowley  
 3,523,395 A 8/1970 Rutter et al.  
 3,609,056 A 9/1971 Hougen  
 3,738,217 A 6/1973 Walker  
 4,042,980 A 8/1977 Swanson et al.  
 4,147,464 A 4/1979 Watson et al.  
 4,250,600 A 2/1981 Gunther  
 4,261,062 A 4/1981 Amstutz et al.  
 4,406,023 A 9/1983 Harris  
 4,550,450 A 11/1985 Kinnett  
 4,623,353 A 11/1986 Buechel et al.  
 4,632,111 A 12/1986 Roche  
 4,743,262 A 5/1988 Tronzo  
 4,865,605 A 9/1989 Dines et al.  
 4,883,491 A 11/1989 Mallory et al.  
 4,919,670 A 4/1990 Dale et al.  
 4,964,865 A 10/1990 Burkhead et al.  
 4,986,833 A 1/1991 Worland  
 5,026,373 A 6/1991 Ray et al.  
 5,032,132 A 7/1991 Matsen et al.  
 5,044,393 A 9/1991 Jiles  
 5,080,673 A 1/1992 Burkhead et al.  
 5,112,338 A 5/1992 Anspach, III  
 5,163,964 A 11/1992 Lazzeri et al.  
 5,171,277 A 12/1992 Roger  
 5,257,995 A 11/1993 Umber et al.  
 5,282,865 A 2/1994 Dong  
 5,358,526 A 10/1994 Tornier  
 5,489,309 A 2/1996 Lackey et al.  
 5,489,310 A 2/1996 Mikhail  
 5,507,817 A 4/1996 Craig et al.  
 5,540,697 A 7/1996 Rehmann et al.  
 5,681,134 A 10/1997 Ebert  
 5,702,486 A 12/1997 Craig et al.  
 5,723,018 A 3/1998 Cyprien et al.  
 5,776,194 A 7/1998 Mikol et al.  
 5,800,551 A 9/1998 Williamson et al.

(56)

References Cited

U.S. PATENT DOCUMENTS

8,663,334 B2 3/2014 Viscardi et al.  
 8,690,958 B2 4/2014 Klawitter et al.  
 8,702,800 B2 4/2014 Linares et al.  
 D705,438 S \* 5/2014 Wainwright ..... D24/216  
 8,753,402 B2 6/2014 Winslow et al.  
 8,795,379 B2 8/2014 Smith et al.  
 8,840,671 B2 9/2014 Ambacher  
 8,845,742 B2 9/2014 Kusogullari et al.  
 8,864,834 B2 10/2014 Boileau et al.  
 8,870,962 B2 10/2014 Roche et al.  
 8,876,908 B2 11/2014 Katrana et al.  
 8,882,845 B2 11/2014 Wirth et al.  
 8,992,623 B2 3/2015 Hopkins et al.  
 D743,552 S \* 11/2015 Bronnimann ..... D24/155  
 D745,678 S 12/2015 Courtney et al.  
 9,233,003 B2 1/2016 Roche et al.  
 9,289,218 B2 3/2016 Courtney, Jr. et al.  
 9,326,865 B2 5/2016 Katrana et al.  
 9,364,334 B2 6/2016 Katrana et al.  
 D765,260 S \* 8/2016 Sparr ..... D24/190  
 9,498,345 B2 11/2016 Burkhead, Jr. et al.  
 9,510,839 B2 12/2016 Maroney et al.  
 D776,295 S \* 1/2017 Wainwright ..... D24/224  
 9,603,712 B2 3/2017 Bachmaier  
 9,615,928 B2 4/2017 Visser et al.  
 9,820,859 B2 11/2017 Gervasi et al.  
 10,166,032 B2 1/2019 Stone et al.  
 D840,539 S 2/2019 Courtney et al.  
 10,335,285 B2 7/2019 Viscardi et al.  
 10,368,999 B2 8/2019 Greiwe  
 10,433,969 B2 10/2019 Humphrey  
 10,456,264 B2 10/2019 Hodorek et al.  
 10,463,499 B2 11/2019 Emerick et al.  
 10,722,373 B2 \* 7/2020 Hodorek ..... A61F 2/4014  
 D896,369 S \* 9/2020 Chase ..... D24/123  
 D908,874 S \* 1/2021 Conklin ..... D24/140  
 2001/0034553 A1 10/2001 Michelson  
 2001/0047210 A1 11/2001 Wolf  
 2002/0116007 A1 8/2002 Lewis  
 2002/0156534 A1 10/2002 Grusin et al.  
 2003/0028253 A1 2/2003 Stone et al.  
 2003/0031521 A1 2/2003 Haughton et al.  
 2003/0114933 A1 6/2003 Bouttens et al.  
 2003/0125810 A1 7/2003 Sullivan et al.  
 2004/0049270 A1 3/2004 Gewirtz  
 2004/0186586 A1 9/2004 Seyer et al.  
 2004/0193276 A1 9/2004 Maroney et al.  
 2004/0193277 A1 9/2004 Long et al.  
 2004/0193278 A1 9/2004 Maroney et al.  
 2004/0220674 A1 11/2004 Pria  
 2004/0243136 A1 12/2004 Gupta et al.  
 2004/0254646 A1 12/2004 Stone et al.  
 2005/0107882 A1 5/2005 Stone et al.  
 2005/0112397 A1 5/2005 Rolfe et al.  
 2005/0209597 A1 9/2005 Long et al.  
 2005/0261775 A1 11/2005 Baum et al.  
 2005/0267478 A1 12/2005 Corradi et al.  
 2006/0004378 A1 1/2006 Raines  
 2006/0009852 A1 1/2006 Winslow et al.  
 2006/0064173 A1 3/2006 Guederian  
 2006/0089656 A1 4/2006 Allard et al.  
 2006/0142866 A1 6/2006 Baratz et al.  
 2006/0195105 A1 8/2006 Teeny et al.  
 2006/0200165 A1 9/2006 Tulkis  
 2006/0200249 A1 9/2006 Beguin et al.  
 2007/0010825 A1 1/2007 Leisinger et al.  
 2007/0100458 A1 5/2007 Dalla Pria  
 2007/0123890 A1 5/2007 Way et al.  
 2007/0123893 A1 5/2007 O'Donoghue  
 2007/0123909 A1 5/2007 Rupp et al.  
 2007/0156246 A1 7/2007 Meswania et al.  
 2007/0162141 A1 7/2007 Dews et al.  
 2007/0173945 A1 7/2007 Wiley et al.  
 2007/0212179 A1 9/2007 Khangar et al.  
 2007/0219562 A1 9/2007 Slone et al.

2007/0225817 A1 9/2007 Reubelt et al.  
 2007/0233132 A1 10/2007 Valla  
 2008/0021564 A1 1/2008 Gunther  
 2008/0077146 A1 3/2008 Pernsteiner et al.  
 2008/0195111 A1 8/2008 Anderson  
 2008/0249577 A1 10/2008 Dreyfuss  
 2009/0171462 A1 7/2009 Poncet et al.  
 2009/0281630 A1 11/2009 Delince et al.  
 2009/0306782 A1 12/2009 Schwyzer  
 2010/0042214 A1 2/2010 Nebosky et al.  
 2010/0087927 A1 4/2010 Roche et al.  
 2010/0114326 A1 5/2010 Winslow et al.  
 2010/0191340 A1 7/2010 Dreyfuss  
 2010/0274360 A1 10/2010 Gunther  
 2010/0278601 A1 11/2010 Beynon  
 2011/0153023 A1 6/2011 Deffenbaugh et al.  
 2011/0224673 A1 9/2011 Smith  
 2011/0276144 A1 11/2011 Wirth et al.  
 2011/0313533 A1 12/2011 Gunther  
 2012/0022664 A1 1/2012 Vandermeulen et al.  
 2012/0109321 A1 5/2012 Stone et al.  
 2012/0221111 A1 8/2012 Burkhead, Jr. et al.  
 2012/0265315 A1 10/2012 Kusogullari et al.  
 2012/0277880 A1 11/2012 Winslow et al.  
 2012/0296435 A1 11/2012 Ambacher  
 2013/0123929 A1 5/2013 McDaniel et al.  
 2013/0123930 A1 5/2013 Burt  
 2013/0173006 A1 7/2013 Dupont  
 2013/0178943 A1 7/2013 Dupont  
 2013/0190882 A1 7/2013 Humphrey  
 2013/0211539 A1 8/2013 McDaniel et al.  
 2013/0245775 A1 \* 9/2013 Metcalfe ..... A61F 2/4684  
 623/19.12  
 2013/0261626 A1 10/2013 Chavarria et al.  
 2013/0261629 A1 10/2013 Anthony et al.  
 2013/0261754 A1 10/2013 Anthony et al.  
 2013/0282129 A1 10/2013 Phipps  
 2014/0012272 A1 1/2014 Leisinger  
 2014/0012380 A1 1/2014 Laurence et al.  
 2014/0058523 A1 2/2014 Walch et al.  
 2014/0074246 A1 3/2014 Huebner et al.  
 2014/0107792 A1 4/2014 Hopkins et al.  
 2014/0156012 A1 6/2014 Winslow  
 2014/0236304 A1 \* 8/2014 Hodorek ..... A61B 17/8875  
 623/19.14  
 2014/0257499 A1 9/2014 Winslow et al.  
 2014/0296988 A1 10/2014 Winslow et al.  
 2014/0358239 A1 12/2014 Katrana et al.  
 2014/0358240 A1 12/2014 Katrana et al.  
 2014/0379089 A1 12/2014 Bachmaier  
 2015/0134066 A1 5/2015 Bachmaier  
 2015/0250601 A1 9/2015 Humphrey  
 2015/0289984 A1 10/2015 Budge  
 2015/0297354 A1 10/2015 Walch et al.  
 2016/0051367 A1 2/2016 Gervasi et al.  
 2016/0157911 A1 6/2016 Courtney, Jr. et al.  
 2016/0324648 A1 11/2016 Hodorek et al.  
 2017/0105843 A1 4/2017 Britton et al.  
 2017/0304063 A1 \* 10/2017 Hatzidakis ..... A61F 2/4003  
 2017/0367836 A1 12/2017 Cardon et al.  
 2018/0092760 A1 4/2018 Sperling et al.  
 2018/0271667 A1 9/2018 Kemp et al.  
 2019/0105165 A1 4/2019 Sikora et al.  
 2019/0105169 A1 4/2019 Sperling  
 2019/0159906 A1 5/2019 Knox et al.  
 2019/0175354 A1 6/2019 Knox et al.  
 2019/0216518 A1 7/2019 Courtney, Jr. et al.  
 2019/0328536 A1 10/2019 Martin et al.  
 2020/0214845 A1 \* 7/2020 Knox ..... A61F 2/4612

FOREIGN PATENT DOCUMENTS

DE 102004042502 3/2006  
 EP 0 274 094 8/1990  
 EP 1 413 265 4/2004  
 EP 0 959 822 5/2004  
 EP 1 125 565 12/2004  
 EP 1 518 519 3/2005  
 EP 1 004 283 5/2005

(56)

References Cited

FOREIGN PATENT DOCUMENTS

EP	1 639 967	3/2006
EP	1 762 191	3/2007
EP	1 952 788	8/2008
EP	1 867 303	9/2010
EP	1 977 720	1/2011
EP	1 550 420	2/2012
EP	2 261 303	11/2012
EP	1 706 074	12/2012
EP	2 564 814	3/2013
EP	2 567 676	3/2013
EP	2 574 313	4/2013
EP	2 616 013	7/2013
EP	2 474 288	9/2013
EP	2 663 263	5/2014
EP	2 502 605	8/2014
EP	2 800 541	11/2014
EP	2 815 726	8/2015
EP	2 353 549	6/2016
EP	3 117 801	1/2017
EP	2 965 720 B1	7/2017
FR	2 674 122	9/1992
FR	2997290 B1	11/2015
WO	WO 01/67988	9/2001
WO	WO 02/17822	3/2002
WO	WO 2008/011078	1/2008
WO	WO 2008/146124	12/2008
WO	WO 2011/081797	7/2011
WO	WO 2012/035263	3/2012
WO	WO 2012/130524	10/2012
WO	WO 2013/009407	1/2013
WO	WO 2013/064569	5/2013
WO	WO 2013/148229	10/2013
WO	WO 2014/005644	1/2014
WO	WO 2014/058314	4/2014
WO	WO 2015/112307	7/2015
WO	2016094739 A1	6/2016

WO	WO 2017/165090	9/2017
WO	WO 2017/184792	10/2017
WO	WO 2018/022227	2/2018
WO	WO 2019/060780	3/2019
WO	WO 2019/106278	6/2019

OTHER PUBLICATIONS

Wright Media, "Tornier Aequalis Reversed FX", first available May 19, 2016. ([https://www.wrightmedia.com/ProductFiles/Files/PDFs/CAW-1146\\_EN\\_LR\\_LE.pdf](https://www.wrightmedia.com/ProductFiles/Files/PDFs/CAW-1146_EN_LR_LE.pdf)) (Year: 2016).\*

Wright Media, "Aequalis Ascend Flex", first available Jul. 30, 2019. ([https://www.wrightmedia.com/ProductFiles/Files/PDFs/AP-010187\\_EN\\_LR\\_LE.pdf](https://www.wrightmedia.com/ProductFiles/Files/PDFs/AP-010187_EN_LR_LE.pdf)) (Year: 2019).\*

Arthrex, "Univers Revers Shoulder System", first available Apr. 24, 2019. ([https://www.arthrex.com/resources/surgical-technique-guide/qkv6M00\\_50qt2QFBx1PKnA/univers-revers-shoulder-system](https://www.arthrex.com/resources/surgical-technique-guide/qkv6M00_50qt2QFBx1PKnA/univers-revers-shoulder-system)) (Year: 2019).\*

Barth, et al., "Is global humeral head offset related to intramedullary canal width? A computer tomography morphometric study," Journal of Experimental Orthopaedics, 2018, vol. 5, pp. 1-8.

Boileau, et al., "The Three-Dimensional Geometry of the Proximal Humerus: Implications for Surgical Technique and Prosthetic Design," J Bone Joint Surg, Sep. 1997, vol. 79-B, Issue 5, pp. 857-865.

Routman, et al., "Reverse Shoulder Arthroplasty Prosthesis Design Classification System," Bulletin of the Hospital for Joint Diseases, 2015, vol. 73 (Suppl 1), pp. S5-S14.

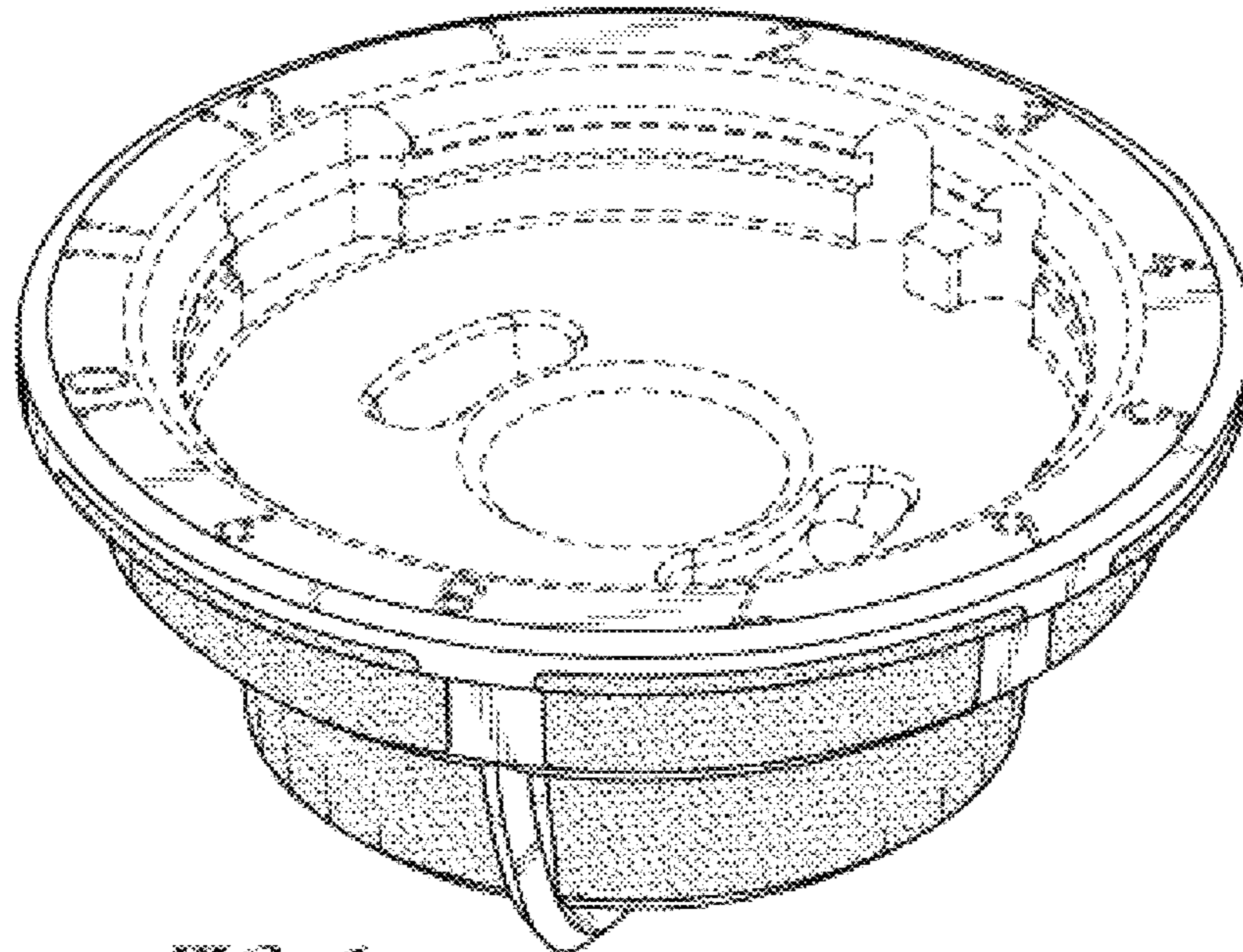
Non-Final Office Action issued in connection with U.S. Appl. No. 17/250,964, dated Jul. 26, 2021, 27 pages.

Non-Final Office Action issued in connection with U.S. Appl. No. 16/519,937, dated Aug. 17, 2021, 21 pages.

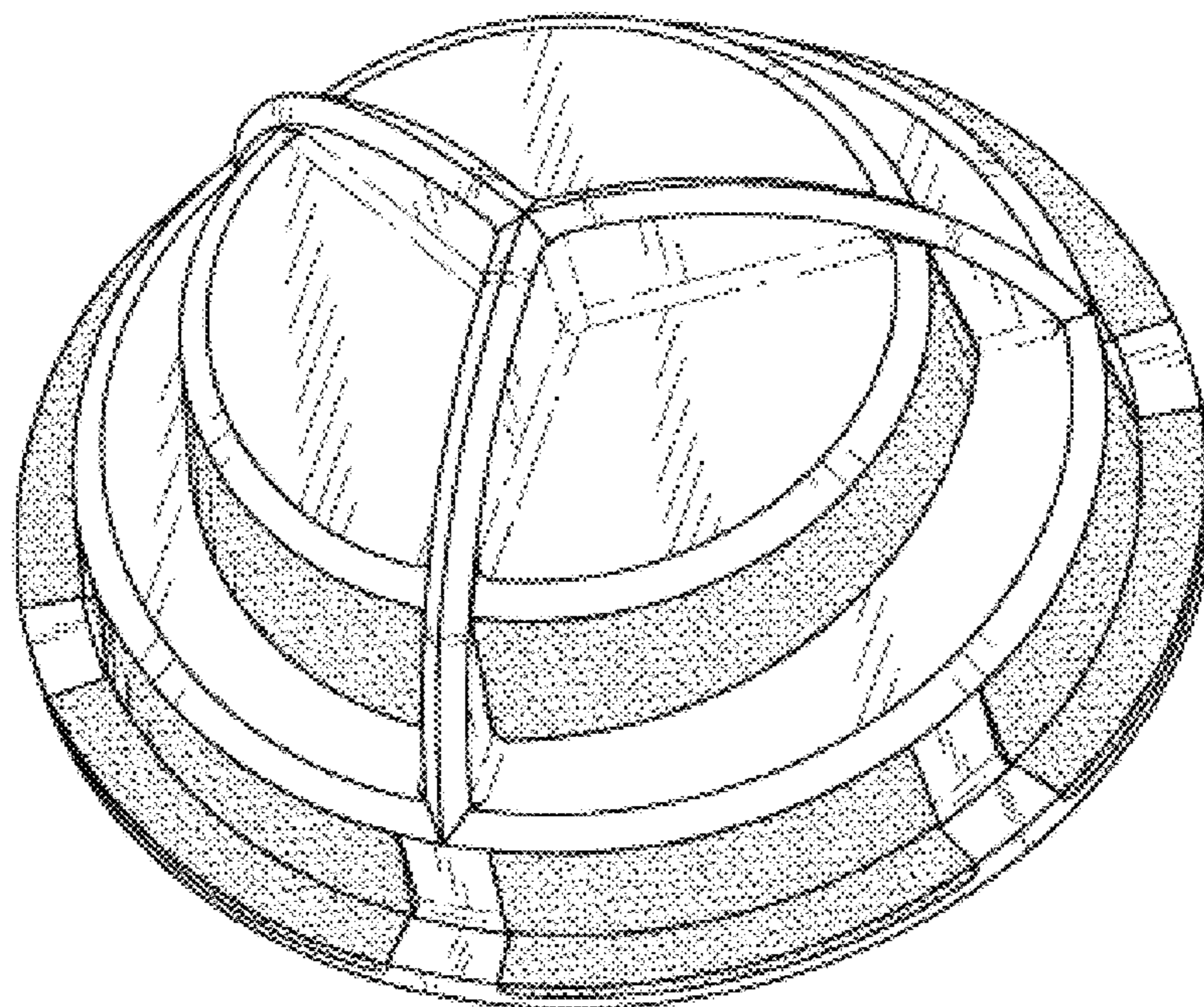
Final Rejection issued in connection with U.S. Appl. No. 16/580,367, dated Aug. 24, 2021, 9 pages.

First Office Action issued in connection with Japanese Patent Application No. 2019-555151, dated Feb. 21, 2022, 5 pages.

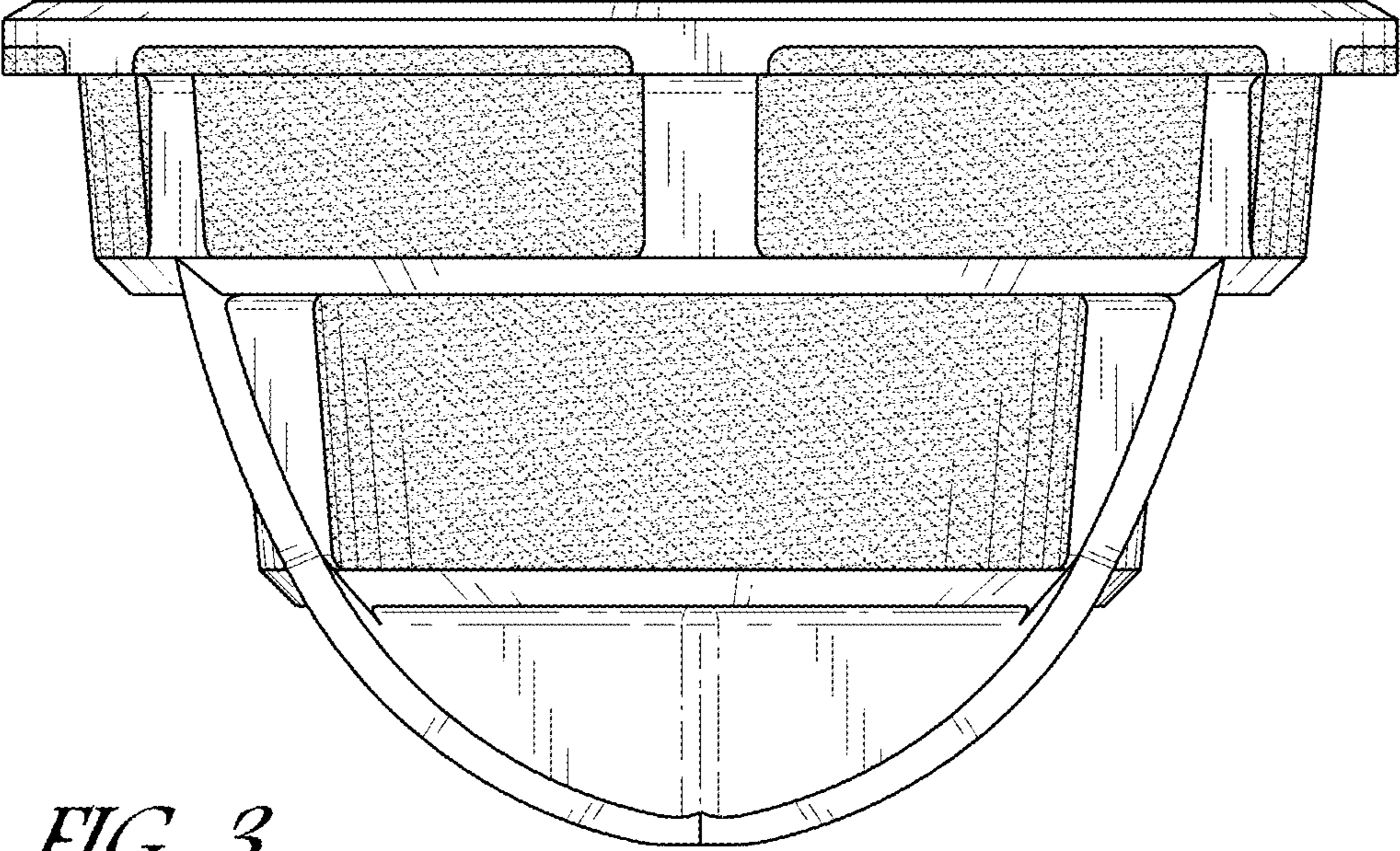
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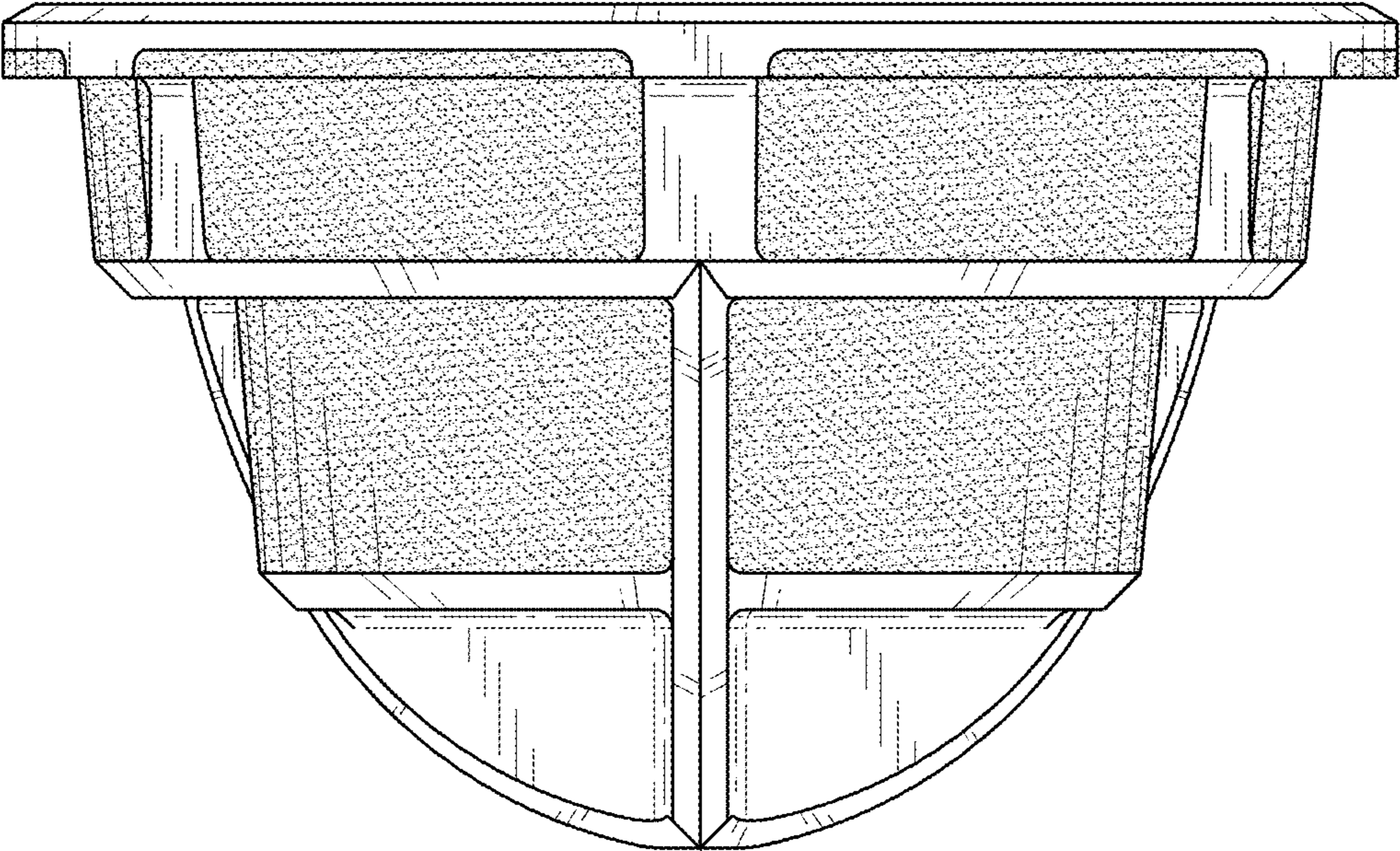
*FIG. 1*



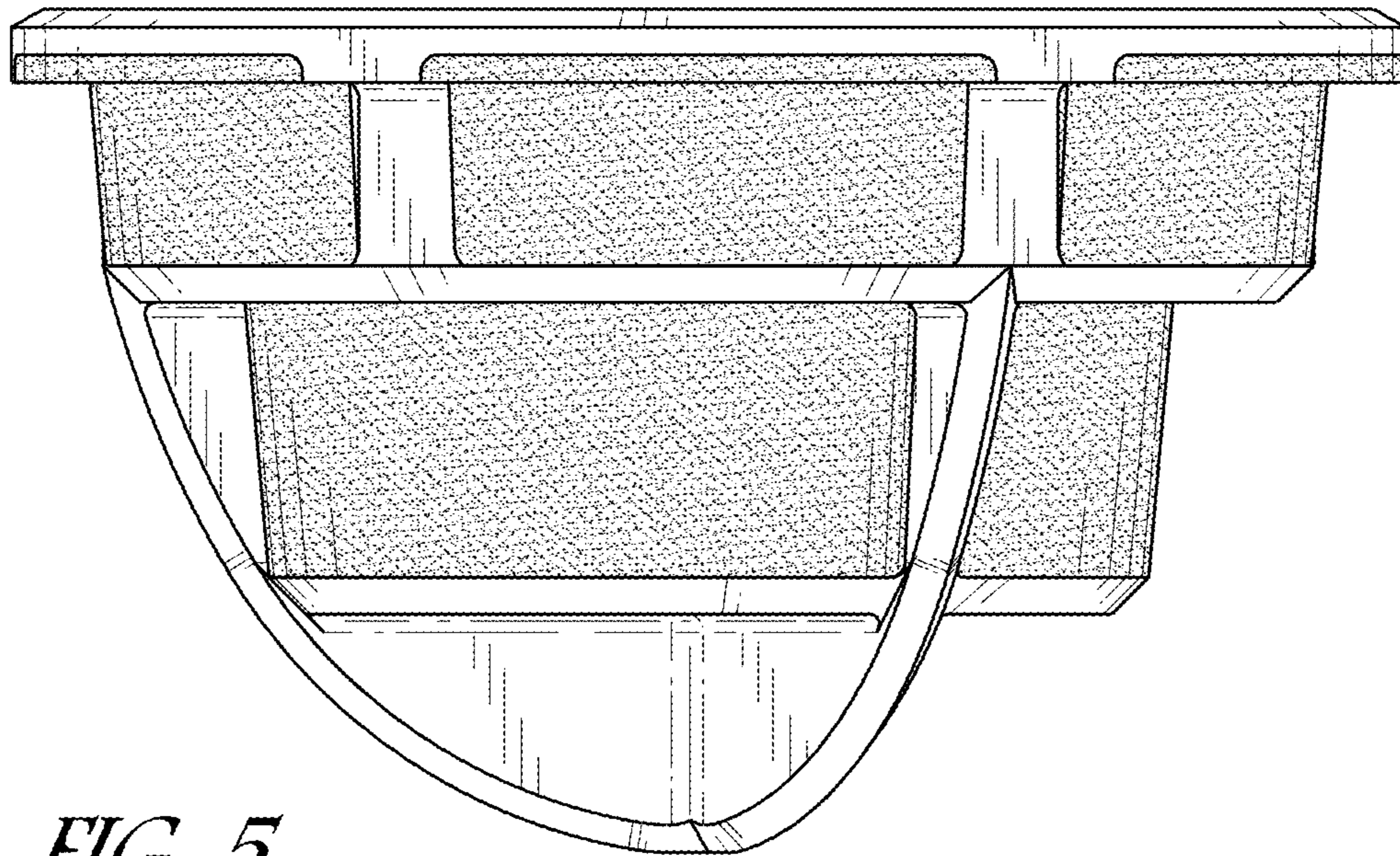
*FIG. 2*



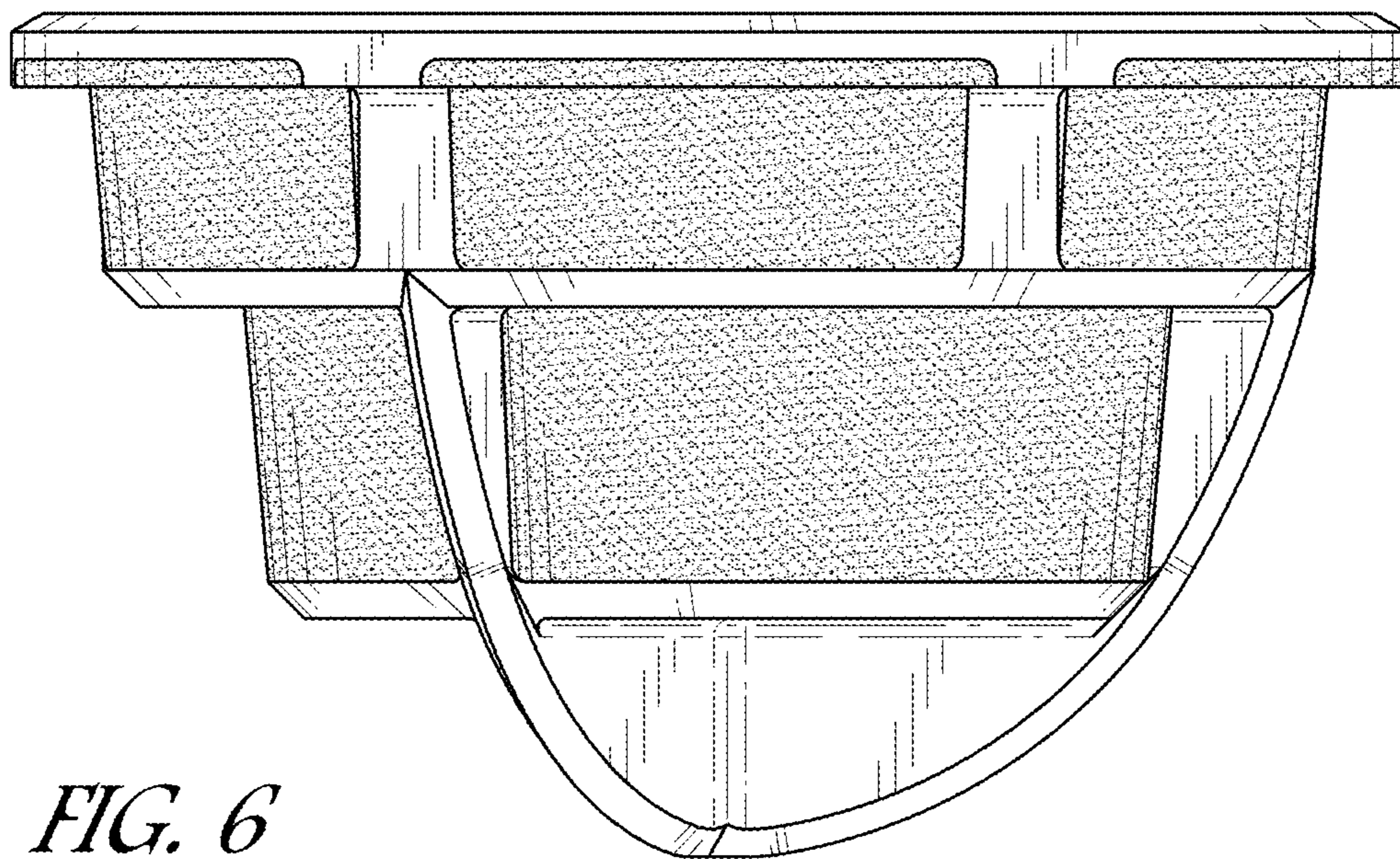
*FIG. 3*



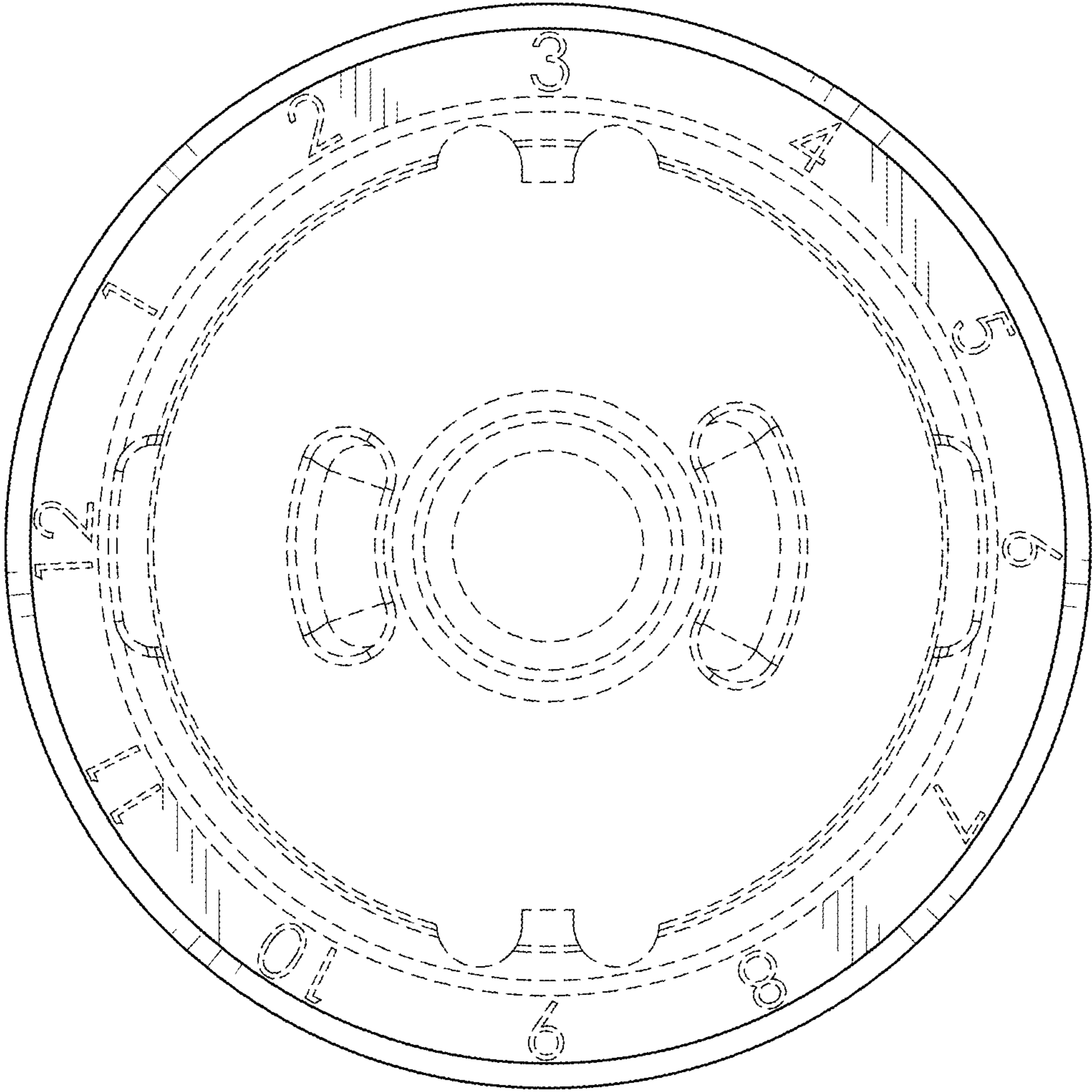
*FIG. 4*



*FIG. 5*

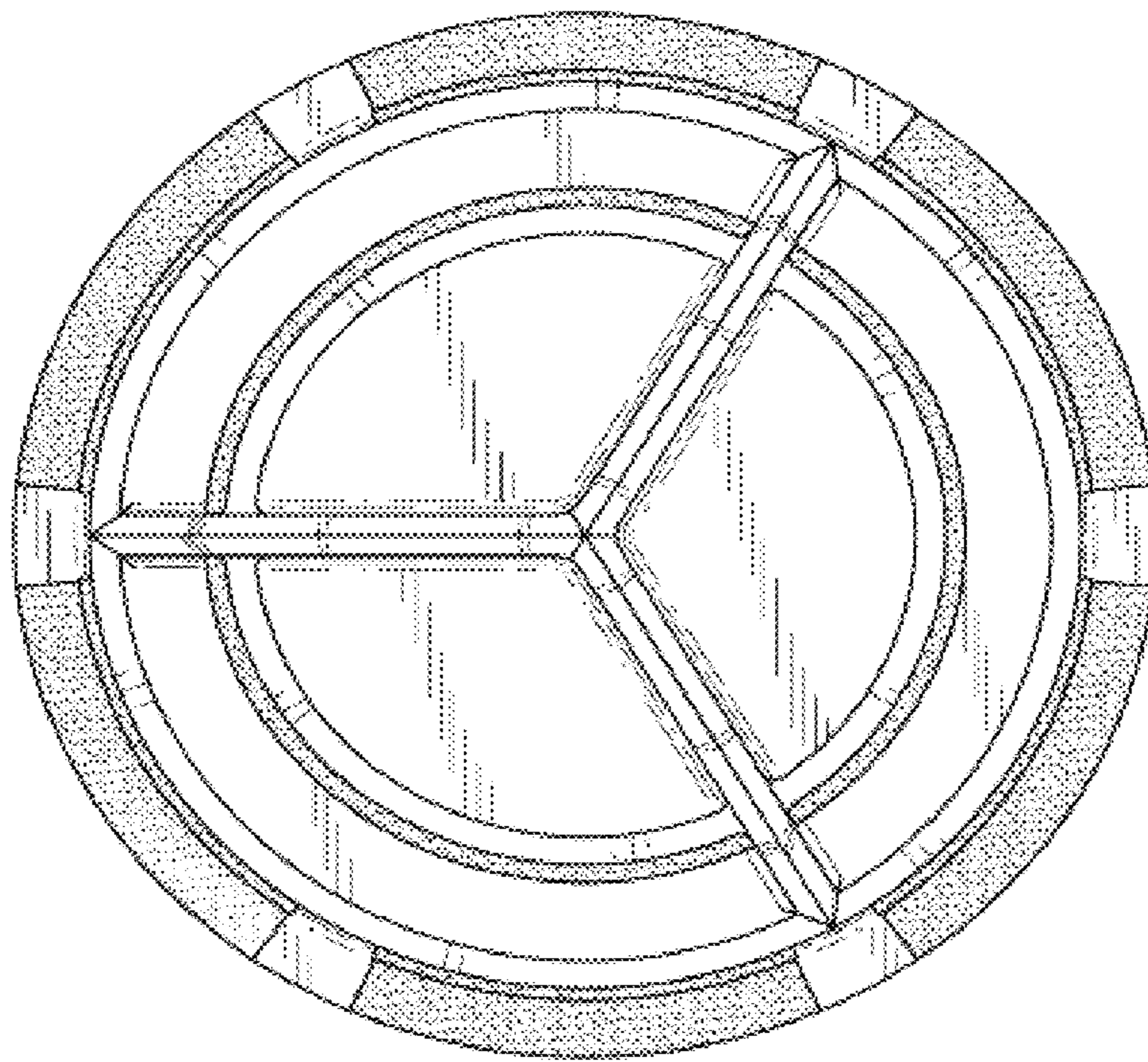


*FIG. 6*

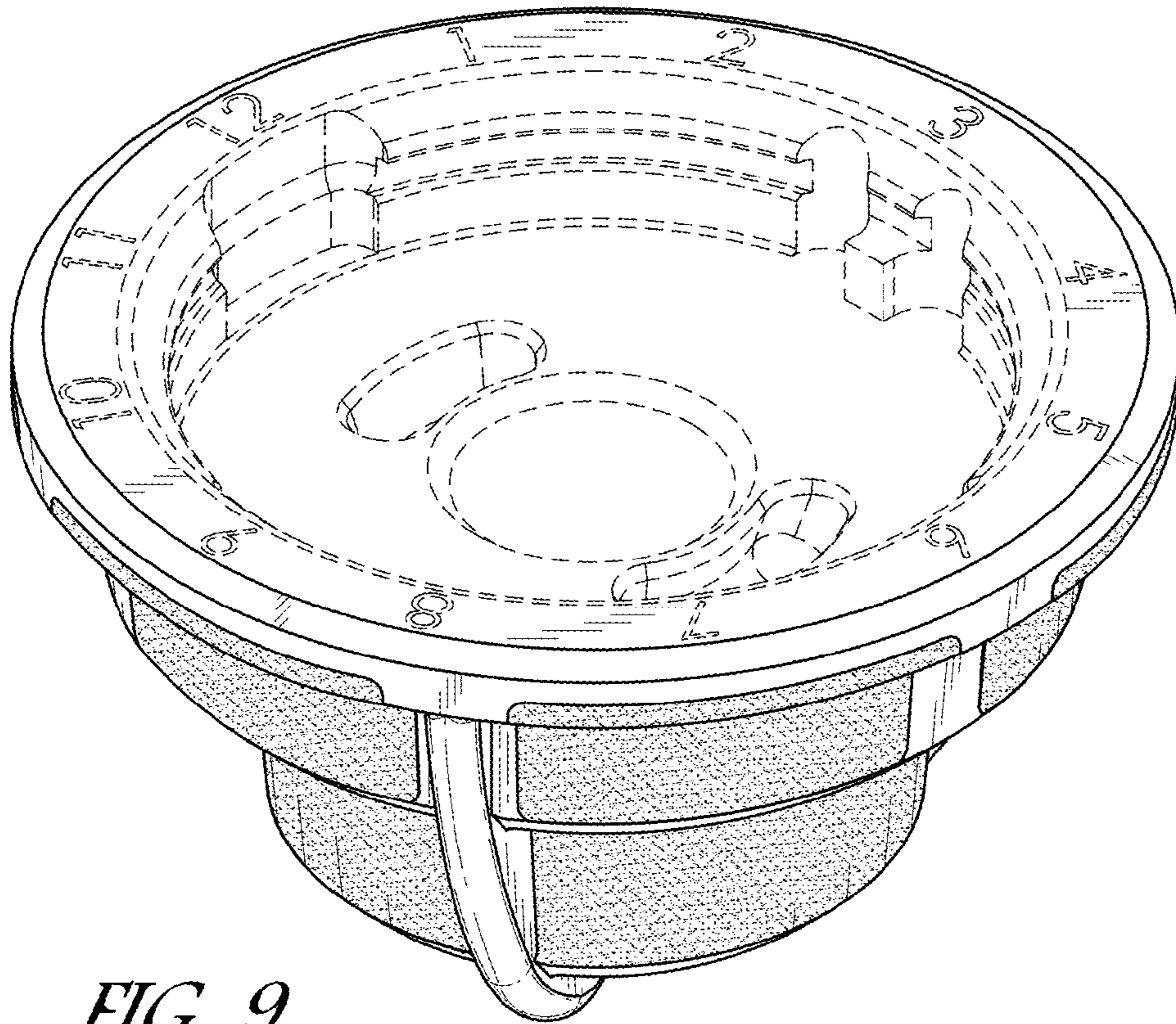


*FIG. 7*

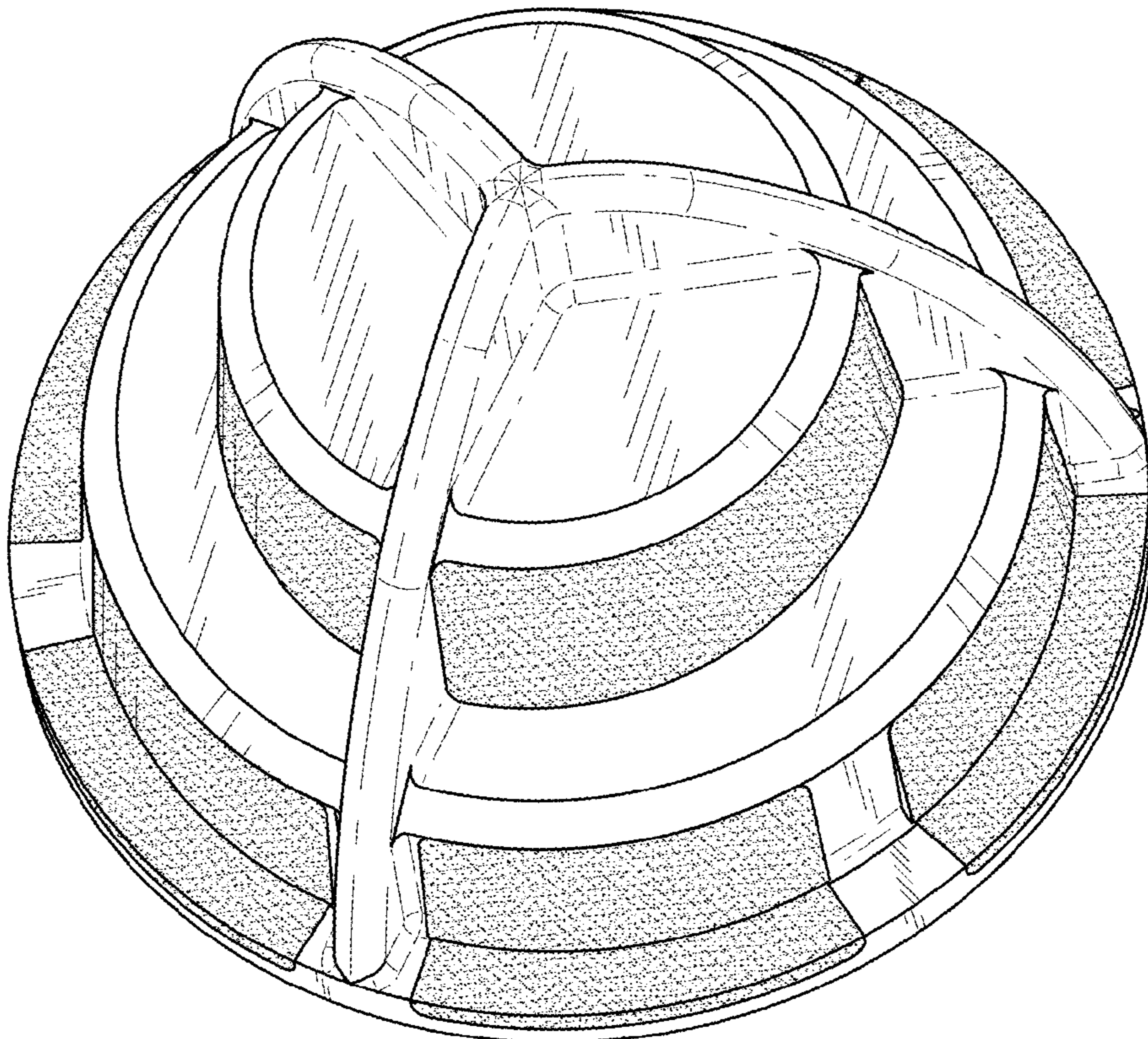




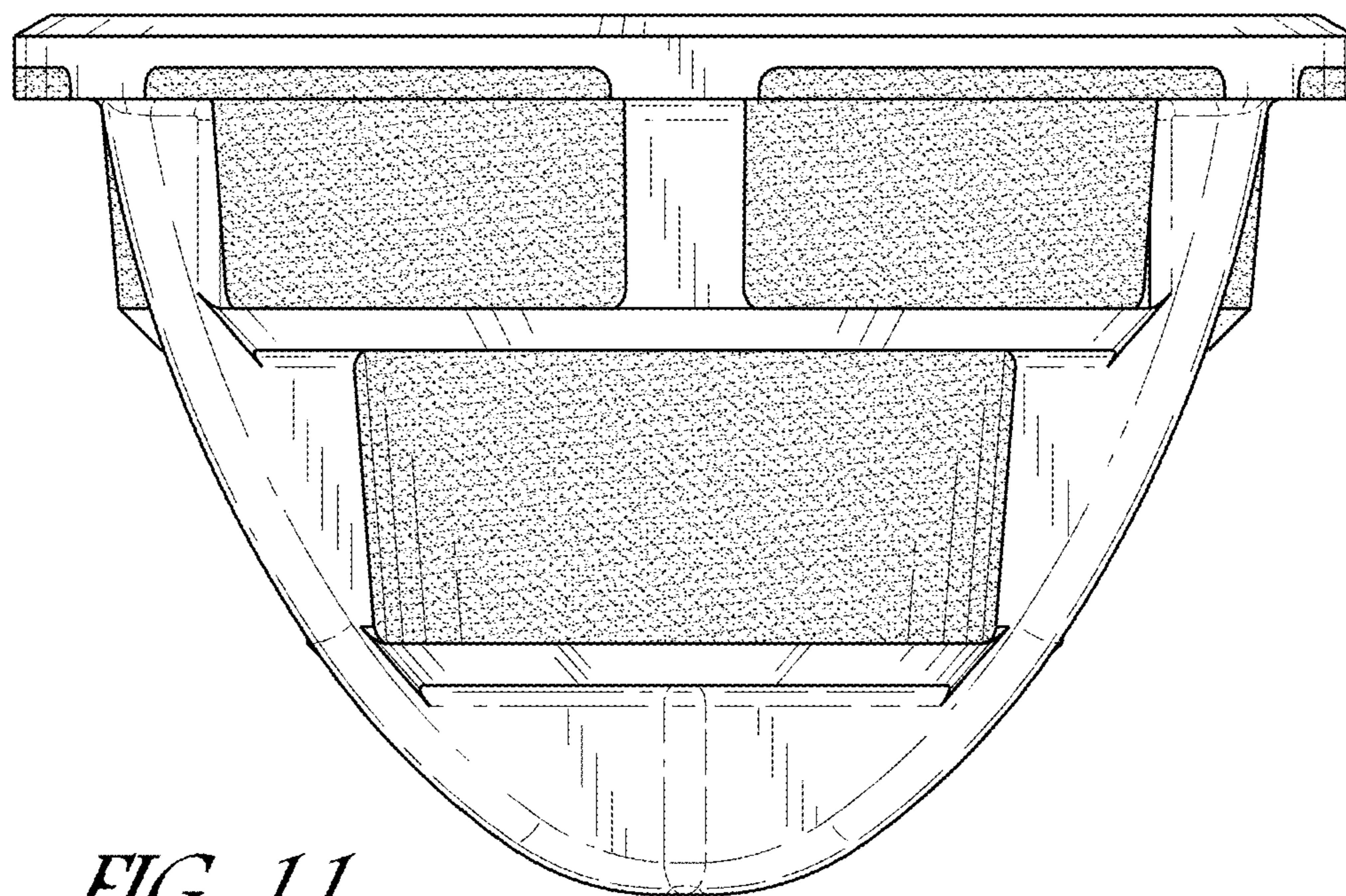
*FIG. 8*



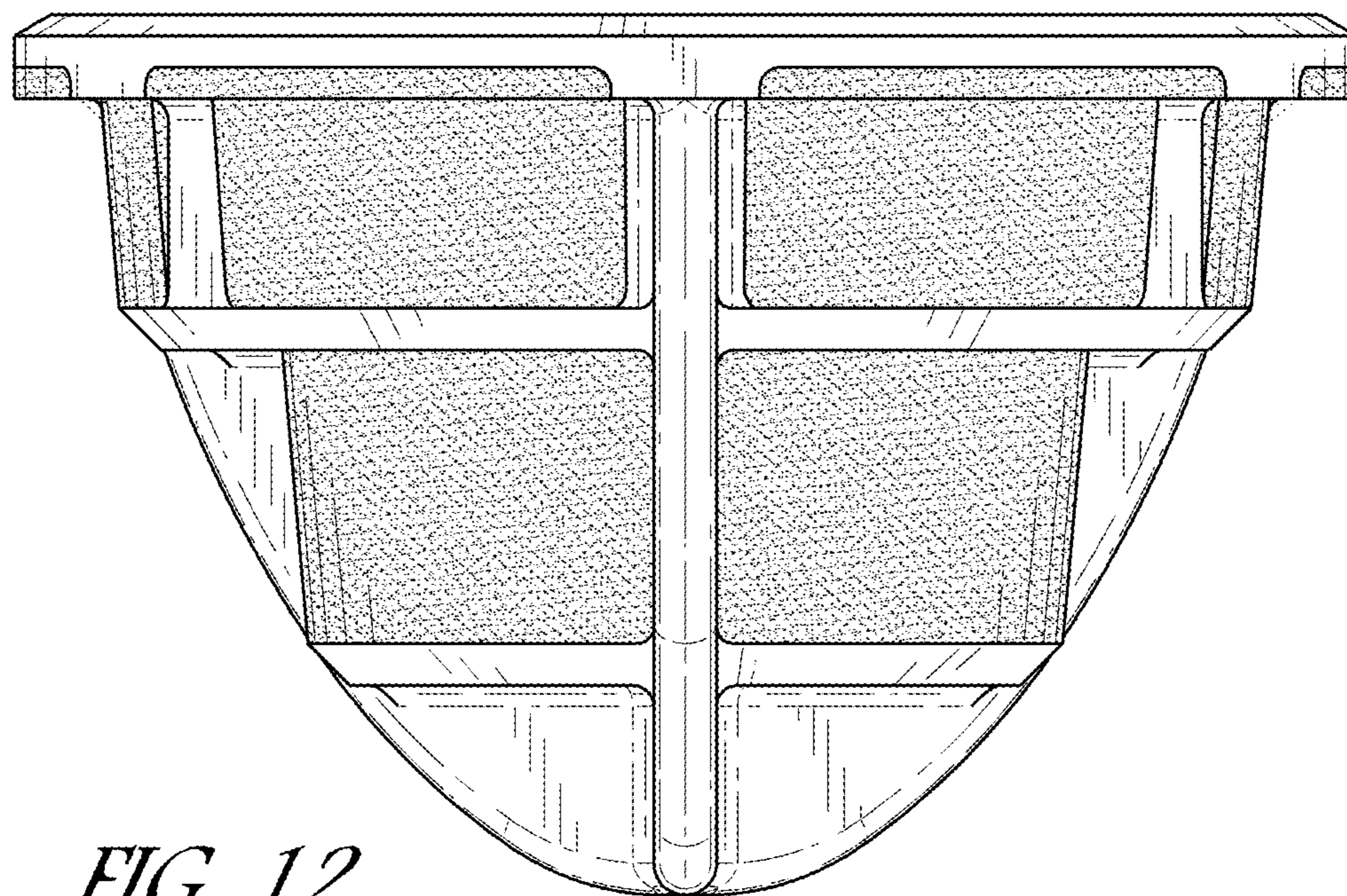
*FIG. 9*



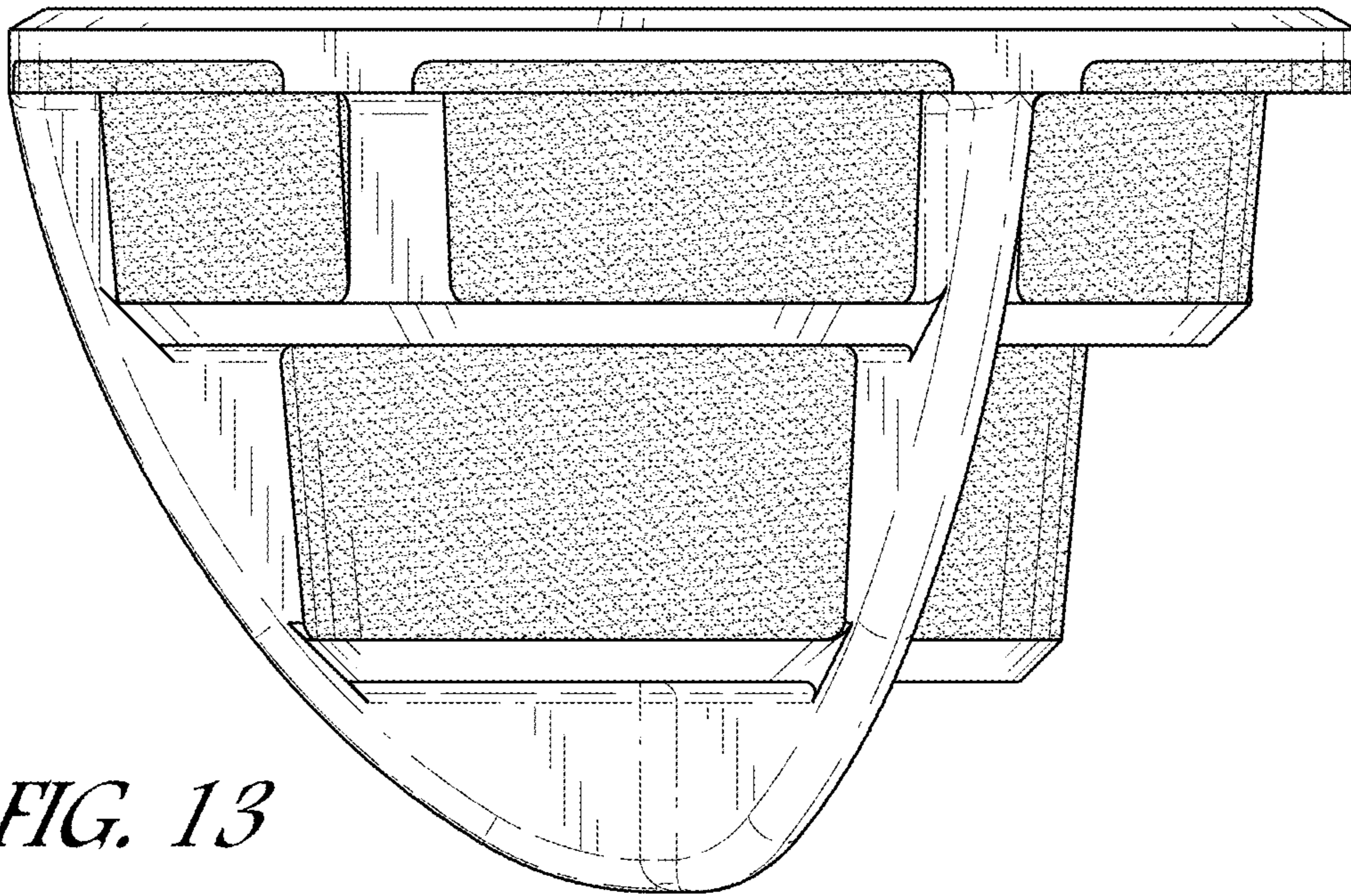
*FIG. 10*



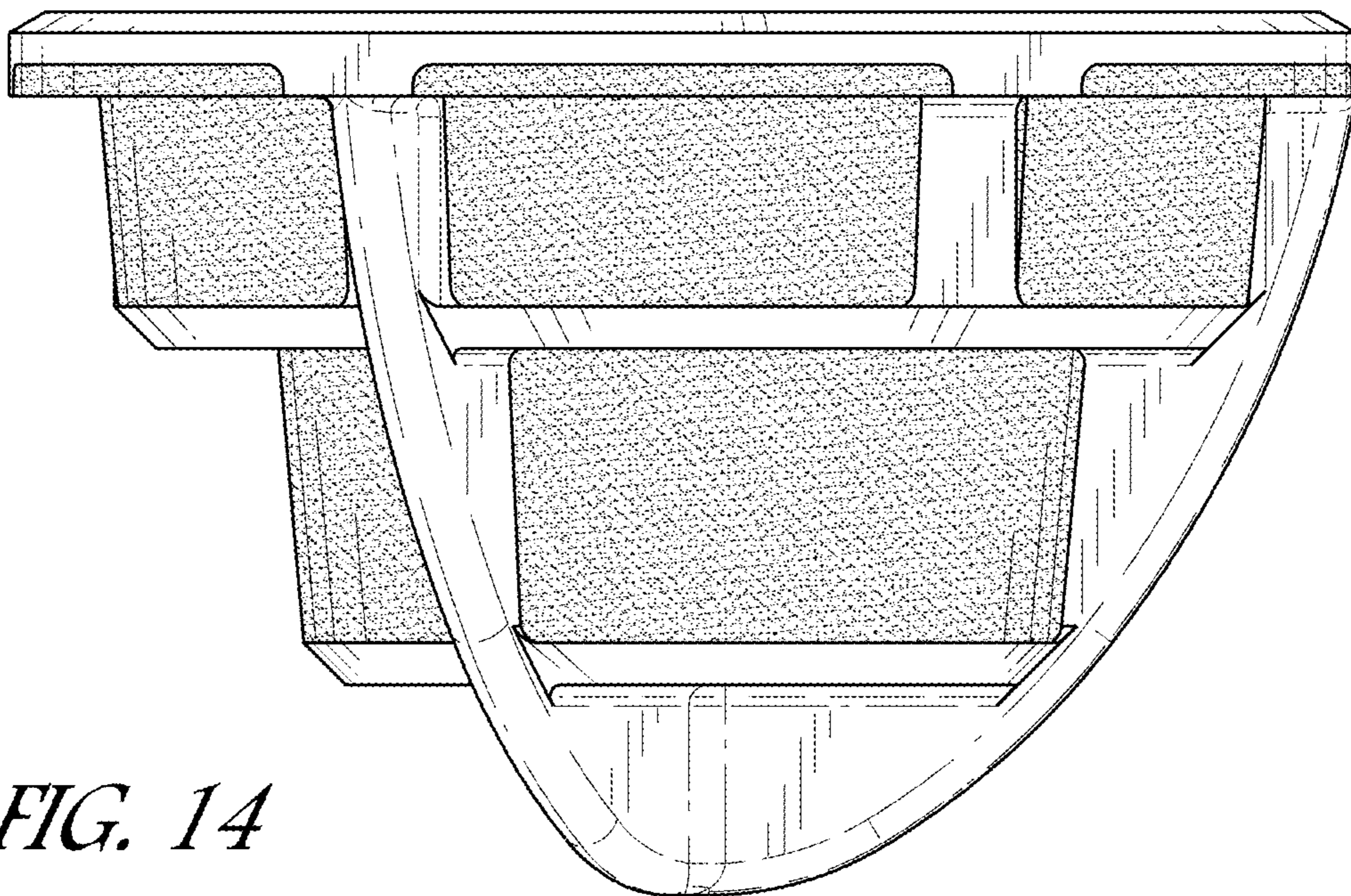
*FIG. 11*



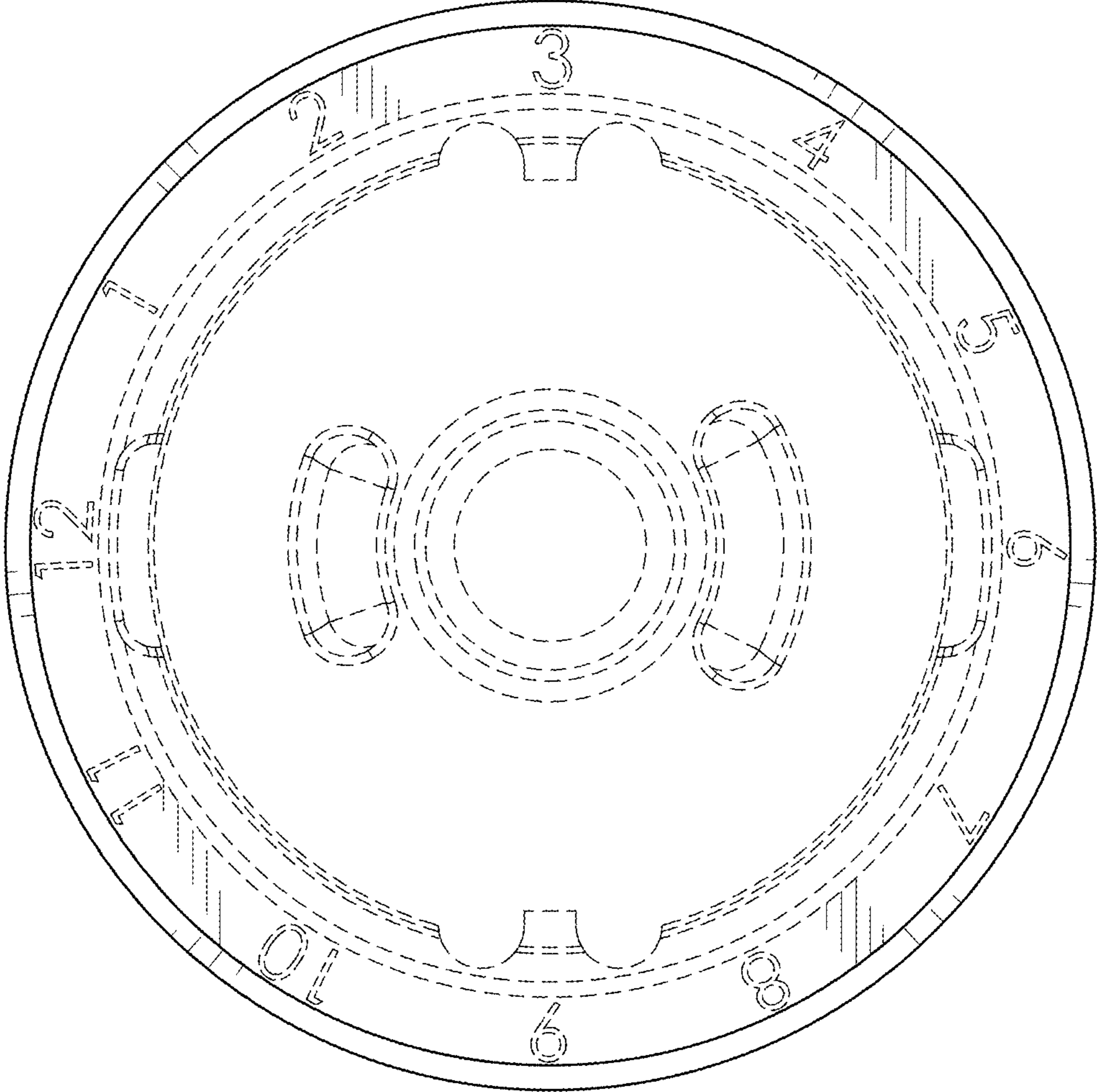
*FIG. 12*



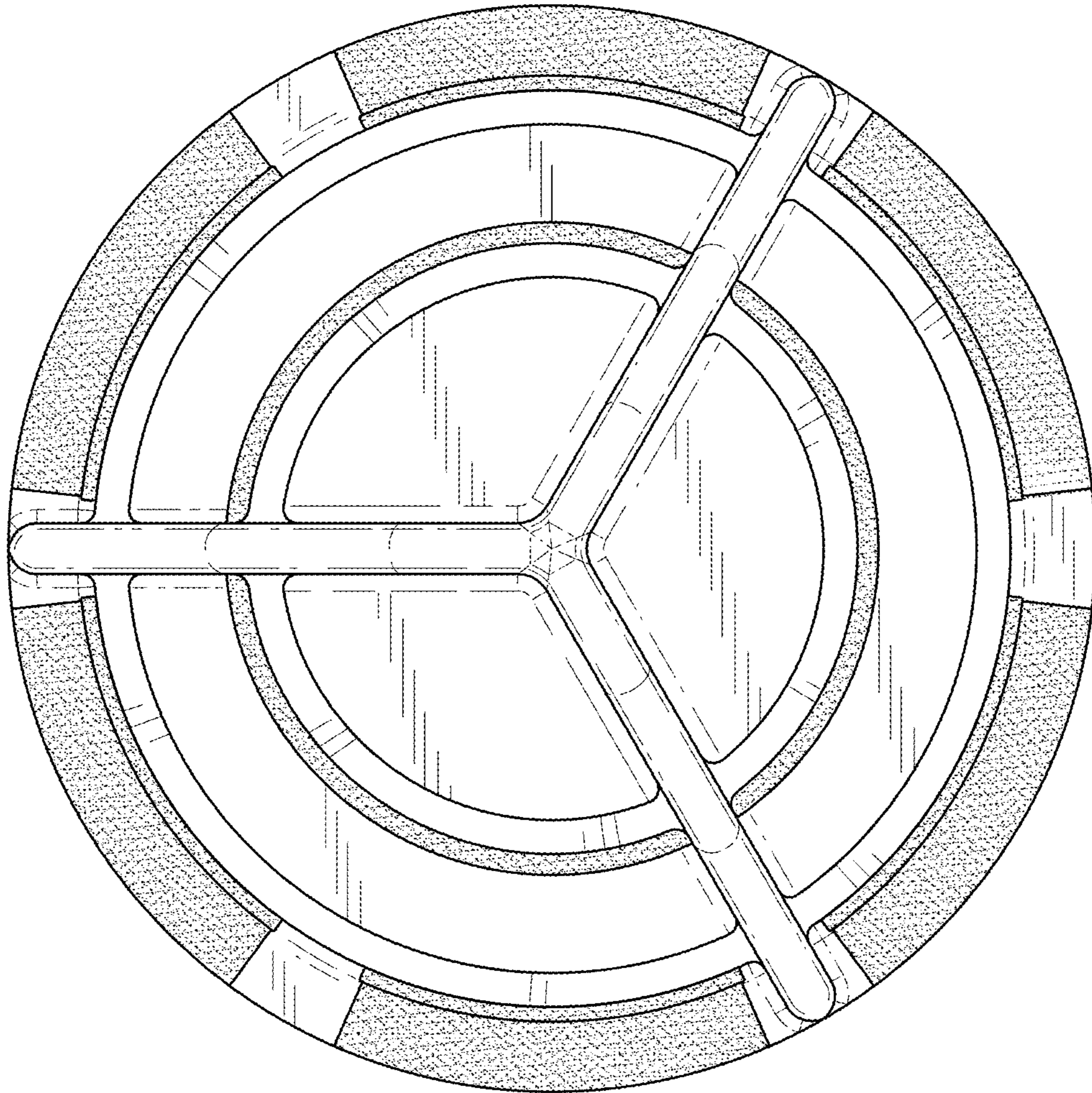
*FIG. 13*



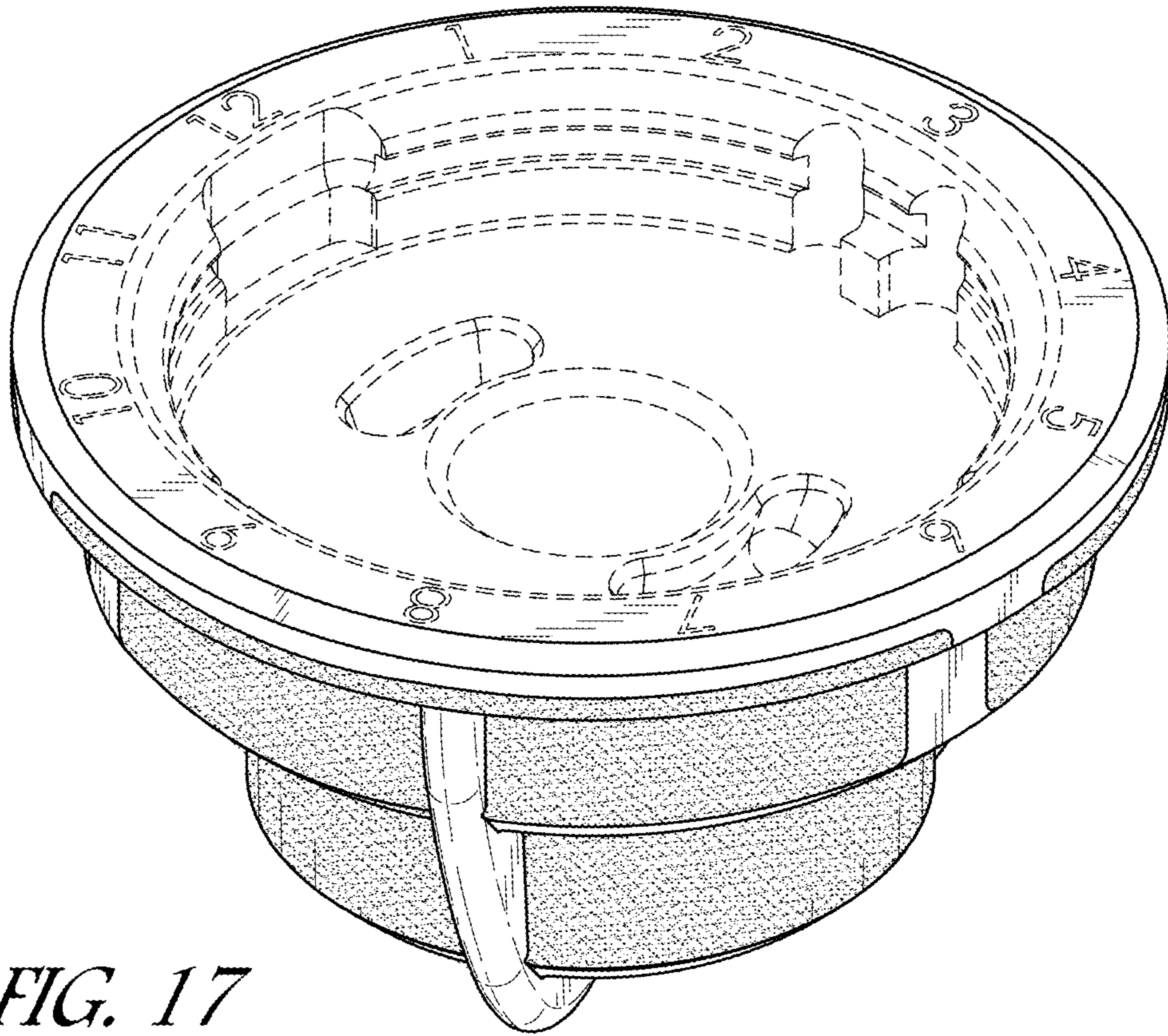
*FIG. 14*



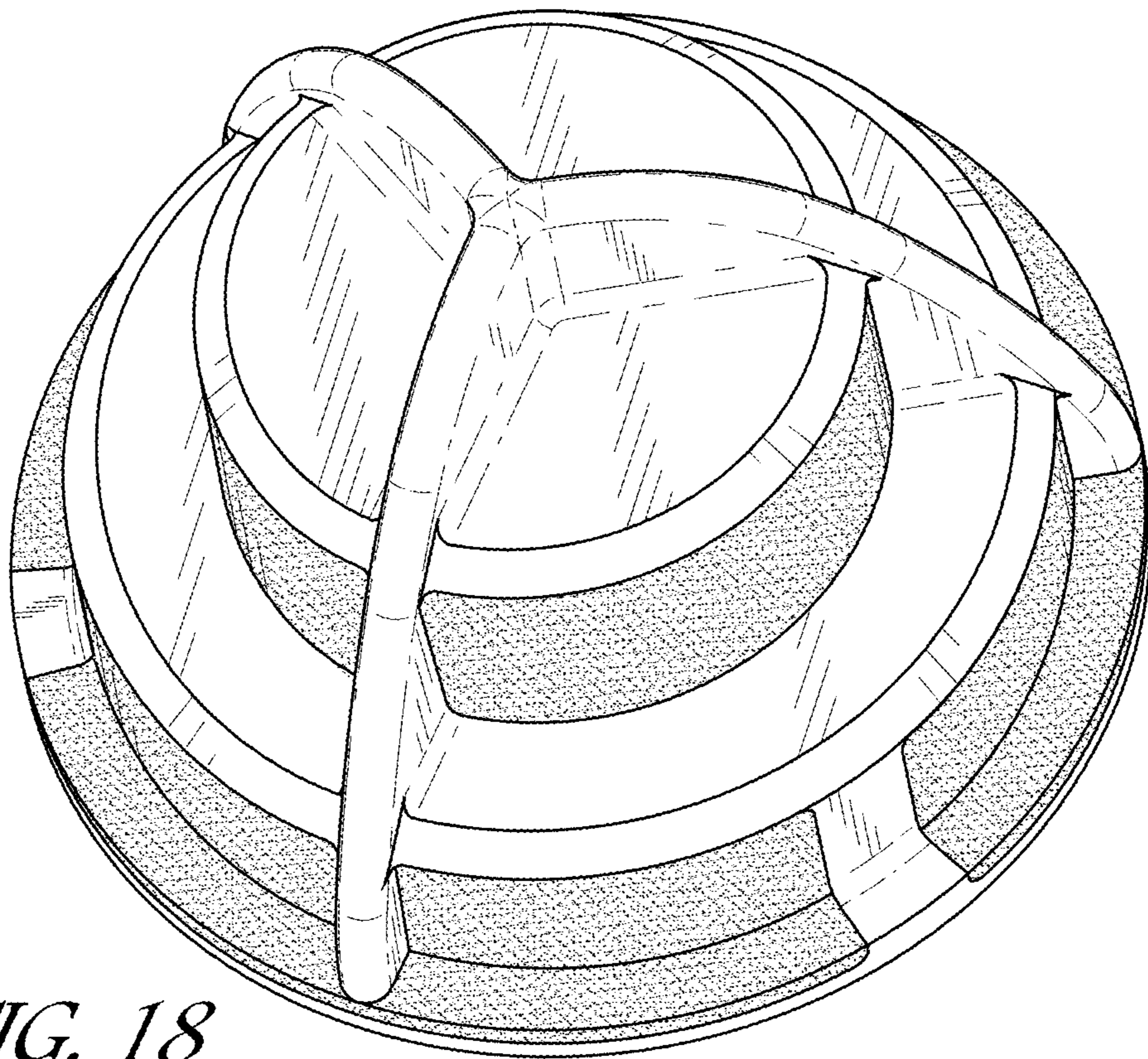
*FIG. 15*



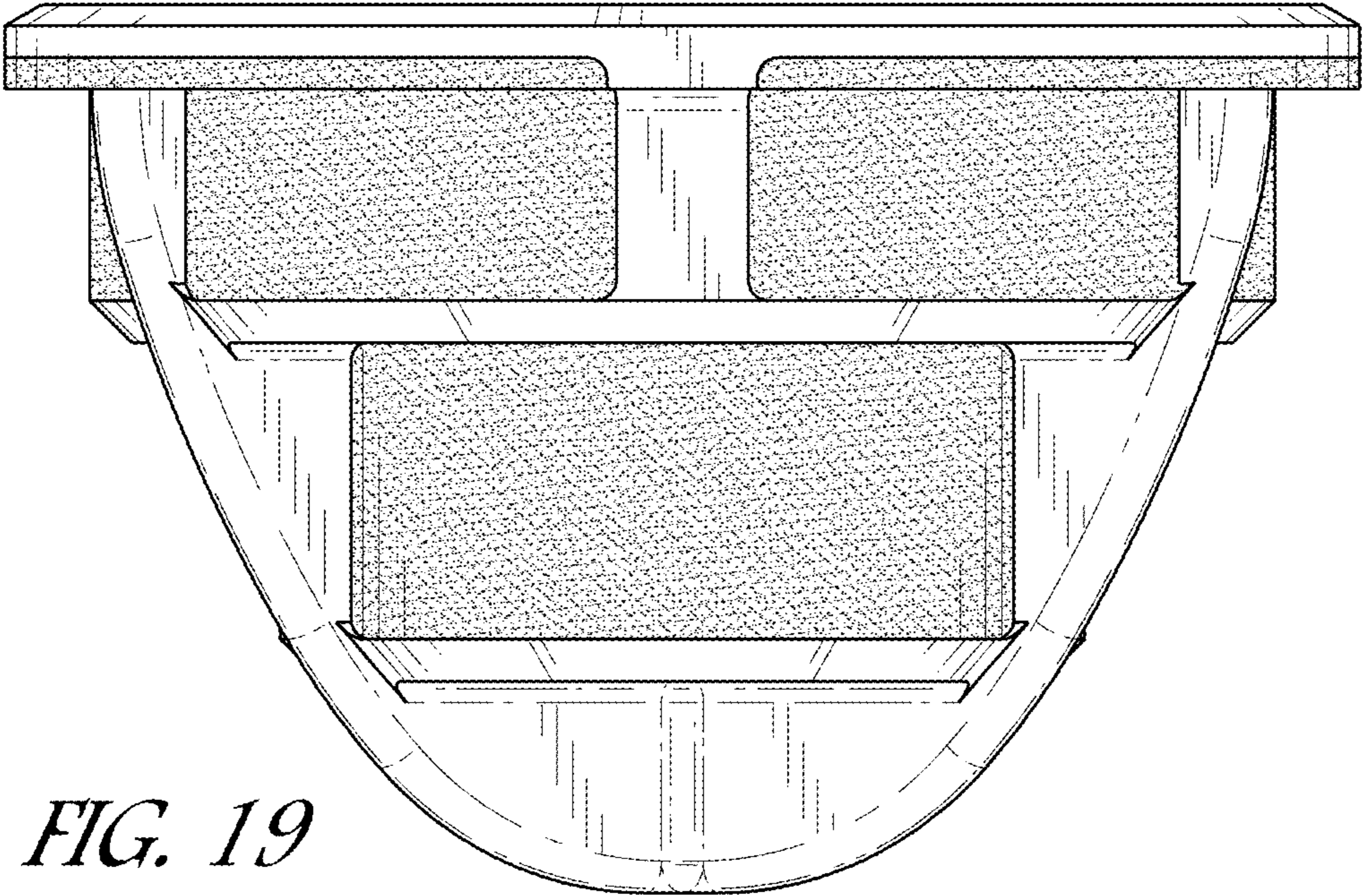
*FIG. 16*



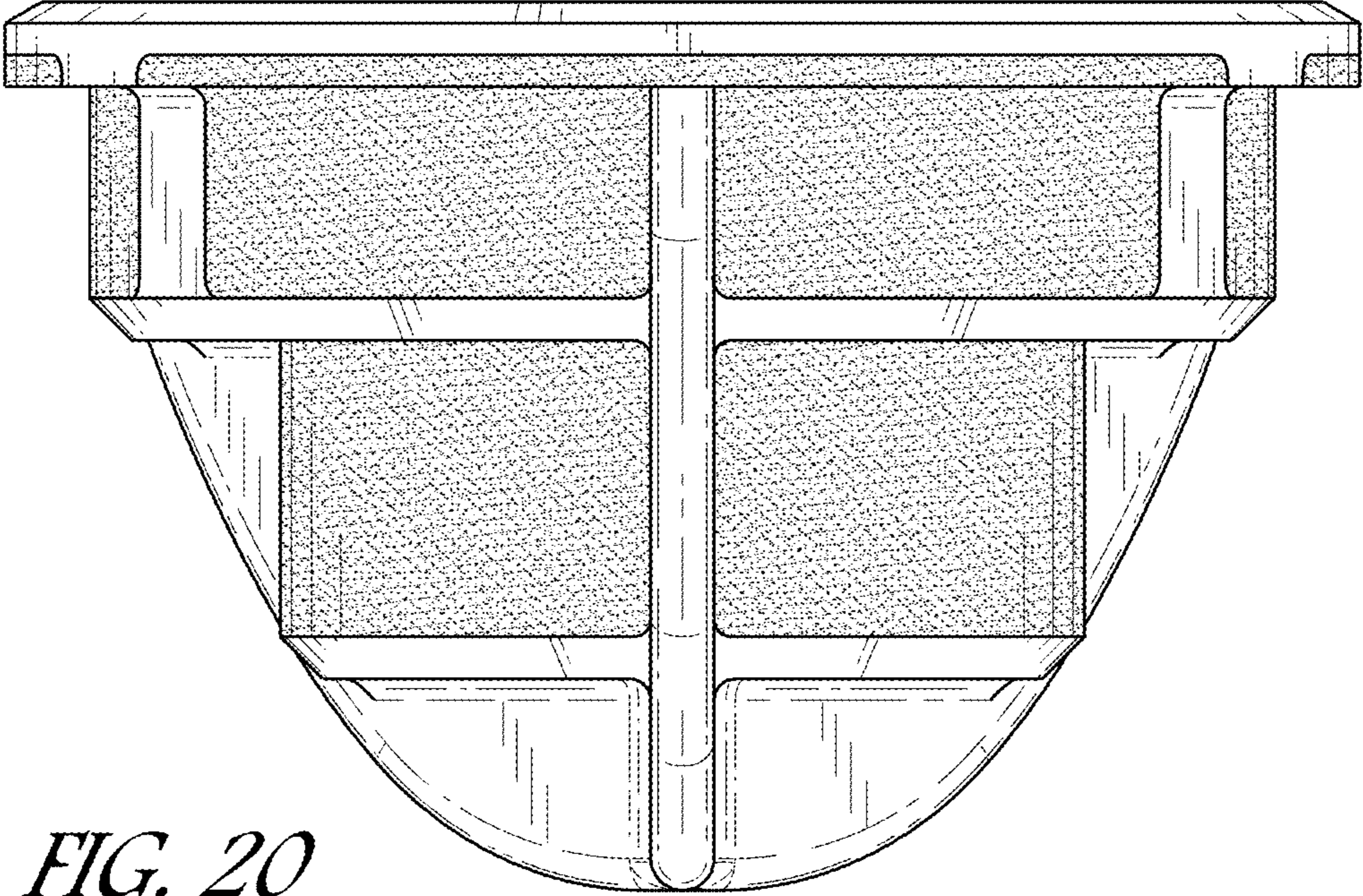
*FIG. 17*



*FIG. 18*

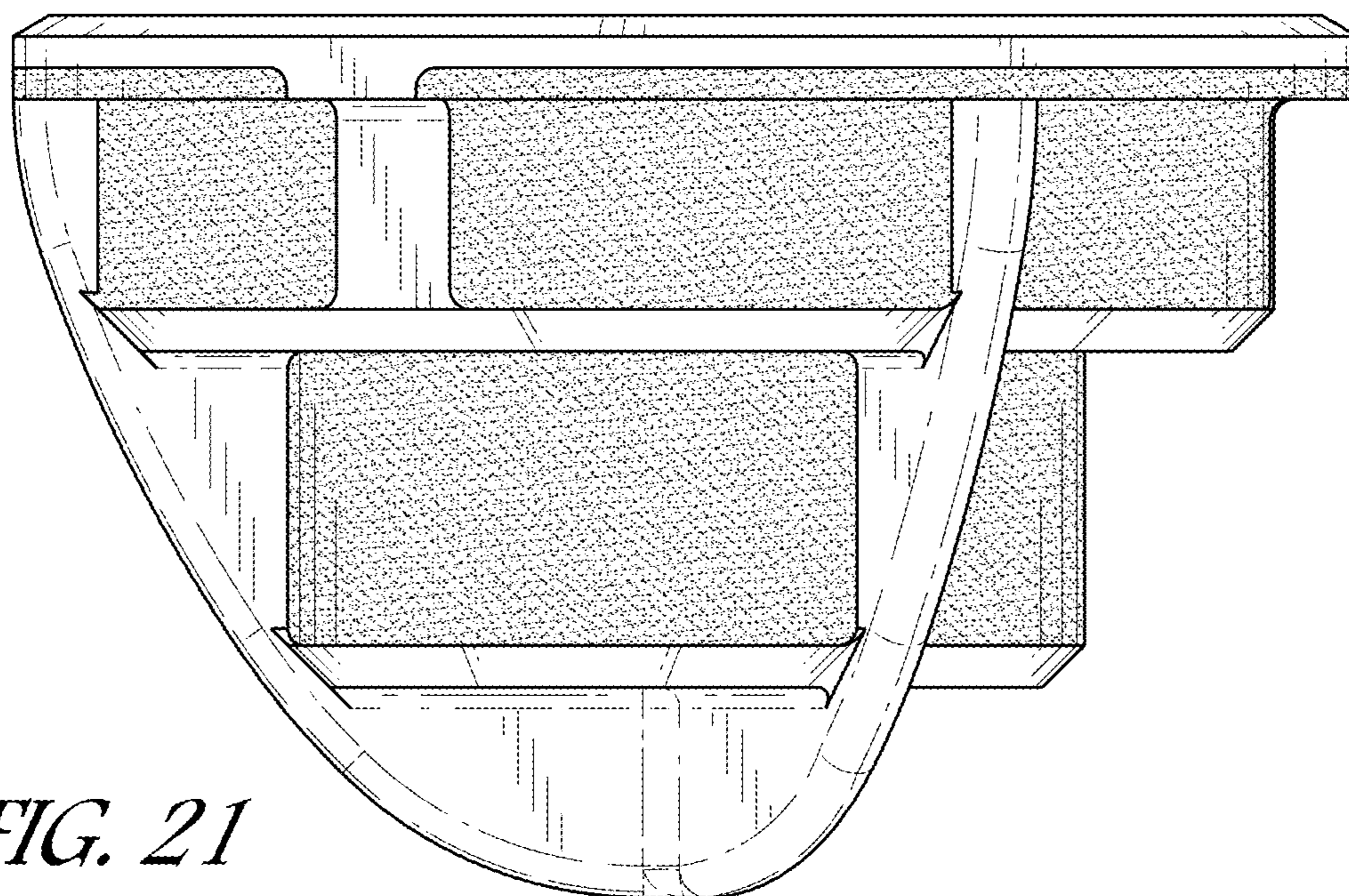


*FIG. 19*

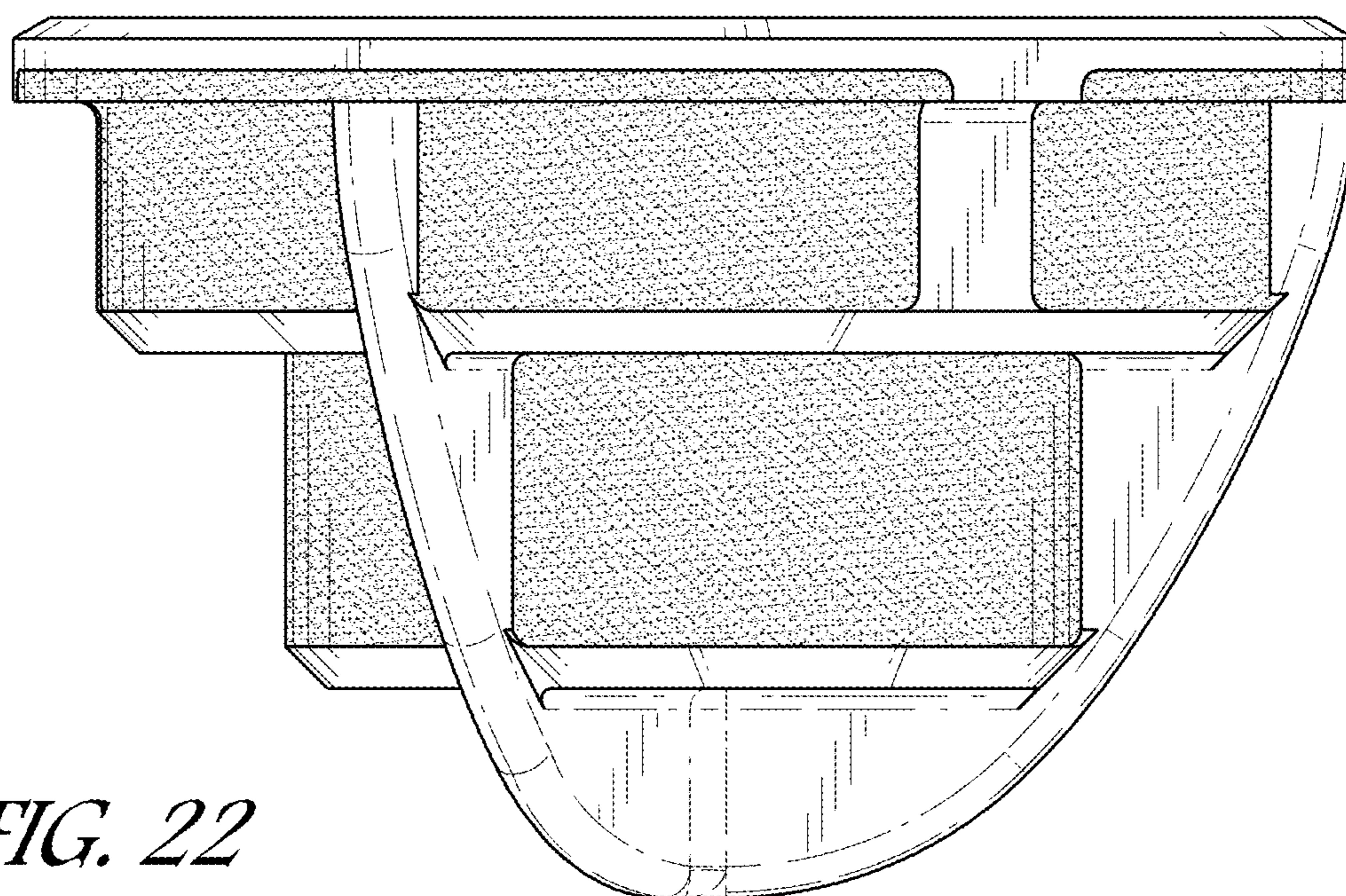


*FIG. 20*

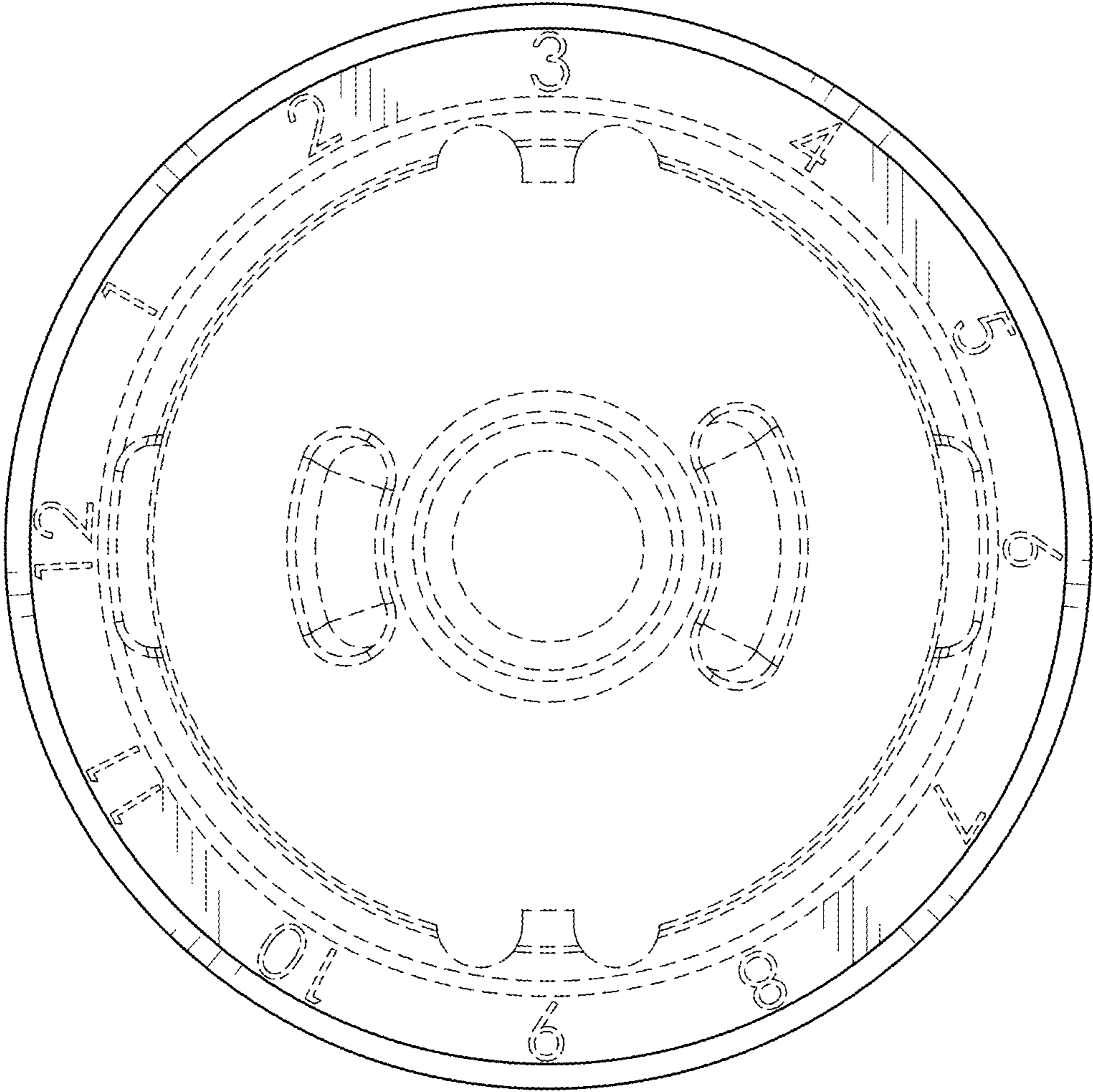




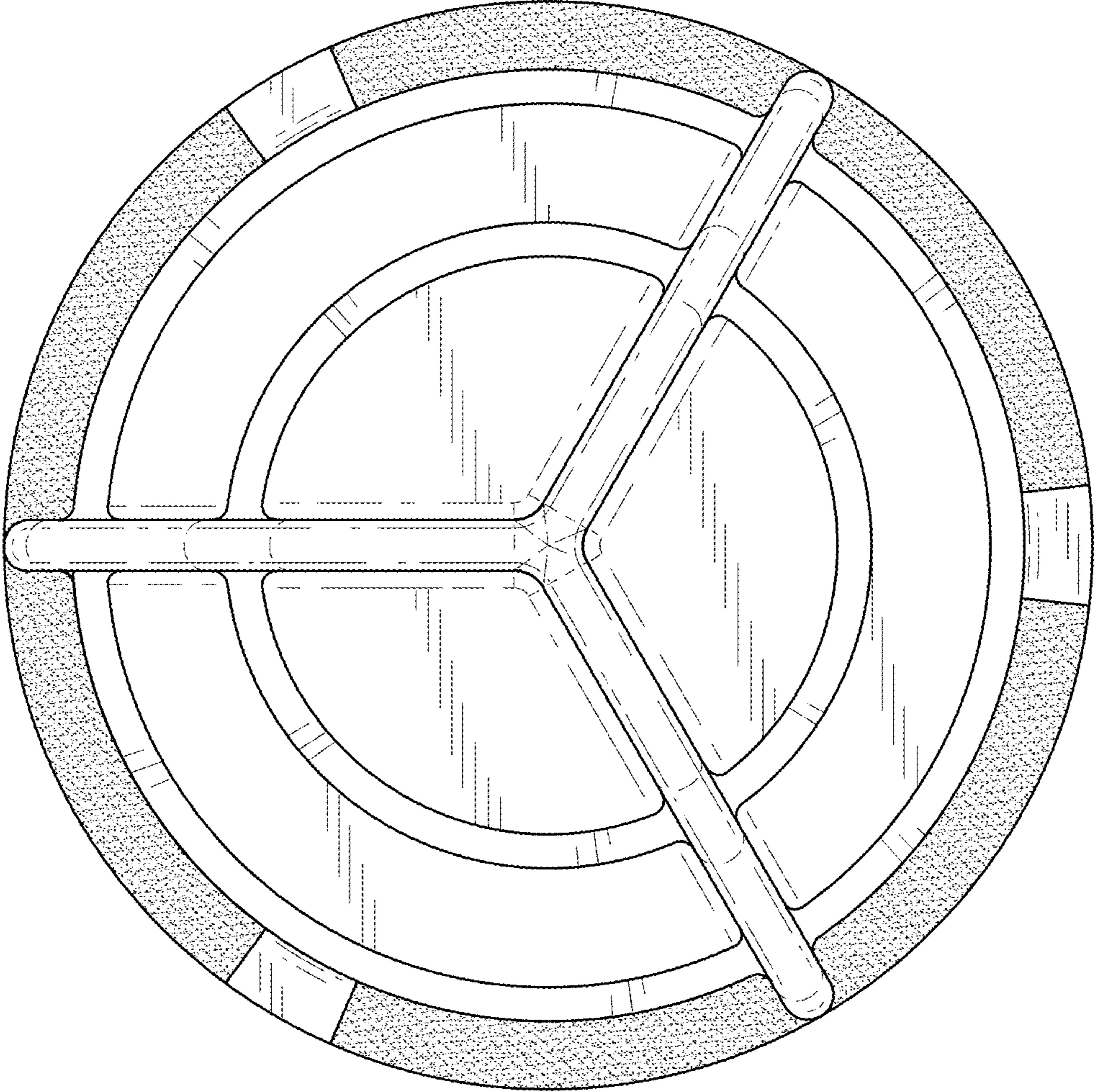
*FIG. 21*



*FIG. 22*



*FIG. 23*



*FIG. 24*