US00D958763S

(12) United States Design Patent

Satoh et al.

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(45) Date of Patent: ** Jul. 26, 2022

(54) **PIEZOELECTRIC ELEMENT**

(71) Applicant: **TDK CORPORATION**, Tokyo (JP)

(72) Inventors: **Akira Satoh**, Tokyo (JP); **Kaoru Kijima**, Tokyo (JP)

(73) Assignee: **TDK CORPORATION**, Tokyo (JP)

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

(21) Appl. No.: **29/713,826**

(22) Filed: **Nov. 19, 2019**

(30) **Foreign Application Priority Data**

May 20, 2019 (JP) 2019-010843
May 20, 2019 (JP) 2019-010844
May 20, 2019 (JP) 2019-010845

(51) **LOC (13) Cl.** **13-03**

(52) **U.S. Cl.**
USPC **D13/182**

(58) **Field of Classification Search**
USPC D13/101, 110, 118, 121, 123, 133, 179, D13/182, 184, 199; D14/432, 433, 435, D14/438, 299; D10/75, 80
(Continued)

(56) **References Cited**

U.S. PATENT DOCUMENTS

5,525,813 A * 6/1996 Miyake H01L 29/78696 257/292
D489,319 S * 5/2004 Mansson D13/101
(Continued)

Primary Examiner — Derrick E Holland
(74) *Attorney, Agent, or Firm* — Oliff PLC

(57) **CLAIM**

The ornamental design for a piezoelectric element, as shown and described.

DESCRIPTION

FIG. **1** is a front view of the a piezoelectric element showing our new design;

FIG. **2** is a rear view thereof;
FIG. **3** is a top plan view thereof;
FIG. **4** is a bottom view thereof;
FIG. **5** is a right side view thereof;
FIG. **6** is a left side view thereof;
FIG. **7** is a perspective view thereof;
FIG. **8** is an enlarged view showing a portion of FIG. **3** defined by the lines **8-8**;
FIG. **9** is an enlarged view showing a portion of FIG. **3** defined by the line **9-9**;
FIG. **10** is an enlarged view showing a portion of FIG. **4** defined by the line **10-10**;
FIG. **11** is an enlarged view showing a portion of FIG. **4** defined by the line **11-11**;
FIG. **12** is an enlarged view showing a portion of FIG. **5** defined by the line **12-12**;
FIG. **13** is an enlarged view showing a portion of FIG. **6** defined by the line **13-13**;
FIG. **14** is an enlarged sectional view taken along the line **14-14** in FIG. **1** defined by the line **1401-1401**;
FIG. **15** is an enlarged sectional view taken along the line **15-15** in FIG. **1** defined by the line **1501-1501**;
FIG. **16** is an enlarged sectional view taken along the line **16-16** in FIG. **1** defined by the line **1601-1601**;
FIG. **17** is a front view of a second embodiment of a piezoelectric element showing our new design;
FIG. **18** is a rear view thereof;
FIG. **19** is a top plan view thereof;
FIG. **20** is a bottom view thereof;
FIG. **21** is a right side view thereof;
FIG. **22** is a left side view thereof;
FIG. **23** is a perspective view thereof;
FIG. **24** is an enlarged view showing a portion of FIG. **19** defined by the lines **24-24**;
FIG. **25** is an enlarged view showing a portion of FIG. **19** defined by the lines **25-25**;
FIG. **26** is an enlarged view showing a portion of FIG. **20** defined by the line **26-26**;
FIG. **27** is an enlarged view showing a portion of FIG. **20** defined by the line **27-27**;
FIG. **28** is an enlarged view showing a portion of FIG. **21** defined by the line **28-28**;
(Continued)

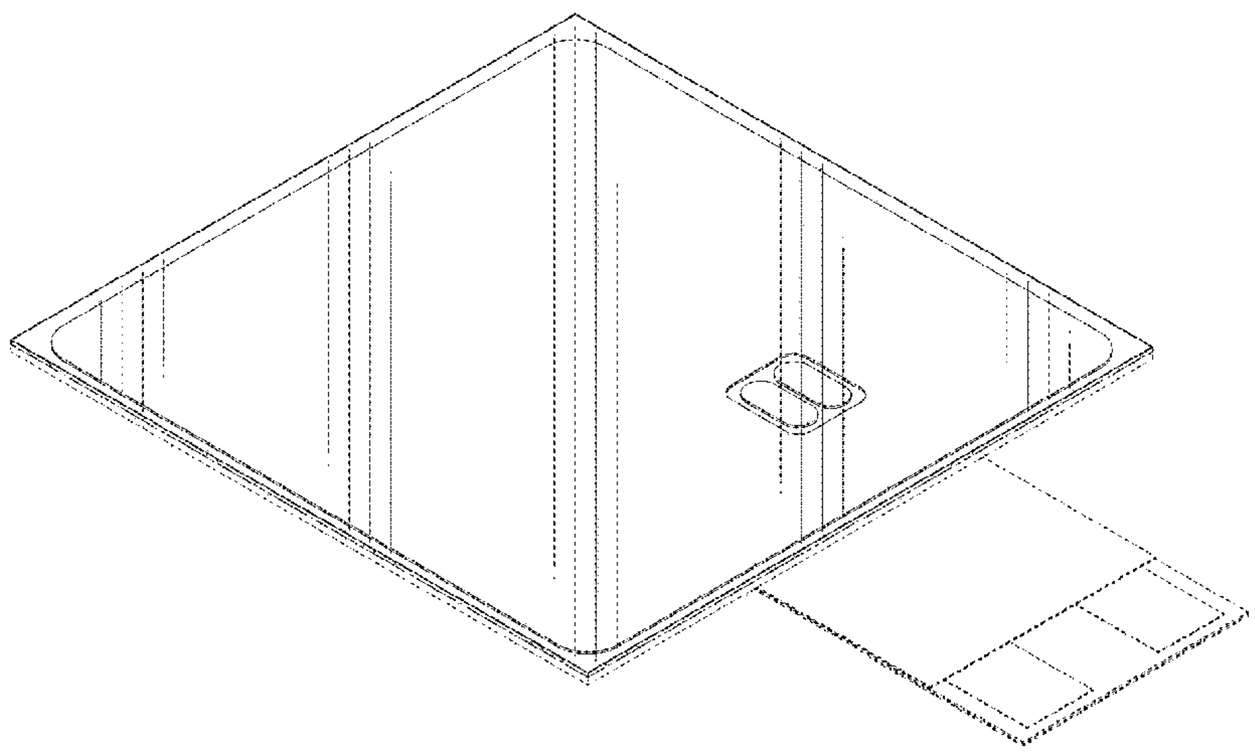


FIG. **29** is an enlarged view showing a portion of FIG. **22** defined by the line **29-29**;
FIG. **30** is an enlarged sectional view taken along the line **30-30** in FIG. **17** defined by the line **3001-3001**;
FIG. **31** is an enlarged sectional view taken along the line **31-31** in FIG. **17** defined by the line **3101-3101**;
FIG. **32** is an enlarged sectional view taken along the line **32-32** in FIG. **17** defined by the line **3201-3201**;
FIG. **33** is a front view of a third embodiment of a piezoelectric element showing our new design;
FIG. **34** is a rear view thereof;
FIG. **35** is a top plan view thereof;
FIG. **36** is a bottom view thereof;
FIG. **37** is a right side view thereof;
FIG. **38** is a left side view thereof;
FIG. **39** is a perspective view thereof;
FIG. **40** is an enlarged view showing a portion of FIG. **35** defined by the lines **40-40**;
FIG. **41** is an enlarged view showing a portion of FIG. **35** defined by the lines **41-41**;
FIG. **42** is an enlarged view showing a portion of FIG. **36** defined by the line **42-42**;
FIG. **43** is an enlarged view showing a portion of FIG. **36** defined by the line **43-43**;
FIG. **44** is an enlarged view showing a portion of FIG. **37** defined by the line **44-44**;
FIG. **45** is an enlarged view showing a portion of FIG. **38** defined by the line **45-45**;
FIG. **46** is an enlarged sectional view taken along the line **46-46** in FIG. **33** defined by the line **4601-4601**;
FIG. **47** is an enlarged sectional view taken along the line **47-47** in FIG. **33** defined by the line **4701-4701**; and,
FIG. **48** is an enlarged sectional view taken along the line **48-48** in FIG. **33** defined by the line **4801-4801**.

The broken lines shown represent the portions of the piezoelectric element that form no part of the claimed design. The dot-dash broken lines shown define the bounds of the claimed design and form no part thereof.

1 Claim, 48 Drawing Sheets

(58) **Field of Classification Search**
CPC H03H 9/02; H03H 9/21; H03H 9/0547; H03H 9/1021; H03H 9/215; H03H 2003/022; H03H 2003/0485; H01L 2224/48091; H01L 2224/73265; H01L 41/047; H01L 41/0471; H01L 41/0838; H05K 7/005; H05K 7/026; H05K 7/02; H05K 7/04; H05K 7/10
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

D604,693	S *	11/2009	Sugawara	D13/101
D678,834	S *	3/2013	Sakamoto	D13/101
D838,302	S *	1/2019	Kijima	D15/147
D857,020	S *	8/2019	Ohta	D13/182
2012/0248940	A1 *	10/2012	Ariji	H03H 9/1035 156/64
2014/0292437	A1 *	10/2014	Tanaka	H03H 9/19 331/158
2015/0155470	A1 *	6/2015	Mori	H01L 41/0973 310/326
2017/0288126	A1 *	10/2017	Uetani	H01L 41/0838
2019/0044053	A1 *	2/2019	Hamada	H01L 41/0838

* cited by examiner

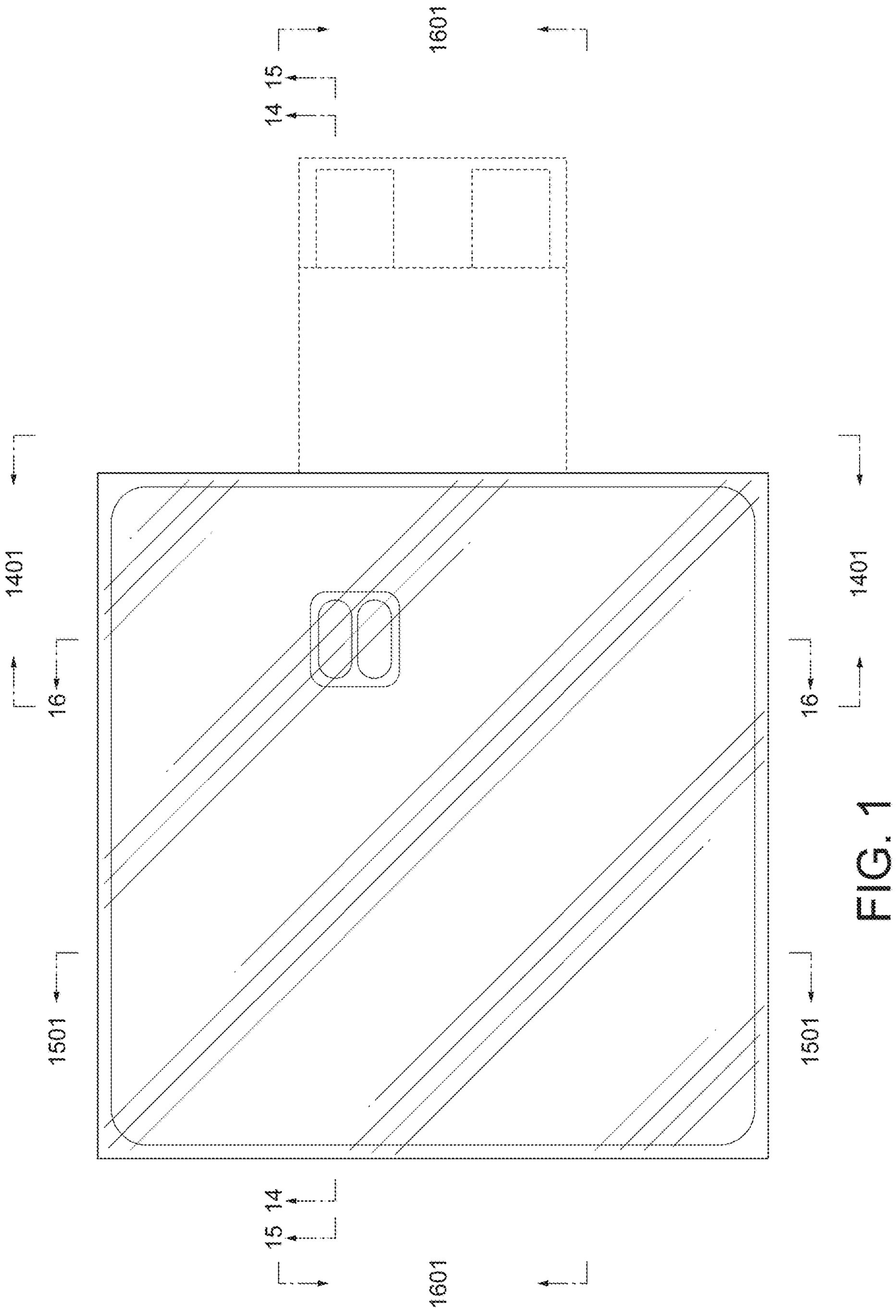


FIG. 1

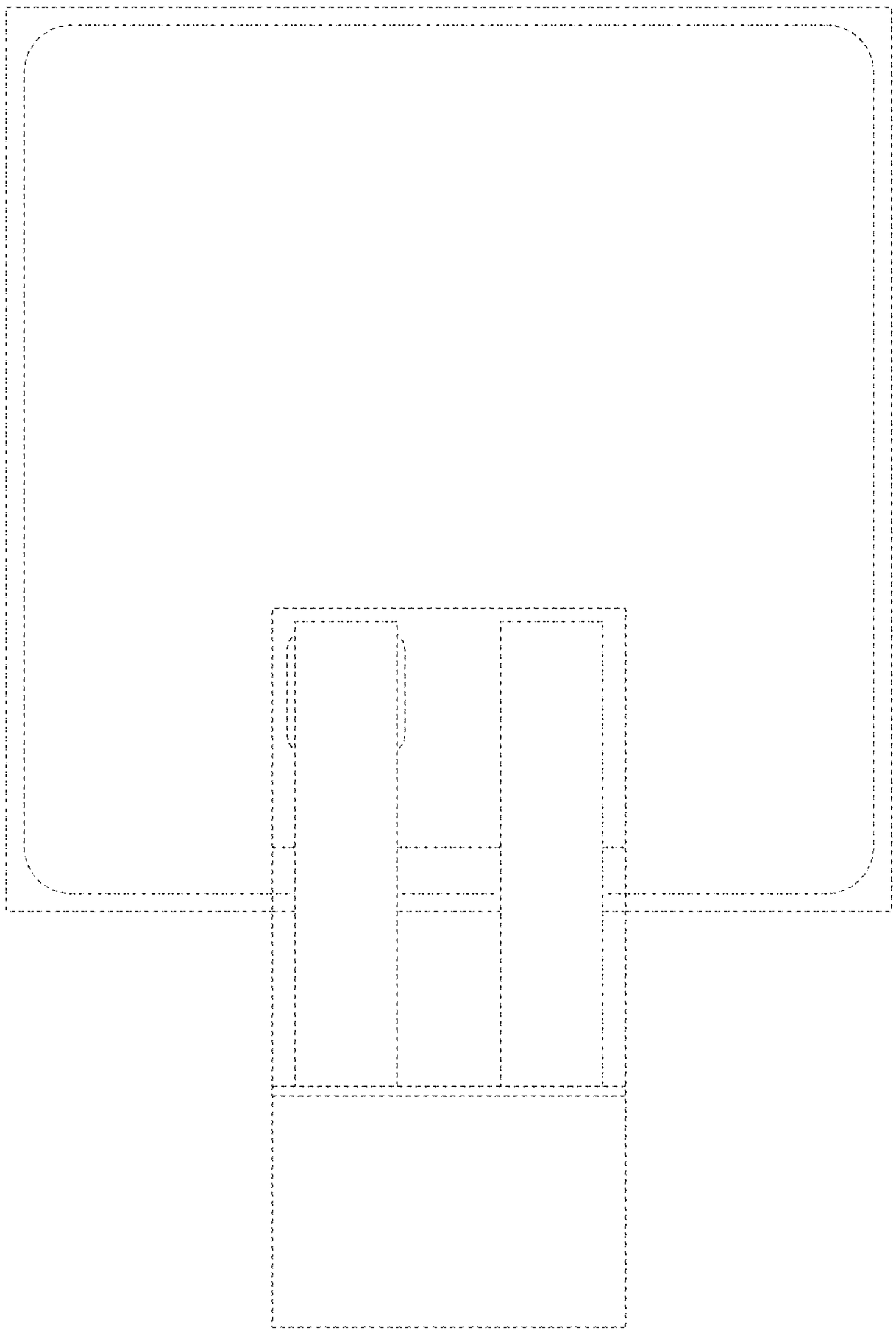


FIG. 2

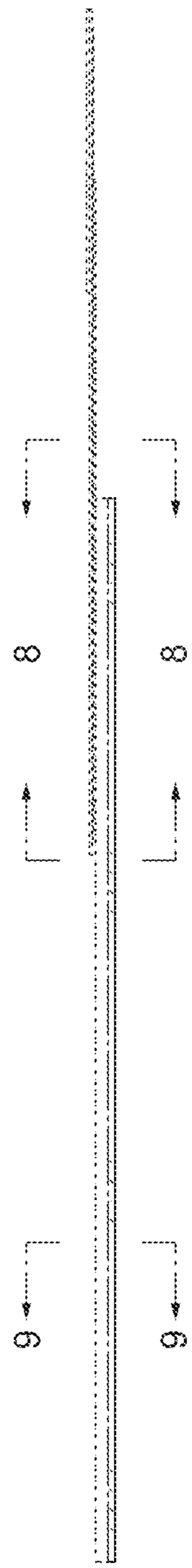


FIG. 3

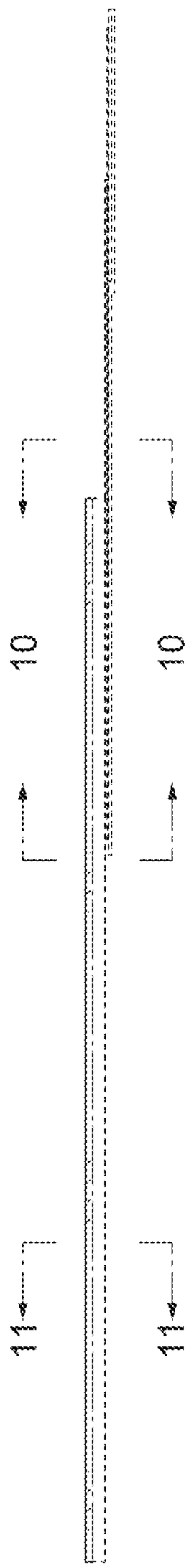


FIG. 4

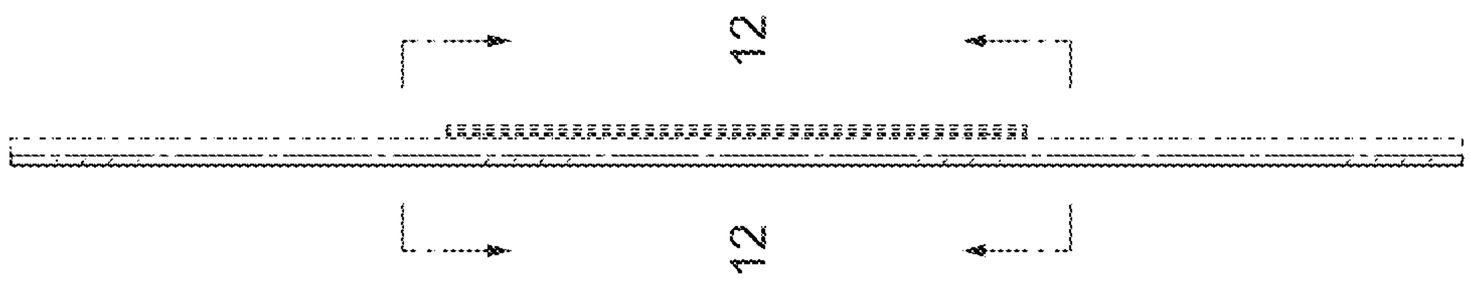


FIG. 5

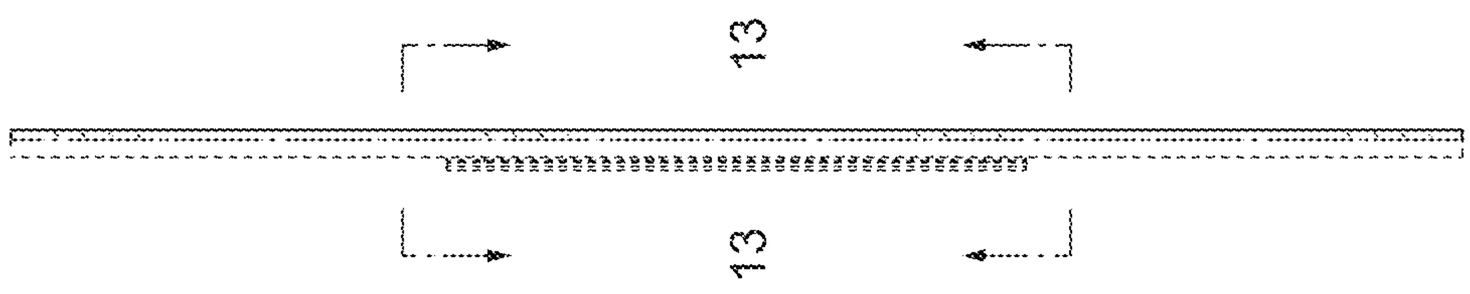


FIG. 6

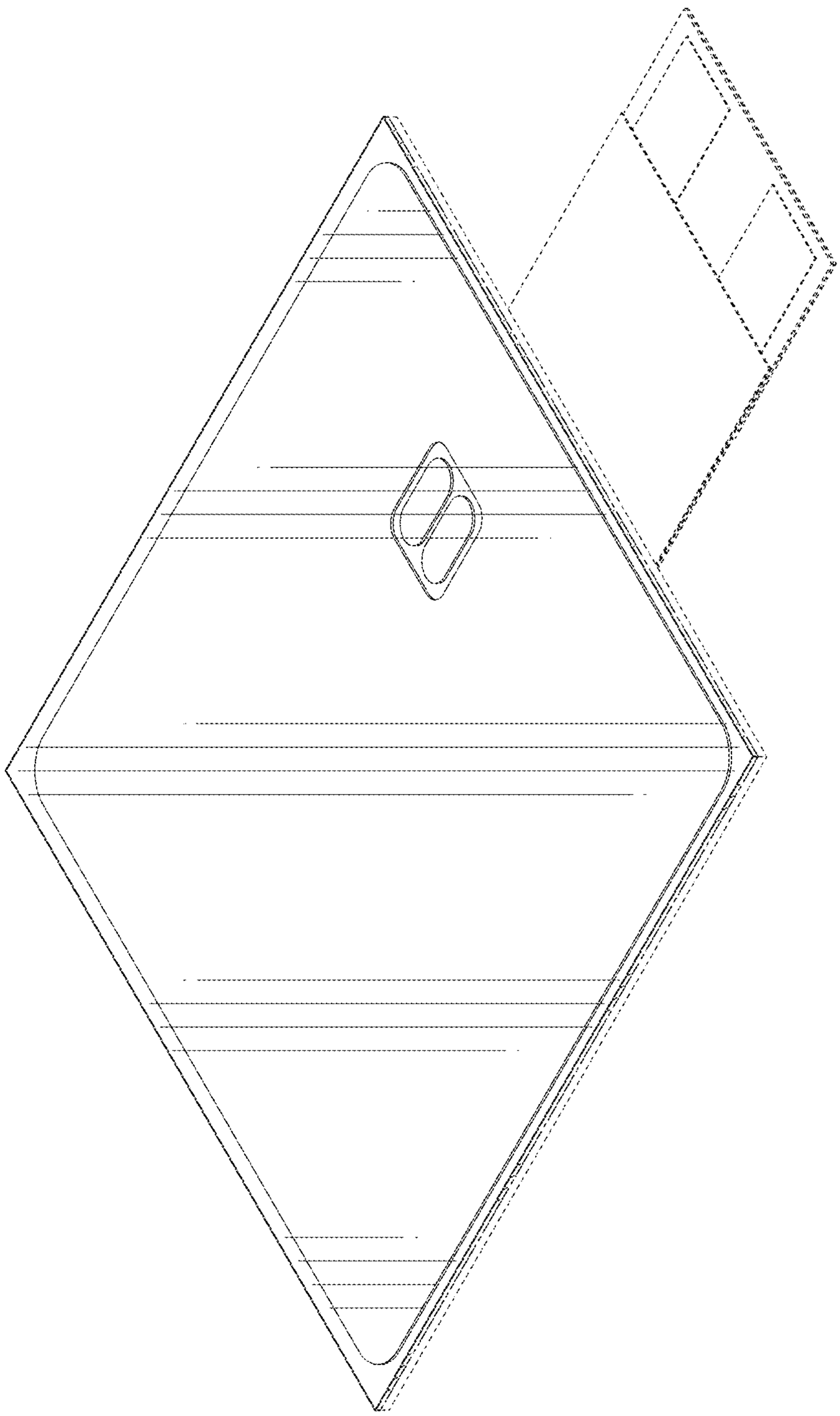


FIG. 7

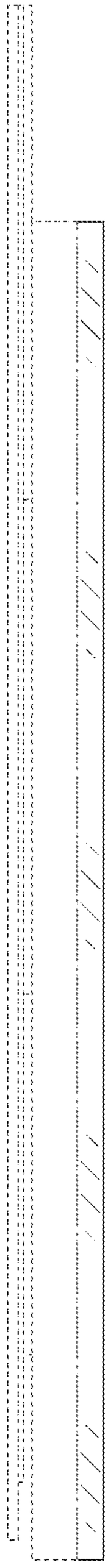


FIG. 8

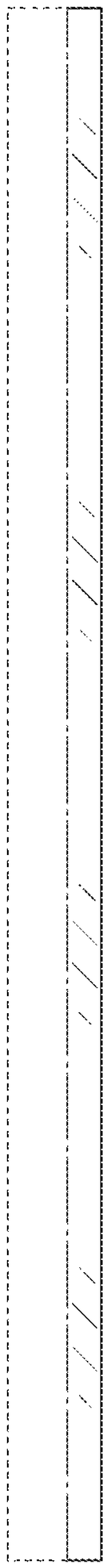


FIG. 6

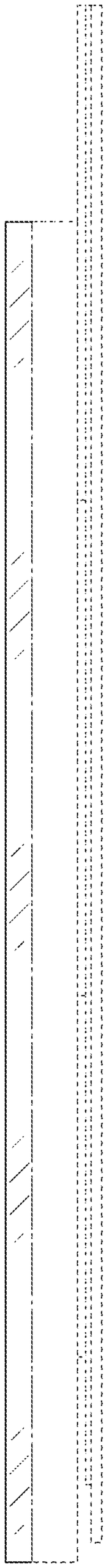


FIG. 10

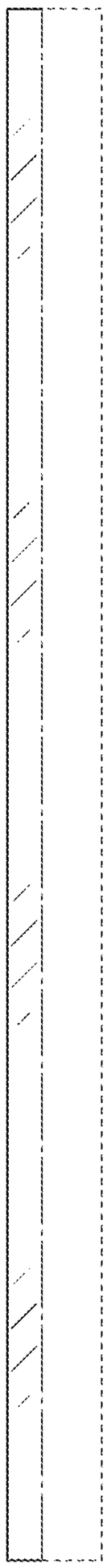


FIG. 11

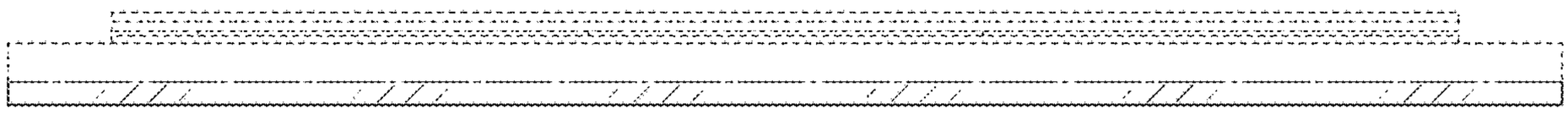


FIG. 12

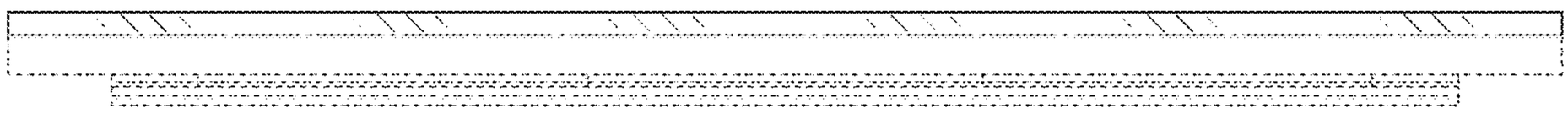


FIG. 13

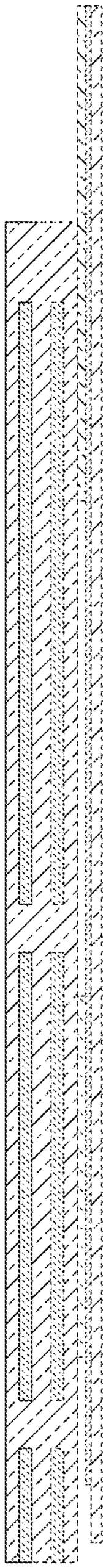


FIG. 14

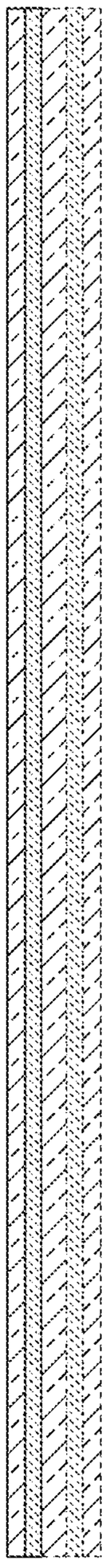


FIG. 15

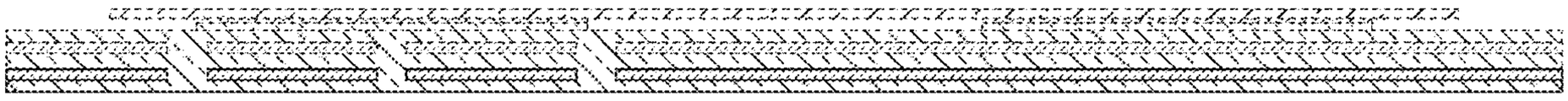


FIG. 16

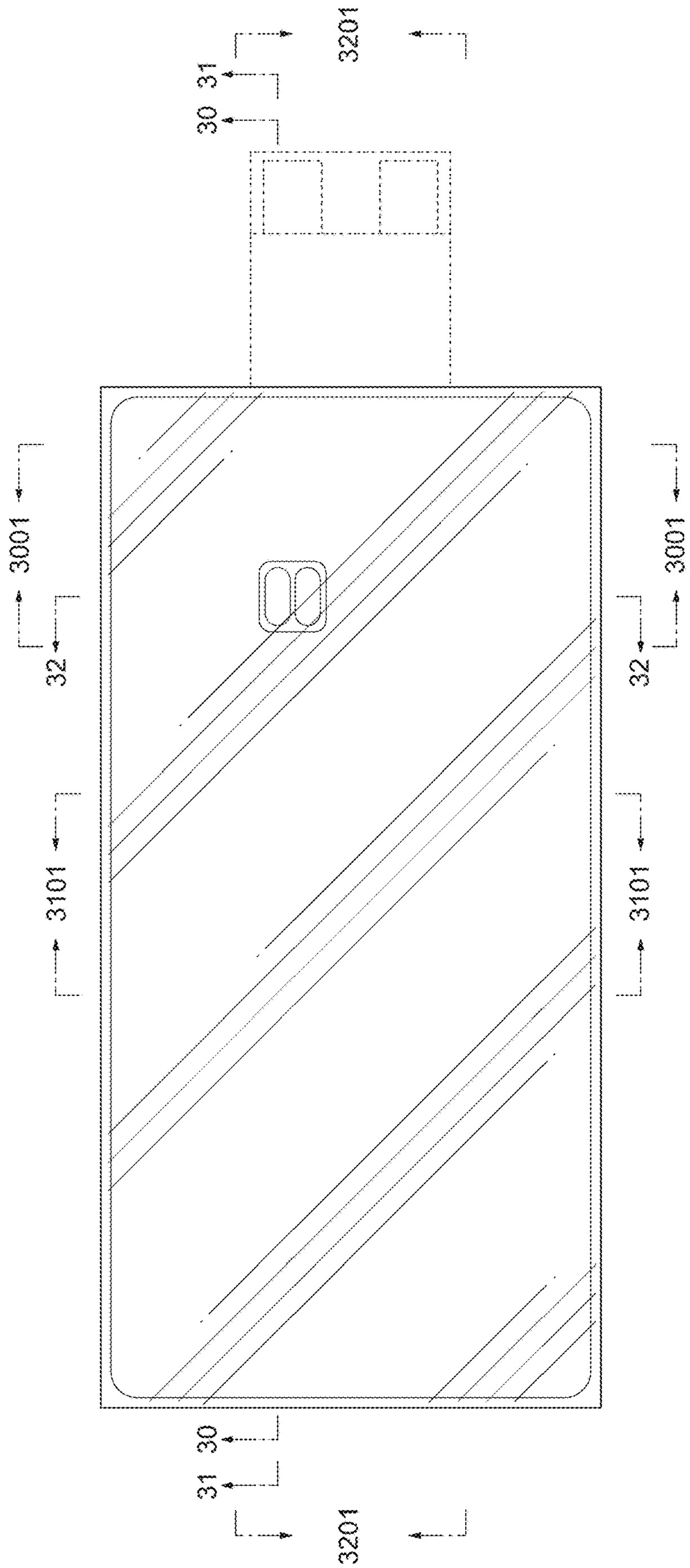


FIG. 17

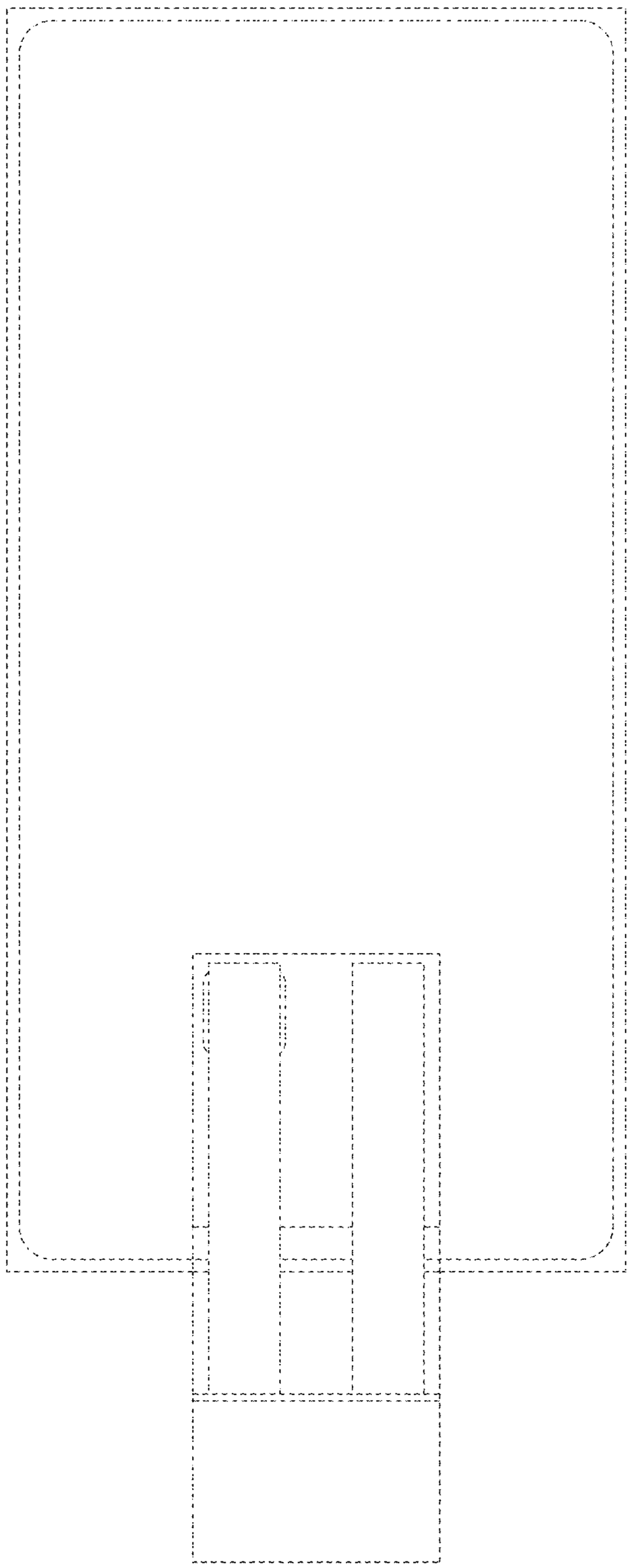


FIG. 18

FIG. 19

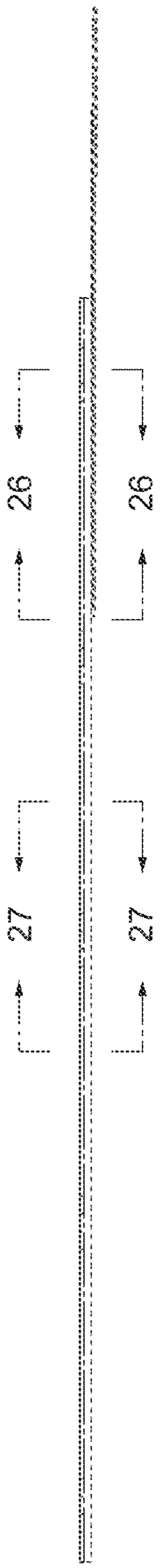


FIG. 20

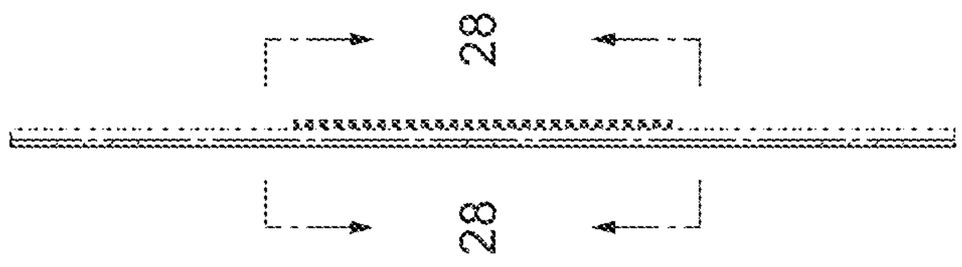


FIG. 21

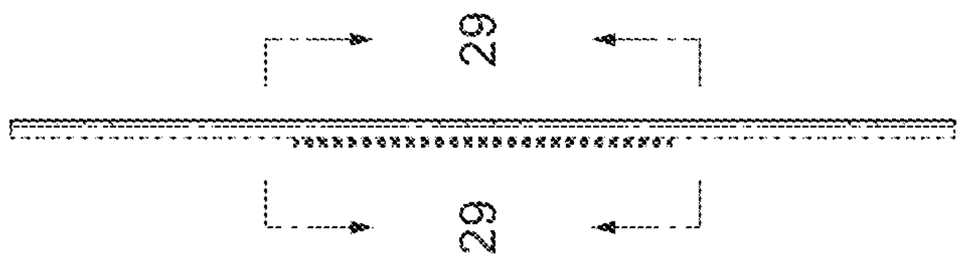


FIG. 22

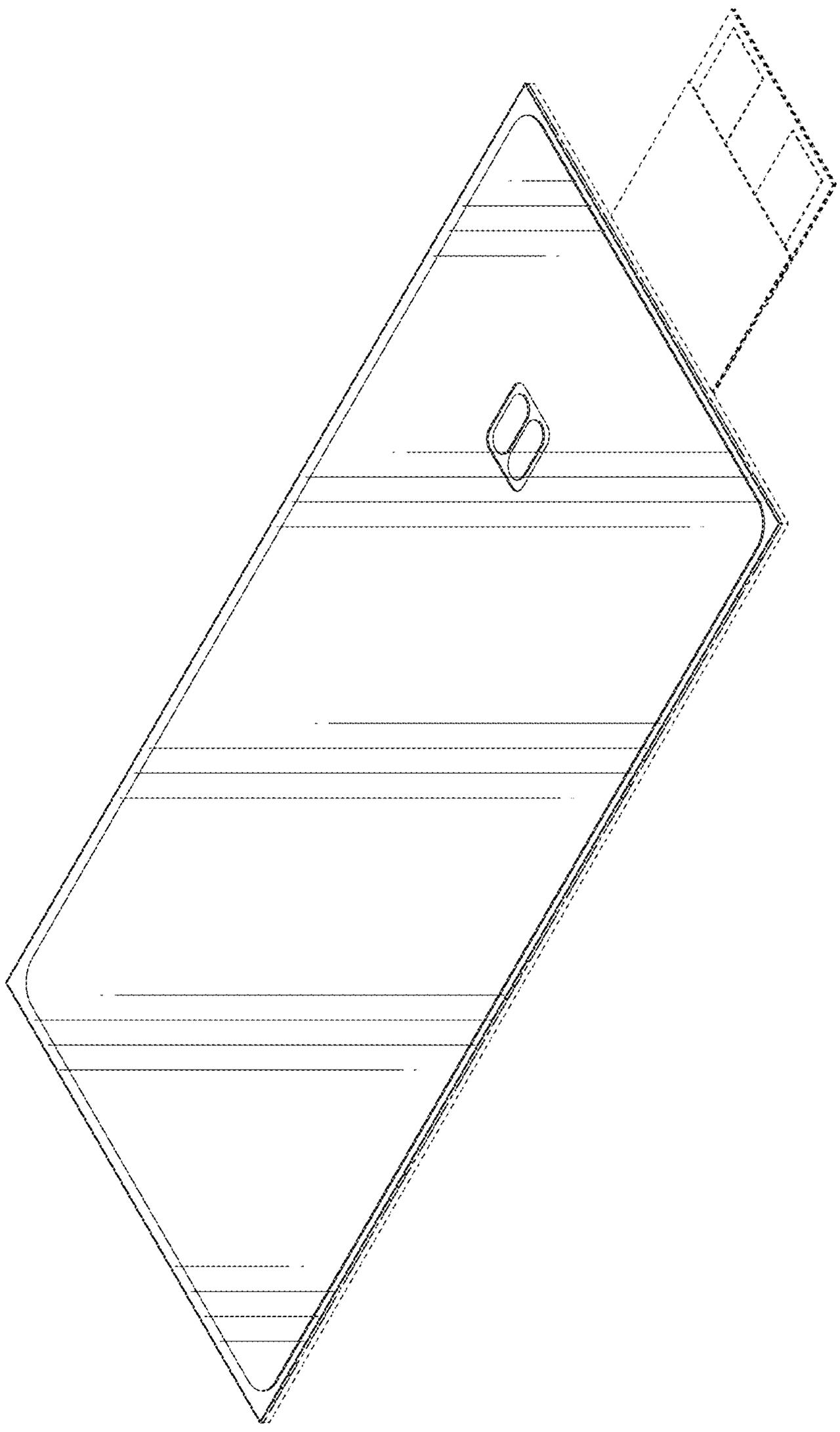


FIG. 23

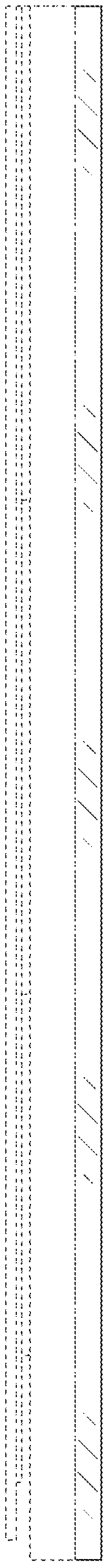


FIG. 24

FIG. 25

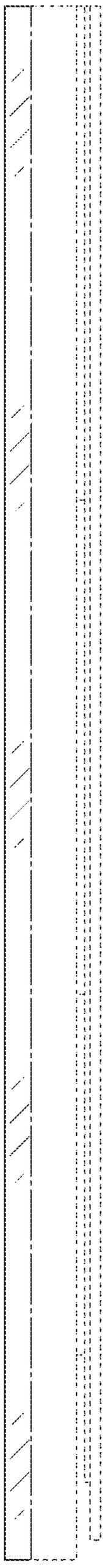


FIG. 26

FIG. 27

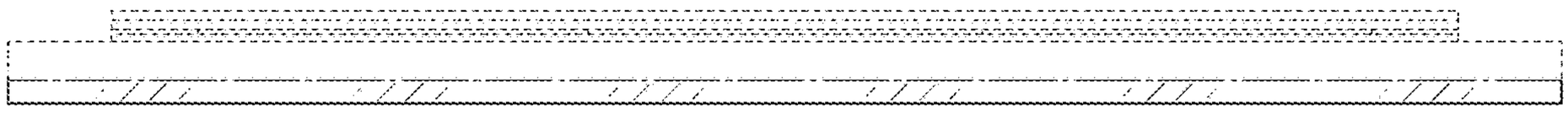


FIG. 28

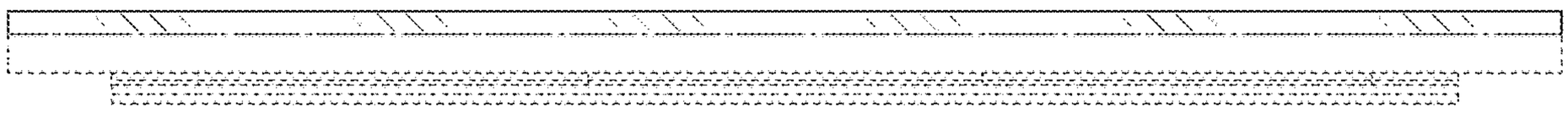
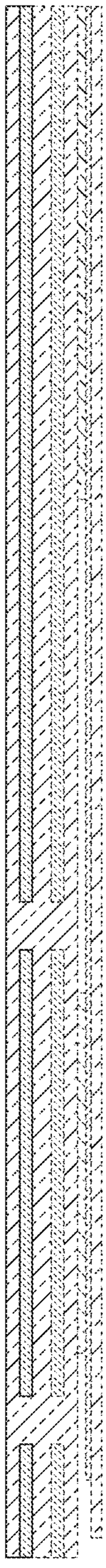


FIG. 29



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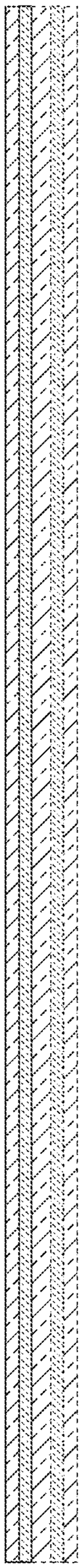
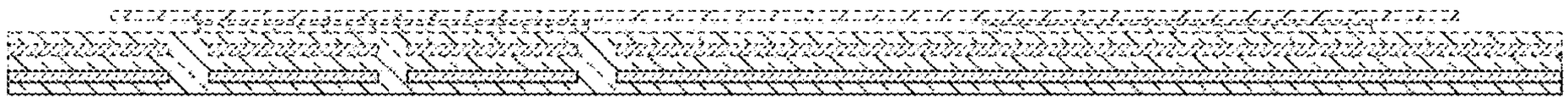


FIG. 31



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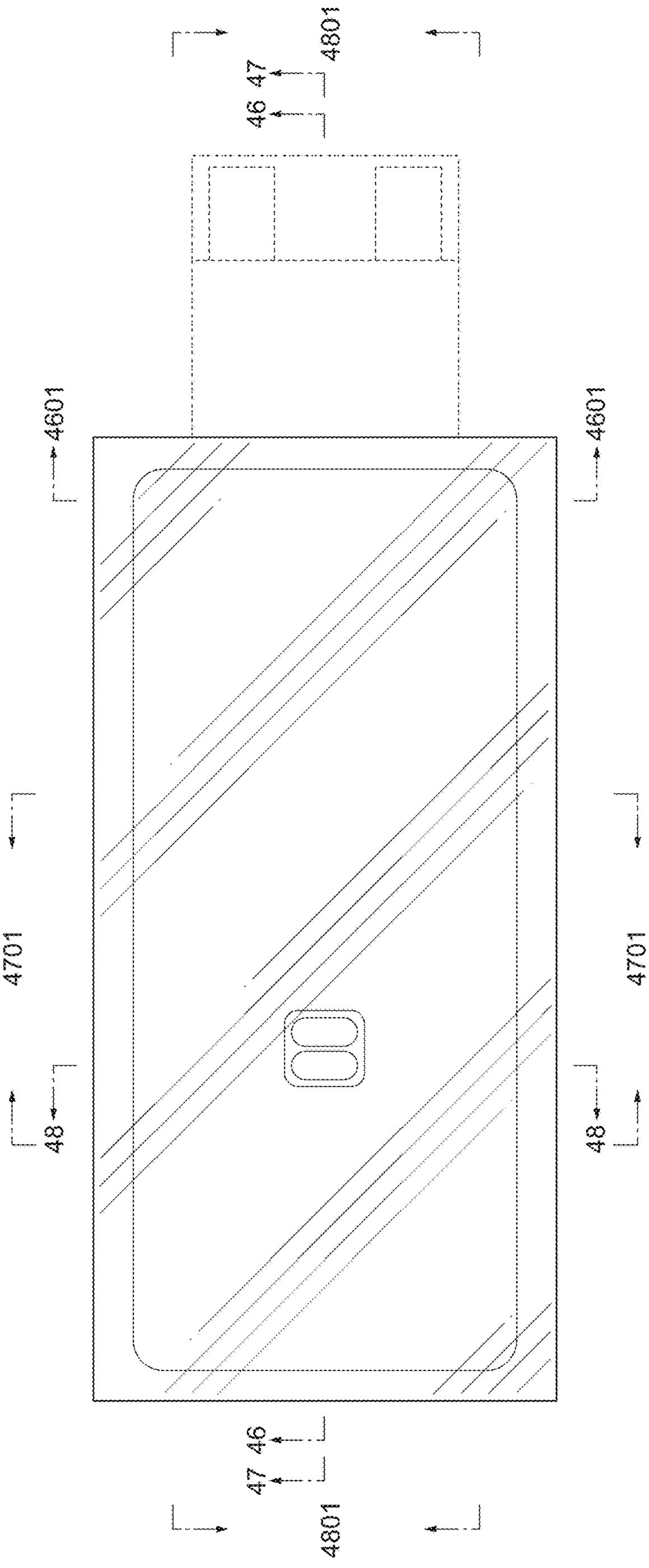


FIG. 33

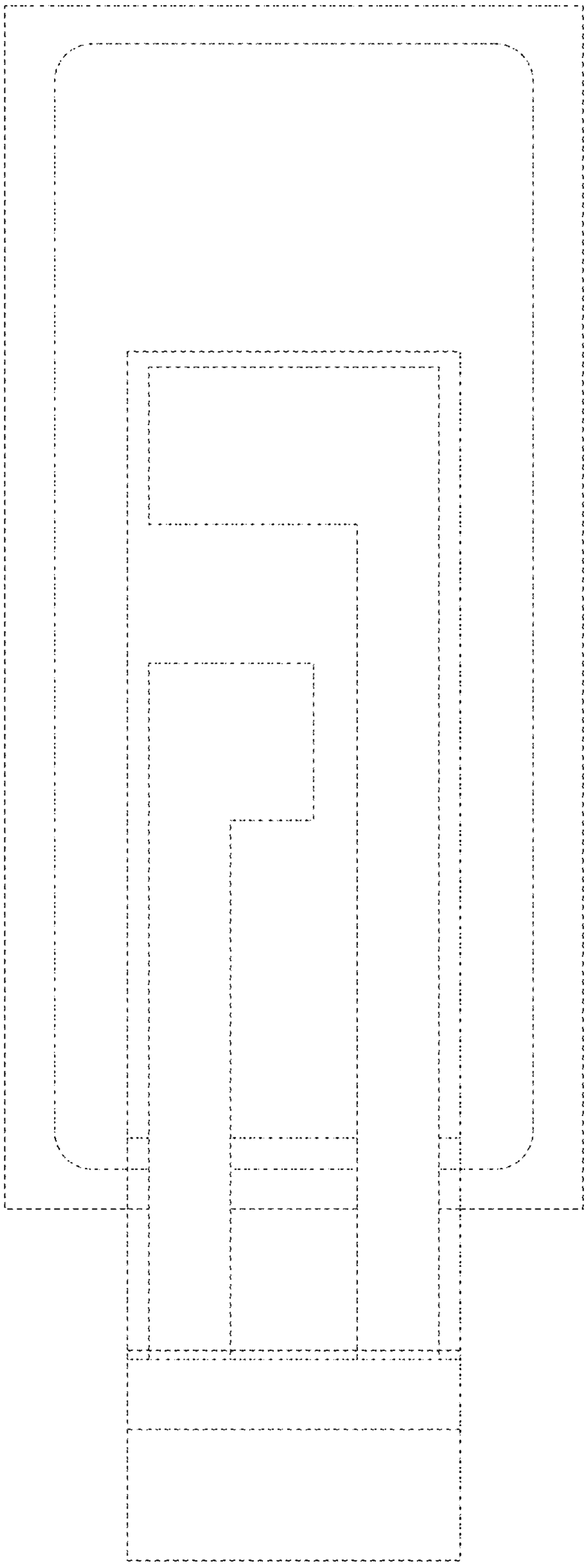
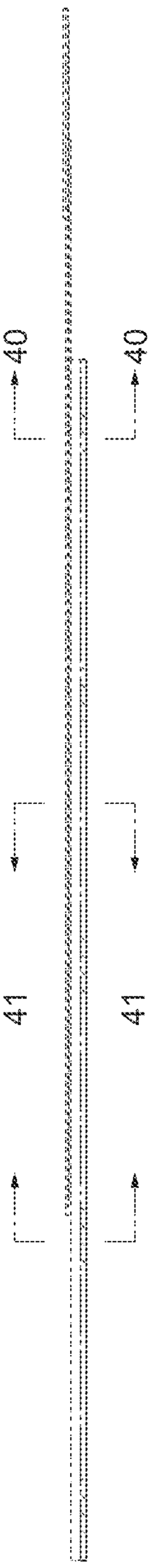


FIG. 34



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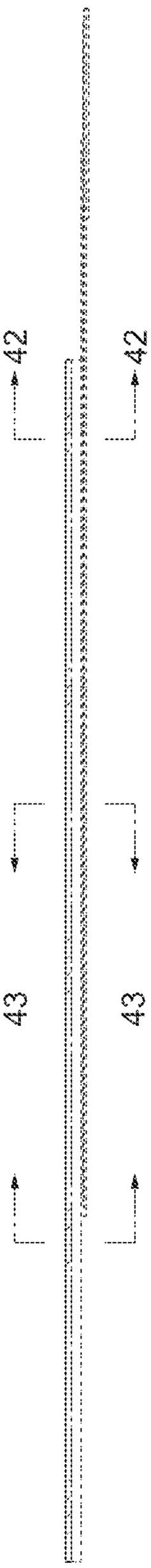

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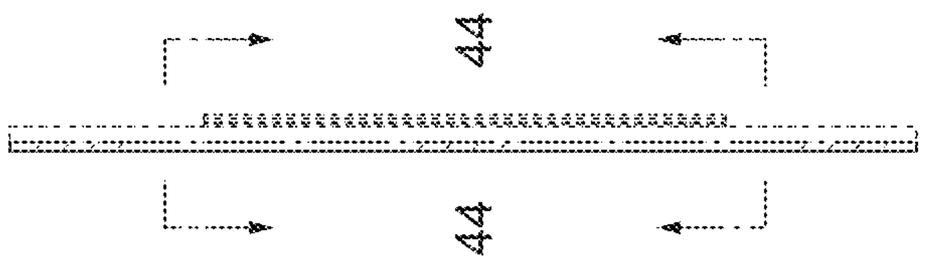

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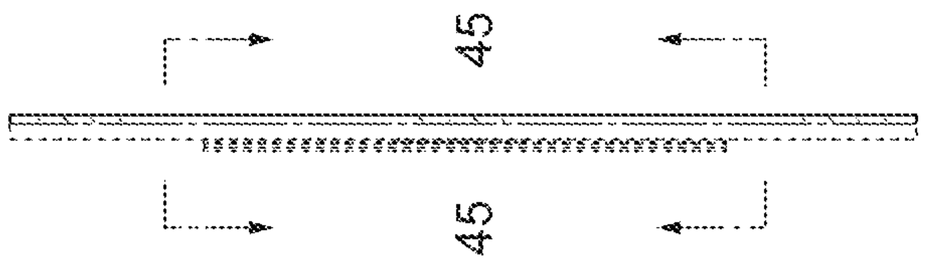

FIG. 38

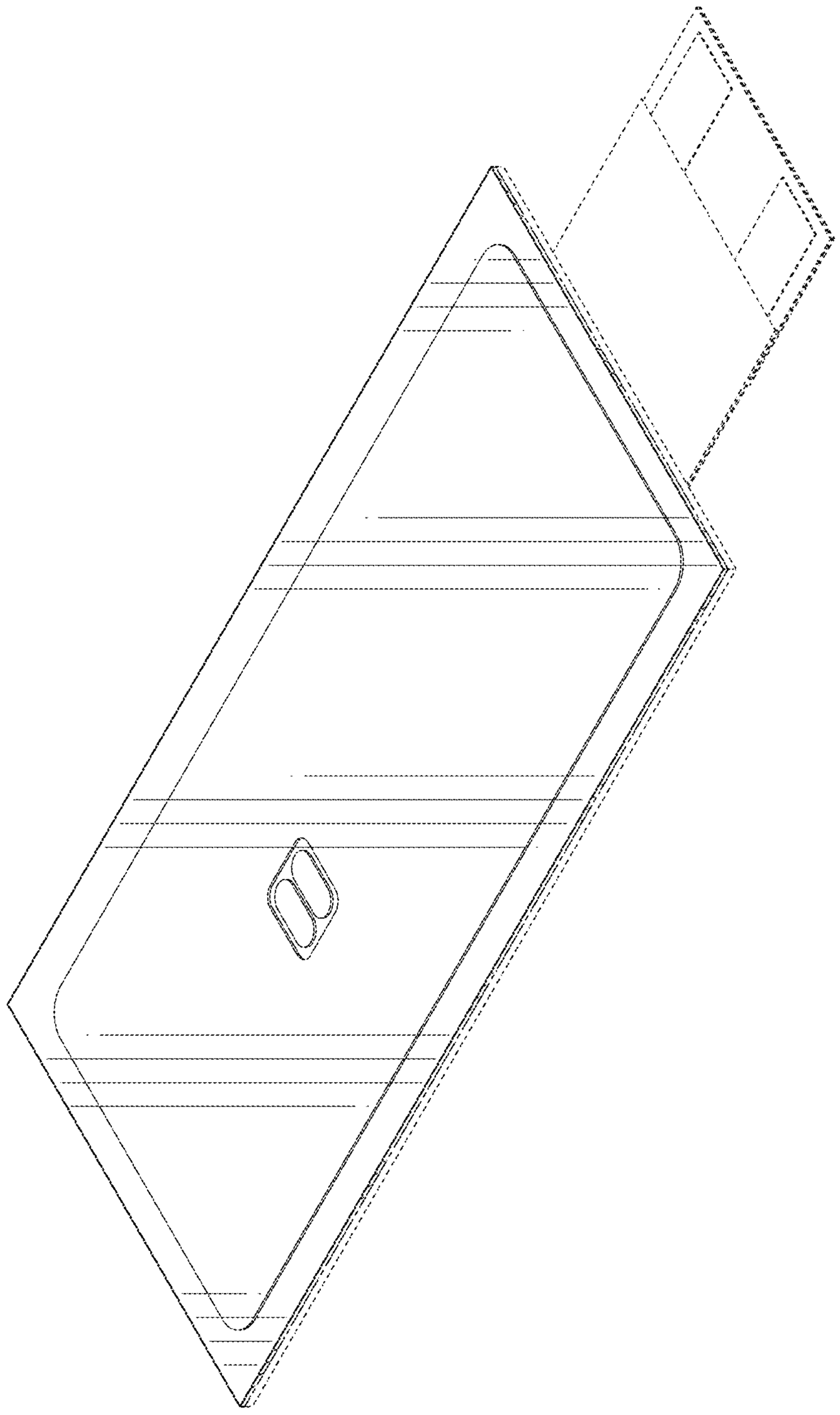

FIG. 39

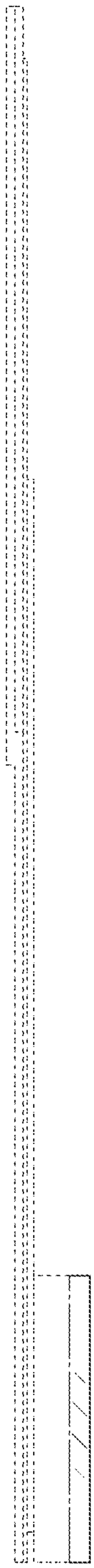

FIG. 40

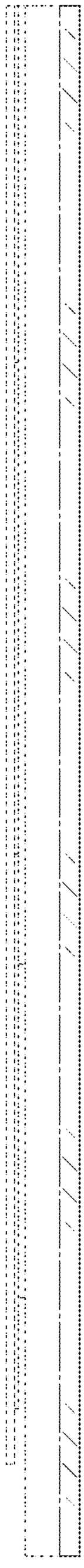

FIG. 41

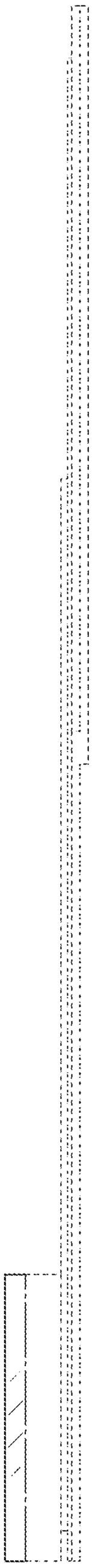

FIG. 42

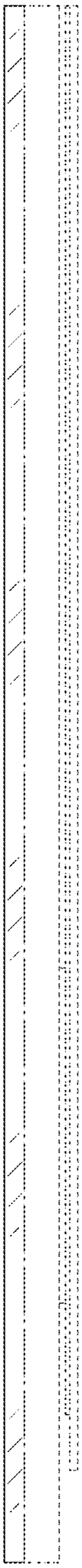

FIG. 43

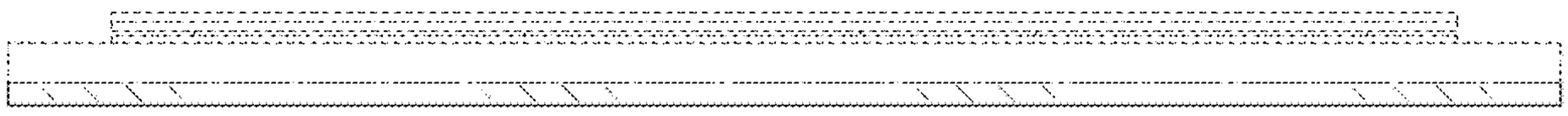

FIG. 44

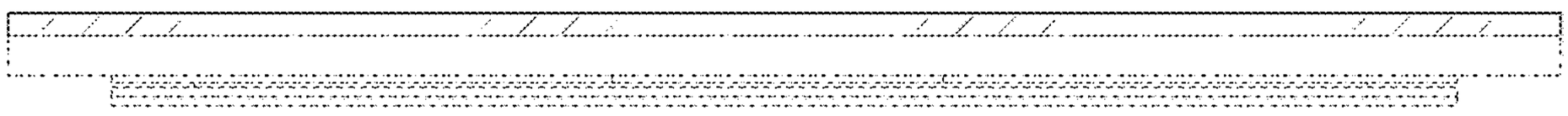

FIG. 45

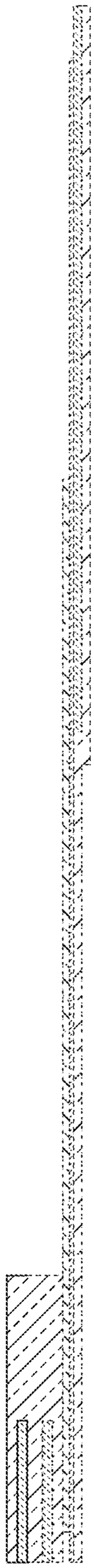

FIG. 46

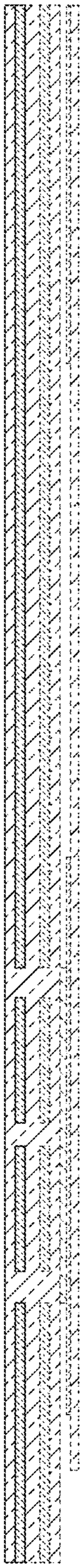

FIG. 47

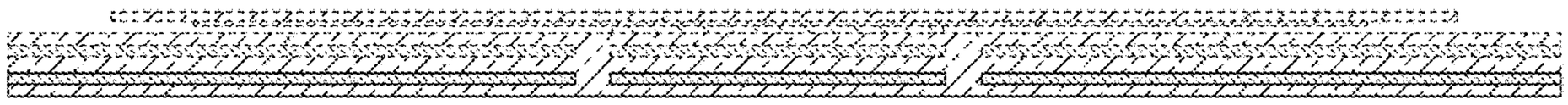

FIG. 48