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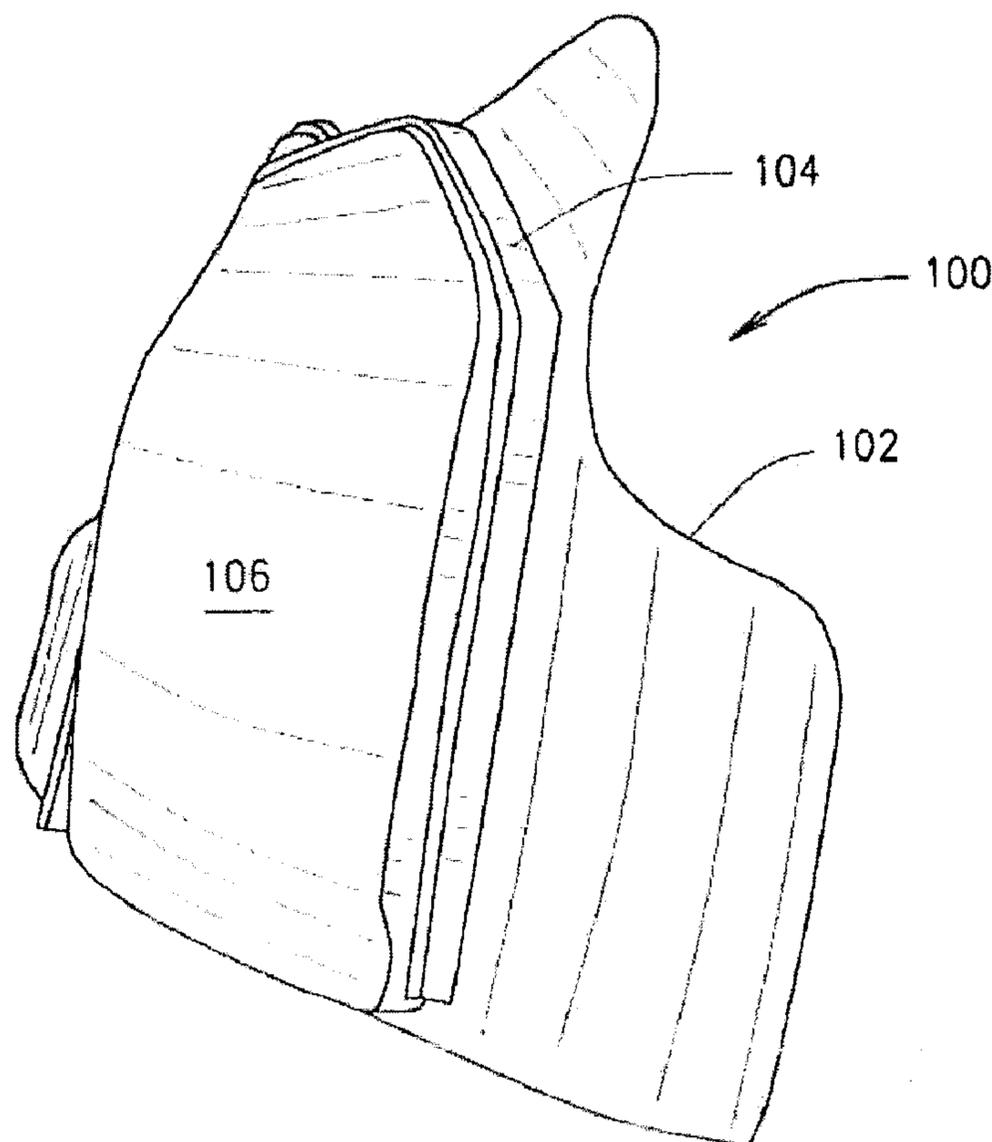
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(54) **Titre : SYSTEME DE VESTE BALISTIQUE AVEC COMPOSANTE BALLISTIC RIDGE**

(54) **Title: BALLISTIC VEST SYSTEM WITH BALLISTIC RIDGE COMPONENT**



(57) **Abrégé/Abstract:**

Embodiments of a ballistic vest system having a ballistic vest plate carrier with a ballistic plate engaged to a ballistic ridge component disposed therein that provides protection against side spall and back face deformation caused by the impact of ballistic projectiles and shrapnel along the peripheral area of the ballistic plate and methods to manufacture such a ballistic vest systems are generally described herein. Other embodiments of a ballistic vest system may be described and claimed.

## **ABSTRACT**

Embodiments of a ballistic vest system having a ballistic vest plate carrier with a ballistic plate engaged to a ballistic ridge component disposed therein that provides protection against side spall and back face deformation caused by the impact of ballistic projectiles and shrapnel along the peripheral area of the ballistic plate and methods to manufacture such a ballistic vest systems are generally described herein. Other embodiments of a ballistic vest system may be described and claimed.

## BALLISTIC VEST SYSTEM WITH BALLISTIC RIDGE COMPONENT

### FIELD

**[0001]** The present disclosure relates to ballistic vest systems having a ballistic plate, and in particular, to ballistic vest systems having a ballistic ridge component located along the peripheral area of the ceramic plate for providing protection against side spall and back face deformation caused by ballistic projectiles and shrapnel impacting along the peripheral area of the ballistic plate.

### BACKGROUND

**[0002]** A ballistic vest is an item of personal armor that helps absorb the impact from firearm-fired projectiles and shrapnel from explosions, and is worn on the torso of an individual. Ballistic vests may include soft body armor made from multiple layers of woven or laminated fibers in addition to a metal or ceramic plate that provides additional protection from rifle rounds. Although such ballistic vests are suitable to protect the individual from most ballistic projectile impacts, there are certain impacts that occur when the trajectories of the ballistic projectiles are at an angle and impact the peripheral edge of the ballistic plate, which can cause side spall or back face deformation. Back face deformation occurs when the ballistic projectile impacts the ballistic plate and causes the backside of the ballistic plate to deform or bulge outwardly. Side spall occurs when the ballistic projectile impacts the peripheral area of the ballistic plate such that shrapnel from the ballistic projectile impact and/or debris of material from the impacted portion of the ballistic plate can potentially penetrate the soft body armor and injure the individual. Referring to FIG. 1, a prior art ballistic vest **10** is shown that illustrates the side spall **16** that occurs when a ballistic projectile impacts the ballistic plate **14** along the peripheral area **18** of the ballistic plate **14**. As the ballistic projectile impacts the peripheral area **18** of

the ballistic plate **14**, the side spall **16** and back face deformation **15** from the ballistic projectile can cause debris from the ballistic plate **14** as well as shrapnel from the ballistic projectile to penetrate or deform the backside **20** of the ballistic plate **14**, which can potentially injure the individual wearing the prior art ballistic vest **10**. As such, there is a need for further improvements that enhance the protection provided by a ballistic vest including protection from side spall and back face deformation to the peripheral area of the ballistic plate.

**BRIEF DESCRIPTION OF THE DRAWINGS**

**[0004]** FIG. 1 is a picture of a prior art ballistic vest system that illustrates the effects of side spall produced by a bullet impacting proximate the side of a ballistic plate;

**[0005]** FIG. 2 is a perspective view of a first embodiment of a ballistic vest system;

**[0006]** FIG. 3 is an exploded view of the ballistic vest system of FIG. 2 including a ballistic vest plate carrier, a ballistic plate, a ballistic ridge component, and ballistic soft armor;

**[0007]** FIG. 4 is a perspective view of the ballistic plate engaged to the ballistic ridge component that rests on the ballistic soft armor;

**[0008]** FIG. 5 is a front view of the ballistic plate engaged to the ballistic ridge component of FIG. 4;

**[0009]** FIG. 6 is a perspective view of a first embodiment of a ballistic ridge component used with the ballistic vest system of FIG. 2;

**[0010]** FIG. 7 is a perspective view of the ballistic vest system showing the ballistic plate engaged to the ballistic ridge component of FIG. 6;

**[0011]** FIG. 8 is a flow chart illustrating one method for manufacturing the ballistic ridge component of FIG. 2;

**[0012]** FIG. 9 is a front perspective view of a second embodiment of a ballistic ridge component;

**[0013]** FIG. 10 is a rear view of the ballistic ridge component of FIG. 9;

**[0014]** FIG. 11 is an elevated perspective view of the ballistic ridge component of FIG. 9;

**[0015]** FIG. 12 is a rear perspective view of the ballistic ridge component of FIG. 9;

**[0016]** FIG. 13 is a front view of the ballistic ridge component of FIG. 9;

**[0017]** FIG. 14 is a rear perspective view of the ballistic ridge component of FIG. 9 shown engaged to the ballistic plate;

**[0018]** FIG. 15 is a front perspective view of the ballistic ridge component of FIG. 9 shown engaged to the ballistic plate; and

**[0019]** FIG. 16 is a front perspective view of a third embodiment of a ballistic ridge component; and

**[0020]** FIG. 17 is a partial elevated perspective view of the ballistic vest plate carrier of FIG. 2.

**[0021]** Corresponding reference characters indicate corresponding elements among the various views of the drawings. The headings used in the figures should not be interpreted to limit the scope of the claims.

## DESCRIPTION

**[0022]** As described herein, embodiments of a ballistic vest system having a ballistic ridge component positioned adjacent the peripheral area of a ballistic plate for protecting an individual from side spall and decreasing back face deformation caused by ballistic projectiles impacting the peripheral area of the ballistic plate.

**[0023]** Referring to the drawings, embodiments of a ballistic vest system are illustrated and generally indicated as **100**, **200** and **300** in FIGS. 2-17. In one embodiment shown in FIGS. 2-5 and 17, the ballistic vest system **100** may include a ballistic vest plate carrier **108** made from a durable, wear resistant composite fabric material, such as a woven fabric material, a nylon material, a hook and loop material such as Kevlar<sup>®</sup>, and/or a combination thereof. For example, the composite fabric material may have a front layer made from a high performance nylon laminated with a back layer made from high tenacity polymer fibers, such as various aramid fibers and high performance polyethylene fibers and the like. As shown in FIG. 2, the ballistic vest plate carrier **108** is secured to the front portion of a ballistic soft armor component **102**, which is configured to be worn around the torso and chest area of an individual. In some embodiments, the ballistic soft armor component **102** may be configured to be worn substantially or completely around the torso of the individual or in other embodiments the ballistic soft armor component **102** may have substantially the same configuration as the ballistic vest plate carrier **108** and cover substantially the chest area of an individual.

**[0024]** In one embodiment the ballistic vest plate carrier **108** may define a front chest pocket **122** configured to receive a ballistic ridge component **104** engaged to a ballistic plate **106** disposed within the front chest pocket **122**. As shown in FIGS. 4 and 5, the ballistic ridge component **104** is configured to engage the peripheral area **120** of the ballistic plate **106**. The ballistic ridge component **104** provides protection against side spall and minimize back face deformation caused when a ballistic projectile impacts the peripheral area of the ballistic plate **106** covered by the ballistic ridge component **104**. For example, the ballistic ridge component **104** is configured to cover both the peripheral edge **122** and a peripheral area **120** of the ballistic plate **106**. In some embodiments, the ballistic ridge component **104** may be made from a polyethylene material; however, other types of thermoplastic materials may be used to manufacture the ballistic ridge component

**104**. For example, the ballistic ridge component **104** may be made from a stretchable and elastic spandex material reinforced with a unidirectional and/or aramid material.

**[0025]** Referring to FIG. 17, as noted above the ballistic vest plate carrier **108** forms an opening **124** in communication with the front chest pocket **122** configured to receive the ballistic plate **106** therein. In addition, the ballistic vest plate carrier **108** may include a ballistic flap **120** that covers the opening **124** to the front chest pocket **122** and is configured to cover and protect the bottom portion of the ballistic plate **106** when disposed within the pocket **122**. In some embodiments, the ballistic flap **120** may be made from a soft armor material that, in combination with the ballistic ridge component **104**, assists in preventing side spall and backside deformation along the bottom portion of the ballistic plate **106**. In some embodiments, the ballistic flap **120** may include a securing arrangement **127**, such as hook and loop arrangement, for example VELCRO<sup>®</sup> or a buckle and strap arrangement (not shown) that allows the ballistic flap **120** to be attached to the bottom portion of the ballistic vest plate carrier **108** to close off the opening **124** and retain the ballistic plate **106** within the front chest pocket **122** of the ballistic vest plate carrier **108**.

**[0026]** As further shown in FIG. 2, in some embodiments the ballistic vest plate carrier **108** may include a soft armor liner **126** that extends along the peripheral edge of the pocket **122** to provide further protection to the ballistic plate **106**. In particular, the soft armor liner **126** may be sewn along the peripheral edge of the pocket **122** such that the soft armor liner **126** at least substantially covers the peripheral edge of the ballistic ridge component **104** when the ballistic plate **106** is disposed within the pocket **122**. In some embodiments the soft armor liner **126** may be a strip of soft armor material, while in other embodiments the soft armor liner **126** may substantially or completely line the interior of the pocket **122**. In some embodiments, the soft armor liner **126** may be made from a soft armor material, such as the soft armor material disclosed in U.S. patent application serial number 13/161,322 filed on June 15, 2011 entitled "High Performance Composite Material", which is herein incorporated by reference in its entirety; however, in other embodiments other types of soft armor material, such as KEVLAR<sup>®</sup>, may be used to form the soft armor liner **126**.

**[0027]** Referring to FIG. 7, one embodiment of the ballistic ridge component **104** may have a configuration that substantially matches the peripheral

edge **125** defined by the ballistic plate **102**. Referring to FIG. **6**, in some embodiments, the ballistic ridge component **104** defines an inner surface **110** and an outer surface **114**. As further shown, the ballistic ridge component **104** may define a side portion **118** and a bottom portion **116** to form an open-ended slot **112** configured to receive the ballistic plate **106**. As shown, the side portion **118** is oriented along a first axis **200**, while bottom portion **116** is oriented along a second axis **202** such that the first axis **200** is in a substantially perpendicular orientation relative to the second axis **202** to form the open-ended slot **112** that extends along the periphery of the ballistic ridge component **104**. By virtue of this structural arrangement, the bottom portion **116** and side portion **118** provide protection against impacts by ballistic projectiles along the front and side of the ballistic plate **106** and also prevent debris and/or shrapnel caused by side spall or head-on impacts to the ballistic plate **106** to penetrate the soft armor component **102**. In some embodiments, the bottom portion **116** and side portion **118** extend along the entire periphery of the ballistic plate **106**.

**[0028]** Referring to FIG. **8**, one method for manufacturing the ballistic vest system **100** is illustrated. At block **300**, forming a ballistic ridge component **104** defining a bottom wall and a side wall that collectively form an open-ended slot **112**. At block **302**, engaging the peripheral area of a ballistic plate **106** within the open-ended slot **112** of the ballistic ridge component **104** as illustrated in FIG. **7**. In some embodiments, the ballistic plate **106** may be freely seated within the open-ended slot **112** or secured to the open-ended slot **112** by glue or other type of suitable adhesive. At block **304**, inserting the ballistic ridge component **104** and the ballistic plate **106** into a ballistic vest plate carrier **108** as shown in FIG. **2**. In some embodiments, the bottom portion **116** and the side portion **118** of the ballistic ridge component **104** may be integral or separate discrete pieces that are secured to one another during manufacture to form the open-ended slot **112**. In other embodiments, the ballistic ridge component **104** may be configured to extend around the entire peripheral areas **125** of the ballistic plate **106**.

**[0029]** Referring to FIGS. **9-15**, another embodiment of the ballistic vest system, designated **200**, may include a second embodiment of the ballistic ridge component **204**. In particular, the ballistic ridge component **204** is configured to substantially encase the entire peripheral area of the ballistic plate **206** (FIGS. **15** and **16**), in which both the ballistic plate **206** and the ballistic ridge component **204**

are configured to be disposed within the ballistic vest plate carrier **108** (FIG. **2**) and positioned in front of the soft armor component **102** (FIG. **3**) when the ballistic vest system **100** is assembled.

**[0030]** In some embodiments, the ballistic ridge component **204** includes a body **210** that defines a rear surface **212**, a front surface **214**, a side surface **216**, and an interior surface **222**. The interior surface **222** formed on the opposite side of the rear surface **212**, front surface **214** and side surface **216** of the ballistic ridge component **204** may collectively define a channel **218** that is configured to substantially cover the entire peripheral area for the ballistic plate **206** when the ballistic ridge component **204** is engaged to the ballistic plate **206** as shown in FIGS. **14** and **15**.

**[0031]** Referring back to FIGS. **9-13**, in some embodiments the body **210** of the ballistic ridge component **204** may further include a middle portion **220** that is secured to the interior surface **222** of the body **210** and extends from an upper portion **226** of the body **210** to the lower portion **228** of the body **210**. The middle portion **220** provides further structural support to maintain the ballistic plate **206** within the confines of the ballistic ridge component **204**. In some embodiments, the middle portion **220** may be secured to the interior surface **222** proximate the rear surface **212** of the ballistic ridge component **204**. In other embodiments, the middle portion **220** may be secured to the interior surface **222** proximate the front surface of the ballistic ridge component **204**. In yet other embodiments, the middle portion **220** may extend in perpendicular fashion relative the upper portion **226** and the lower portion **228** as shown in FIGS. **9-13**, although in other embodiments the middle portion **220** may extend in parallel fashion relative to the upper and lower portions **226** and **228**.

**[0032]** In some embodiments, the upper portion **226** of the ballistic ridge component **204** may be made an aramid/unidirectional material, while the lower portion **228** of the ballistic ridge component **204** is made from the same aramid/unidirectional material. In some embodiments, the ballistic ridge component **204** may be made from a stretchable fabric composite material that allows the ballistic ridge component **204** to easily engage the peripheral area of the ballistic plate **206**. In some embodiments, the body **210** of the ballistic ridge component **204** may have a generally rectangular-shaped body, although in other embodiments the

body **210** of the ballistic ridge component **204** may be configured to substantially match the configuration of the ballistic plate **206**.

**[0032]** In some embodiments, the body **210** of the ballistic ridge component **204** may be stitched and sewn together as indicated by the various stitching patterns **224** shown in FIGS. **9-15**. In other embodiments, the ballistic ridge component **204** may have a unitary construction that does not require sewing or stitching to form the body **210**.

**[0033]** Referring to FIGS. **16** and **17**, another embodiment of the ballistic vest system, designated **300**, may include a third embodiment of the ballistic ridge component **304**. Similar to the other embodiments, the ballistic ridge component **304** is also configured to substantially encase the entire peripheral area of the ballistic plate **306**.

**[0034]** Referring specifically to FIG. **16**, the ballistic ridge component **304** may define a rear surface **312**, a front surface **314**, a side surface **316**, and an interior surface **322**. The interior surface **322** is formed on the opposite side of the rear surface **312**, front surface **314** and side surface **316** of the ballistic ridge component **304** and collectively defines a channel **318** that is configured to substantially cover the entire peripheral area for the ballistic plate **306** when the ballistic ridge component **304** is engaged to the ballistic plate **306** as shown in FIG. **17**. In addition, the rear and front surfaces **212** and **214** collectively define an opening **320** that exposes the non-peripheral area of the ballistic plate **306** when the ballistic ridge component **304** is engaged to the ballistic plate **306**.

**[0035]** In some embodiments as shown in FIG. **16**, the body **310** of the ballistic ridge component **304** may have an upper portion **226** that has a tapered configuration and a lower portion **228** that has a generally rectangular configuration. In other embodiments, the body **210** may be configured to substantially match the configuration of the ballistic plate **306**.

**[0036]** The scope of the claims should not be limited by the embodiments set forth in the examples, but should be given the broadest interpretation consistent with the description as a whole.

## CLAIMS

What is claimed is

1. A ballistic vest system comprising:  
a ballistic ridge component having a body defining a rear surface, a front surface, a side surface, and an interior surface, the body having an upper portion and a lower portion, the interior surface defining a channel extending along the upper portion, the lower portion, and the side surface, the rear surface and the front surface defining an opening; and  
a ballistic plate having a peripheral area and a non-peripheral area, the ballistic plate configured to be received within the channel of the ballistic ridge component such that the channel of the ballistic ridge component substantially covers an entirety of the peripheral area of the ballistic plate and the opening of the ballistic ridge component exposes the non-peripheral area of the ballistic plate.
2. The ballistic vest system of claim 1, wherein the upper portion is made from an aramid material.
3. The ballistic vest system of claim 1, wherein a middle portion extends between the upper portion and the lower portion of the ballistic ridge component.
4. The ballistic vest system of claim 1, wherein the upper portion of the ballistic ridge component is made from a stretchable spandex material.
5. The ballistic vest system of claim 1, wherein the body of the ballistic ridge component is rectangular in shape.
6. The ballistic vest system of claim 1, wherein the upper portion of the body of the ballistic ridge component has a tapered configuration.
7. The ballistic vest system of claim 1, wherein the lower portion of the body of the ballistic ridge component has a rectangular configuration.
8. The ballistic vest system of claim 1, wherein the body of the ballistic ridge component is stitched together.

9. The ballistic vest system of claim 1, wherein the body of the ballistic ridge component has a unitary construction.
10. The ballistic vest system of claim 1, wherein the ballistic plate is freely seated within the channel of the ballistic ridge component.
11. The ballistic vest system of claim 1, wherein a ballistic soft armor component defining a soft armor body is disposed in front of the ballistic plate.
12. The ballistic vest system of claim 1, wherein the upper portion is made from a unidirectional material.
13. The ballistic vest system of claim 1, wherein a ballistic soft armor component defining a soft armor body is disposed behind the ballistic plate.
14. The ballistic vest system of claim 1, wherein the upper portion is made from a polyethylene material.
15. A ballistic vest system comprising:
  - a ballistic ridge component including a body having an upper portion and a lower portion;
  - a side surface of the body connecting a rear surface to a front surface, the rear surface disposed opposite the front surface, the side surface, the front surface, and the rear surface each extending from the lower portion to the upper portion;
  - a channel defined by an interior surface of the rear surface, the front surface, and the side surface; and
  - an opening defined by the rear surface and the front surface, a ballistic plate configured to be received within the channel of the ballistic ridge component such that the channel of the ballistic ridge component substantially covers an entirety of a peripheral area of the ballistic plate and the opening of the ballistic ridge component exposes a non-peripheral area of the ballistic plate.
16. The ballistic vest system of claim 15, wherein the upper portion has a tapered configuration and the lower portion has a rectangular configuration.
17. The ballistic vest system of claim 16, wherein the tapered configuration includes a width of the front surface and the rear surface tapering inwardly.

18. The ballistic vest system of claim 15, wherein the ballistic plate and the ballistic ridge component are receivable into a pocket of a ballistic plate carrier.

19. The ballistic vest system of claim 15, wherein a middle portion is secured to the interior surface and extends between the upper portion and the lower portion.

20. The ballistic vest system of claim 15, wherein the ballistic ridge component is stitched together.

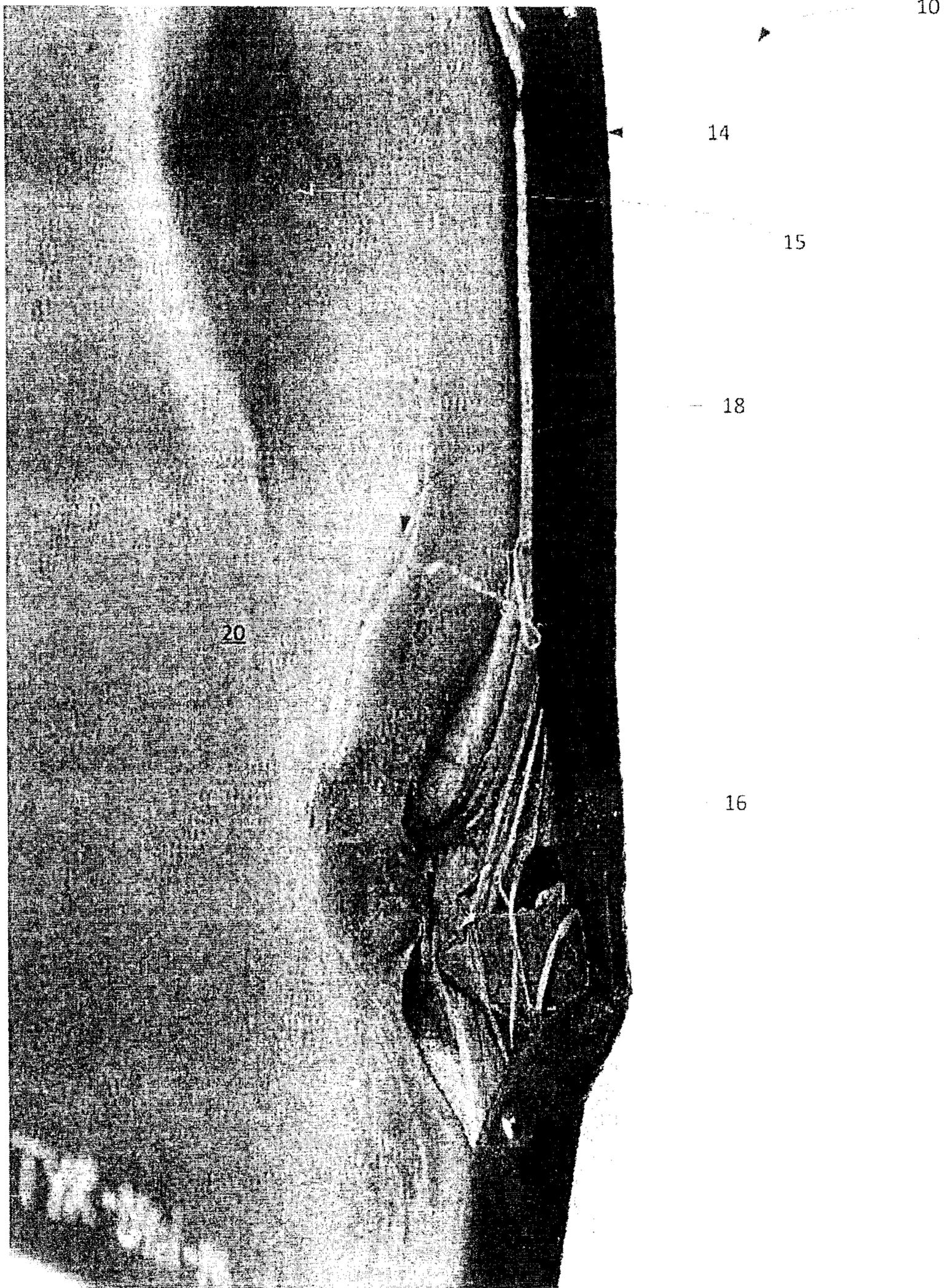


FIG. 1 (Prior Art)

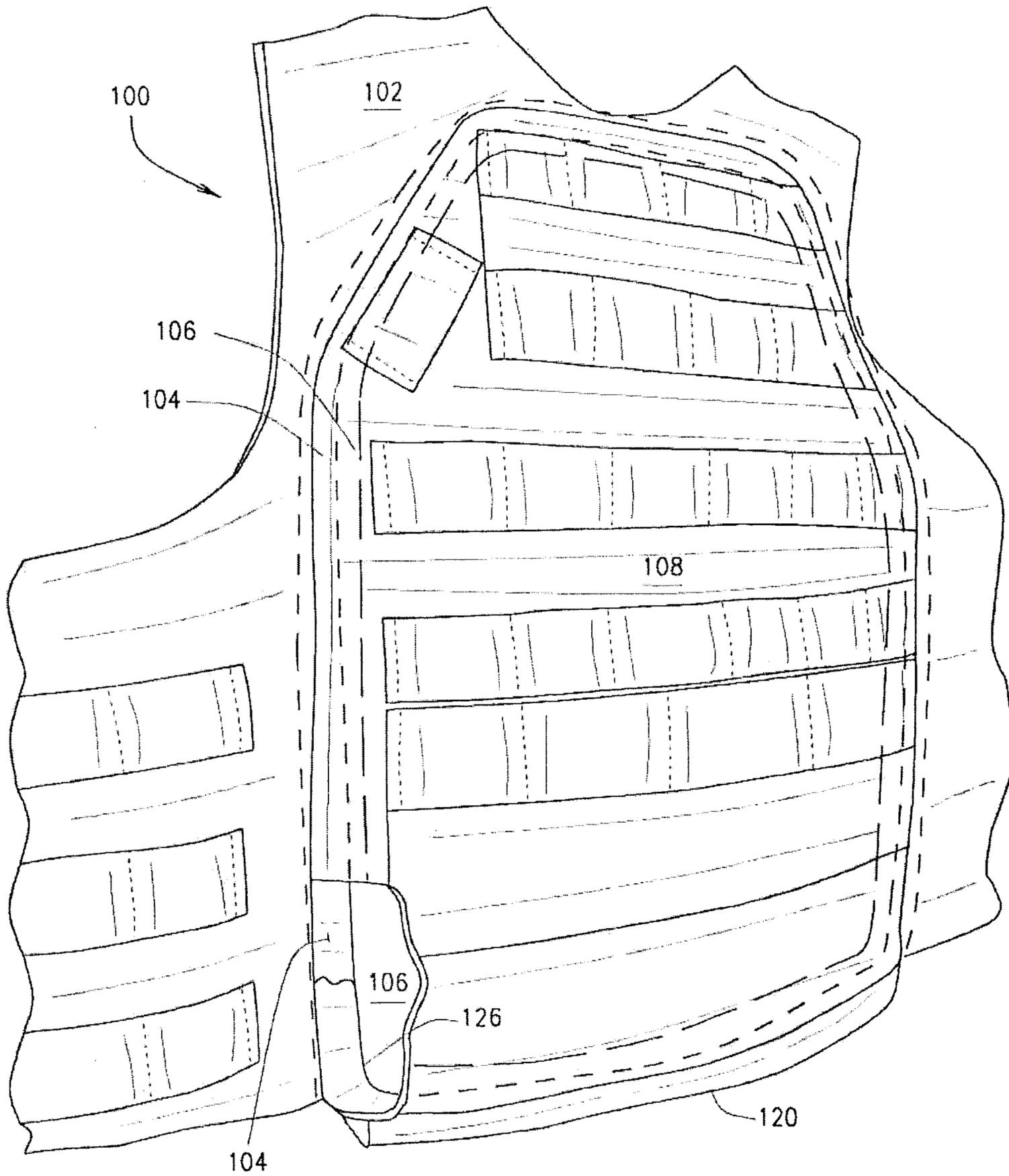


FIG. 2

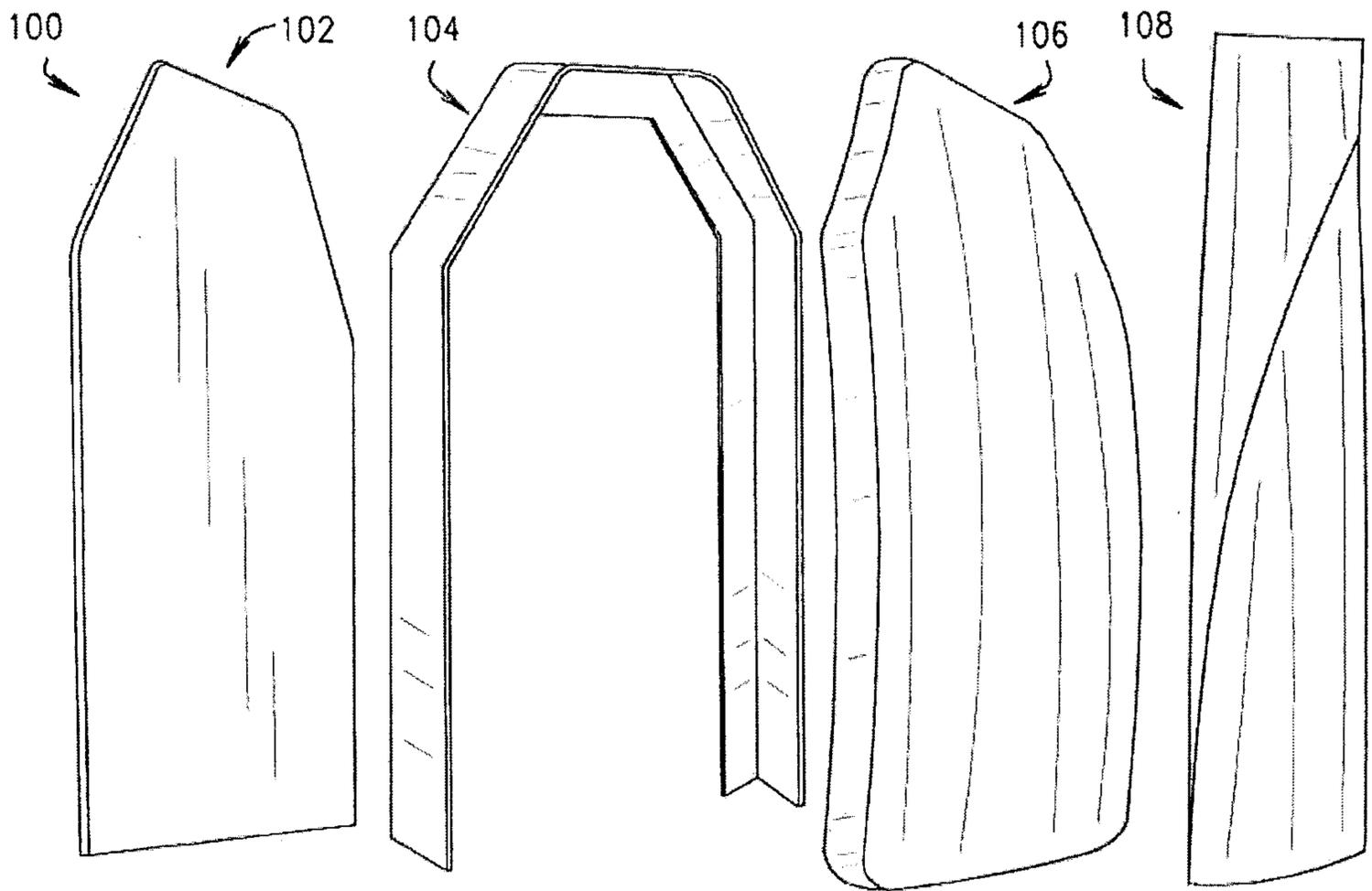


FIG. 3

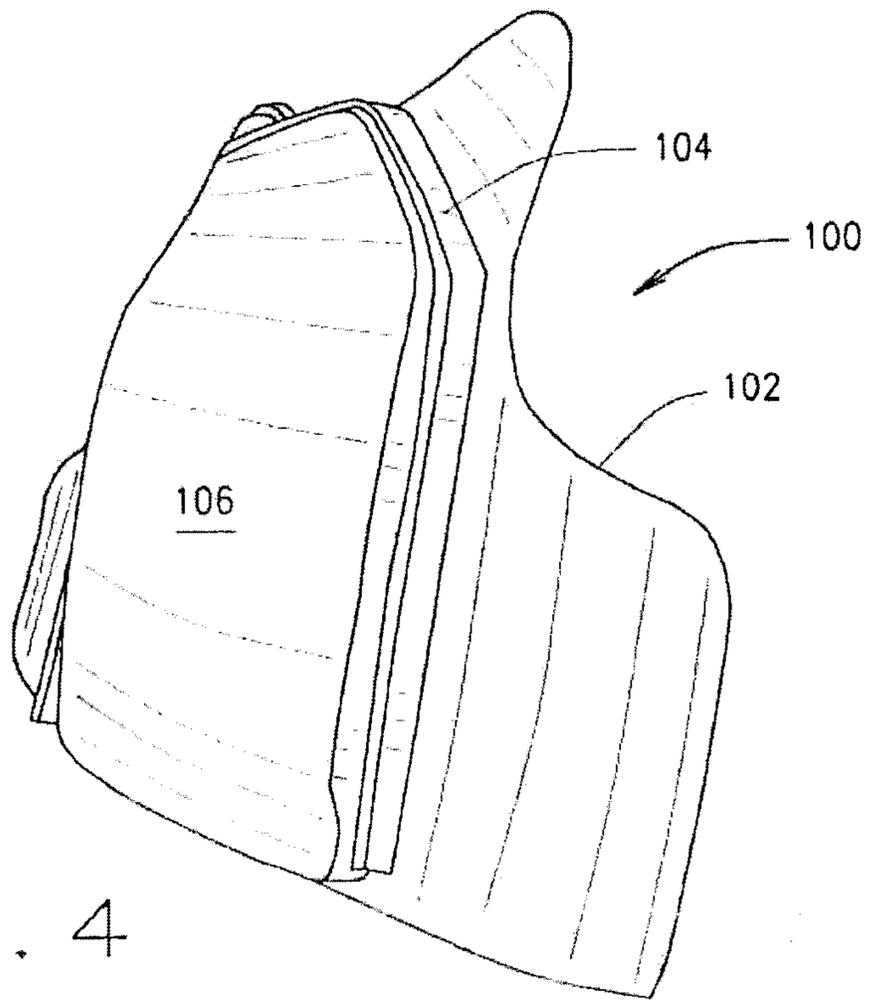


FIG. 4

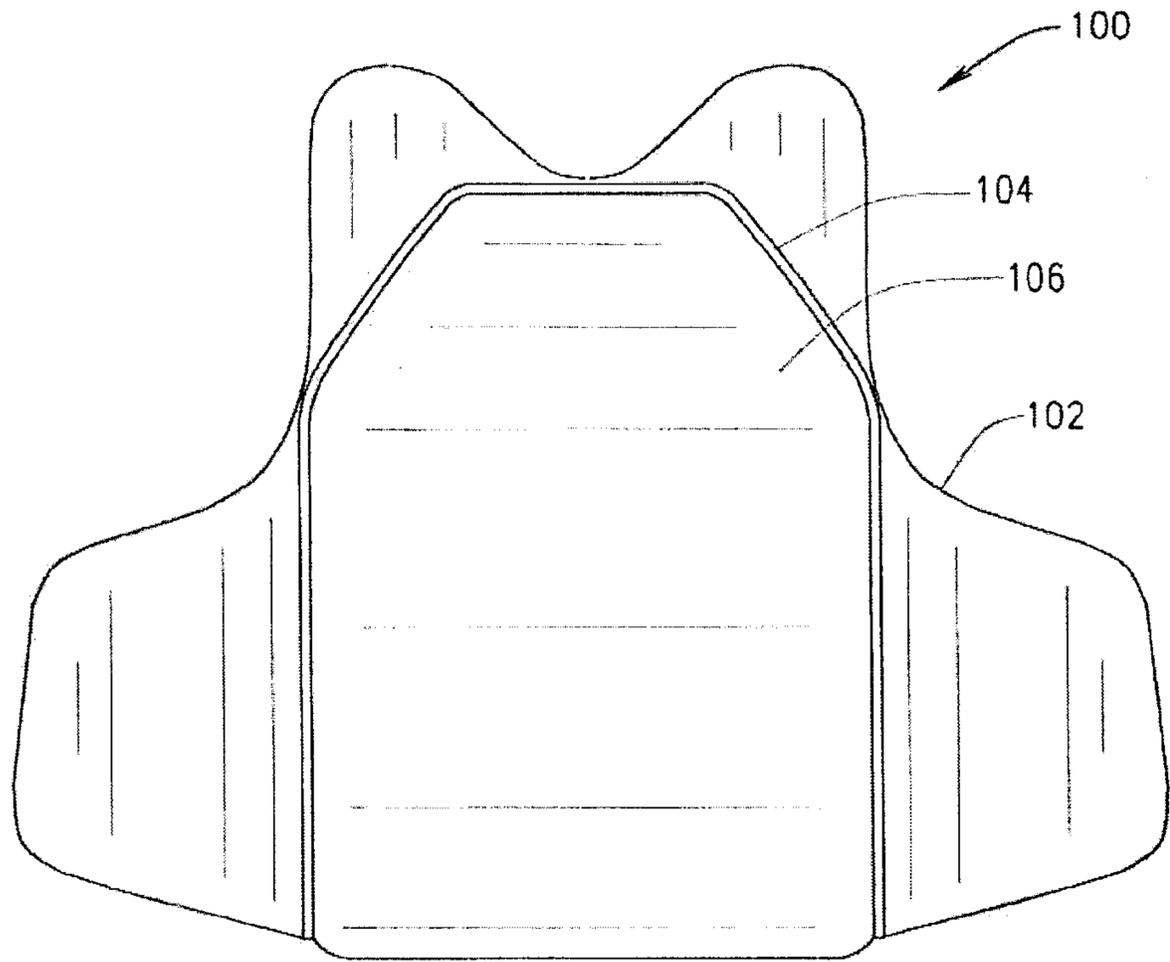


FIG. 5

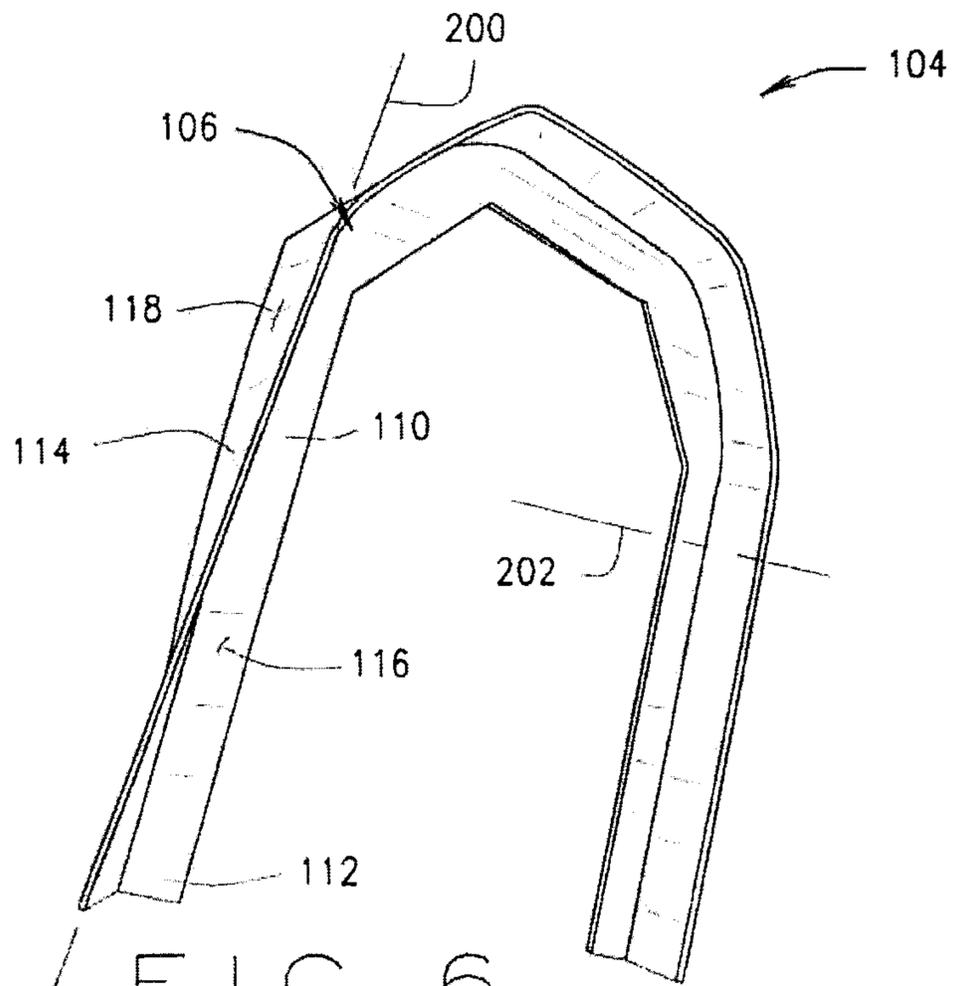


FIG. 6

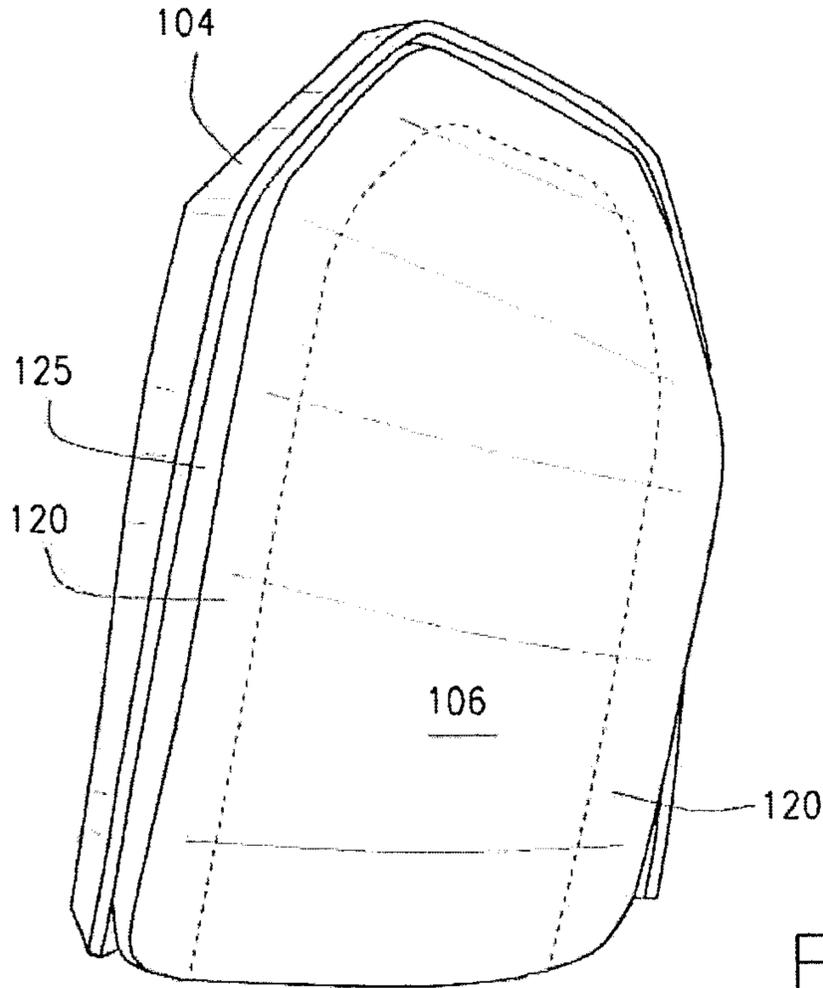


FIG. 7

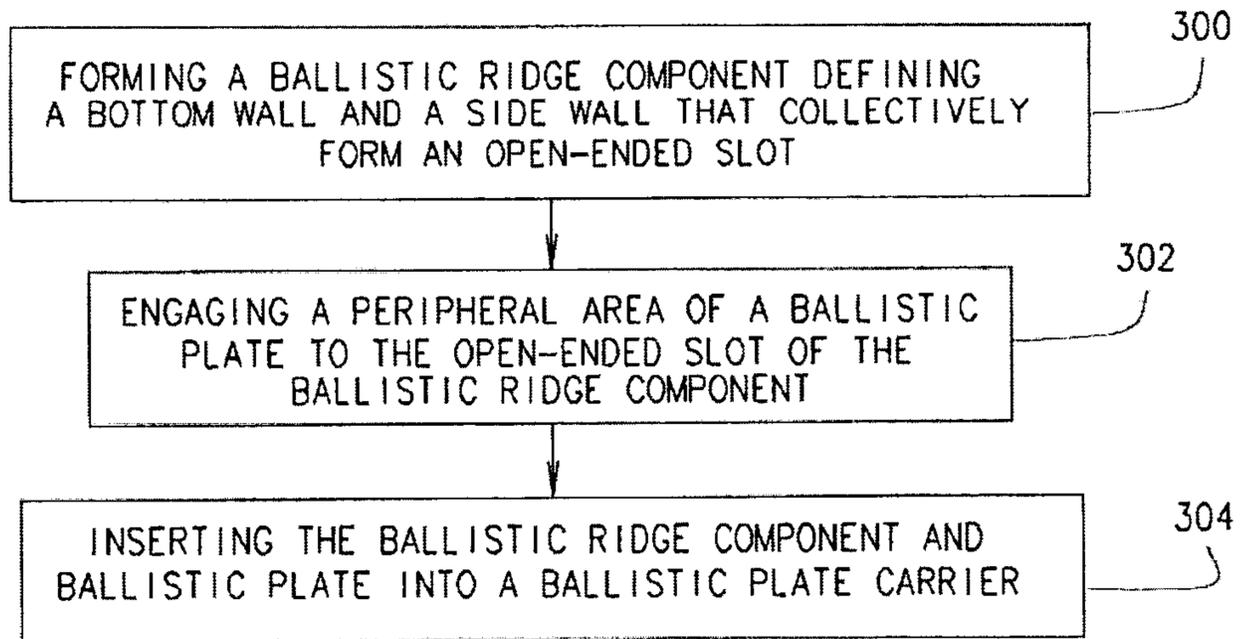
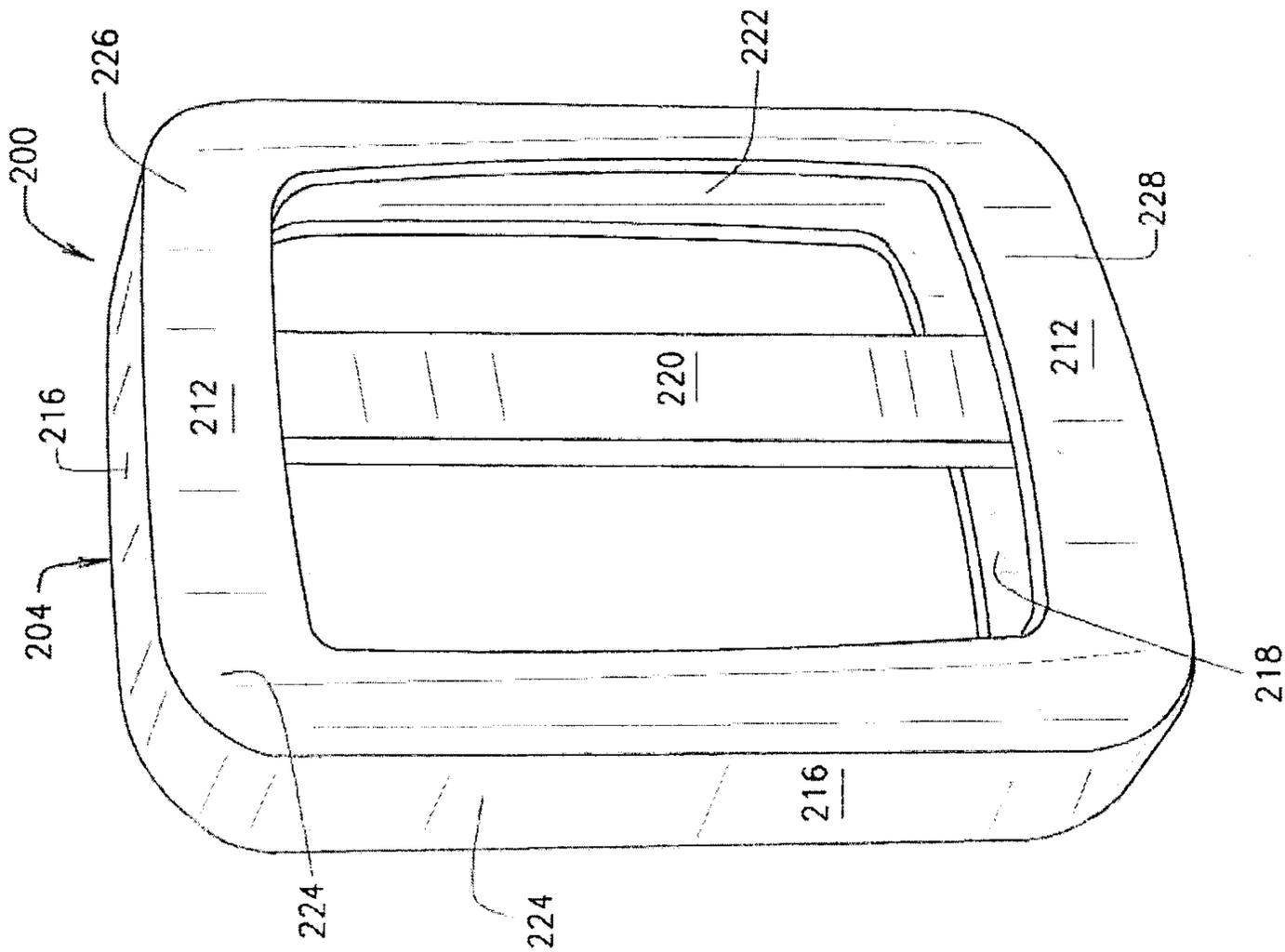
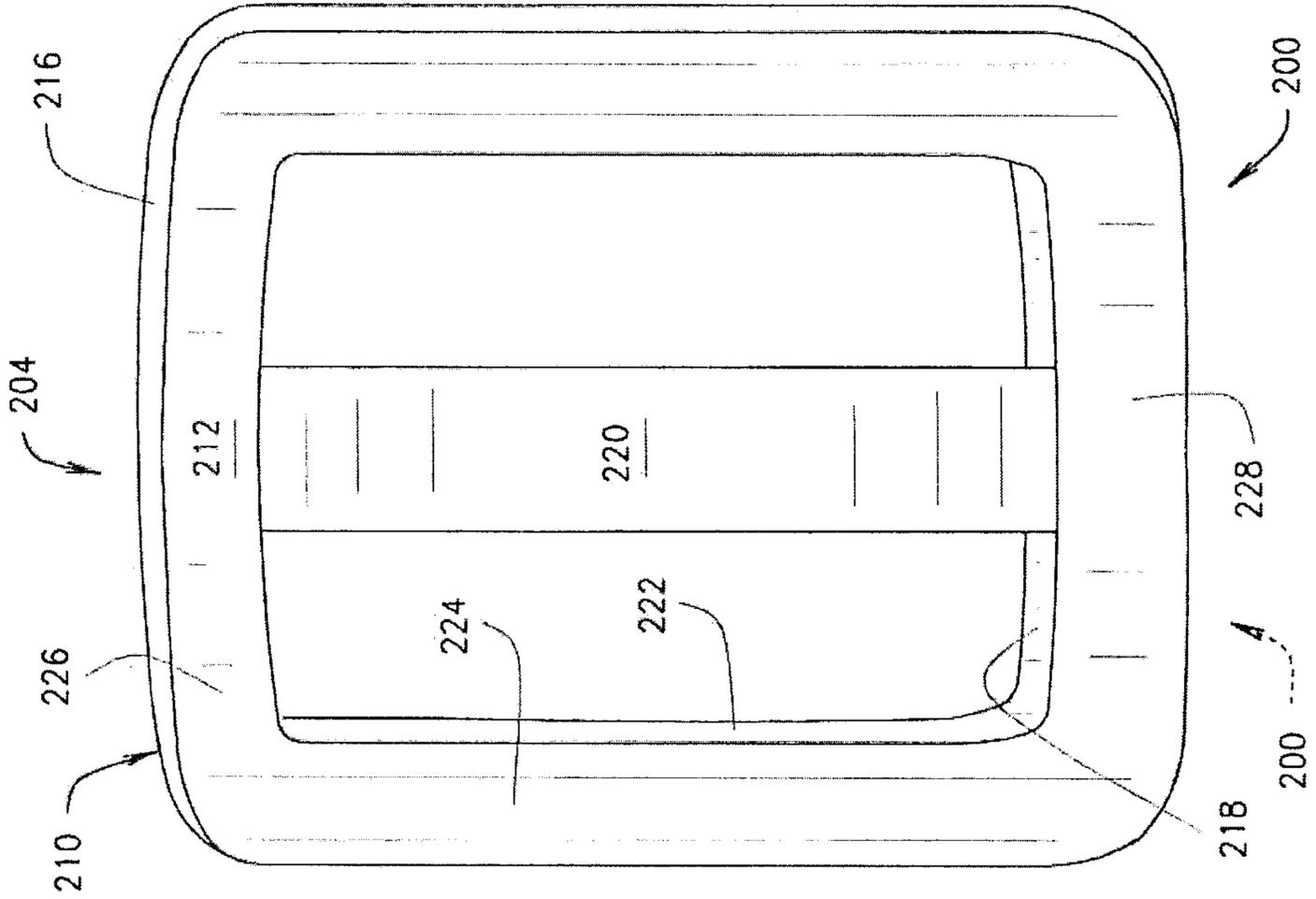


FIG. 8



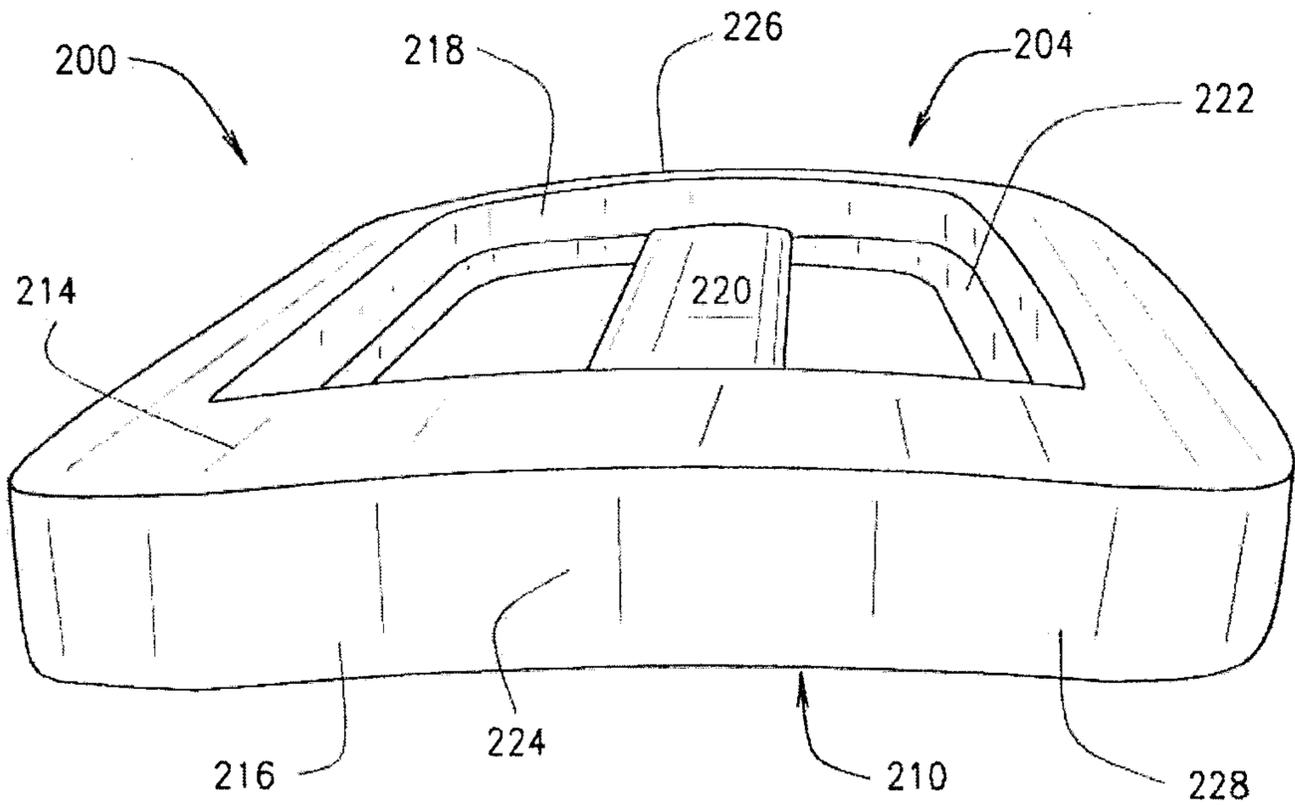


FIG. 11

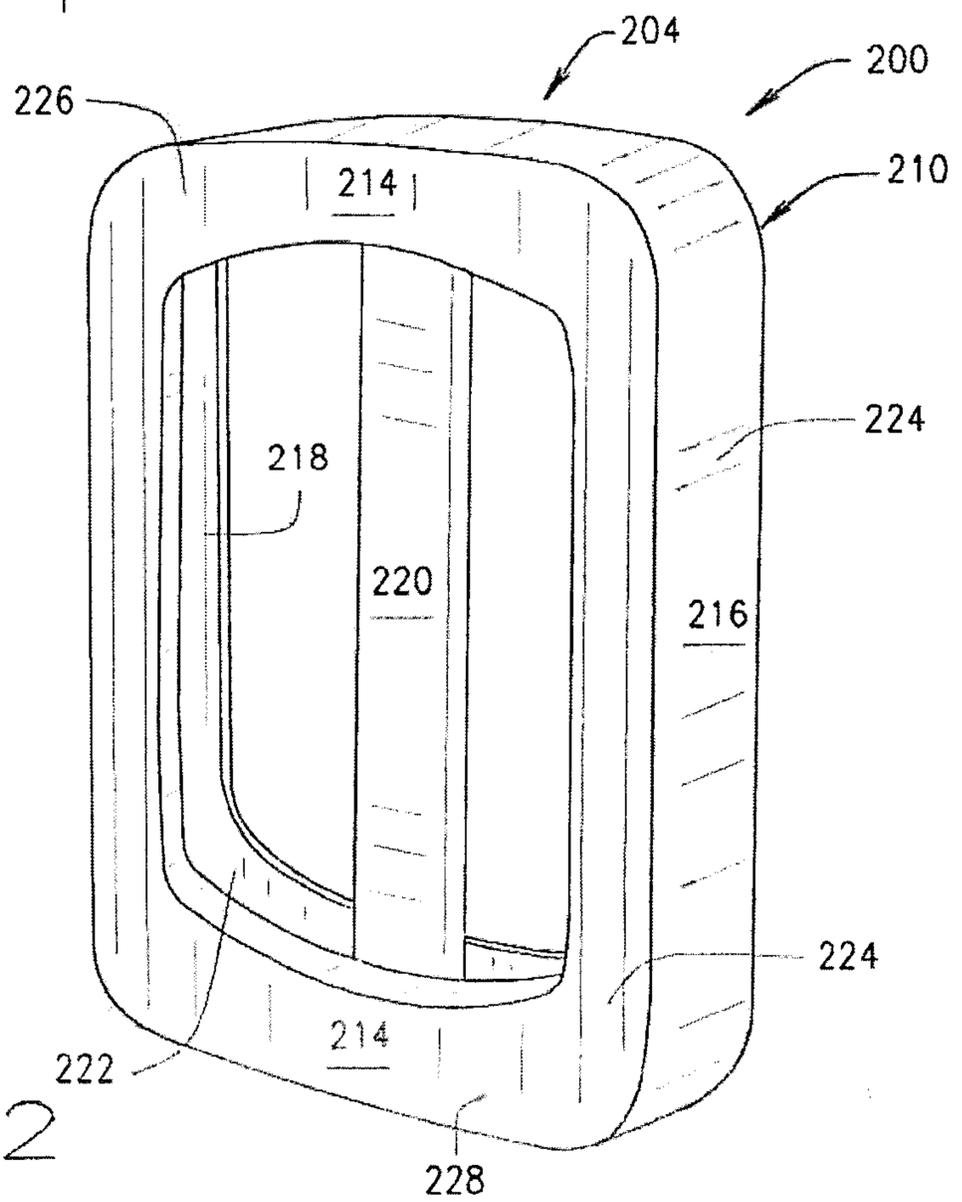


FIG. 12

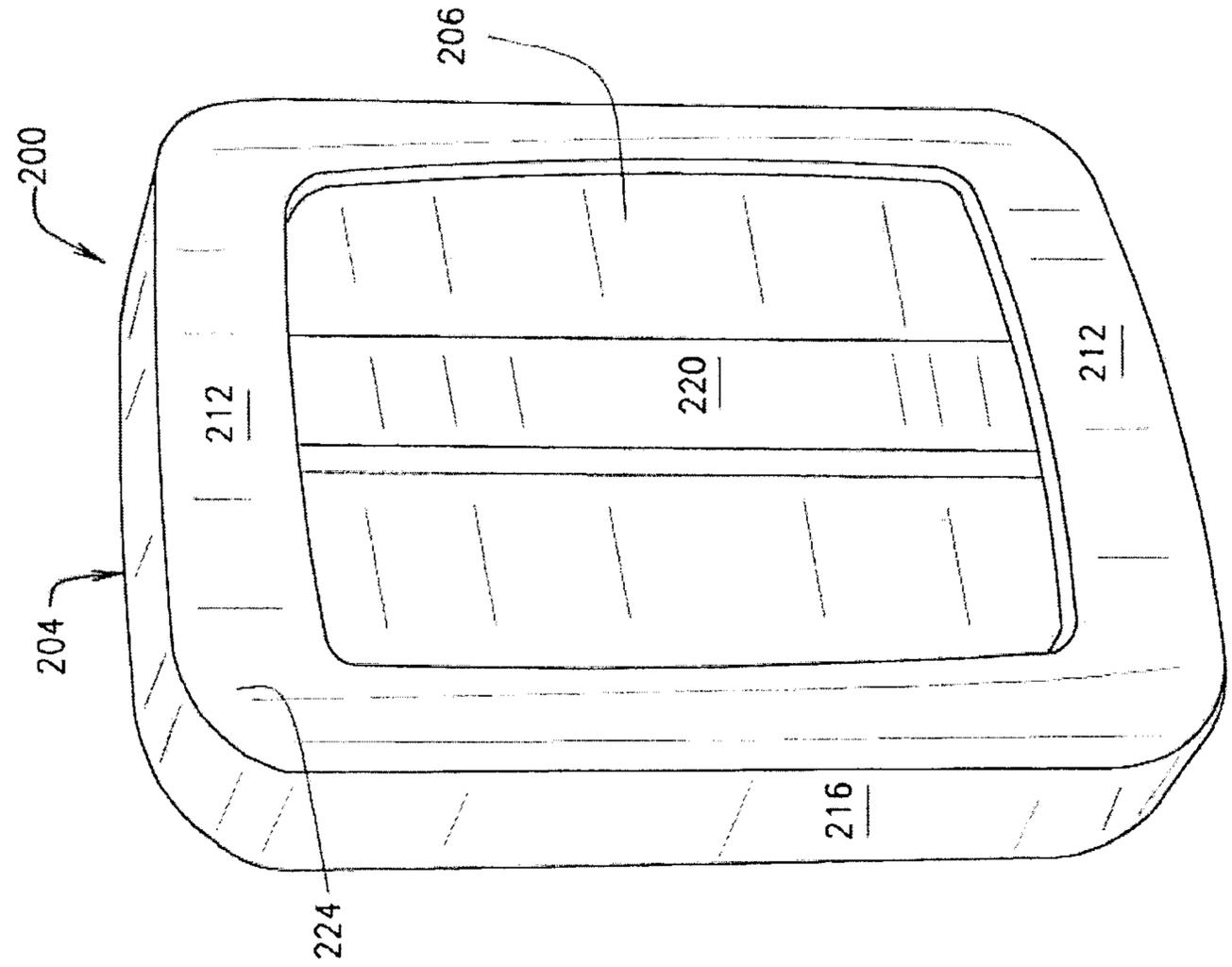


FIG. 13

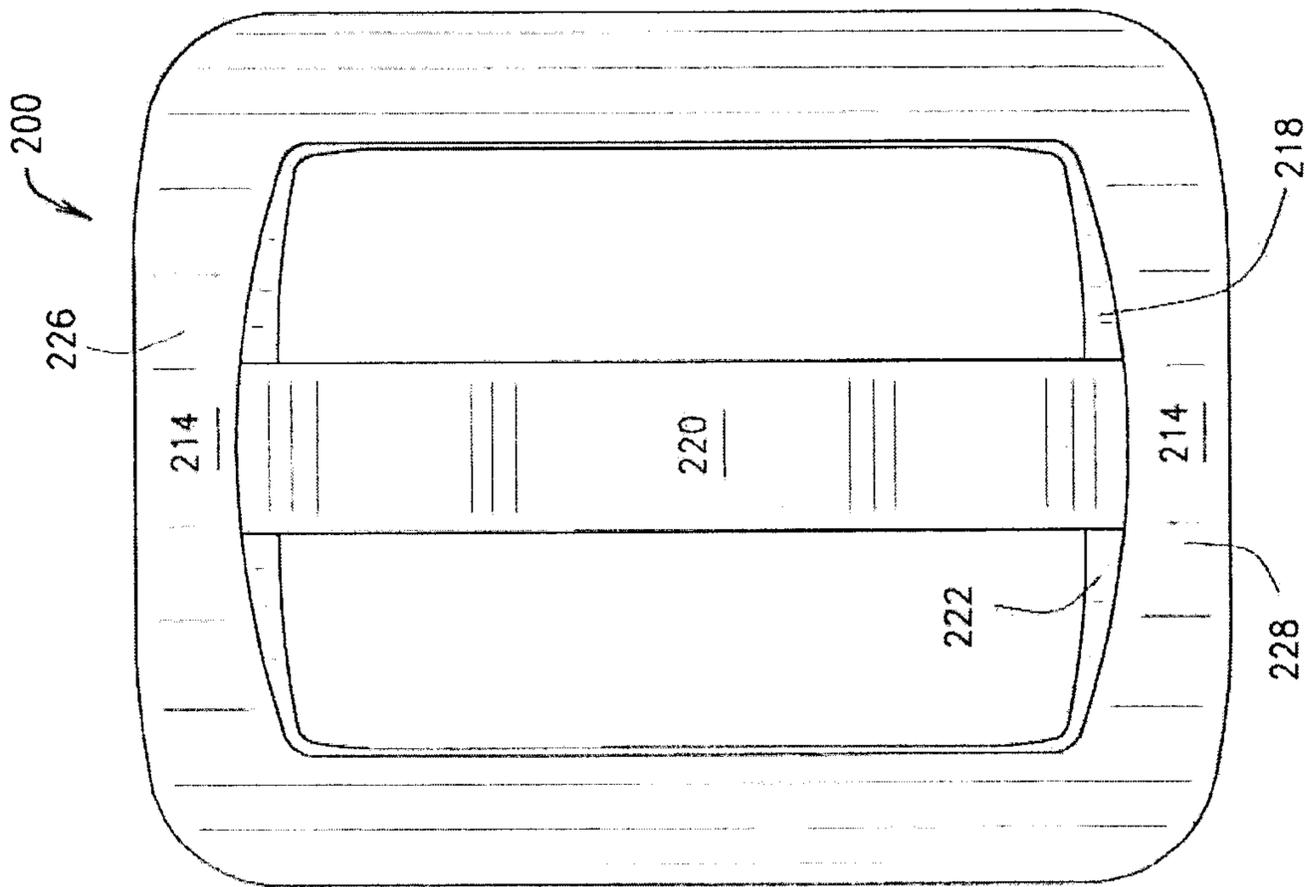


FIG. 14

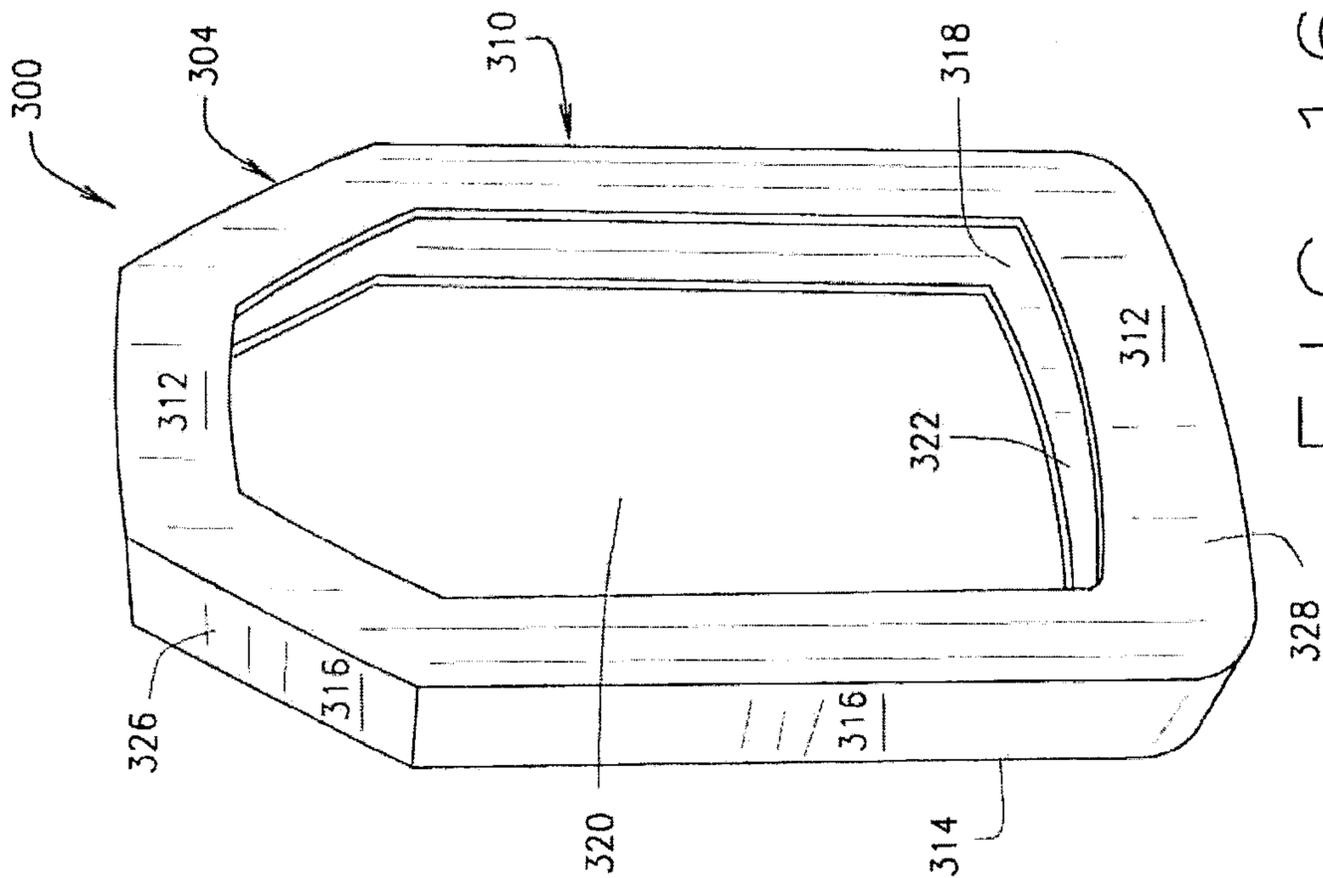


FIG. 15

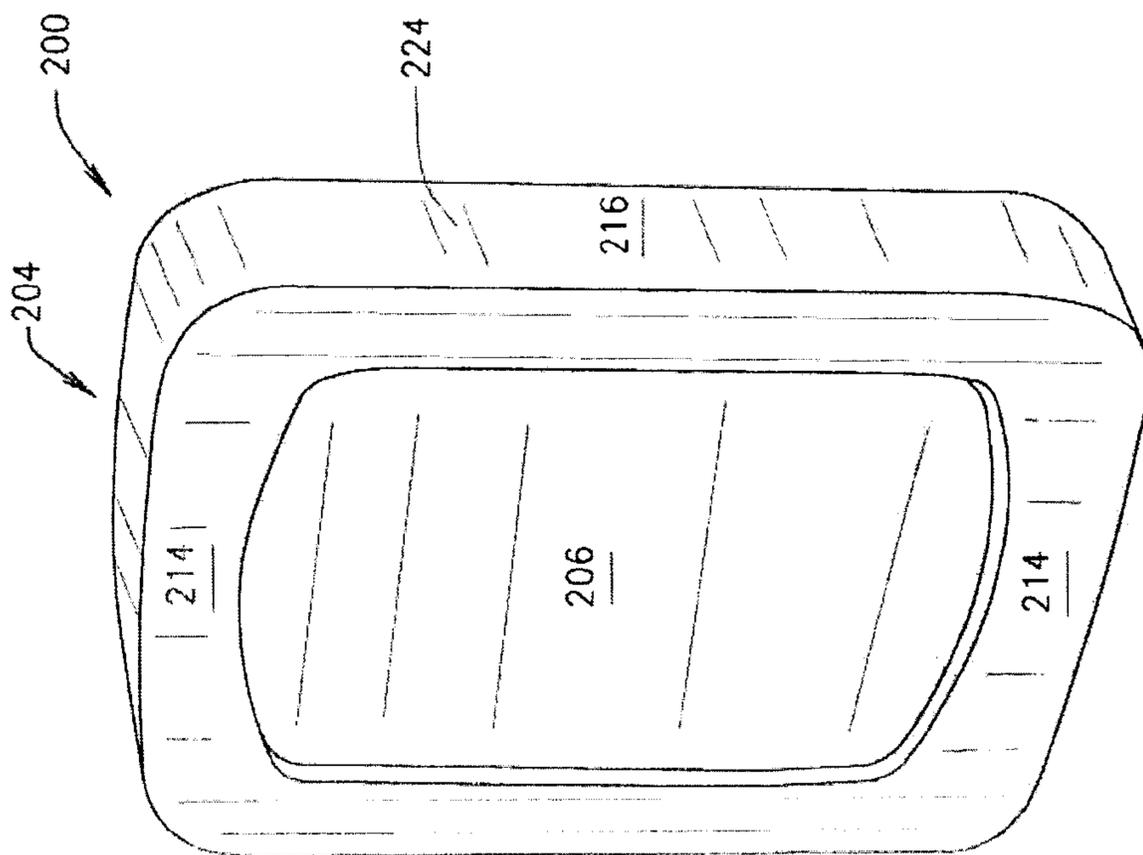


FIG. 16

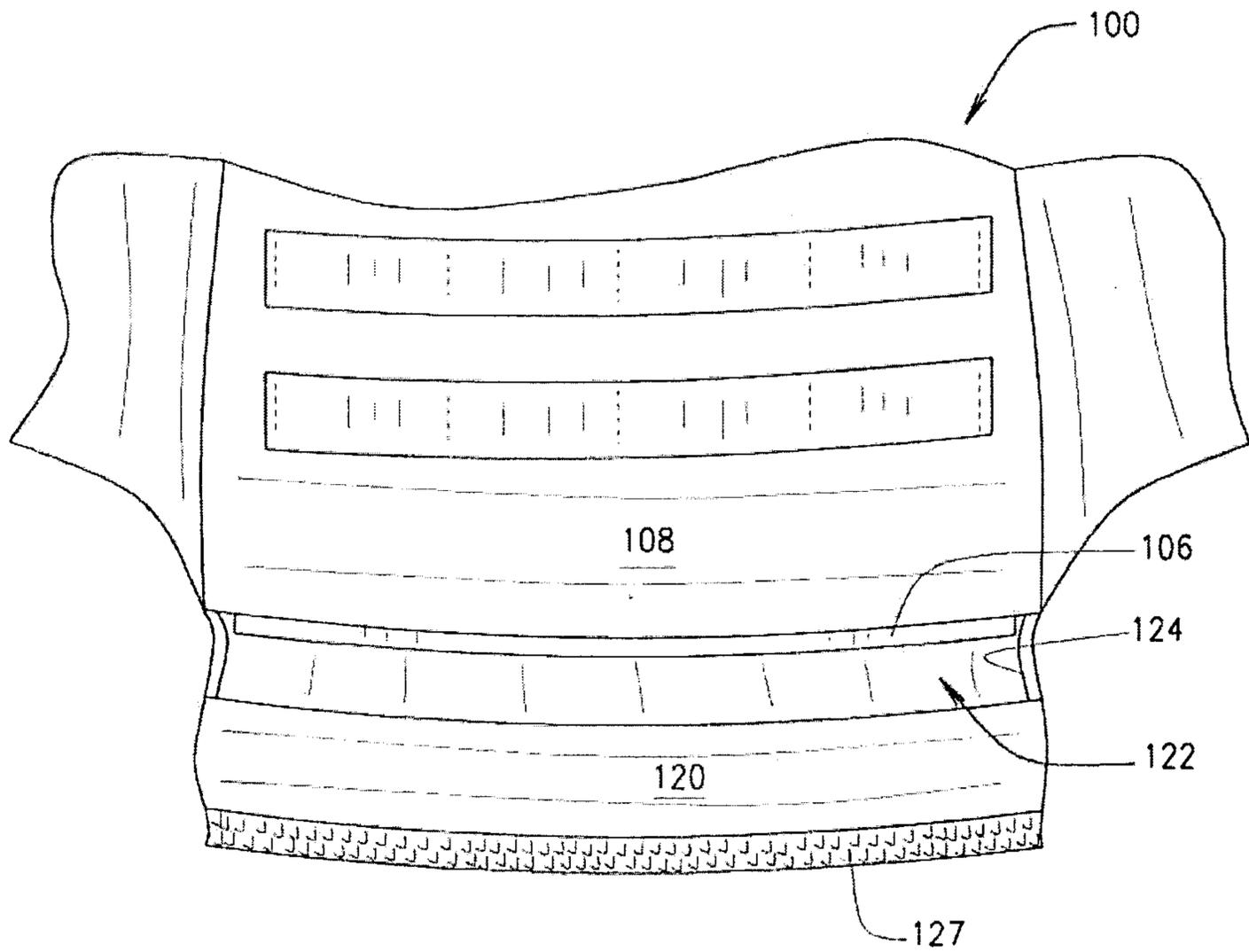


FIG. 17

