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(54) **FARADAY BAG WITH MAGNETIC CLOSURE SYSTEM**

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H05K 9/00 (2006.01)

(52) **U.S. Cl.**
CPC **H05K 9/0043** (2013.01); **H05K 9/0009** (2013.01); **H05K 9/0015** (2013.01); **H05K 9/0094** (2013.01)

(58) **Field of Classification Search**
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See application file for complete search history.

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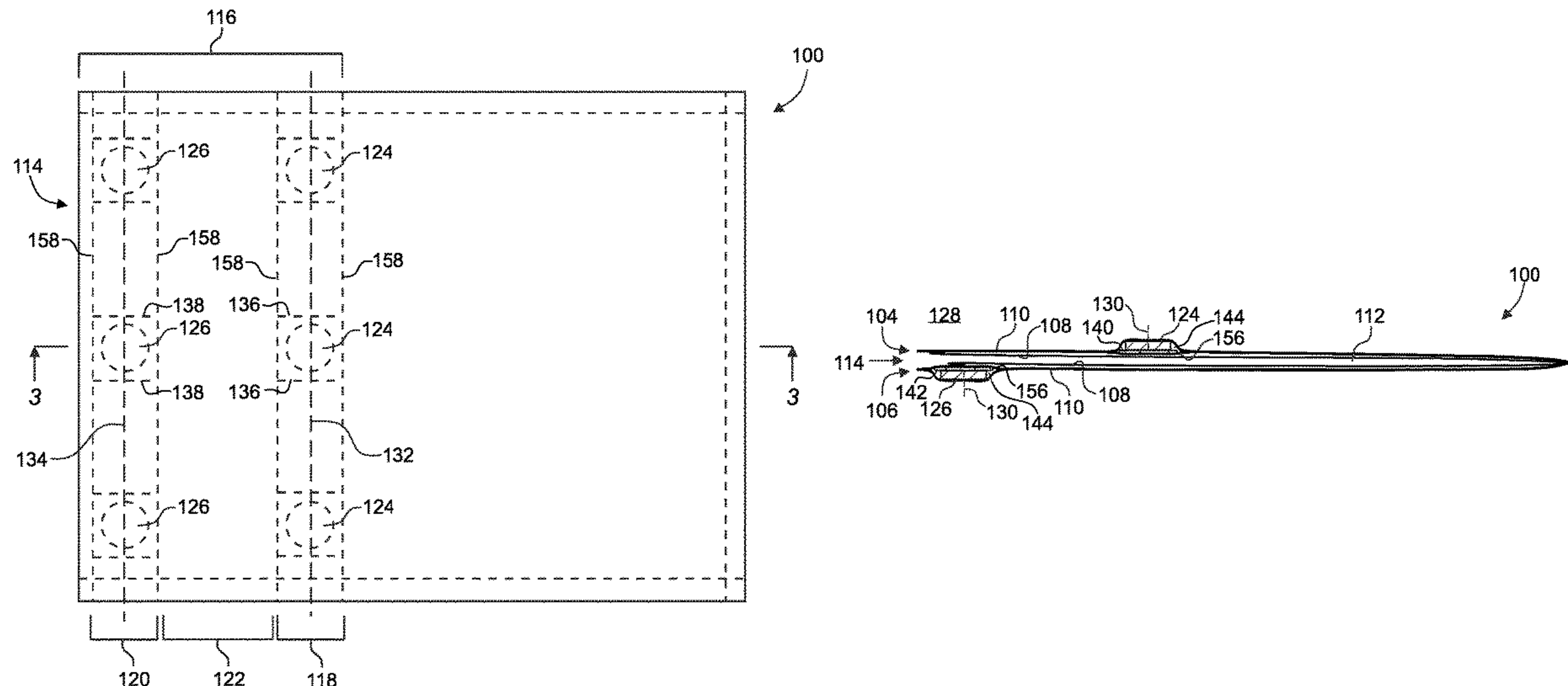
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(57) **ABSTRACT**

An exemplary faraday bag with magnetic closure system includes an actuatable closure section defined between a shielding compartment and an access mouth. The closure section preferably includes a retention segment, a distal flap segment, and an intermediate flap segment therebetween. Base magnets are disposed within the retention segment and a first panel of the bag. Flap magnets are disposed within the distal flap segment and a second panel of the bag. When the closure section is in open configuration, the flap magnets are substantially out of attractive magnetic engagement with respective base magnets, and the shielding compartment is accessible from an ambient environment through the access mouth. When the closure section is in closed configuration, the flap and retention segments are folded with respect to one another, the flap magnets are in attractive magnetic engagement with respective base magnets, and the access mouth is thereby retained in an RF-sealed configuration.

1 Claim, 8 Drawing Sheets



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PRIOR ART

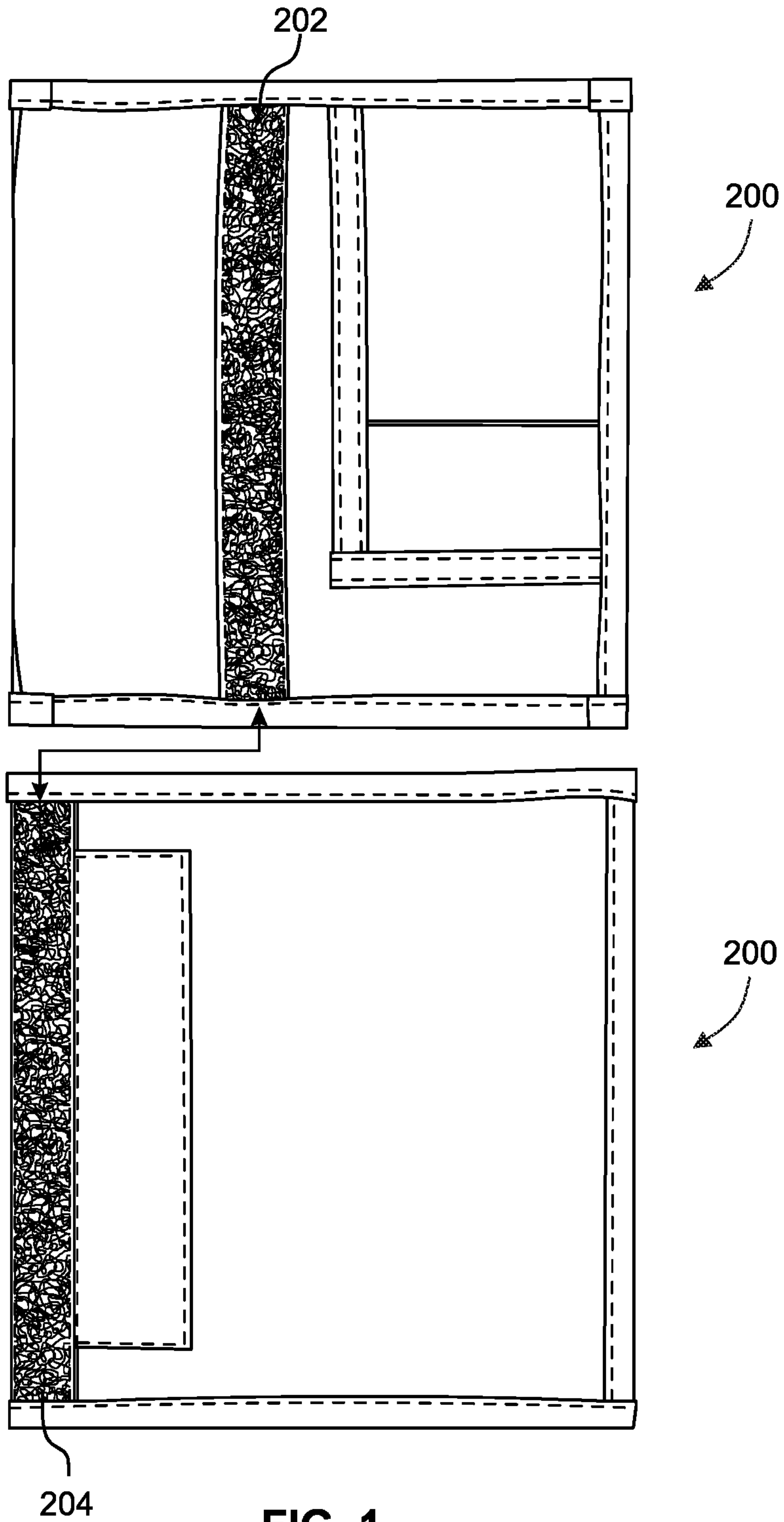
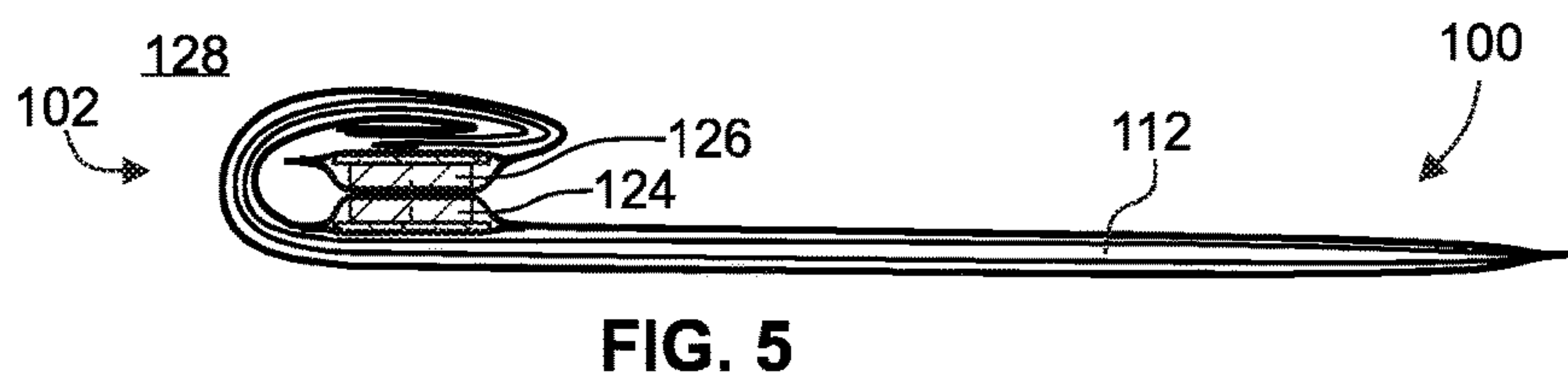
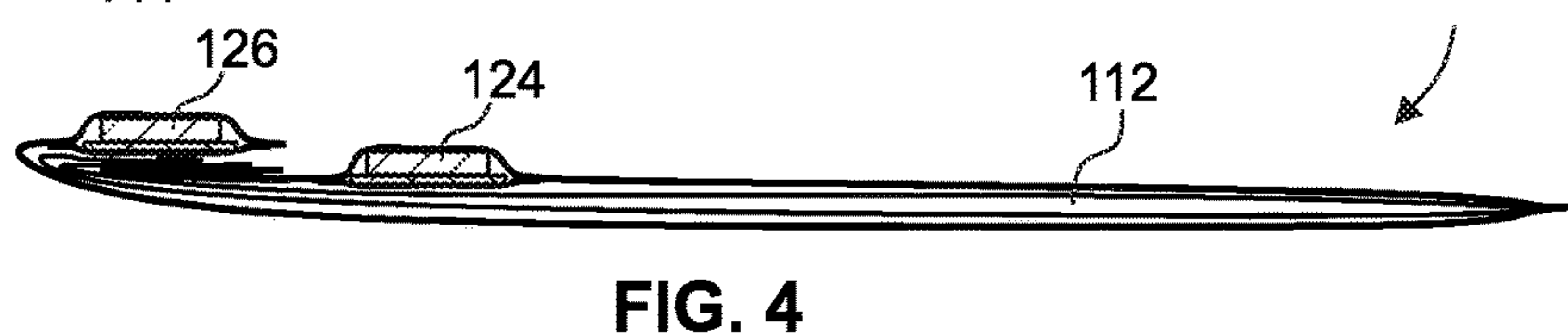
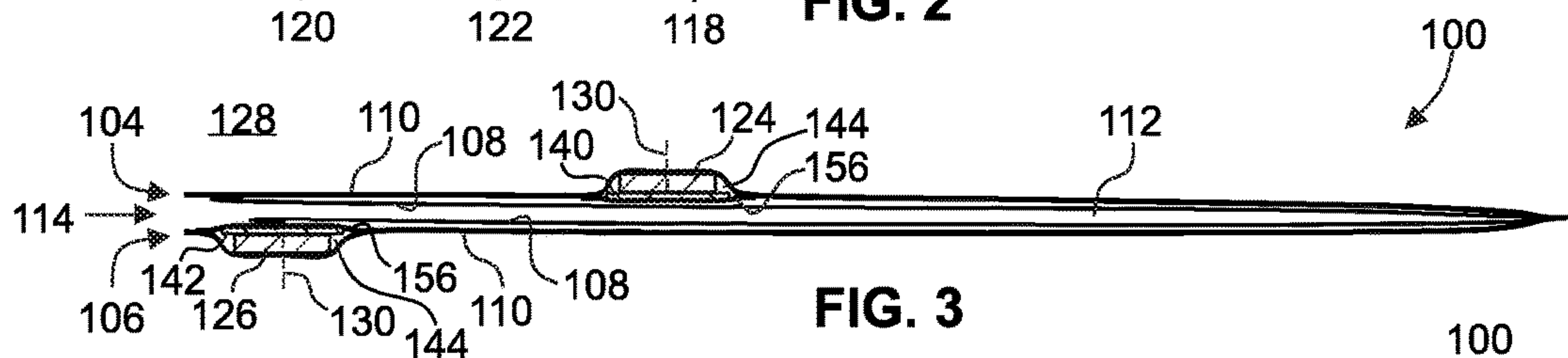
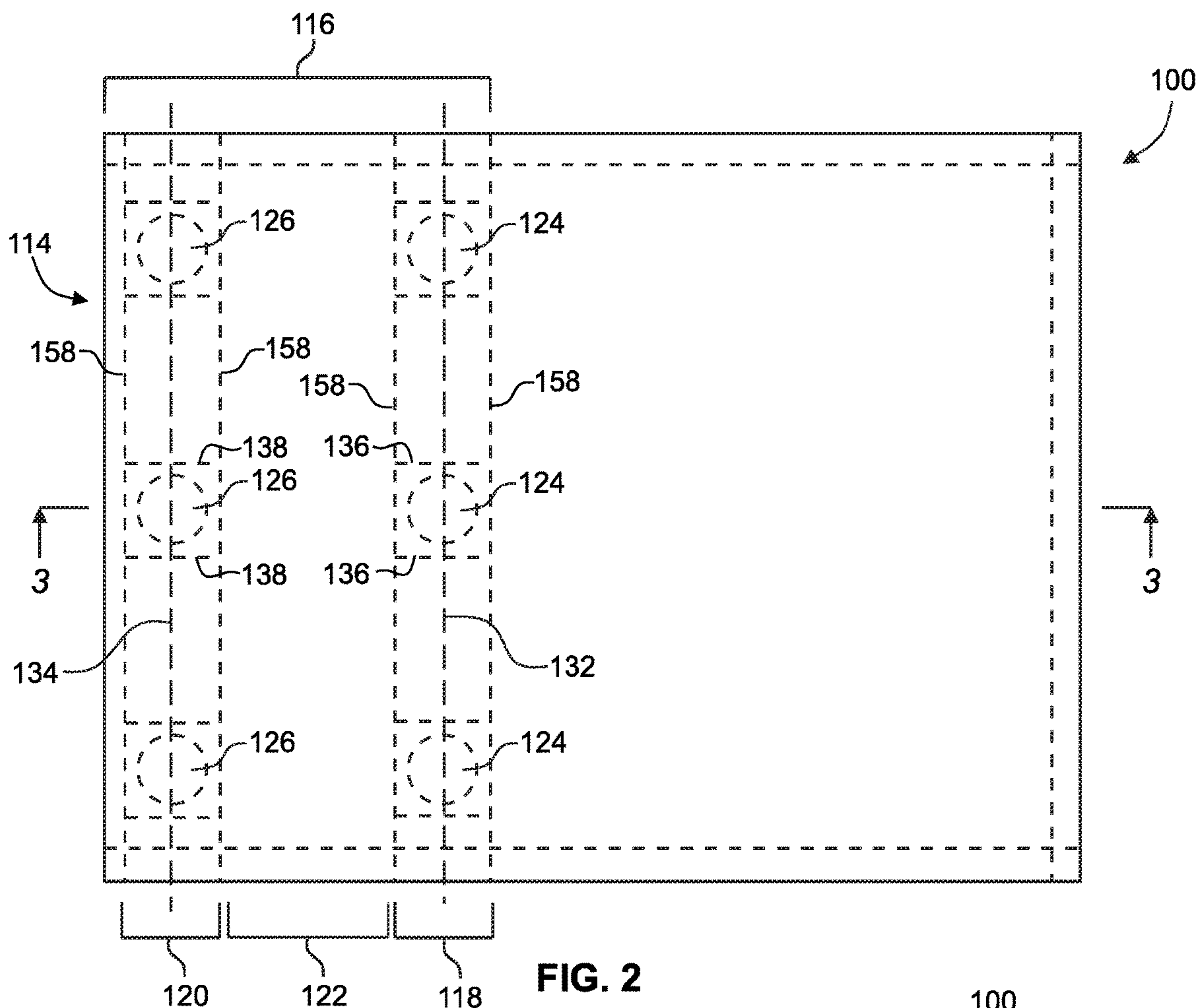


FIG. 1



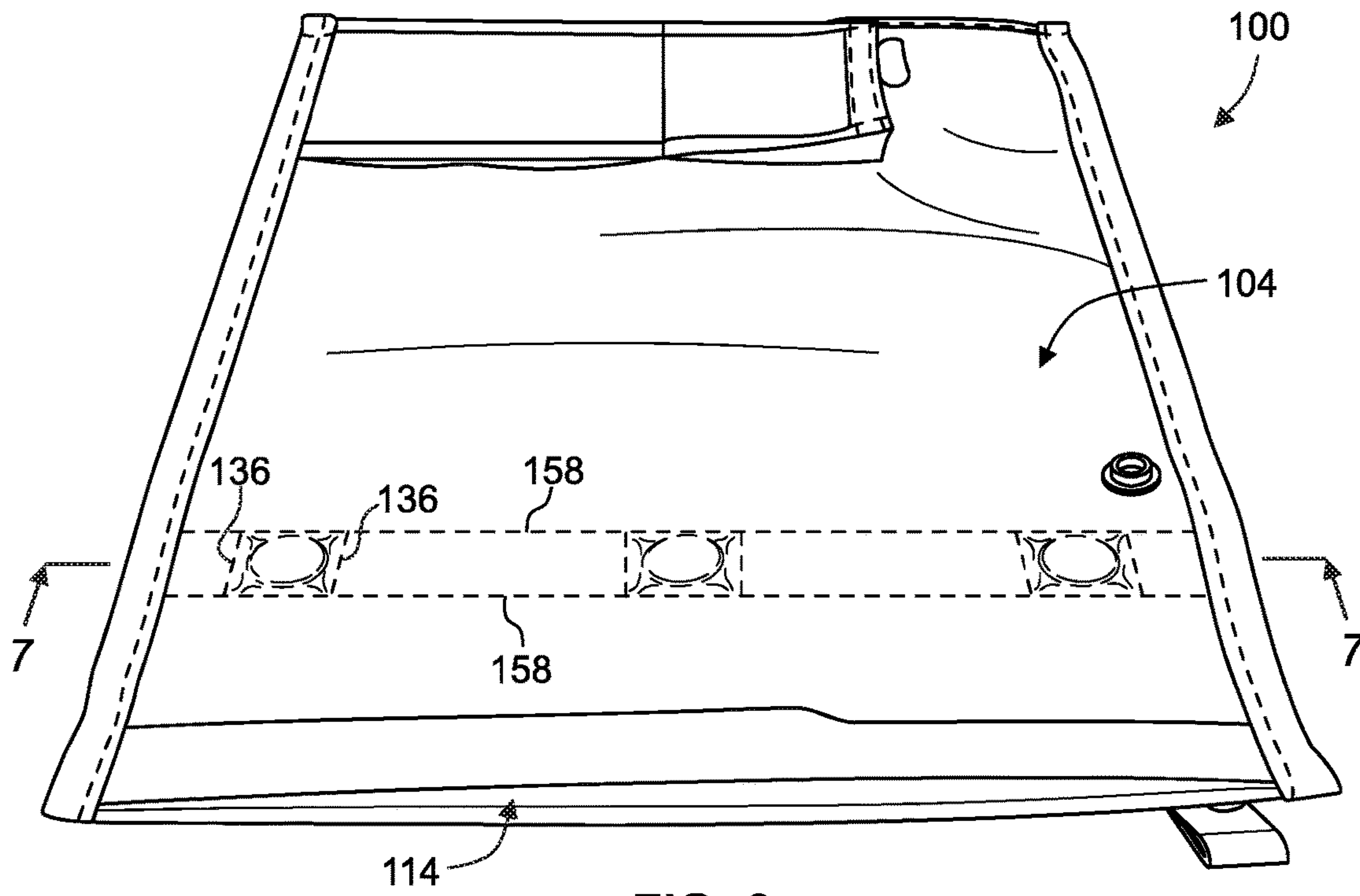


FIG. 6

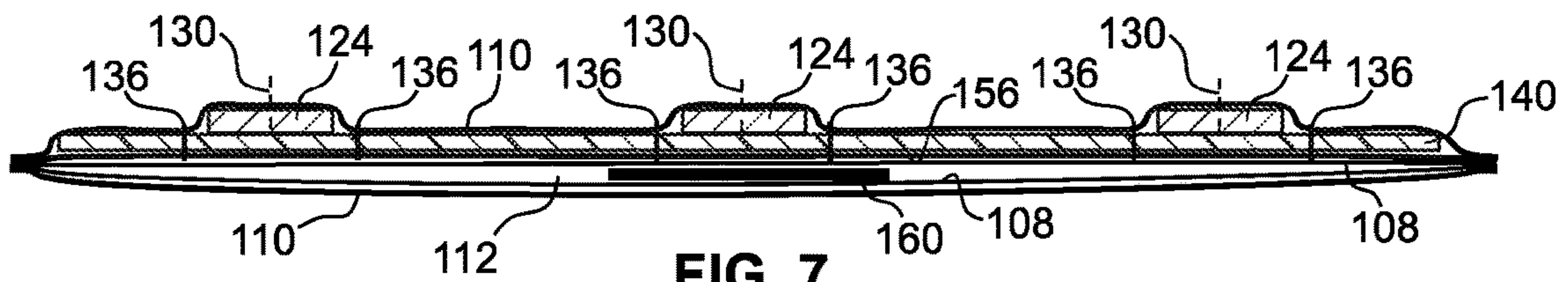


FIG. 7

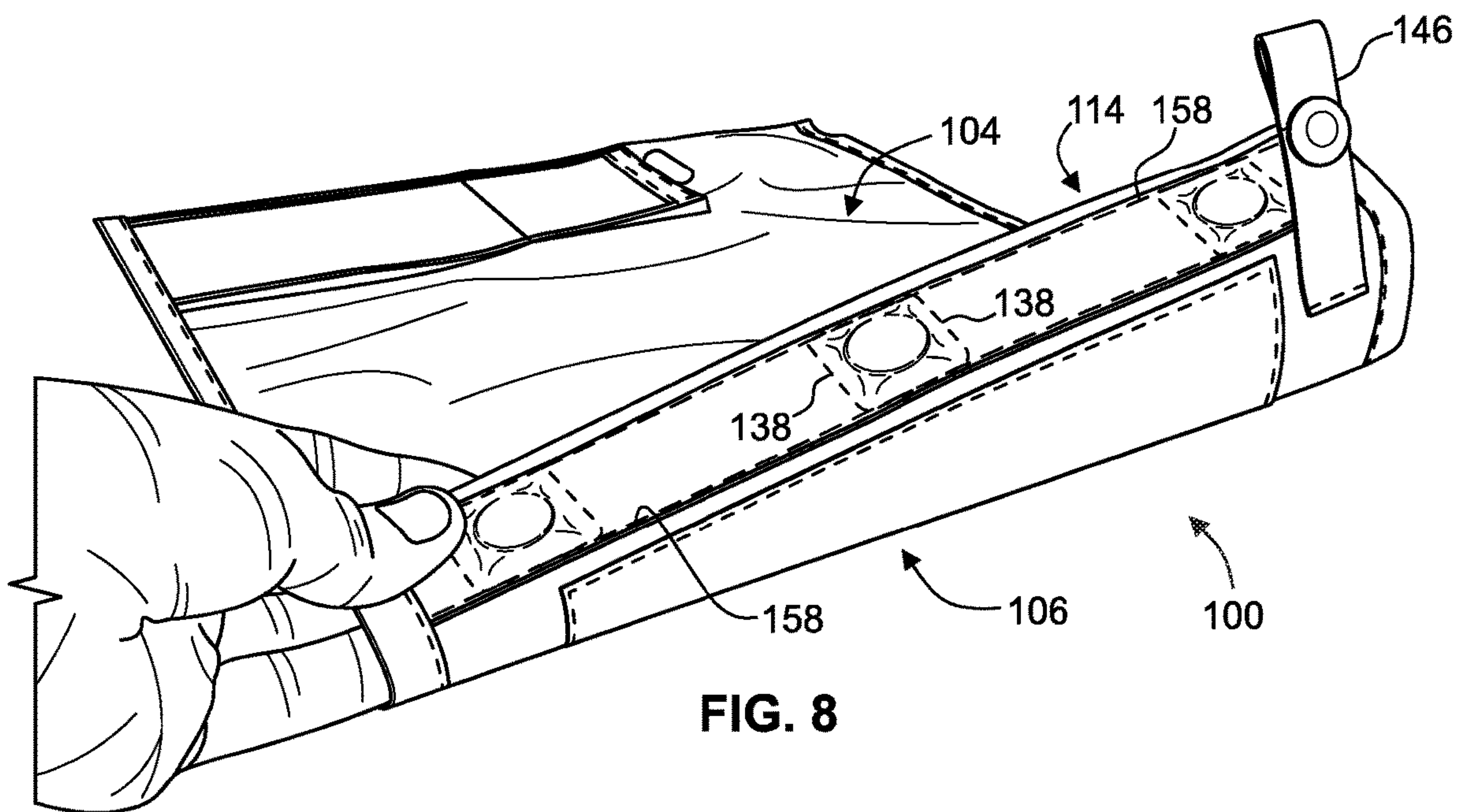
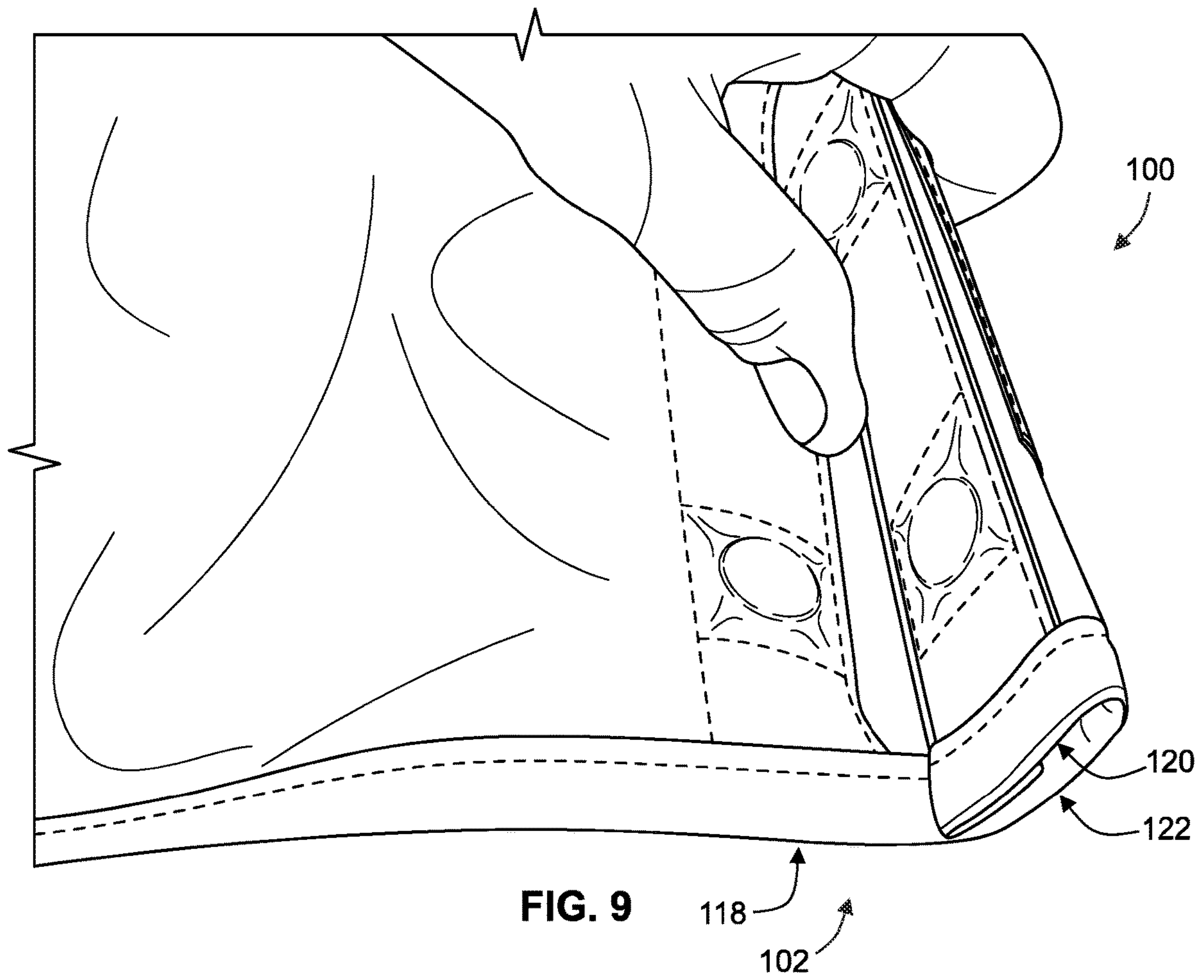


FIG. 8



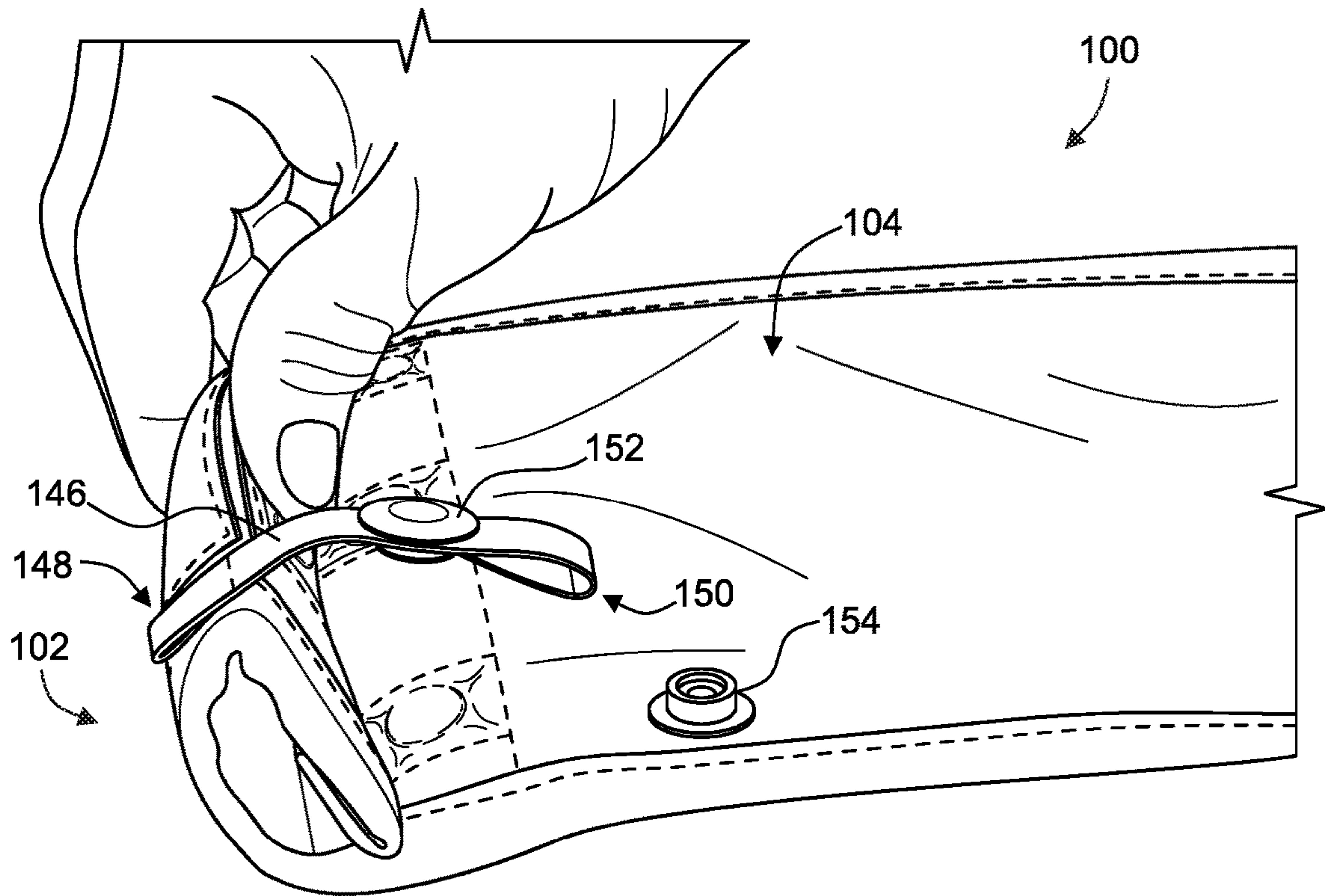


FIG. 10

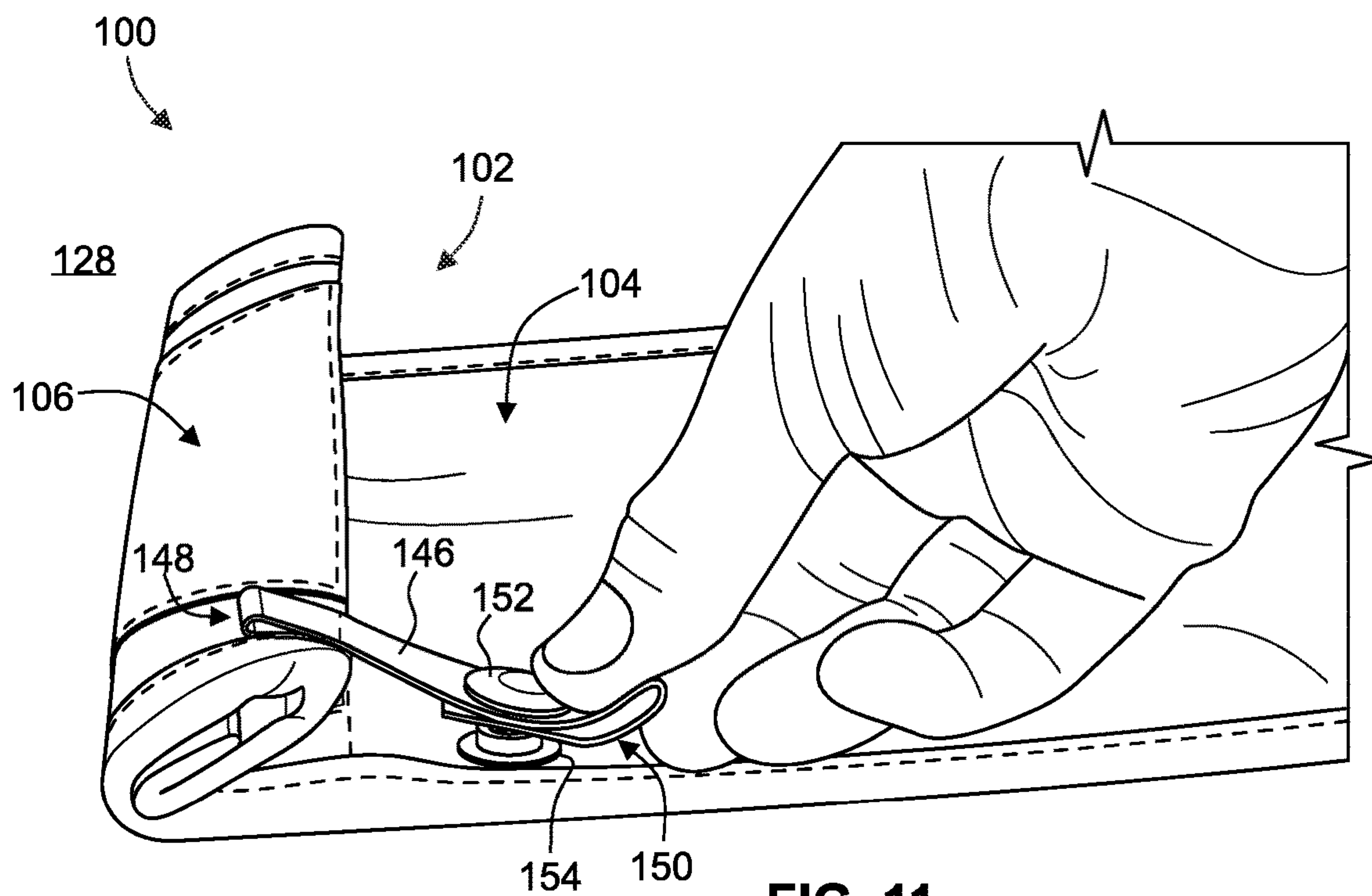


FIG. 11

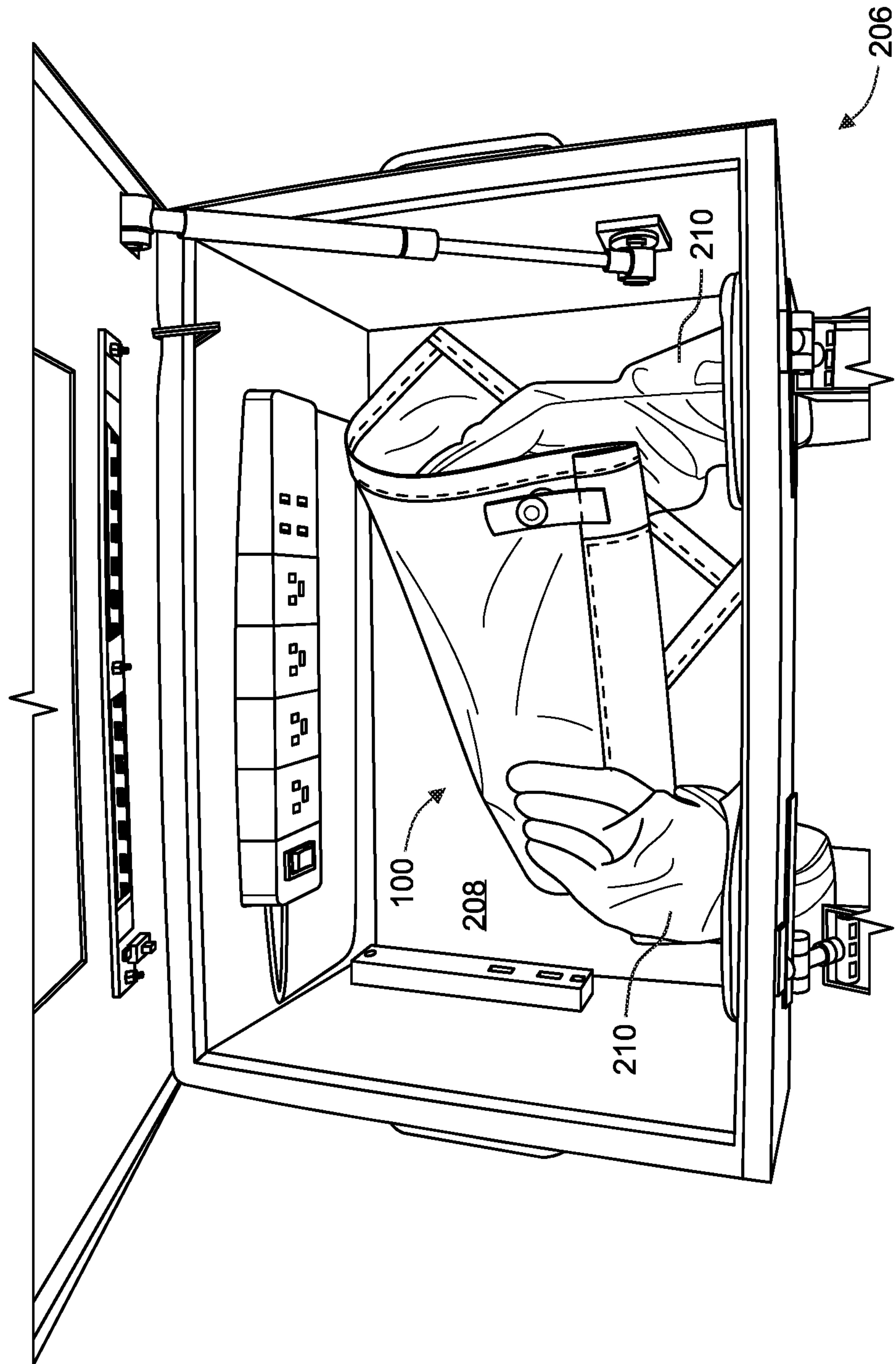


FIG. 12

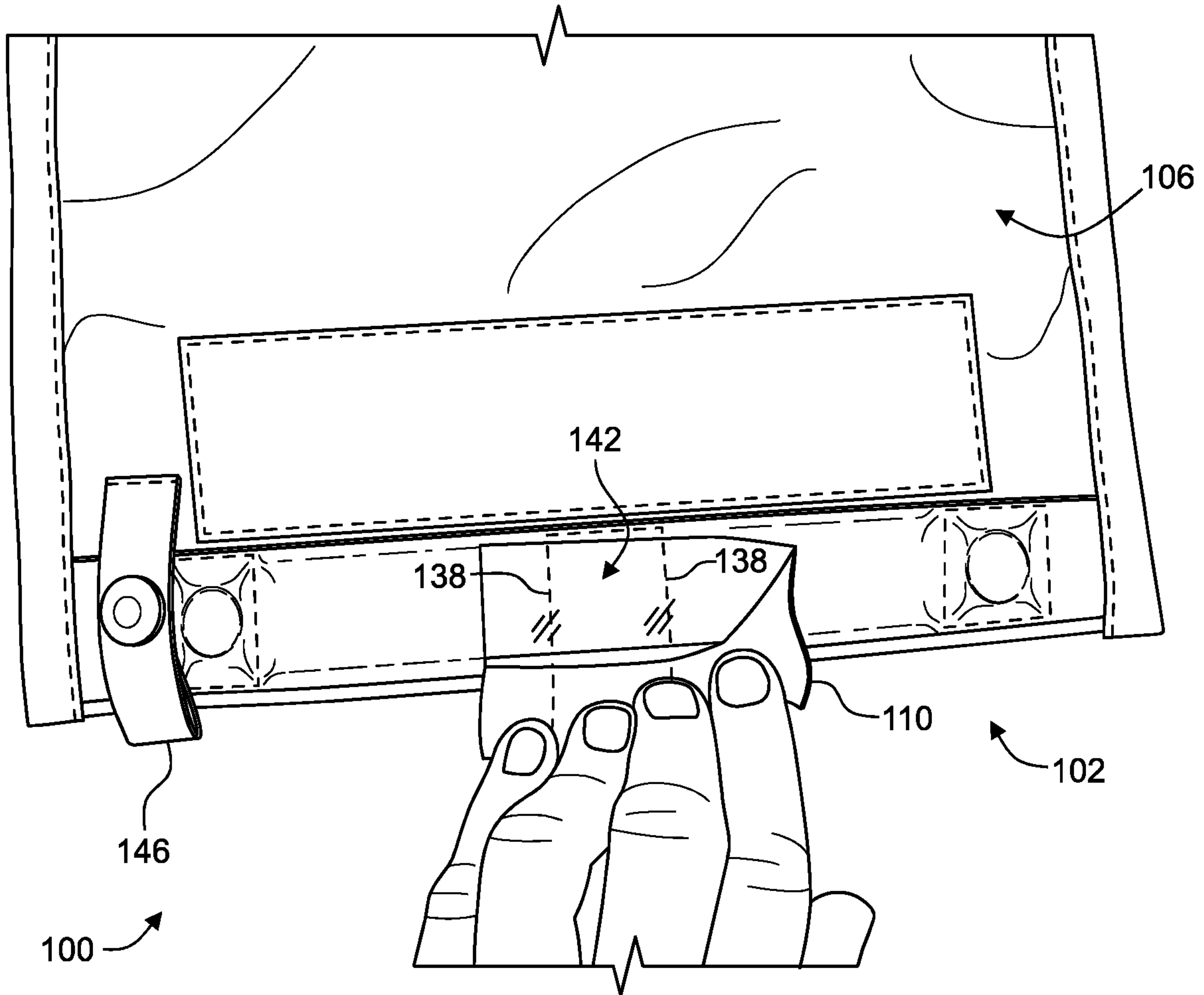


FIG. 13

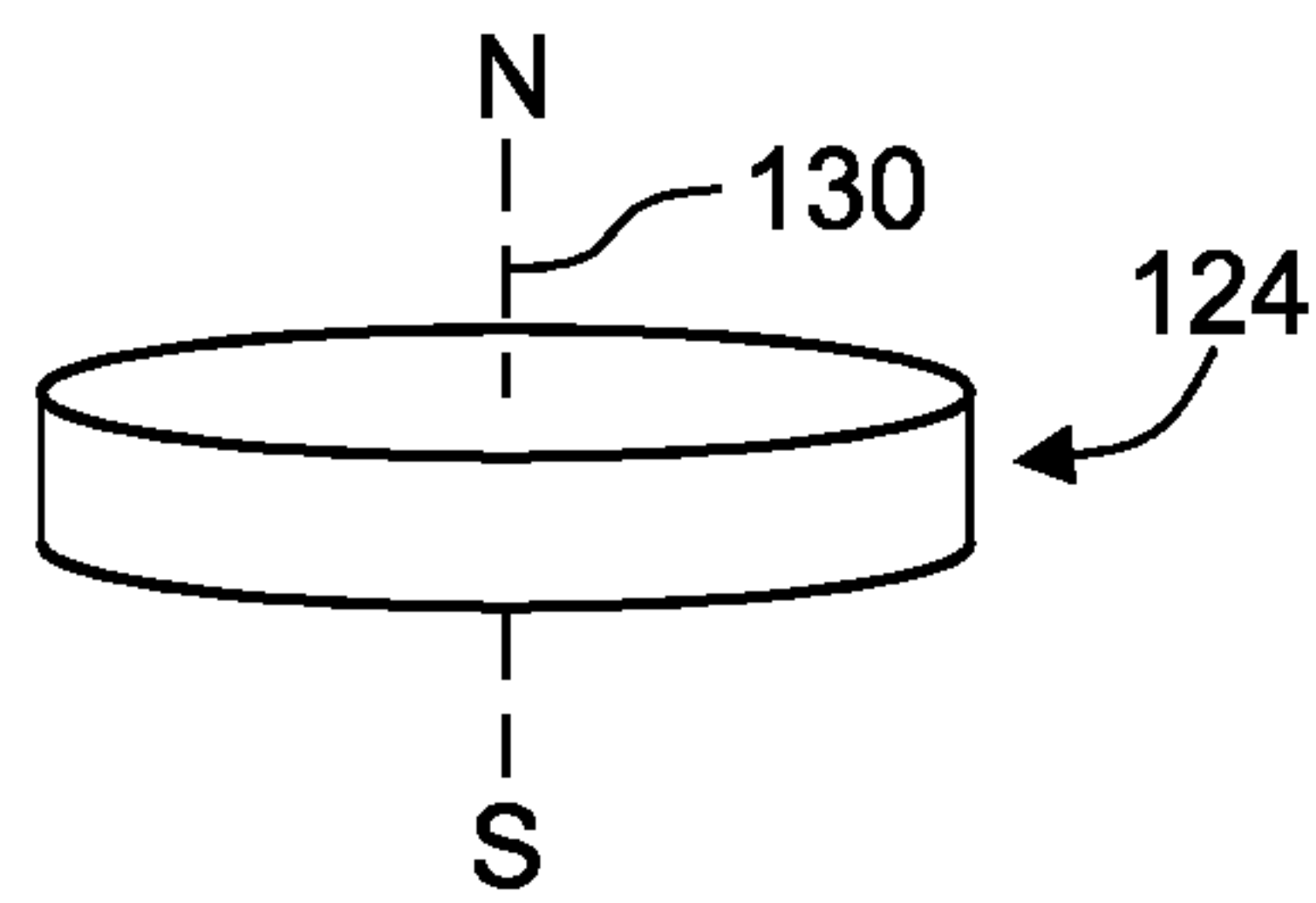


FIG. 14

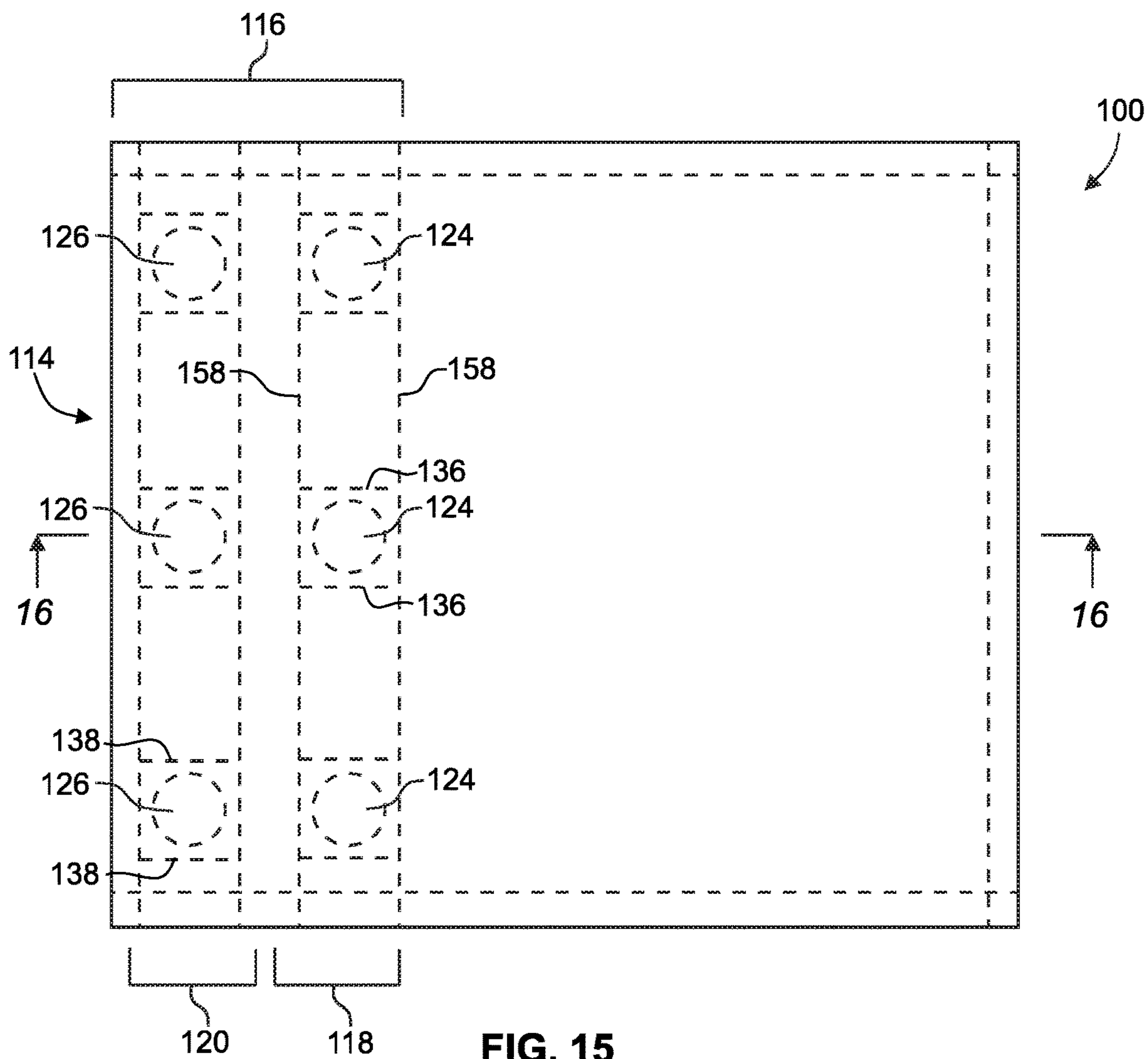


FIG. 15

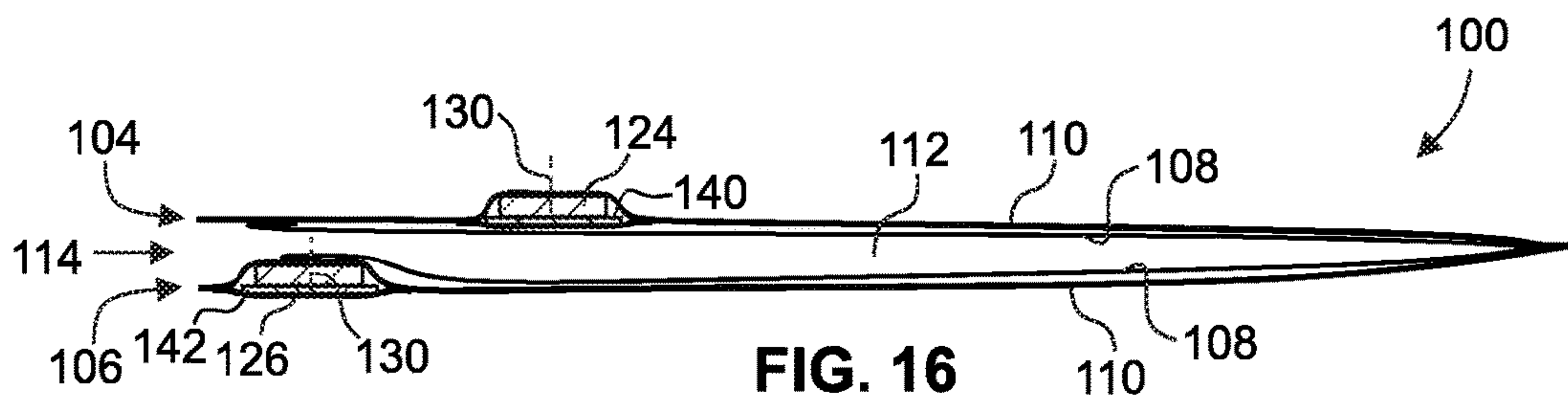


FIG. 16

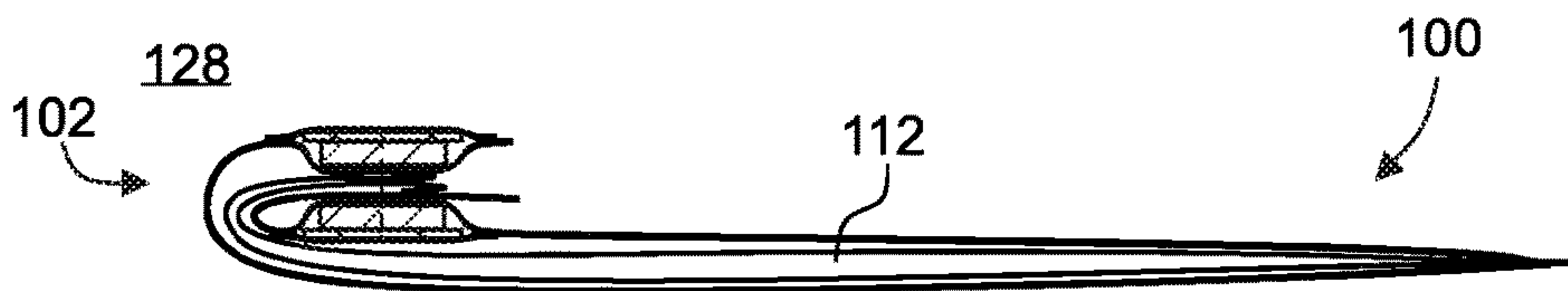


FIG. 17

1

FARADAY BAG WITH MAGNETIC
CLOSURE SYSTEM

RELATED APPLICATIONS

This application is a continuation of U.S. patent application Ser. No. 16/246,452 filed on Jan. 11, 2019, now U.S. Pat. No. 10,709,044.

TECHNICAL FIELD

The present disclosure relates generally to the field of electromagnetic shielding enclosures. More particularly, the present disclosure relates to closure systems for RF-shielded enclosures.

BACKGROUND

Most conventional faraday bags on the market use hook-and-loop strip closures. Hook-and-loop strips are cheap to produce, adequate for most uses, and holds the faraday bag together tightly so RF signal does not leak. FIG. 1 illustrates a typical conventional faraday bag **200** with hook-and-loop closure system. There could be a hook fabric strip **202** on one side of the bag, and a loop fabric strip **204** on the opposing side. The mouth of the bag could roll over twice so the hook strip connects with the loop strip and holds the bag closed.

Although the hook-and-loop faraday bag closure is prevalent, it does have downsides. For example, the hook-and-loop closure can be slow to open and close, may be painful on fingers, and may degrade over time due to wear and tear. Additionally, forensic investigators often use hard-sided RF enclosures (as shown, for example, at **206** in FIG. 12, for example) which may contain conductive gloves (as shown, for example, at **210** in FIG. 12) as part of the enclosure. These conductive gloves are typically made with a soft conductive fabric that can be susceptible to damage through scoring and abrasion. A complaint from users of these enclosures has been the degradation of the conductive gloves by way of opening and closing faraday bags while hands are inside of the gloves—an operation that must occur when a closed faraday bag has been introduced inside of the enclosure. Until now a solution for these problems has not existed, and users of conventional faraday bags have generally been left to contend with the downsides of the hook-and-loop-closure.

SUMMARY

Certain deficiencies of the prior art may be overcome by the provision of one or more embodiments of a faraday bag with magnetic closure system in accordance with the present disclosure.

BRIEF DESCRIPTION OF THE DRAWINGS

Further advantages of the present invention may become apparent to those skilled in the art with the benefit of the following detailed description of the preferred embodiments and upon reference to the accompanying drawings in which:

FIG. 1 is a diagrammatic perspective view of a prior art faraday pouch wherein the foldable closure section is securable by way of complementary hook-and-loop fastener strips;

2

FIG. 2 is a diagrammatic plan view of an example faraday bag in accordance with the present disclosure, wherein the faraday bag is in an open configuration;

FIG. 3 is a diagrammatic cross-sectional view taken along lines 3-3 in FIG. 2, showing the closure section in an open configuration with the shielding compartment being accessible from (e.g., in communication with) an ambient environment by way of the access mouth;

FIG. 4 is a further diagrammatic cross-sectional view taken along lines 3-3 in FIG. 2, but wherein the distal flap is folded with respect to the intermediate flap segment;

FIG. 5 is a further diagrammatic cross-sectional view taken along lines 3-3 in FIG. 2, but showing the closure section in a closed configuration with the distal flap folded with respect to the intermediate flap segment, the intermediate flap segment folded with respect to the retention segment, and the access mouth retained in an RF-sealed configuration;

FIG. 6 is a diagrammatic perspective view of the example faraday bag of FIG. 1, with the first panel element facing upward;

FIG. 7 is a diagrammatic cross-sectional view taken along lines 7-7 in FIG. 6;

FIG. 8 is a diagrammatic perspective view similar to that of FIG. 6, but wherein the closure section is manually bent upward so as to partially expose the second panel element;

FIG. 9 is a diagrammatic partial perspective view of an example closure section showing the distal flap folded with respect to the intermediate flap segment, and the intermediate flap segment in the process of being folded with respect to the retention segment;

FIG. 10 is a further diagrammatic partial perspective view of an example closure section placed in a configuration similar to that of FIG. 9, but showing an auxiliary securement element with the second end being disengaged from the first panel element;

FIG. 11 is a diagrammatic partial perspective view similar to that of FIG. 10, but showing an auxiliary securement element with the second end in engagement with the first panel element;

FIG. 12 is a diagrammatic perspective view illustrating an example faraday bag in accordance with the present disclosure being manipulated within a prior art hard-sided RF-shielded enclosure;

FIG. 13 is a diagrammatic partial view of an example faraday bag in accordance with the present disclosure, wherein the outboard layer of the second panel element is shown partially cut and peeled away, and the center flap magnet removed, thereby exposing a portion of the flap stiffener element thereunder;

FIG. 14 is a diagrammatic perspective view of an example base magnet with pole axis;

FIG. 15 is a diagrammatic perspective view of an alternate example of a faraday bag in accordance with the present disclosure, wherein the closure section is configured to operate without an intermediate flap segment disposed between the retention segment and the distal flap segment;

FIG. 16 is a diagrammatic cross-sectional view taken along lines 16-16 in FIG. 15, showing the closure section in an open configuration with the shielding compartment being accessible from (e.g., in communication with) an ambient environment by way of the access mouth; and

FIG. 17 is a further diagrammatic cross-sectional view taken along lines 16-16 in FIG. 15, but showing the closure section in a closed configuration with the distal flap folded with respect to the retention segment, and the access mouth retained in an RF-sealed configuration.

DETAILED DESCRIPTION OF THE
PREFERRED EMBODIMENTS

Referring now to the drawings, like reference numerals designate identical or corresponding features throughout the several views.

Features of particular preferred embodiments of a faraday bag with magnetic closure system in accordance with the present disclosure are disclosed herein. However, alternate embodiments of the faraday bag may be constructed with fewer or more features and components than those shown and described in connection with the illustrated embodiments.

Example embodiments of a faraday bag with magnetic closure system in accordance with the present disclosure are shown generally at **100**, with the magnetic closure system in particular being shown at **102**. Referring to FIGS. 2-5, a faraday bag **100** with magnetic closure system **102** may comprise a first panel element **104**, a second panel element **106**, a closure section **116**, a plurality of base magnets **124** and a multiplicity of flap magnets **126**.

Referring to FIGS. 3 and 7, the first panel element **104** and second panel element **106** may each include an RF-shielding layer **108**. In preferred embodiments of the faraday bag **100**, the first panel element **104** and/or the second panel element **106** may also comprise an outboard layer **110**. The outboard layers **110** may preferably be comprised of a ballistic Nylon or similar material. Preferred embodiments of the panel elements may be connected to one another (e.g., along their peripheries via stitching or adhesive) to define an RF-shielding compartment **112** therebetween and an access mouth **114**. The RF-shielding compartment **112** is preferably sufficiently large so as to be capable of receiving and housing therein one or more electronic devices **160** configured to transmit and/or receive RF signals (e.g., a cell phone). The access mouth **114** is preferably sufficiently large so as to allow the aforementioned electric devices **160** to pass therethrough as they are manually inserted into and removed from the RF-shielded compartment **112**.

The closure section **116** may be defined between the RF-shielding compartment **112** and the access mouth **114**. Referring to FIGS. 2 and 3, in certain preferred embodiments of the faraday bag **100**, the closure section **116** may include a retention segment **118**, a distal flap segment **120**, and an intermediate flap segment **122** therebetween. In such embodiments, the distal flap segment **120** may be foldably associated with the intermediate flap segment **122** (see, for example, FIG. 4), and the intermediate flap segment **122** may be foldably associated with the retention segment **118** (see, for example, FIG. 5). The closure section **116** may be selectively actuatable between an open configuration (shown, for example, in FIG. 3) and a closed configuration (shown for example, in FIG. 5). Once the closure section **116** reaches the closed configuration, it is retained there by magnetic engagement between corresponding base and flap magnets until a user manually forces disengagement of these magnets from one another. In certain preferred embodiments of the faraday bag **100**, the closure section **116** is devoid of any hook-and-loop fasteners.

Referring to FIGS. 2 and 3, the plurality of base magnets **124** may each be disposed within the first panel element **104** and within the retention segment **118**. Similarly, the multiplicity of flap magnets **126** may each be disposed within the second panel element **106** and within the distal flap segment **120**. Although the embodiments illustrated in the figures include three base magnets and three flap magnets, other embodiments may be configured to employ a different

number of base and flap magnets. The base magnets **124** and flap magnets **126** may preferably be rare-earth magnets, such as neodymium magnets.

Referring again to FIGS. 2 and 3, when the closure section **116** is in the open configuration, the flap magnets **126** are out of attractive magnetic engagement with respective said base magnets **124**, and the shielding compartment **112** is accessible from an ambient environment **128** by way of the access mouth **124**. In contrast, referring to FIG. 5, when the closure section **116** is in the closed configuration, the distal flap segment **120** is folded with respect to the intermediate flap segment **122**, the intermediate flap segment **122** is folded with respect to the retention segment **118**, the flap magnets **126** are in attractive magnetic engagement with respective said base magnets **124**, and the access mouth **114** is retained in an RF-sealed configuration (thus restricting or preventing RF signals from entering or exiting the RF-shielded compartment **112** via the access mouth **114**).

Referring to FIGS. 2 and 14, in particular preferred embodiments of the faraday bag **100**, the flap magnets **126** and base magnets **124** are each circular-cylindrical and axially-magnetized along a pole axis **130**. Moreover, in preferred such embodiments, when the closure section **116** is in the closed configuration, the pole axis **130** of each flap magnet **126** is axially aligned with the pole axis **130** of a respective said base magnet **124**.

Referring to FIGS. 2 and 7, in certain preferred embodiments of the faraday bag **100**, the base magnets **124** may be spaced from one another along a base magnet axis **132**, and the flap magnets **126** may be spaced from one another along a flap magnet axis **134**. In such embodiments, the base magnets **124** may be constrained from movement along the base magnet axis **132** with respect to the first panel element **104**, and the flap magnets **126** may be constrained from movement along the flap magnet axis **134** with respect to the second panel element **106**. The constraining of the base magnets **124** may be at least in part by way of base lateral stitching **136** extending orthogonally to the base magnet axis. Similarly, the constraining of the flap magnets **126** may be at least in part by way of flap lateral stitching **138** extending orthogonally to the flap magnet axis **134**. In certain embodiments of the faraday bag **100**, the term "extending orthogonally" may mean that the path of the lateral stitching extends substantially or entirely at a right angle with respect to the respective magnet axis. However, in certain alternate embodiments, the term "extending orthogonally" may mean that the path of the lateral stitching extends in a direction outward from the respective magnet axis, regardless of whether such path is linear, curved or at a right angle with respect to the respective magnet axis.

Referring to FIGS. 3, 7 and 13, particular preferred embodiments of a faraday bag **100** in accordance with the present disclosure may further comprise a base stiffener element **140** and a flap stiffener element **142**. The base stiffener element **140** may be elongated and simultaneously disposed within the first panel element **104**, within the retention segment **118**, and supportingly adjacent to the base magnets **124**. Similarly, the flap stiffener element **142** may be elongated and simultaneously disposed within the second panel element **106**, within the distal flap segment **120**, and supportingly adjacent to the flap magnets **126**. Referring to FIG. 5, the base magnets **124** and flap magnets **126** may be disposed between the base stiffener element **140** and flap stiffener element **142** when the closure section **116** is in the closed configuration. In certain preferred embodiments of the faraday bag **100**, the base stiffener element **140** may be

in direct contact with the base magnets **124** and the flap stiffener element **142** may be in direct contact with the flap magnets **126**.

In particular preferred embodiments, the base stiffener element **140** and/or the flap stiffener element **142** may be comprised of, for example, a polymer strip, and may be flat-planar. Moreover, referring to FIG. **7**, the base lateral stitching **136** may extend into the first panel element **104** and through the base stiffener element **140**. Similarly, the flap lateral stitching **138** may extend into the second panel element **106** and through the flap stiffener element **142**.

Referring to FIGS. **2** and **3**, the first panel element **104** may include a first elongated pocket **144** housing the base stiffener element **140**. Similarly, the second panel element **106** may include a second elongated pocket **144** housing the flap stiffener element **142**. Each elongated pocket **144** may be defined between a respective outboard layer **110** and respective closeout strip **156** connected to one another by respective longitudinal stitching **158**. The outboard layer **110** and the closeout strip **156** may preferably be made of a fabric such as ballistic Nylon or the like.

Referring to FIGS. **10** and **11**, certain preferred embodiments of a faraday bag **100** may further comprise an auxiliary securement element **146** having a first portion **148** affixed to the second panel element **106** (for example, by stitching, rivet or adhesive) and a second portion **150** configured to engage and disengage the first panel element **104**. When the second portion **150** is in engagement with the first panel element **104**, the auxiliary securement element **146** aids in securing the closure section **116** in the closed configuration. Contrastingly, when the second portion **150** is disengaged from the first panel element **104**, the auxiliary securement element **146** does not aid in securing the closure section **116** in the closed configuration. The engagement and disengagement of the second portion **150** may be, for example, by way of mutually-engageable snap or clasp components (see, for example, complementary snap components **152** and **154**).

Referring to FIGS. **15-17**, in certain alternate embodiments of a faraday bag **100** with magnetic closure system **102**, the closure section **116** may include a retention segment **118** and a distal flap segment **120** being foldably associated with the retention segment **118**, and may lack an intermediate flap segment therebetween. In such an embodiment, when the closure section **116** is in the closed configuration, the distal flap segment **120** is folded with respect to the retention segment **118**, the flap magnets **126** are in attractive magnetic engagement with respective base magnets **124**, and the access mouth is retained in an RF-sealed configuration.

The present disclosure is directed, in large part, to magnetic closure systems and methods which remedy the deficiencies associated with the conventional use of hook-and-loop closures. Implementations of the magnetic closure systems described herein may employ a “roll style” method of rolling (folding) the bag over twice to seal the main RF compartment, and use magnets to retain that seal. The magnets may be sewn in a configuration of two separate strips, which magnetically engage one another when the closure section of the bag is rolled over twice. When the closure section is rolled (folded), the corresponding magnet pairs come together and cause the access mouth of the bag to be sealed. To ensure that the seal does not come unrolled at any time, a safety strap with a button closure may preferably be used.

Those of ordinary skill in the production of bags might use a few methods of production that would differ from the

teachings provided in the present disclosure. For example, a person who is somehow provided motivation to implement a magnetic closure may assume that a strip magnet would suffice. Strip magnets, however, lack the strength to keep this type of closure sealed at all times. The sensitive application of the product requires a tighter seal than a strip magnet, and as such, a different solution is required. Accordingly, preferred embodiments of the presently-disclosed faraday bag employ a series of rare earth (e.g., neodymium) magnets instead. This is because neodymium magnets are stronger, and proper sealing of the double roll closure requires a high-strength connection. Conventional manufacturers of bags would likely not be motivated to use this method since the individual magnets must be aligned to the corresponding opposing magnets (precision sewing is more difficult), rare-earth magnets are more expensive than strip magnets, and the closure would be expected to result in seal gaps due to the more “point-to-point” engagement of a series of individual magnets. To allow fewer, spaced-apart, individual magnets to be used without resulting in connection seal gaps at the access mouth, preferred embodiments of the presently-disclosed faraday bag **100** employ a backing strip (also referred to herein as stiffener elements) placed behind each linear set of magnets. When sewn near the respective magnets, this backing strip keeps the full length of the access mouth sealed against the opposing side. Notably, in the preferred embodiments of the faraday bag **100**, the magnets have been placed in front of the backing strips, instead of behind. See, for example, FIGS. **3** and **5**. Applicant’s experimentation has proven this configuration yields a stronger linearly-continuous RF-seal at the access mouth compared to a configuration in which the backing strips end up disposed between the engaged magnets when the closure section is in the closed configuration.

While embodiments of the invention have been illustrated and described, it is not intended that these embodiments illustrate and describe all possible forms of the invention. Rather, the words used in the specification are words of description rather than limitation, and it is understood that various changes may be made without departing from the spirit and scope of the invention.

What is claimed is:

1. A faraday bag with magnetic closure system, the faraday bag comprising:

a first panel element and a second panel element each including an RF-shielding layer, the panel elements being connected to one another to define an RF-shielding compartment therebetween and an access mouth;

a closure section defined between the shielding compartment and the access mouth, the closure section including a retention segment, a distal flap segment, and an intermediate flap segment therebetween, the distal flap segment being foldably associated with the intermediate flap segment, the intermediate flap segment being foldably associated with the retention segment, the closure section being selectively actuatable between an open configuration and a closed configuration;

a plurality of base magnets each being disposed

(a) within the first panel element, and
(b) within the retention segment;

a multiplicity of flap magnets each being disposed

(a) within the second panel element, and
(b) within the distal flap segment;

a base stiffener element being elongated and disposed

(a) within the first panel element, and
(b) within the retention segment; and

7

a flap stiffener element being elongated and disposed

- (a) within the second panel element, and
- (b) within the distal flap segment;

wherein

- (a) when the closure section is in the open configuration 5
 - (i) the flap magnets are out of attractive magnetic engagement with respective said base magnets, and
 - (ii) the shielding compartment is accessible from an ambient environment by way of the access mouth; 10
- (b) when the closure section is in the closed configuration
 - (i) the distal flap segment is folded with respect to the intermediate flap segment,
 - (ii) the intermediate flap segment is folded with respect to the retention segment, 15
 - (iii) the flap magnets are in attractive magnetic engagement with respective said base magnets, and
 - (iv) the access mouth is retained in an RF-sealed configuration; 20
- (c) the flap magnets and base magnets are each circular-cylindrical and axially-magnetized along a pole axis;

8

- (d) when the closure section is in the closed configuration, the pole axis of each flap magnet is axially aligned with the pole axis of a respective said base magnet;
- (e) the base magnets are spaced from one another along a base magnet axis;
- (f) the flap magnets are spaced from one another along a flap magnet axis;
- (g) the base magnets are constrained from movement along the base magnet axis with respect to the first panel element;
- (h) the flap magnets are constrained from movement along the flap magnet axis with respect to the second panel element;
- (i) the first panel element includes a first elongated pocket housing the base stiffener element;
- (j) the second panel element includes a second elongated pocket housing the flap stiffener element; and
- (k) each elongated pocket is defined between a respective outboard layer and respective closeout strip connected to one another by respective longitudinal stitching.

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