



US00D776801S

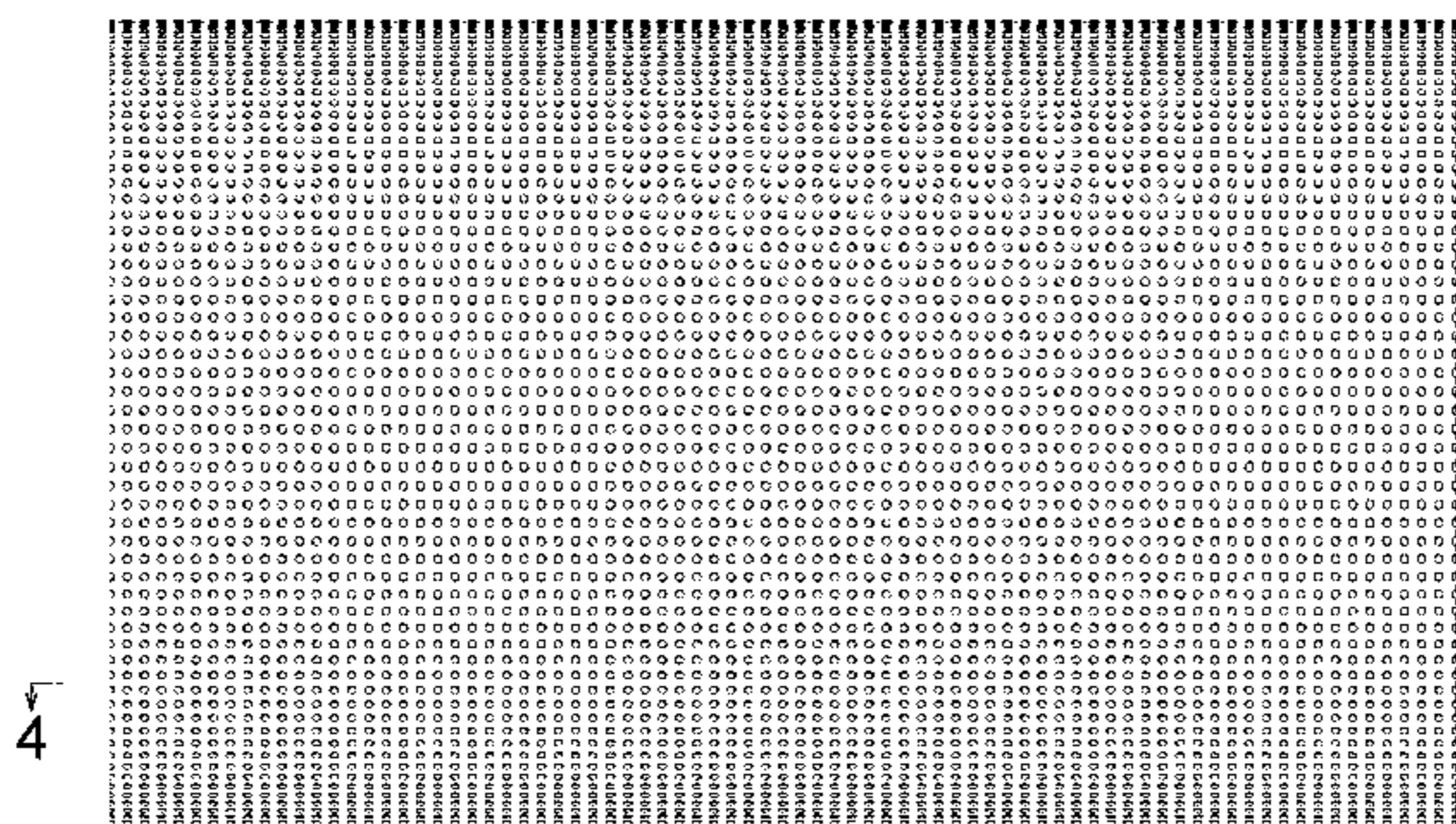
(12) **United States Design Patent** (10) **Patent No.:** **US D776,801 S**  
**Tamura et al.** (45) **Date of Patent:** **\*\* Jan. 17, 2017**

(54) **HEAT EXCHANGER TUBE** (56)  
(71) Applicant: **KOBE STEEL, LTD.**, Kobe-shi (JP)  
(72) Inventors: **Keitaro Tamura**, Hyogo (JP);  
**Yasuyuki Fujii**, Hyogo (JP); **Yoshio**  
**Itsumi**, Hyogo (JP); **Hideto Oyama**,  
Hyogo (JP)  
(73) Assignee: **Kobe Steel, Ltd**, Kobe-shi (JP)  
(\*\*) Term: **14 Years**  
(21) Appl. No.: **29/513,046**  
(22) Filed: **Dec. 24, 2014**  
(30) **Foreign Application Priority Data**  
Jun. 24, 2014 (JP) ..... 2014-013719  
Jun. 24, 2014 (JP) ..... 2014-013720  
(51) **LOC (10) Cl.** ..... **23-03**  
(52) **U.S. Cl.**  
USPC ..... **D23/386; D23/330**  
(58) **Field of Classification Search**  
USPC ... D14/356; D10/93, 104.1, 108, 114; D8/4,  
D8/25, 52; D17/20, 22, 23; D23/323,  
D23/328, 333, 335, 336, 337, 341, 352,  
D23/357, 370, 385, 386, 397, 399, 400,  
D23/406, 411, 413, 499, 330; D11/143,  
D11/144; D13/182  
CPC ..... H01R 13/5213; B60Q 1/04; B60Q 1/26;  
G10D 3/006; G10D 13/023; G10D  
13/027; B25B 15/001; G10H 3/143;  
G10H 3/181; G10G 5/005; A42B 1/04;  
B64C 11/04; B64C 11/16; B64C 11/18;  
B64C 11/20; B64C 2001/009; F03D  
3/062; F03D 11/04; F04D 19/002; F04D  
25/068; F04D 25/088; F24F 1/0018;  
B64D 13/02; E04C 2/427; E06B 3/5892;  
B24B 37/04  
See application file for complete search history.

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

974,536	A *	11/1910	Stoltey	.....	E04F 13/04 52/660
D54,930	S *	4/1920	Knapp	.....	D23/336
1,406,251	A *	2/1922	Vincent	.....	B64C 11/04 416/214 R
2,322,763	A *	6/1943	Martino	.....	B64C 11/04 416/146 R
RE23,445	E *	12/1951	Teague, Jr.	.....	B64D 13/02 454/73
2,994,123	A *	8/1961	Kritzer	.....	B21D 53/085 165/151
D221,853	S *	9/1971	Kimura	.....	D23/386
3,675,878	A *	7/1972	Von Beckh	.....	B64D 13/02 244/171.7
3,984,881	A *	10/1976	Gerlach	.....	E04H 4/08 126/565
D258,081	S *	1/1981	Britt	.....	D23/369
D270,175	S *	8/1983	Stout	.....	D22/122
4,432,514	A *	2/1984	Brandon	.....	B64C 1/18 137/513.3
4,434,844	A *	3/1984	Sakitani	.....	F28F 1/325 165/133
D278,614	S *	4/1985	Moss	.....	D11/143
D288,714	S *	3/1987	Wilson	.....	D23/366
D293,154	S *	12/1987	McKellar	.....	D99/28
4,723,599	A *	2/1988	Hanson	.....	F28F 1/325 165/151
D300,240	S *	3/1989	Sakuma	.....	D23/314
D301,608	S *	6/1989	Ballard	.....	D23/314
D302,853	S *	8/1989	Takahashi	.....	D23/314
D312,069	S *	11/1990	Williamson	.....	D13/102
D316,836	S *	5/1991	Kistner	.....	D11/156
D317,500	S *	6/1991	Ueda	.....	D23/386
D330,760	S *	11/1992	Yoshida	.....	D23/323
D331,624	S *	12/1992	Yoshida	.....	D23/323
D332,998	S *	2/1993	Burridge	.....	D23/335
D334,728	S *	4/1993	Ishiyama	.....	D11/155
5,205,714	A *	4/1993	Shah	.....	B64C 11/04 416/217
D353,192	S *	12/1994	Alexandersson	.....	D23/386
D356,367	S *	3/1995	Kolb	.....	D23/386
D358,204	S *	5/1995	Ferrier	.....	D23/314
5,525,145	A *	6/1996	Hodge	.....	B01D 46/001 454/309
D371,522	S *	7/1996	Weder	.....	D11/164
D373,414	S *	9/1996	Bucher	.....	D23/332
D373,996	S *	9/1996	Ko	.....	D13/158
D380,172	S *	6/1997	Howell	.....	D11/164
D386,561	S *	11/1997	Campbell	.....	D23/330

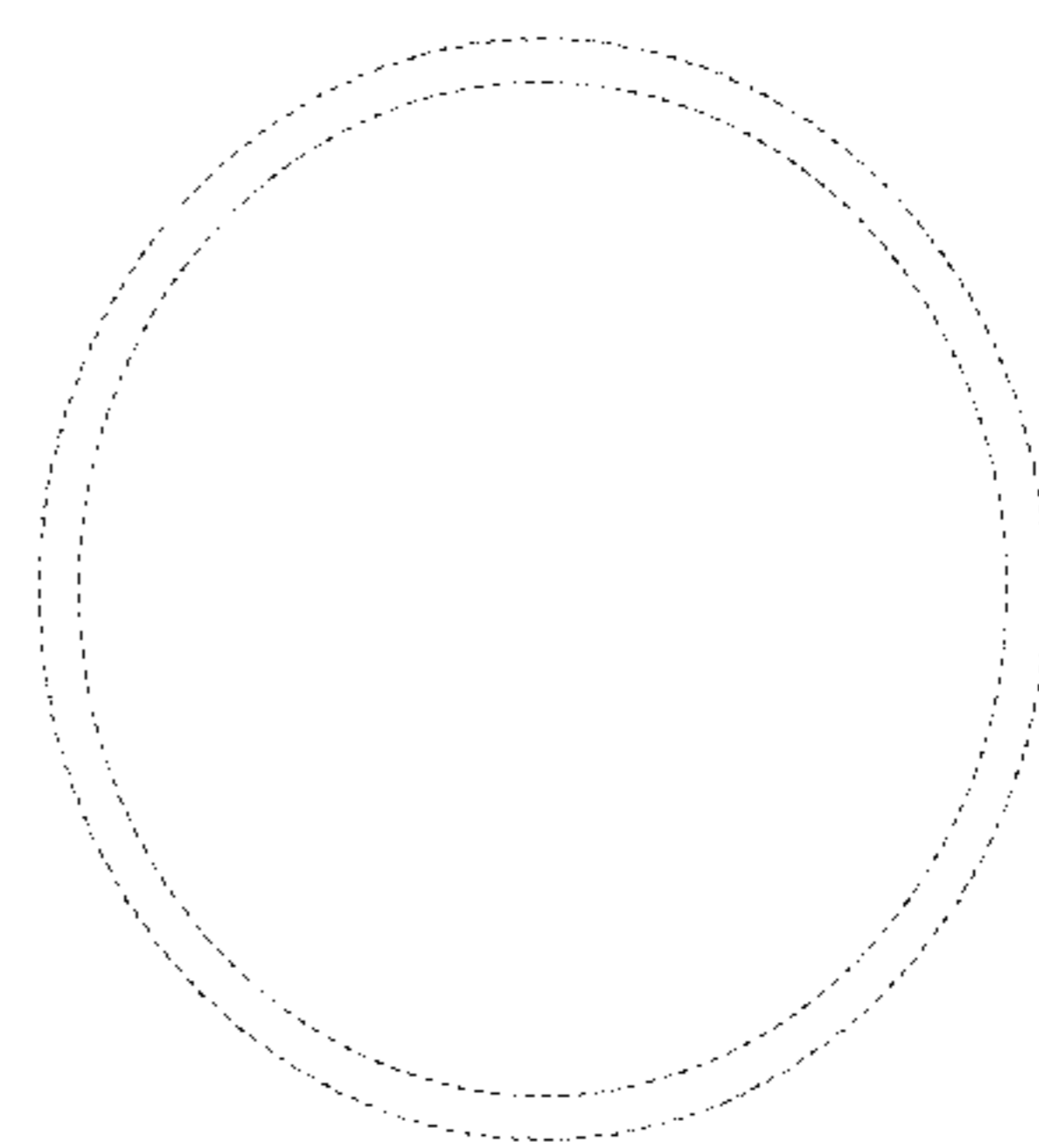
→5



4

4

→5





(56)

## References Cited

## U.S. PATENT DOCUMENTS

5,752,567	A *	5/1998	Obosu .....	F28F 1/325 165/151	D589,134	S *	3/2009	O'Hagin .....	D23/373
D396,201	S *	7/1998	Lashlee .....	D11/143	D591,925	S *	5/2009	Roesch, Jr. ....	D99/34
D399,938	S *	10/1998	Miller .....	D23/351	D593,660	S *	6/2009	Gao .....	D23/317
D399,939	S *	10/1998	Nystrom .....	D23/355	D596,594	S *	7/2009	Kressy .....	D13/184
D400,239	S *	10/1998	Miller .....	D23/355	D597,653	S *	8/2009	Calkins .....	D23/388
5,844,167	A *	12/1998	Zekowski .....	F04D 25/088 174/377	D598,598	S *	8/2009	Zhou .....	D26/68
D410,074	S *	5/1999	Lee .....	D23/332	D600,791	S *	9/2009	Wyman .....	D23/393
D410,078	S *	5/1999	Doubet .....	D23/411	D601,687	S *	10/2009	Chan .....	D23/364
D414,859	S *	10/1999	Hapgood .....	D23/386	D601,979	S *	10/2009	Sato .....	D13/182
D415,832	S *	10/1999	Schubert .....	D23/386	D606,637	S *	12/2009	Wakabayashi ..	D23/317
6,053,700	A *	4/2000	Fosdick .....	B63J 3/04 416/124	D606,934	S *	12/2009	Taggart .....	D13/102
D428,133	S *	7/2000	Chen .....	D23/377	D609,795	S *	2/2010	Yeung .....	D23/332
D429,371	S *	8/2000	Matoba .....	D27/141	7,665,941	B2 *	2/2010	Wolf .....	E04B 1/4157 411/429
D431,640	S *	10/2000	Rong .....	D23/335	D612,383	S *	3/2010	Wen .....	D14/434
6,227,289	B1 *	5/2001	Yokoyama .....	F28F 1/325 165/135	D616,394	S *	5/2010	Sato .....	D13/182
D445,889	S *	7/2001	Resmo .....	D23/342	D618,328	S *	6/2010	Chan .....	D23/364
D448,462	S *	9/2001	Nanjo .....	D23/351	D622,372	S *	8/2010	Grey .....	D23/372
D454,944	S *	3/2002	Hotaling .....	D23/335	D623,317	S *	9/2010	Moore .....	D25/138
D457,704	S *	5/2002	Fiscus .....	D34/19	7,795,769	B2 *	9/2010	Cartwright .....	F04D 25/088 150/165
D459,007	S *	6/2002	Campacci .....	D25/119	7,802,412	B2 *	9/2010	Jensen .....	E04H 12/085 52/651.07
D461,551	S *	8/2002	Teskey .....	D23/373	D624,890	S *	10/2010	Schadeck .....	D13/182
D462,434	S *	9/2002	Kojima .....	D23/372	D626,204	S *	10/2010	Morgan .....	D23/365
6,480,672	B1 *	11/2002	Rosenzweig .....	F24H 3/0417 392/365	7,815,419	B2 *	10/2010	Teraoka .....	F04D 29/283 416/178
6,484,714	B1 *	11/2002	Smith .....	F23H 3/02 126/163 R	D628,201	S *	11/2010	Tian .....	D14/434
D467,273	S *	12/2002	Brooks .....	D19/155	D628,335	S *	11/2010	Hyland .....	D26/74
D467,324	S *	12/2002	Ching .....	D23/335	D628,422	S *	12/2010	Meyers .....	D6/583
D470,731	S *	2/2003	Hipgrave .....	D8/1	D631,225	S *	1/2011	Plato .....	D6/707.2
D476,404	S *	6/2003	Chen .....	D23/341	D631,683	S *	2/2011	Ash .....	D6/558
D483,102	S *	12/2003	Ching .....	D23/335	7,877,935	B2 *	2/2011	Ollgaard .....	E04H 12/08 52/153
D486,559	S *	2/2004	Otero .....	D23/254	7,919,898	B2 *	4/2011	Wang .....	H02K 1/276 310/216.058
D502,258	S *	2/2005	Hart .....	D23/415	D637,705	S *	5/2011	Park .....	D23/360
D504,405	S *	4/2005	Kawaguchi .....	D13/182	D638,358	S *	5/2011	Sauer, Jr. ....	D13/115
D505,485	S *	5/2005	Blateri .....	D23/335	D638,923	S *	5/2011	Choi .....	D23/364
D508,734	S *	8/2005	Gao .....	D23/335	D639,926	S *	6/2011	Fowler .....	D23/406
D510,988	S *	10/2005	Blateri .....	D23/335	D639,928	S *	6/2011	Malone .....	D23/422
D512,774	S *	12/2005	O'Hagin .....	D23/393	D641,658	S *	7/2011	Thorn .....	D11/152
6,988,942	B2 *	1/2006	Chen .....	B23H 5/08 257/E21.304	D643,913	S *	8/2011	Ching .....	D23/342
D519,203	S *	4/2006	Haas .....	D23/405	D643,915	S *	8/2011	Endo .....	D23/364
7,021,370	B2 *	4/2006	Papapanu .....	F28F 1/325 165/151	D644,143	S *	8/2011	Hollihan .....	D11/143
D522,975	S *	6/2006	Egawa .....	D13/180	D652,164	S *	1/2012	Sherry .....	D27/192
D525,213	S *	7/2006	Enderlein .....	D13/182	D657,443	S *	4/2012	Siemieczuk .....	D23/418
7,094,183	B2 *	8/2006	Hsieh .....	A63B 22/18 482/123	D662,008	S *	6/2012	Harshman .....	D11/146
D528,719	S *	9/2006	No .....	D32/29	D667,537	S *	9/2012	Le .....	D23/412
D543,610	S *	5/2007	Catron .....	D23/332	8,263,027	B2 *	9/2012	Girlea .....	126/259 M
D543,953	S *	6/2007	Dugas .....	D13/179	D669,974	S *	10/2012	McNeal .....	D23/314
D547,430	S *	7/2007	Low .....	D21/713	D671,355	S *	11/2012	Zmrhal .....	D7/354
D550,893	S *	9/2007	Huang .....	D26/142	D672,495	S *	12/2012	Roxbury .....	D26/118
D552,565	S *	10/2007	Nakamura .....	D13/182	D673,245	S *	12/2012	Cooney .....	D23/260
D557,779	S *	12/2007	Ching .....	D23/342	D674,079	S *	1/2013	Shiraichi .....	D23/413
7,310,898	B2 *	12/2007	Wei .....	D06F 81/08 38/107	D674,080	S *	1/2013	Shiraichi .....	D23/413
D562,618	S *	2/2008	Bodum .....	D7/330	D676,949	S *	2/2013	Dornau .....	D23/366
D566,824	S *	4/2008	Umetsu .....	D23/386	D681,992	S *	5/2013	Ng .....	D6/580
D567,354	S *	4/2008	Jacak .....	D23/388	D683,000	S *	5/2013	Smith .....	D23/314
D567,931	S *	4/2008	Hollingsworth ..	D23/388	D683,494	S *	5/2013	Verdin .....	D26/137
D570,464	S *	6/2008	Normark .....	D23/364	D684,527	S *	6/2013	Ishikawa .....	D13/102
D570,467	S *	6/2008	Nishio .....	D23/386	D686,711	S *	7/2013	Towiwat .....	D23/323
D571,828	S *	6/2008	Braun .....	D15/89	D686,712	S *	7/2013	Towiwat .....	D23/323
D574,005	S *	7/2008	Chung .....	D14/447	D691,117	S *	10/2013	Silvera .....	D14/213
D577,806	S *	9/2008	Grey .....	D23/372	D692,843	S *	11/2013	Masuda .....	D13/182
D578,190	S *	10/2008	Gao .....	D23/332	D694,871	S *	12/2013	Maholick .....	D23/365
D578,627	S *	10/2008	Gao .....	D23/314	D696,755	S *	12/2013	Towiwat .....	D23/323
D578,633	S *	10/2008	Schluter .....	D23/370	D696,756	S *	12/2013	Towiwat .....	D23/323
D579,455	S *	10/2008	Chu .....	D14/447	D699,148	S *	2/2014	Murr .....	D11/143
D586,768	S *	2/2009	Inoue .....	D13/182	8,646,219	B2 *	2/2014	Lyness .....	F03D 1/001 248/544
D588,079	S *	3/2009	Okada .....	D13/182	D700,689	S *	3/2014	Obosu .....	D23/323
					D702,824	S *	4/2014	Martel .....	D23/323
					D707,339	S *	6/2014	Garbusi .....	D23/366
					D708,729	S *	7/2014	Platt .....	D23/365
					D713,020	S *	9/2014	Kitajima .....	D23/322
					D714,132	S *	9/2014	Hazantonis .....	D8/382
					D715,842	S *	10/2014	Smith .....	D15/152
					D718,848	S *	12/2014	Norberg .....	D23/314



(56)

References Cited

U.S. PATENT DOCUMENTS

D719,648 S \* 12/2014 Moody ..... D23/267  
 D719,909 S \* 12/2014 Iwasaki ..... D13/102  
 D720,843 S \* 1/2015 Jackson ..... D23/387  
 D721,009 S \* 1/2015 Wagner ..... D11/164  
 D722,212 S \* 2/2015 Kim ..... D32/29  
 D723,215 S \* 2/2015 Chen ..... D27/101  
 8,957,290 B2 \* 2/2015 Vochezer ..... G10G 5/005  
 84/280  
 D724,196 S \* 3/2015 Turner ..... D23/415  
 D724,265 S \* 3/2015 Alima ..... D27/167  
 D725,976 S \* 4/2015 Sikes ..... D8/1  
 D726,093 S \* 4/2015 Perkins ..... D12/345  
 D726,869 S \* 4/2015 Lepine ..... D23/209  
 D728,305 S \* 5/2015 Henry ..... D7/388  
 D730,304 S \* 5/2015 Matsumoto ..... D13/182  
 D733,277 S \* 6/2015 Yamada ..... D23/365  
 D736,902 S \* 8/2015 Ryu ..... D23/364  
 D737,945 S \* 9/2015 Leatzow ..... D23/365  
 D740,405 S \* 10/2015 Yamaguchi ..... D23/355  
 D740,926 S \* 10/2015 Lin ..... D23/332  
 D741,456 S \* 10/2015 Elwertowski ..... D23/259  
 D741,963 S \* 10/2015 Baumann ..... D21/688  
 D742,628 S \* 11/2015 Clark ..... D23/379  
 D743,131 S \* 11/2015 Jeon ..... D32/29  
 D743,521 S \* 11/2015 Jackson ..... D23/393  
 D744,626 S \* 12/2015 Leatzow ..... D23/365  
 D744,996 S \* 12/2015 Keisling ..... D14/308  
 D746,870 S \* 1/2016 Chen ..... D15/5  
 D747,887 S \* 1/2016 Seitzinger ..... D5/57  
 D748,593 S \* 2/2016 Dempster ..... D13/182  
 D748,769 S \* 2/2016 Hanna ..... D23/366  
 D749,201 S \* 2/2016 Hokazono ..... D23/323  
 D749,381 S \* 2/2016 Magri ..... D24/230  
 D751,013 S \* 3/2016 Curic ..... D12/163  
 D751,474 S \* 3/2016 Kirkland, Jr. .... D12/171  
 D752,202 S \* 3/2016 Berkman ..... D23/412  
 D753,357 S \* 4/2016 Song ..... D32/29  
 D755,545 S \* 5/2016 Trinh ..... D6/672  
 D757,662 S \* 5/2016 Fujii ..... D13/179  
 D763,804 S \* 8/2016 Sakamoto ..... D13/179  
 2002/0027762 A1 \* 3/2002 Yamaguchi ..... G03F 7/707  
 361/234  
 2002/0124636 A1 \* 9/2002 Massie ..... B82Y 35/00  
 73/105  
 2003/0000686 A1 \* 1/2003 Kester ..... F28F 1/325  
 165/151  
 2003/0057089 A1 \* 3/2003 Nguyen ..... C23C 14/50  
 204/298.15  
 2003/0150601 A1 \* 8/2003 Park ..... F28F 1/325  
 165/151  
 2005/0274503 A1 \* 12/2005 Gong ..... F28F 1/32  
 165/151  
 2007/0163764 A1 \* 7/2007 Kaga ..... F28F 1/325  
 165/151  
 2008/0217478 A1 \* 9/2008 Keeler ..... B64C 1/18  
 244/119  
 2011/0159786 A1 \* 6/2011 Joseph ..... B24B 37/042  
 451/36  
 2013/0062041 A1 \* 3/2013 Sakae ..... B21C 3/04  
 165/154  
 2014/0290460 A1 \* 10/2014 Vochezer ..... G10D 3/18  
 84/280  
 2015/0076933 A1 \* 3/2015 Hoemann ..... H02K 3/487  
 310/43  
 2015/0107647 A1 \* 4/2015 Nakamura ..... H02S 20/00  
 136/245  
 2015/0380255 A1 \* 12/2015 Lee ..... B24B 37/08  
 451/262  
 2016/0107286 A1 \* 4/2016 Sakashita ..... C09K 3/1436  
 451/36

FOREIGN PATENT DOCUMENTS

EM 001318182-0001 3/2012  
 EM 001318182-0002 3/2012  
 EM 001318182-0003 3/2012

OTHER PUBLICATIONS

Heat Exchanger Tube for Outdoor Barbecue Grills & Smokers, image post date Nov. 14, 2014, site visited Apr. 21, 2016, (online), <<http://outdoorgrill.com/nexgrill-outdoor-patio-heater/>>.\*  
 Stainless steel tube sheet and flange, image post date 2007, site visited May 2, 2016, (online), <[https://www.alibaba.com/product-detail/Stainless-steel-tube-sheet-and-flange\\_1205882910.html](https://www.alibaba.com/product-detail/Stainless-steel-tube-sheet-and-flange_1205882910.html)>.\*  
 Enhanced surface tubes, image post date Apr. 7, 2015, site visited May 2, 2016, (online), <[http://web.archive.org/web/20150407013313/http://www.wieland-thermalsolutions.com/internet/en/products/finned\\_tubes/hochleistungsrohre/Hochleistungsrohre.jsp](http://web.archive.org/web/20150407013313/http://www.wieland-thermalsolutions.com/internet/en/products/finned_tubes/hochleistungsrohre/Hochleistungsrohre.jsp)>.\*  
 Heat Exchanger Products, image post date Sep. 28, 2014, site visited May 2, 2016, (online), <<http://web.archive.org/web/20140928145808/http://www.indiamart.com/marco-blowers-india/heat-exchanger-products.html>>.\*

\* cited by examiner

Primary Examiner — Kevin Rudzinski

Assistant Examiner — Sean D Lough

(74) Attorney, Agent, or Firm — Oblon, McClelland, Maier & Neustadt, L.L.P.

(57)

CLAIM

The ornamental design for a heat exchanger tube, as shown and described.

DESCRIPTION

FIG. 1 is a front view of a heat exchanger tube showing a first embodiment of our new design, the opposite side being an identical image of the side shown herein;  
 FIG. 2 is a left side view thereof, the opposite side being an identical image of the side shown herein;  
 FIG. 3 is a top view thereof, the opposite side being an identical image of the side shown herein;  
 FIG. 4 is an enlarged view of part 4-4 in FIG. 1 thereof;  
 FIG. 5 is a cross-sectional view taken along line 5-5 in FIG. 1;  
 FIG. 6 is an enlarged view of part 6-6 in FIG. 5 thereof;  
 FIG. 7 is a front view of a heat exchanger tube showing a second embodiment of our new design, the opposite side being an identical image of the side shown herein;  
 FIG. 8 is a left side view thereof, the opposite side being an identical image of the side shown herein;  
 FIG. 9 is a top view thereof, the opposite side being an identical image of the side shown herein;  
 FIG. 10 is an enlarged view of part 10-10 in FIG. 7 thereof;  
 FIG. 11 is a cross-sectional view taken along line 11-11 in FIG. 7; and,  
 FIG. 12 is an enlarged view of part 12-12 in FIG. 11 thereof.  
 The broken lines wherever present in the drawing disclosure illustrate portions of the heat exchanger tube that form no part of the claimed design or represent numbered section lines that form no part of the claimed design.  
 No claim is made to portions of the heat exchanger tube beyond the broken line boundaries of the left and right ends of the claimed design. Any portions of the design not shown form no part of the claimed design.



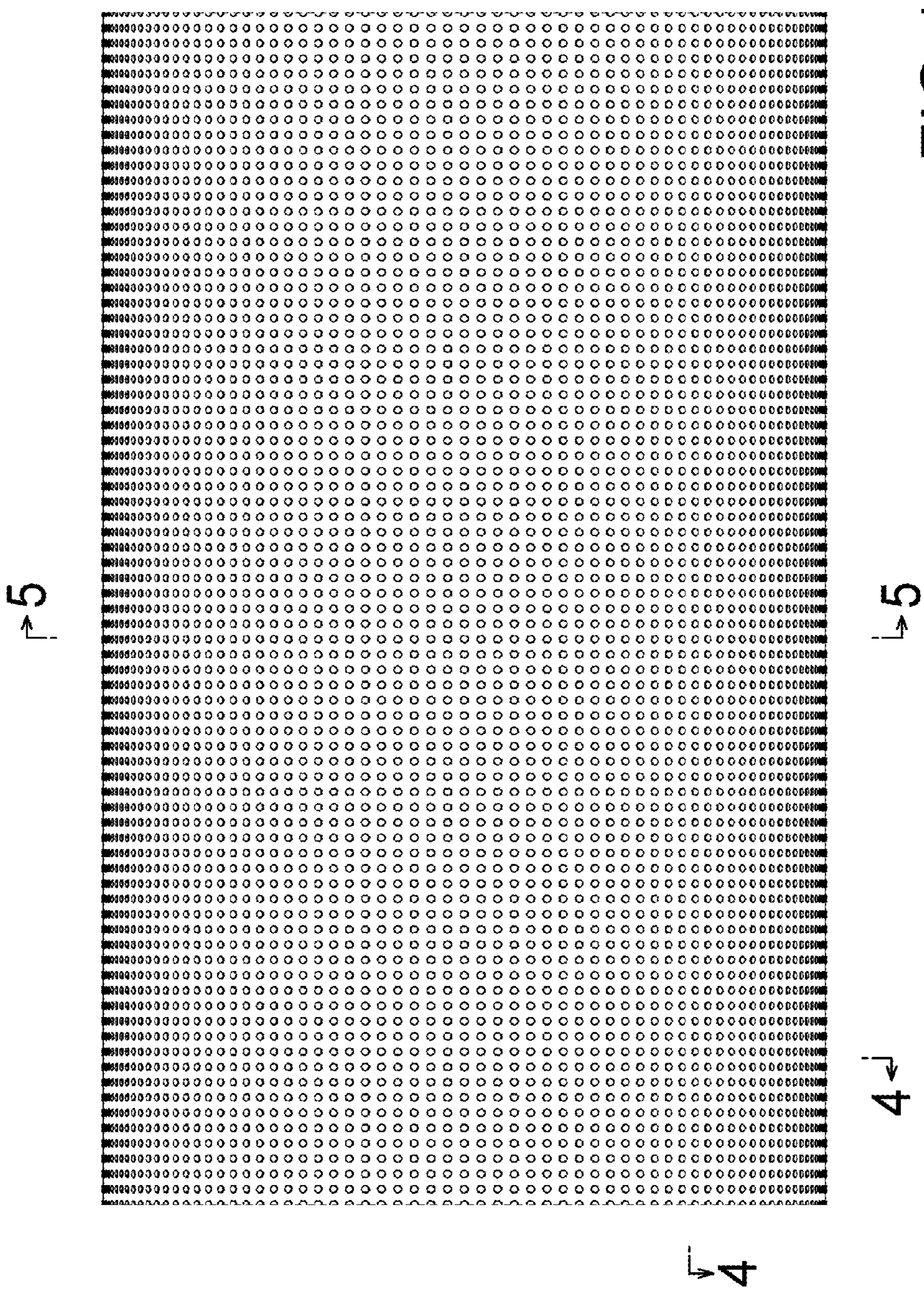


FIG. 1

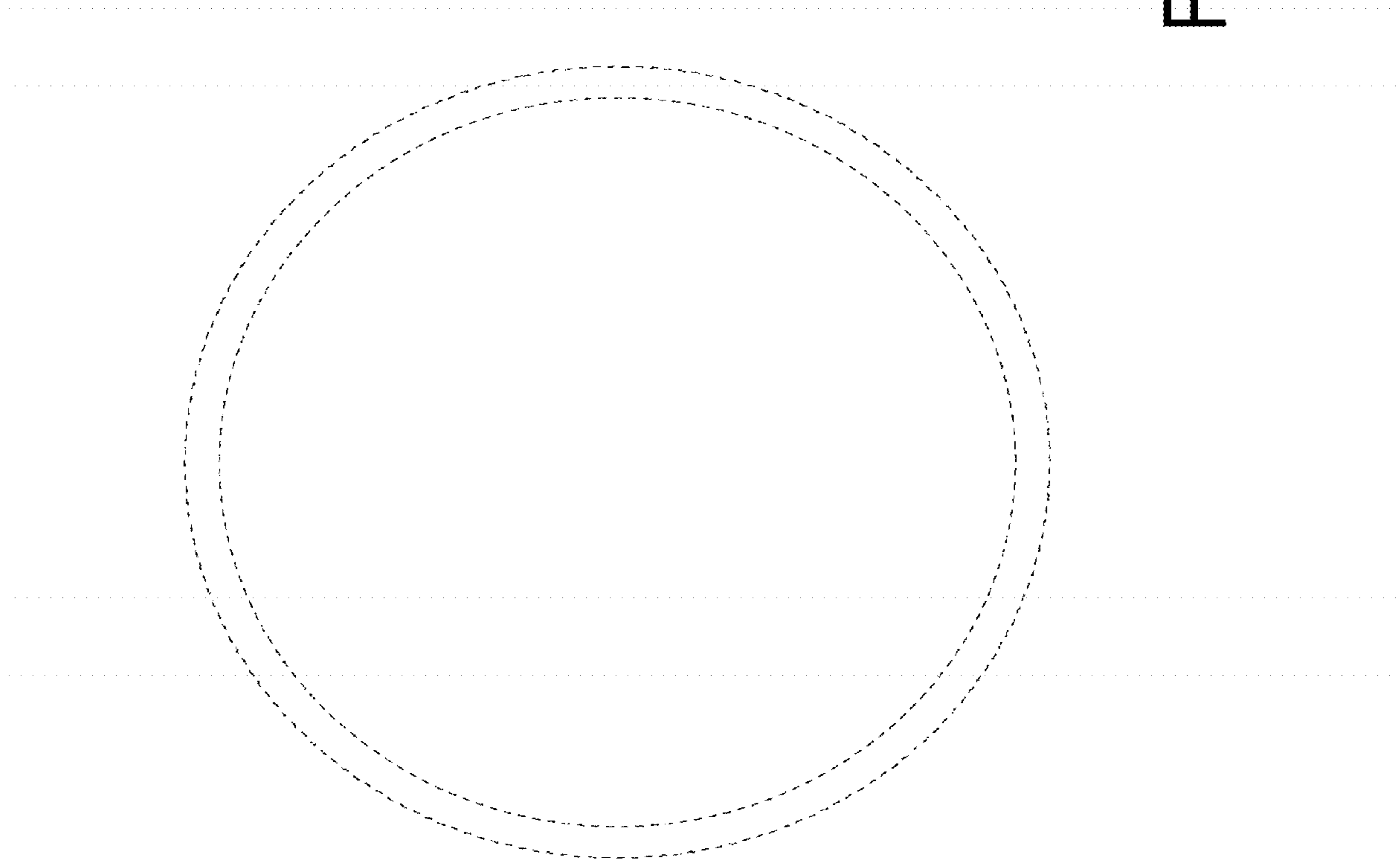


FIG. 2



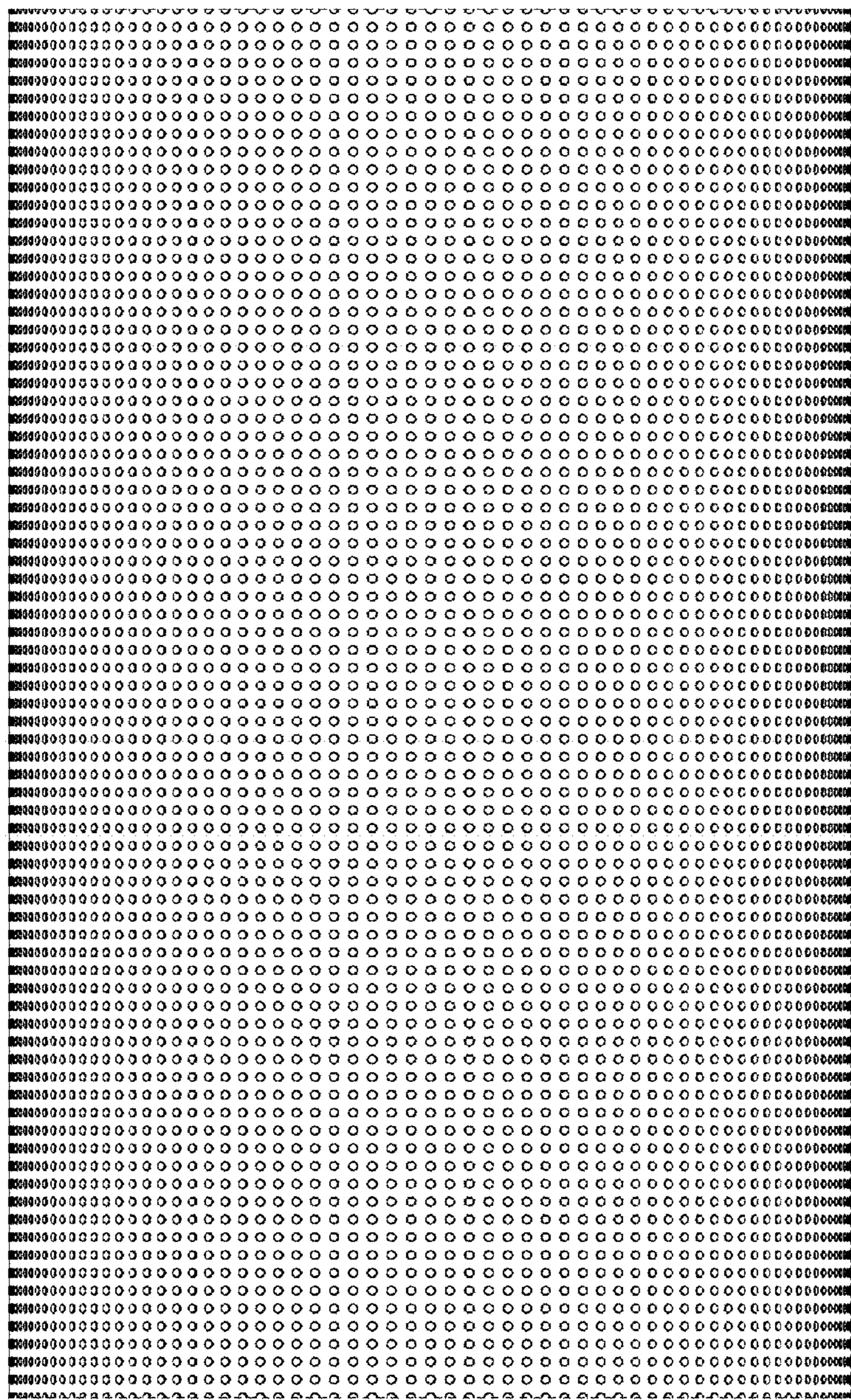


FIG. 3

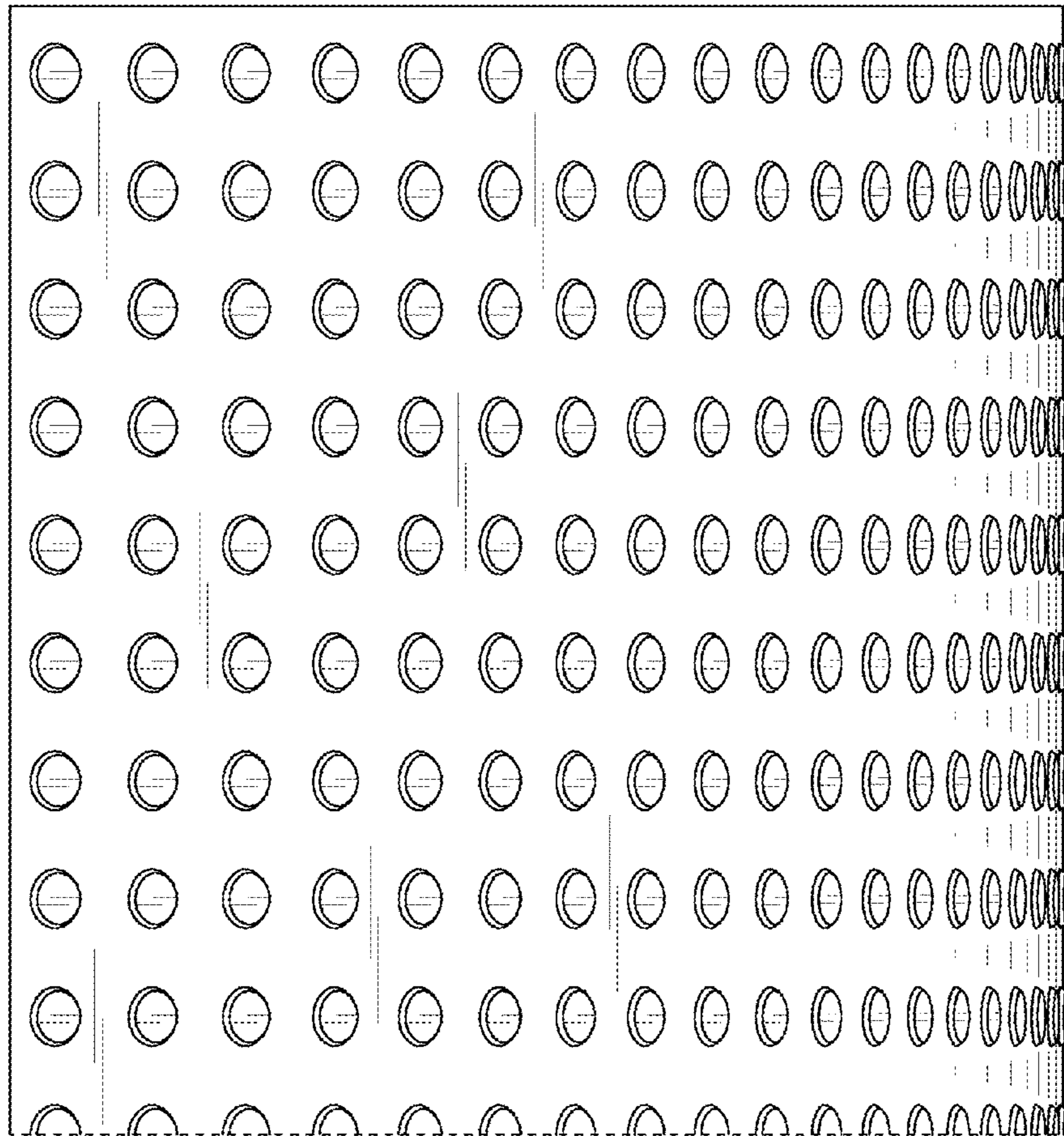


FIG.4

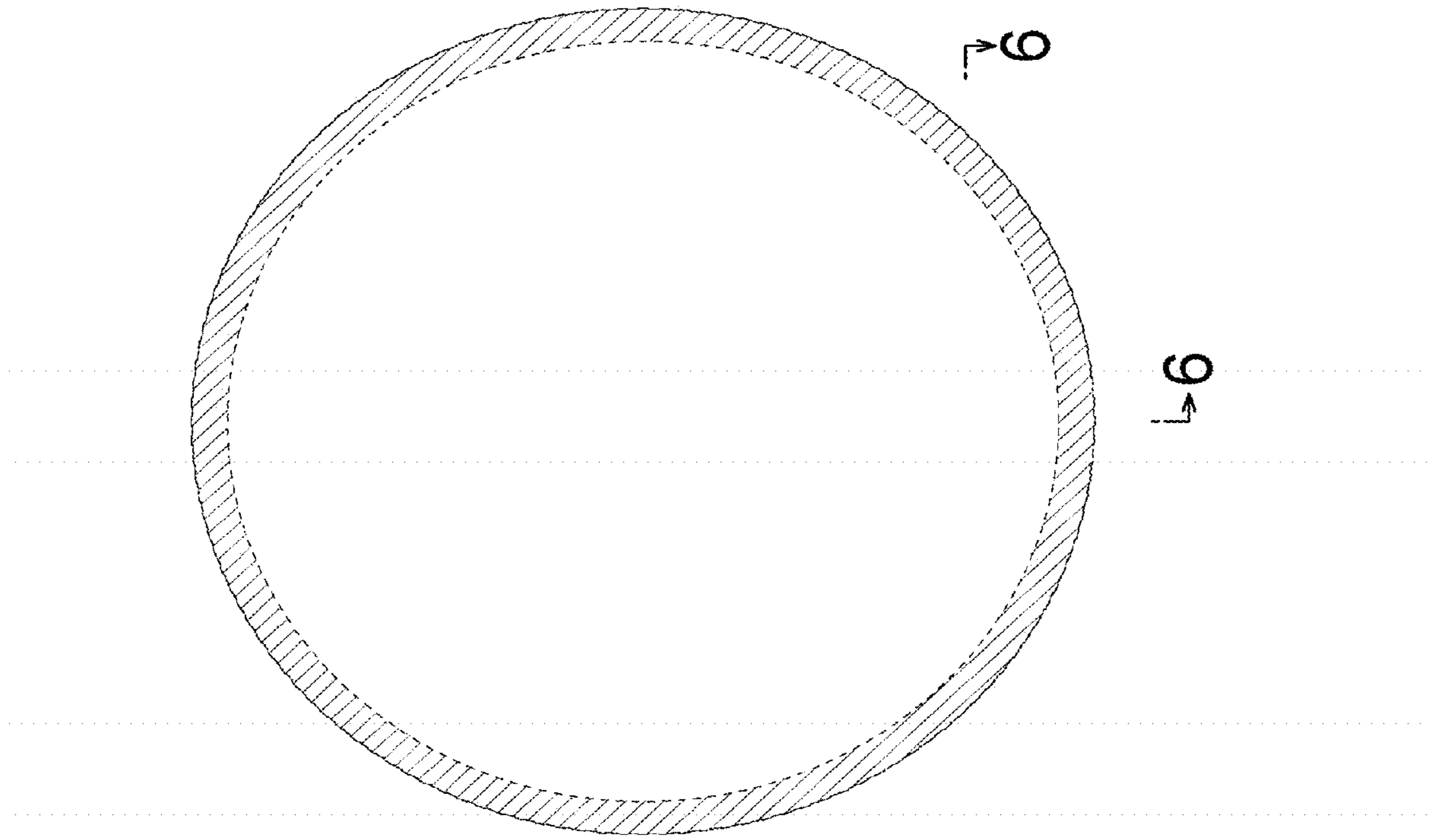
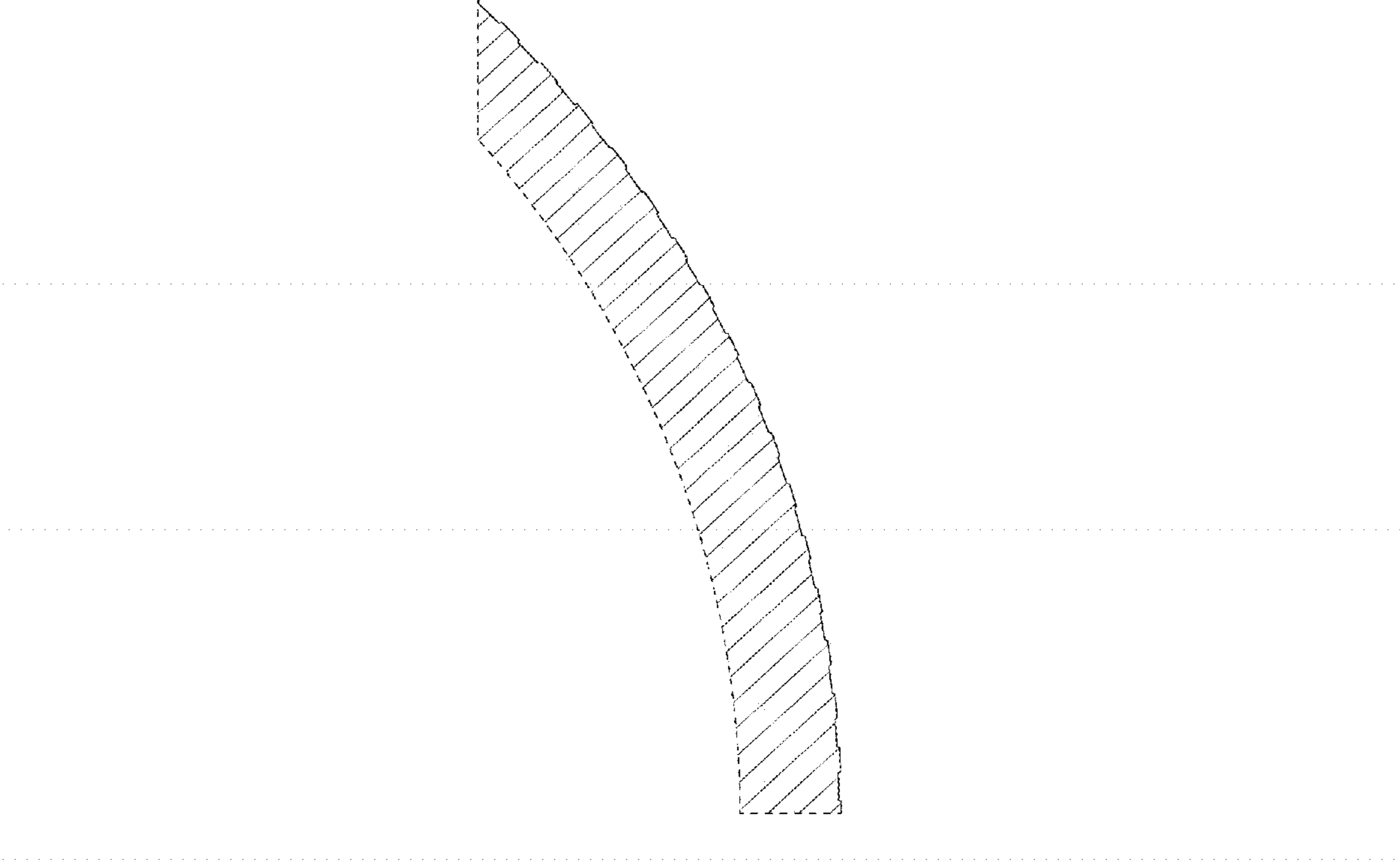


FIG. 5



FIG. 6



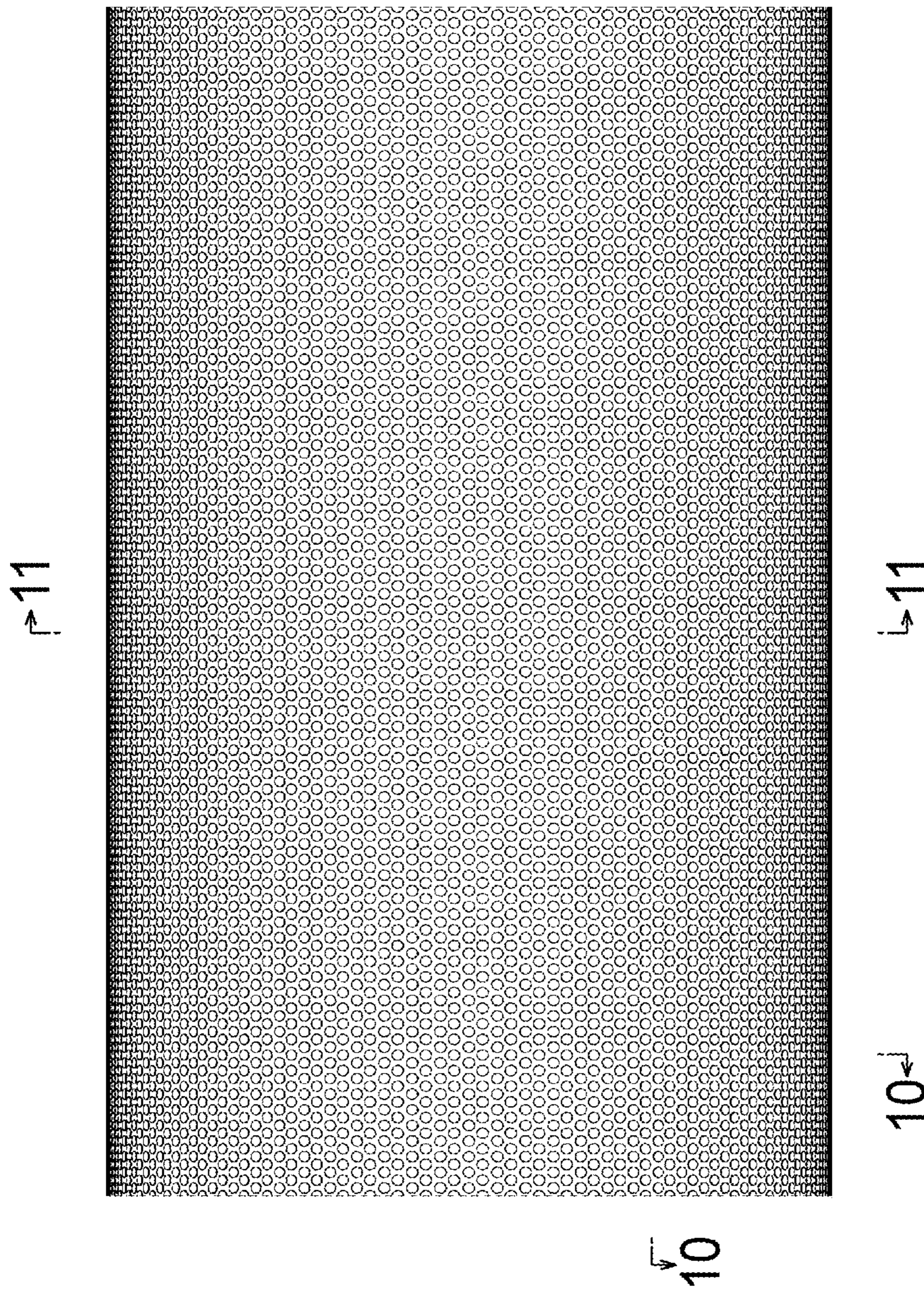


FIG. 7



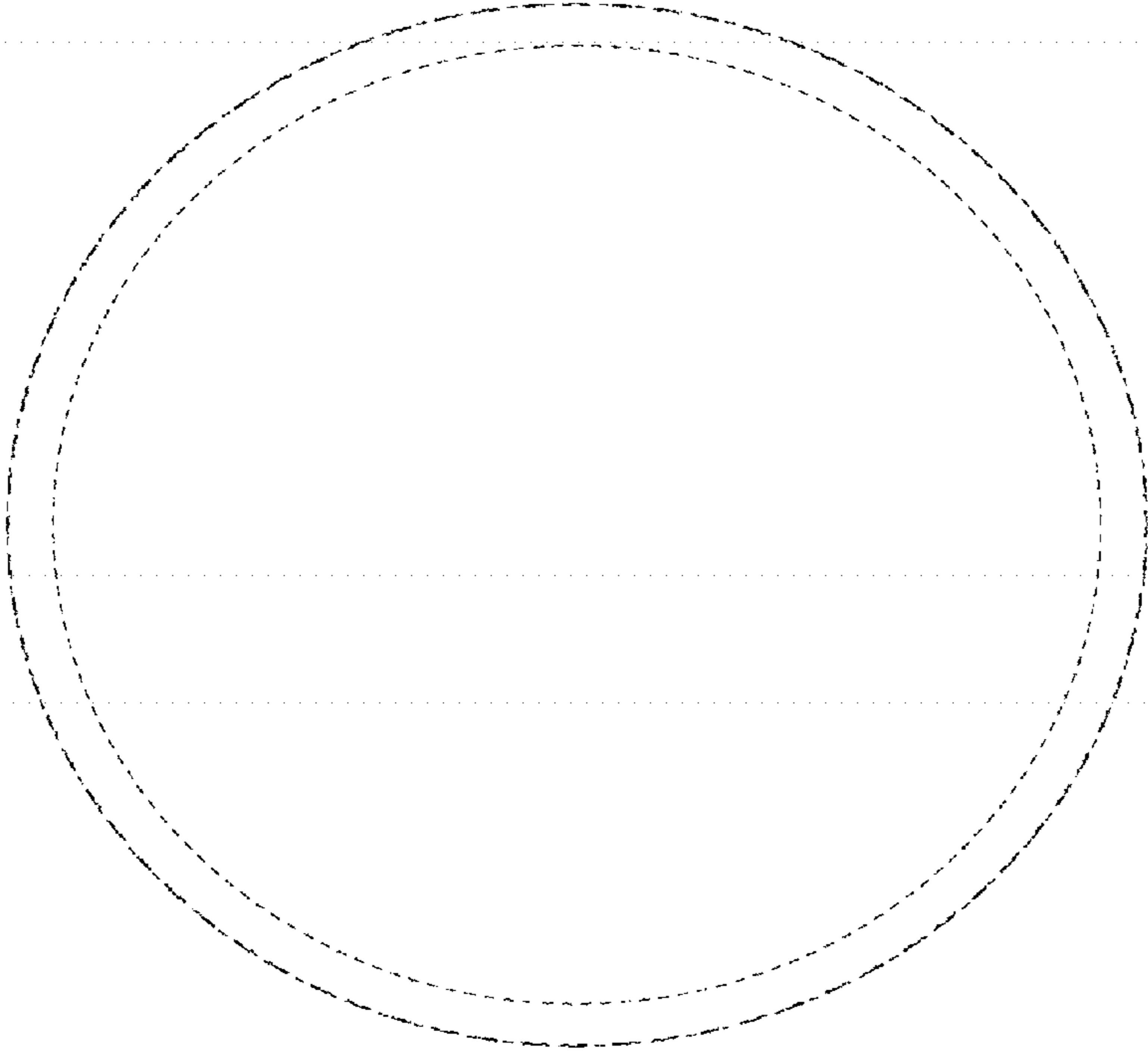


FIG. 8



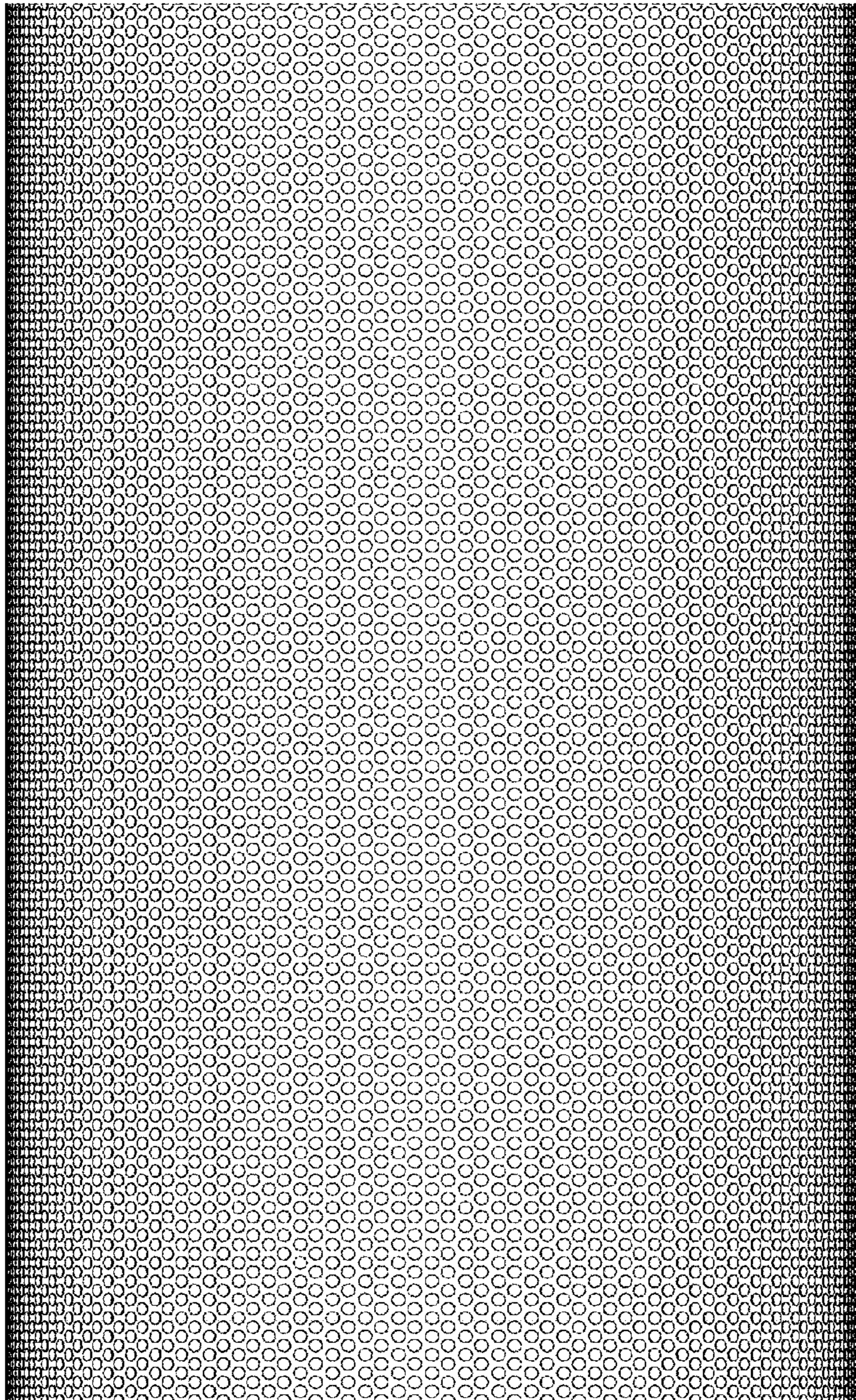


FIG. 9



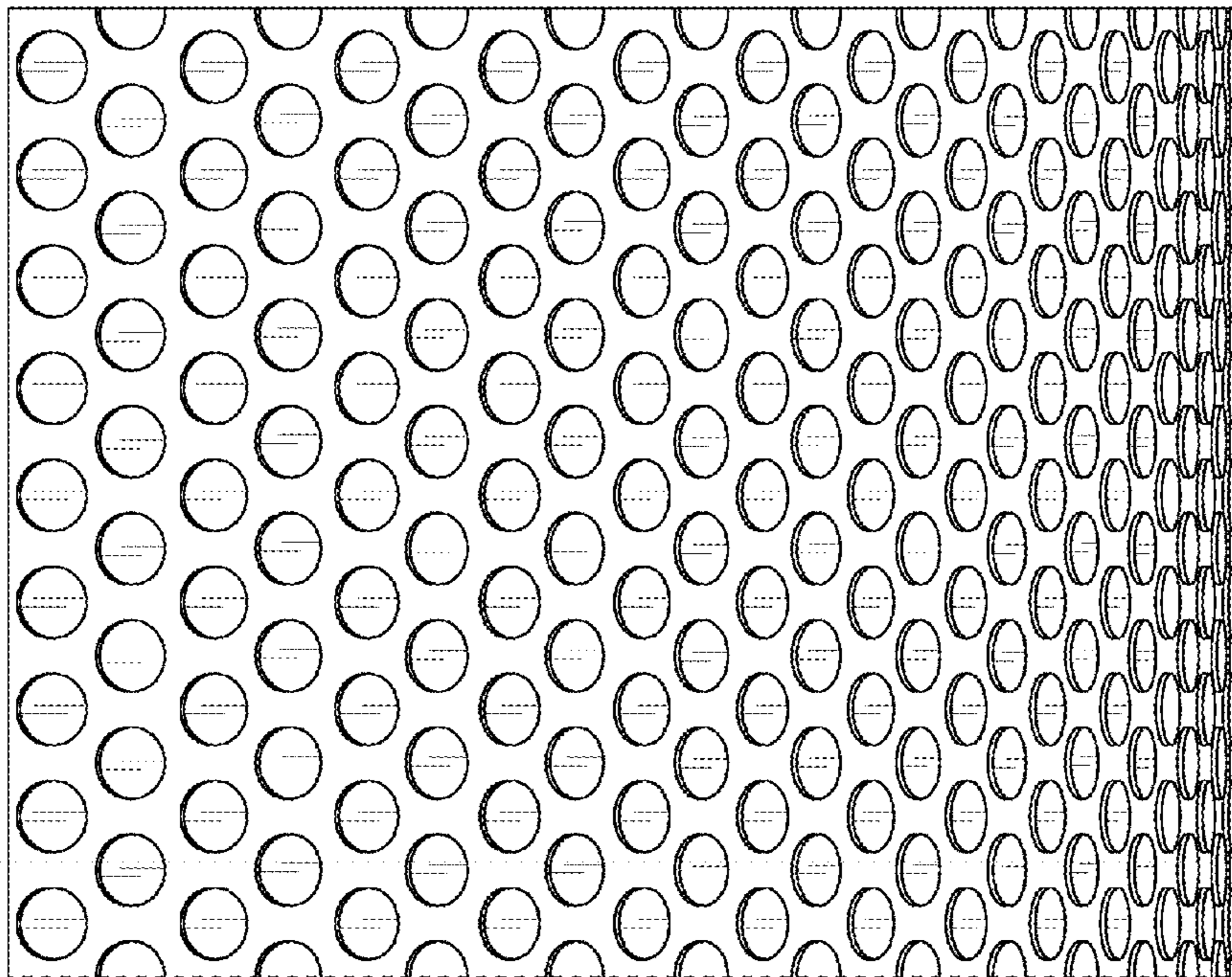
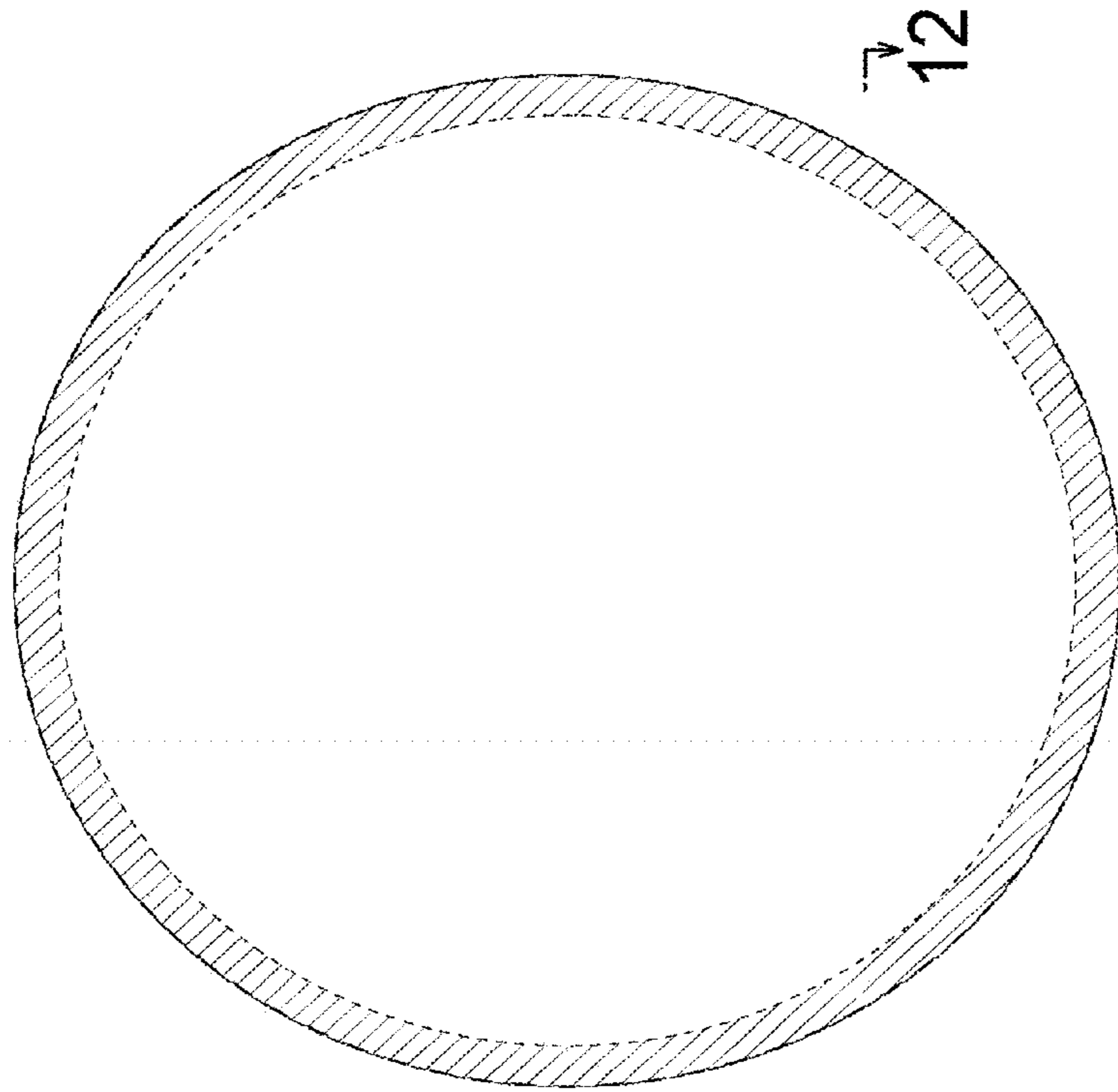


FIG.10



12

12

FIG. 11



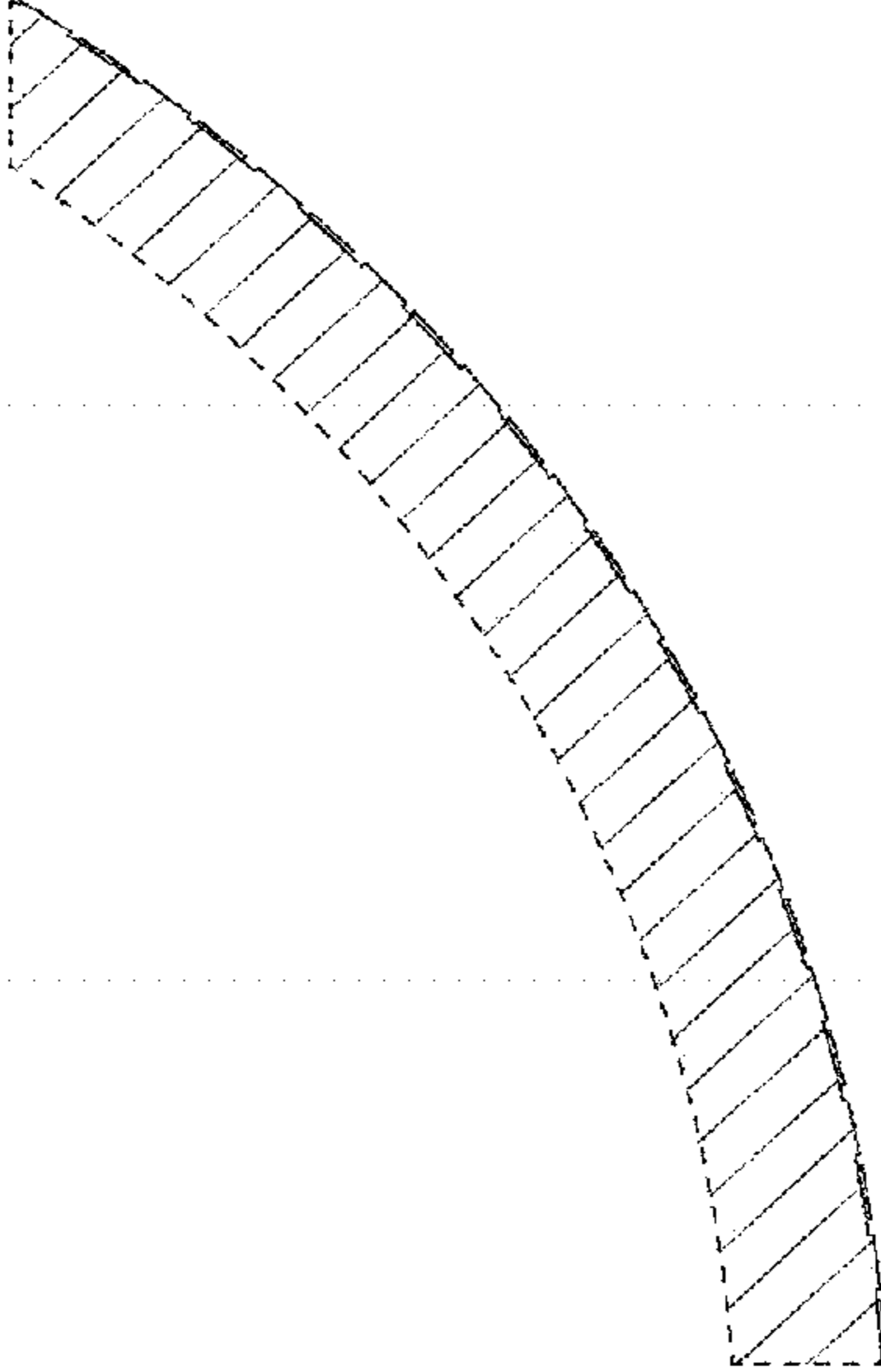


FIG.12