



US00D818093S

(12) **United States Design Patent** (10) **Patent No.:** **US D818,093 S**
Erno et al. (45) **Date of Patent:** **** May 15, 2018**

(54) **HEAT EXCHANGER INCLUDING FURCATING UNIT CELLS**

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

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Related U.S. Application Data

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(51) **LOC (11) Cl.** **23-03**

(52) **U.S. Cl.**
USPC **D23/323; D23/329**

(58) **Field of Classification Search**
USPC D23/314, 329, 322, 323
(Continued)

(56) **References Cited**

U.S. PATENT DOCUMENTS

3,228,464 A 1/1966 Stein et al.
4,915,164 A 4/1990 Harper, Jr.

(Continued)

FOREIGN PATENT DOCUMENTS

CN 102721303 B 4/2014
EP 1777479 A2 4/2007

(Continued)

OTHER PUBLICATIONS

Silva et al., "Constructal multi-scale tree-shaped heat exchangers", Journal of Applied Physics, vol. 96, Issue: 3, 2004.

(Continued)

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(57) **CLAIM**

We claim the ornamental design for a heat exchanger including furcating unit cells, as shown and described.

DESCRIPTION

FIG. 1 is a front view of a heat exchanger showing our new design;

FIG. 2 is a side view of the heat exchanger shown in FIG. 1;

FIG. 3 is a sectional view of the heat exchanger shown in FIG. 1;

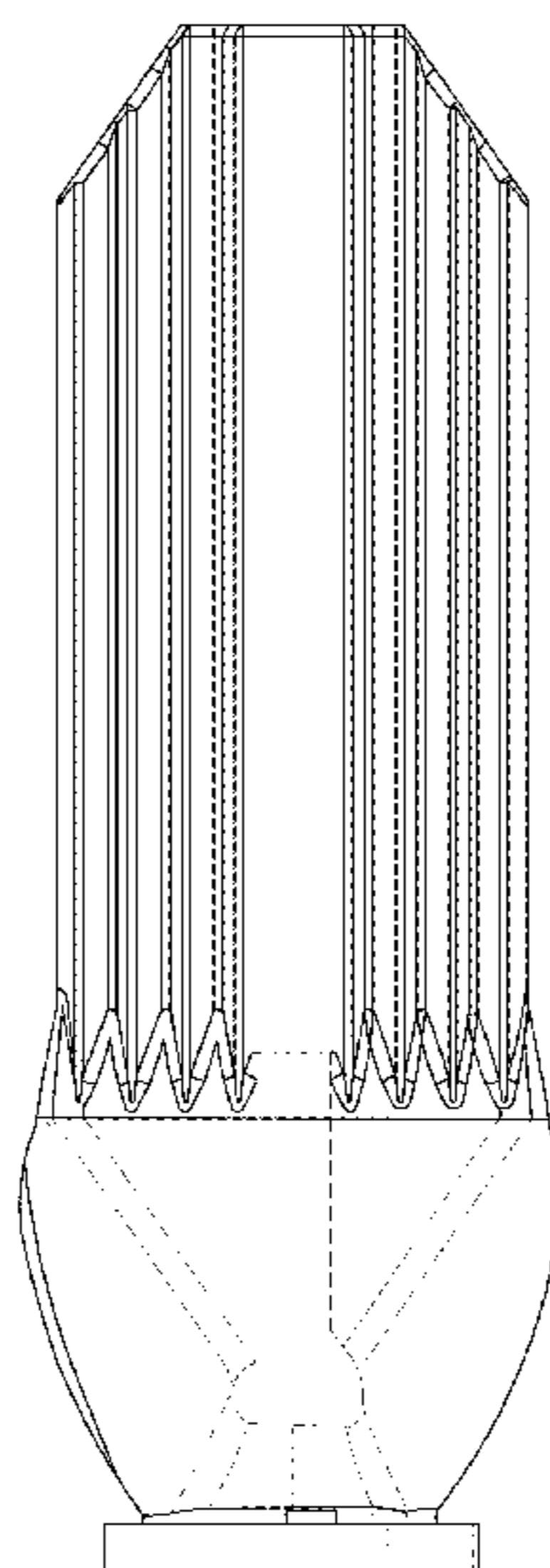
FIG. 4 is an enlarged perspective view of a portion of the heat exchanger shown in FIG. 3;

FIG. 5 is a perspective view of the heat exchanger shown in FIG. 1 with a portion removed to show the interior; and,

FIG. 6 is an enlarged sectional view of a portion of the heat exchanger shown in FIG. 1.

In these drawings, the broken lines illustrate unclaimed environmental features and form no part of the claimed design. In particular, broken lines are used in FIGS. 3-6 to illustrate the interior of the heat exchanger and form no part of the claimed design. In addition, broken lines are used in FIGS. 1 and 2 to illustrate portions of the exterior of the heat exchanger and form no part of the claimed design.

1 Claim, 6 Drawing Sheets



(58) **Field of Classification Search**
 CPC .. F28F 13/06; F28F 7/02; F28F 9/0229; F28F
 13/00; F28F 13/02; F02C 7/14; F28D
 9/00; F28D 9/0012; F28D 9/02
 See application file for complete search history.

2013/0292103	A1*	11/2013	Eindhoven	F28B 1/06 165/173
2014/0014493	A1	1/2014	Ryan	
2014/0251585	A1	9/2014	Kusuda et al.	
2016/0202003	A1*	7/2016	Gerstler	F02C 7/14 165/165

(56) **References Cited**

U.S. PATENT DOCUMENTS

5,941,303	A	8/1999	Gowan et al.	
7,069,980	B2	7/2006	Hofbauer	
7,866,377	B2	1/2011	Slaughter	
7,871,578	B2	1/2011	Schmidt	
8,015,832	B2	9/2011	Setoguchi et al.	
8,235,101	B2	8/2012	Taras et al.	
8,794,820	B2	8/2014	Mathys et al.	
9,134,072	B2	9/2015	Roisin et al.	
2004/0125691	A1*	7/2004	Streiff	B01F 5/0616 366/337
2008/0149299	A1	6/2008	Slaughter	
2013/0139541	A1	6/2013	Seybold et al.	
2013/0206374	A1	8/2013	Roisin et al.	
2013/0276469	A1	10/2013	Dryzun	

FOREIGN PATENT DOCUMENTS

EP	1837616	A2	9/2007
GB	2310896	A	9/1997
WO	3192788	A1	12/2001
WO	2011115883	A2	9/2011
WO	2014105113	A1	7/2014

OTHER PUBLICATIONS

Kim et al., "Two-phase flow distribution of air—water annular flow in a parallel flow heat exchanger", International Journal of Multiphase Flow, vol. 32, Issue: 12, pp. 1340-1353, Dec. 2006.
 International Search Report and Written Opinion, dated Jan. 22, 2016, for International Application No. PCT/US2015/054115.

* cited by examiner

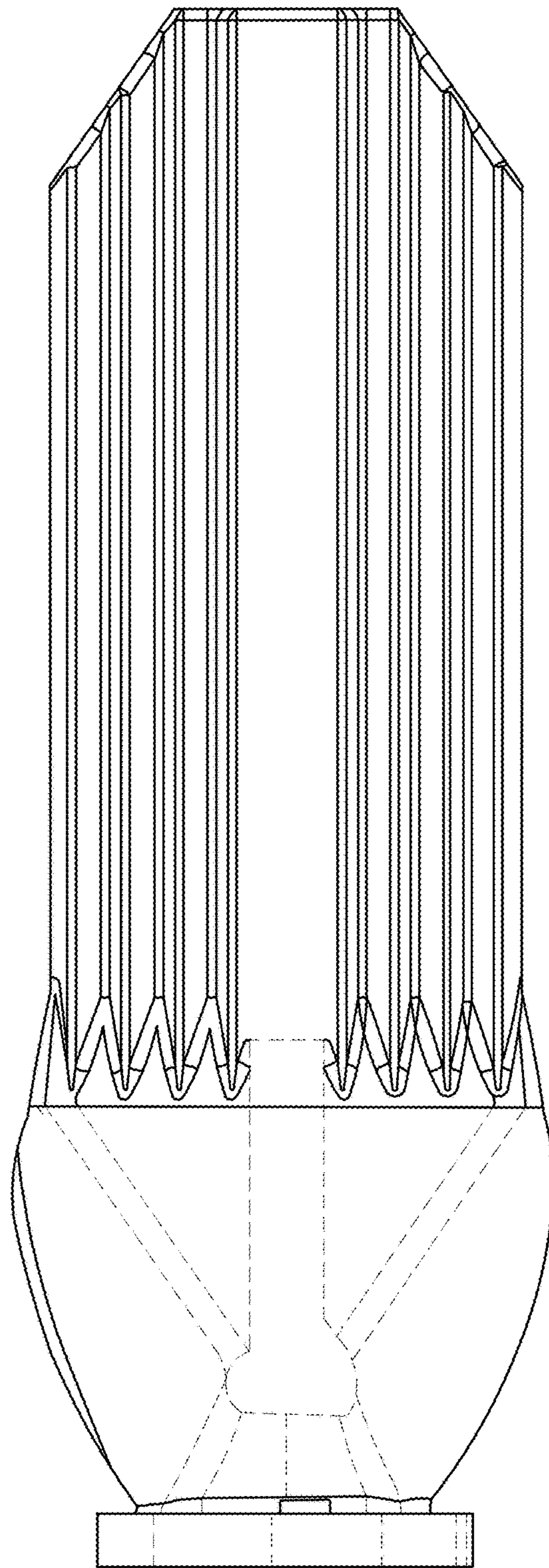


FIG. 1

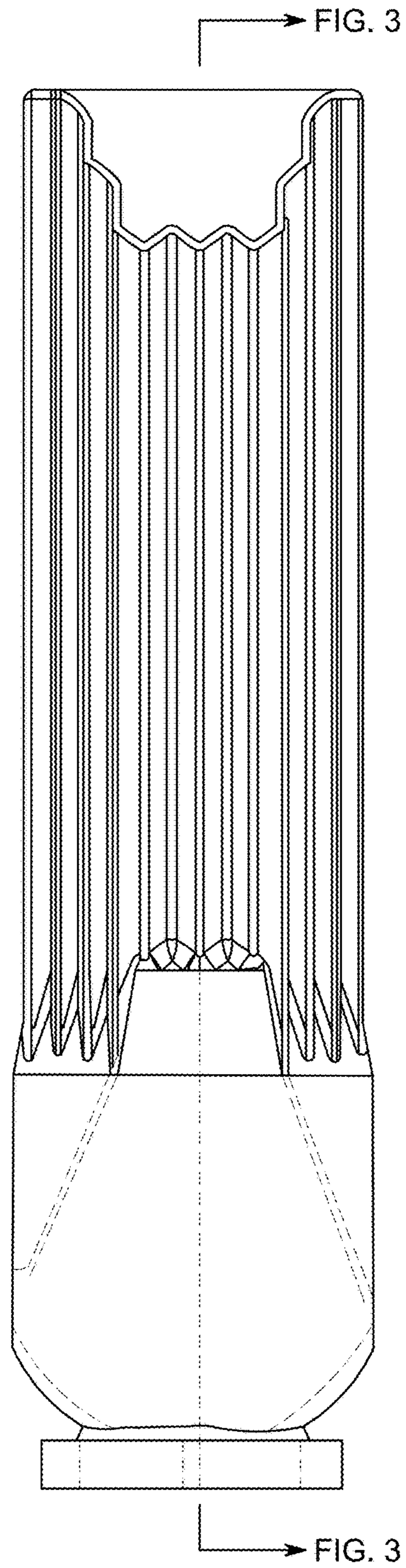


FIG. 2

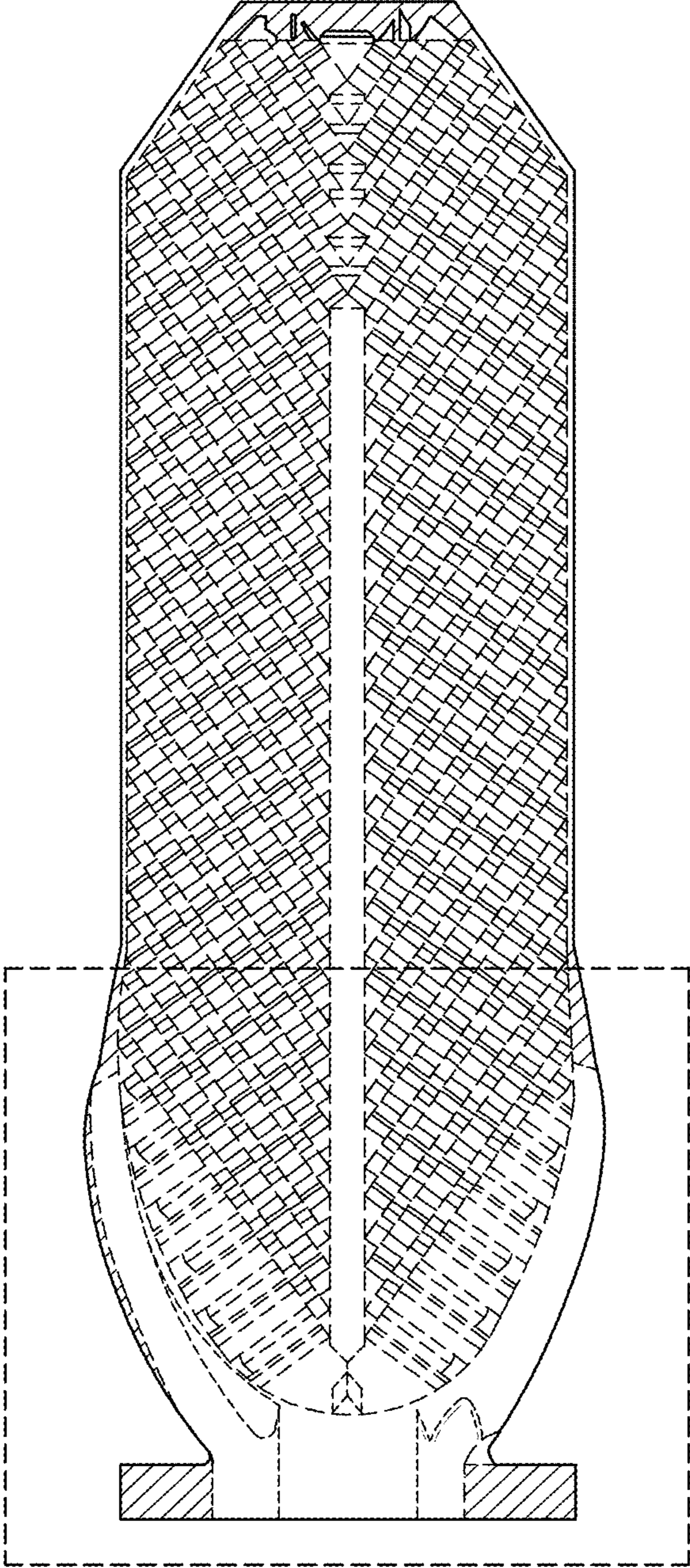


FIG. 4

FIG. 3

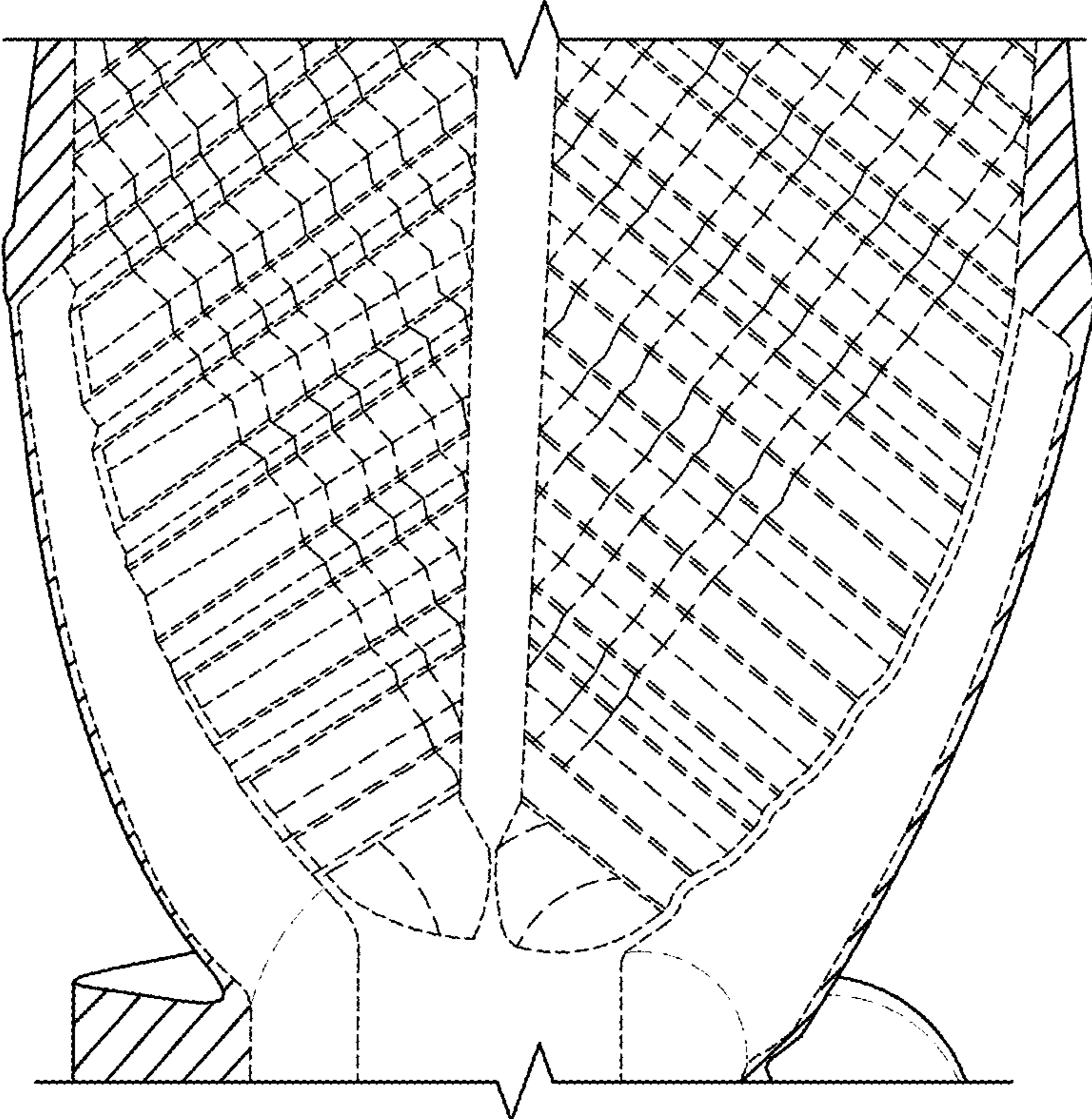


FIG. 4

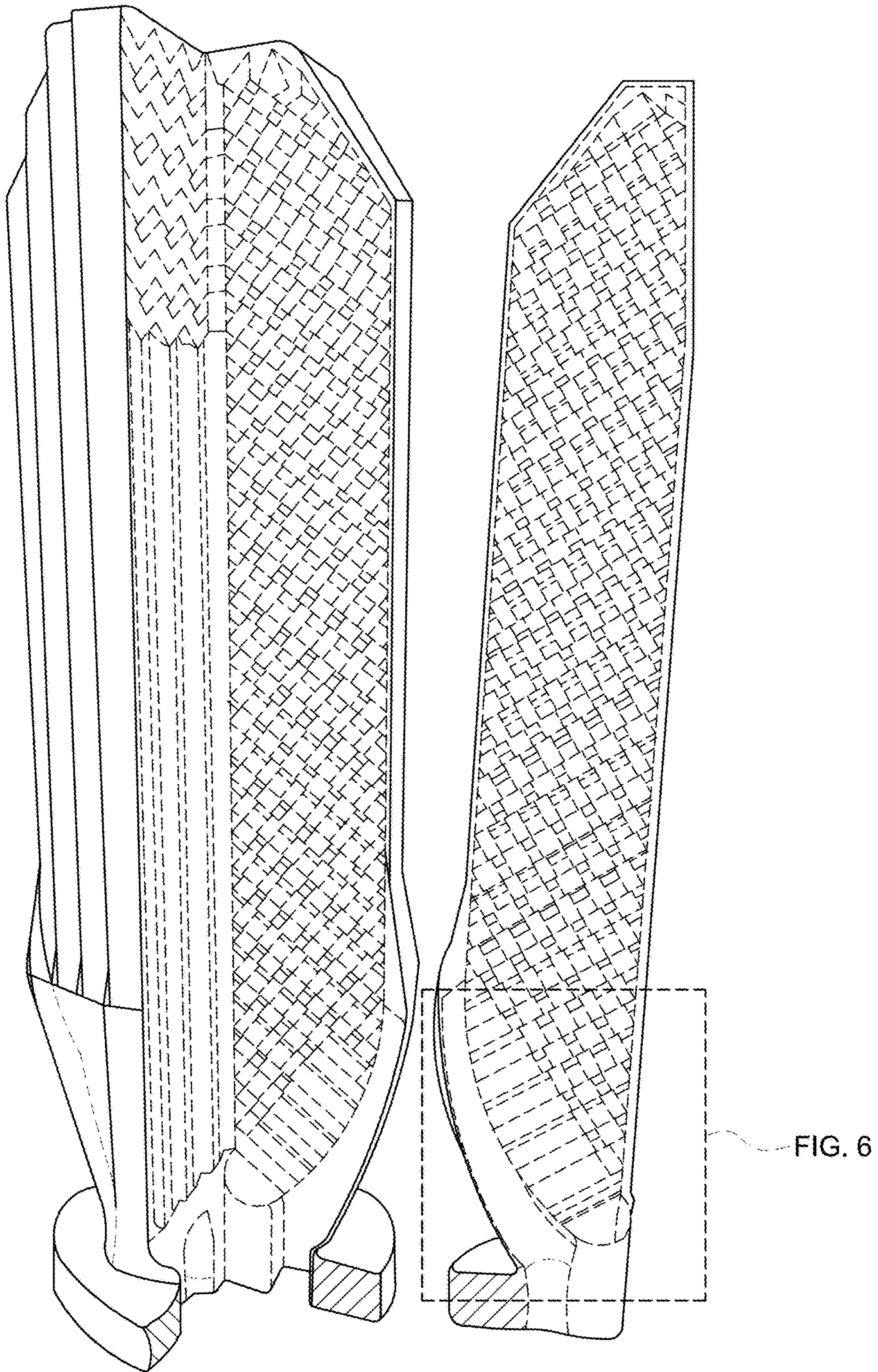


FIG. 5

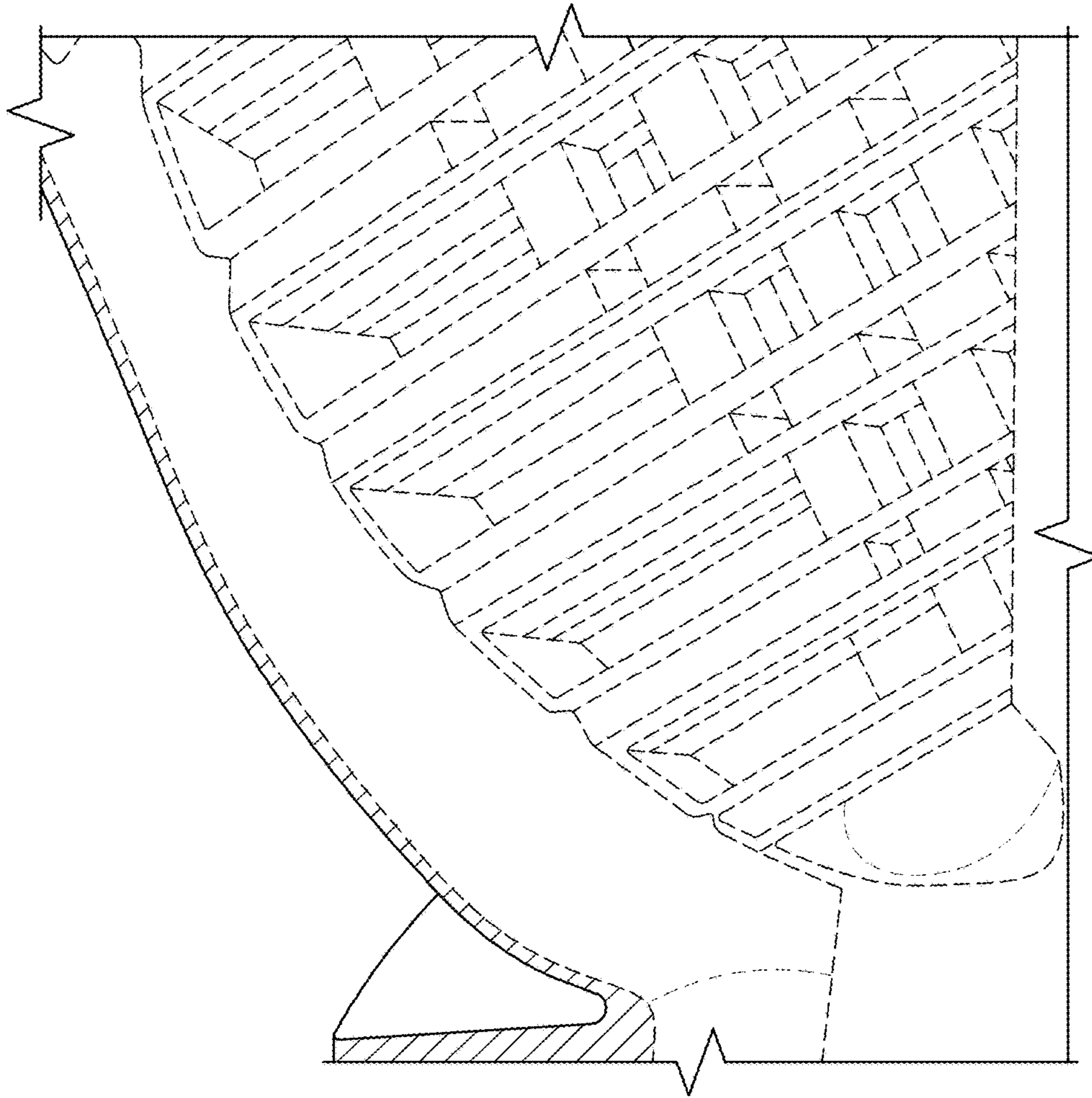


FIG. 6