US011286083B2

(12) **United States Patent**
Lee et al.

(10) **Patent No.: US 11,286,083 B2**
(45) **Date of Patent: Mar. 29, 2022**

(54) **PALLET WITH DECK OPENING AND BRACE**

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(73) Assignee: **Rehrig Pacific Company**, Los Angeles, CA (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **16/988,859**

(22) Filed: **Aug. 10, 2020**

(65) **Prior Publication Data**

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Related U.S. Application Data

(60) Provisional application No. 62/948,419, filed on Dec. 16, 2019, provisional application No. 62/884,656, filed on Aug. 8, 2019.

(51) **Int. Cl.**
B65D 19/18 (2006.01)
B65D 19/44 (2006.01)

(52) **U.S. Cl.**
CPC ***B65D 19/18*** (2013.01); ***B65D 19/44*** (2013.01); *B65D 2519/00034* (2013.01); *B65D 2519/00069* (2013.01); *B65D 2519/00139* (2013.01); *B65D 2519/00273* (2013.01); *B65D 2519/00288* (2013.01); *B65D 2519/00308* (2013.01); *B65D 2519/00572* (2013.01); *B65D 2519/00636* (2013.01); *B65D 2519/00796* (2013.01); *B65D 2519/00815* (2013.01)

(58) **Field of Classification Search**
CPC B65D 21/02; B65D 21/00; B65D 21/0209; B65D 21/0215; B65D 21/0224; B65D 21/023; B65D 2519/00935; B65D 19/44
USPC 108/55.3, 55.5, 53.1
See application file for complete search history.

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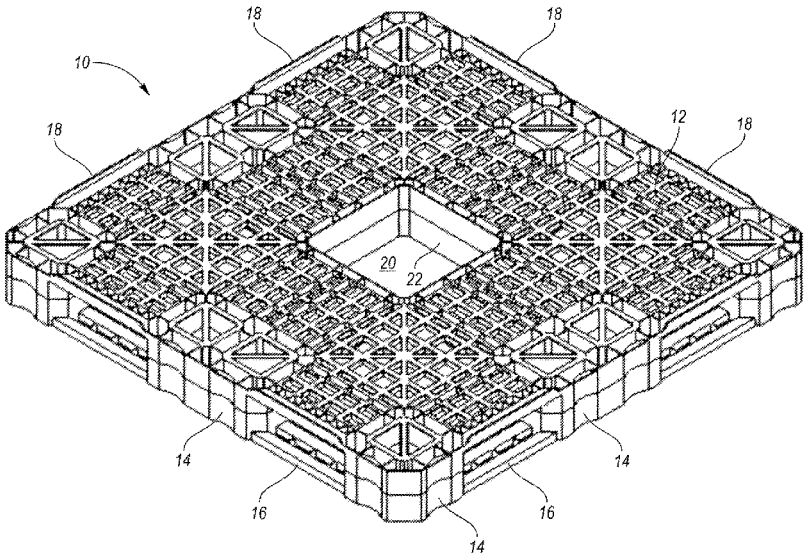
(74) *Attorney, Agent, or Firm* — Carlson, Gaskey & Olds, P.C.

(57) **ABSTRACT**

A pallet includes a deck having an opening therethrough, such that product can be removed through the opening from a box loaded on the deck of a pallet. A plurality of columns support the deck. The box may be supported on the deck over the opening. The bottom wall of the box may be opened though the opening in the deck. The items can then be removed from the box through the opening through the deck without removing the box from the pallet. Optionally, fasteners may secure flaps of the box in corners of the deck of a pallet. According to another feature, a brace having an elongated body portion can be secured to an opening of the pallet, such that the elongated body portion abuts goods that are supported on the deck.

25 Claims, 65 Drawing Sheets



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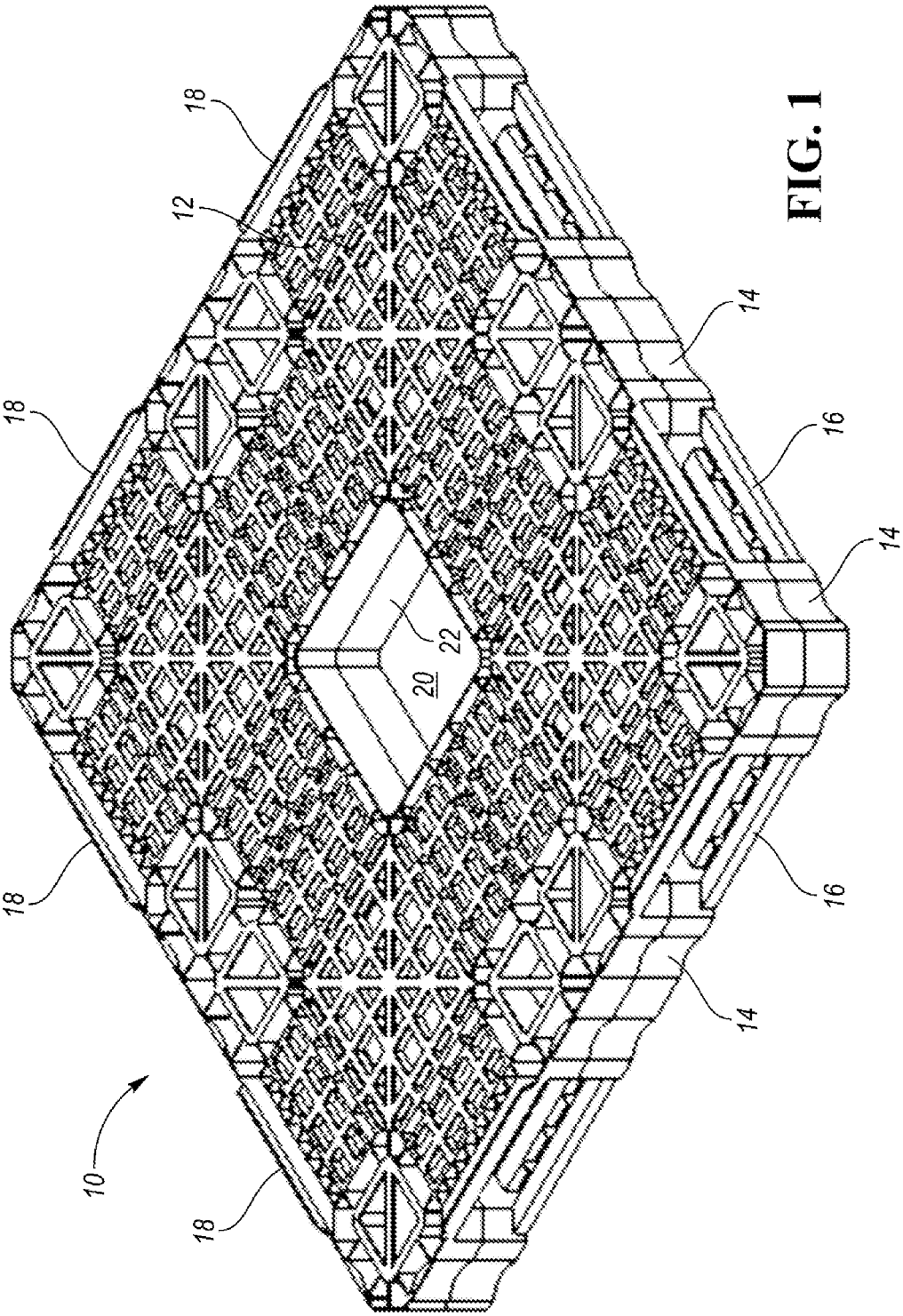


FIG. 1

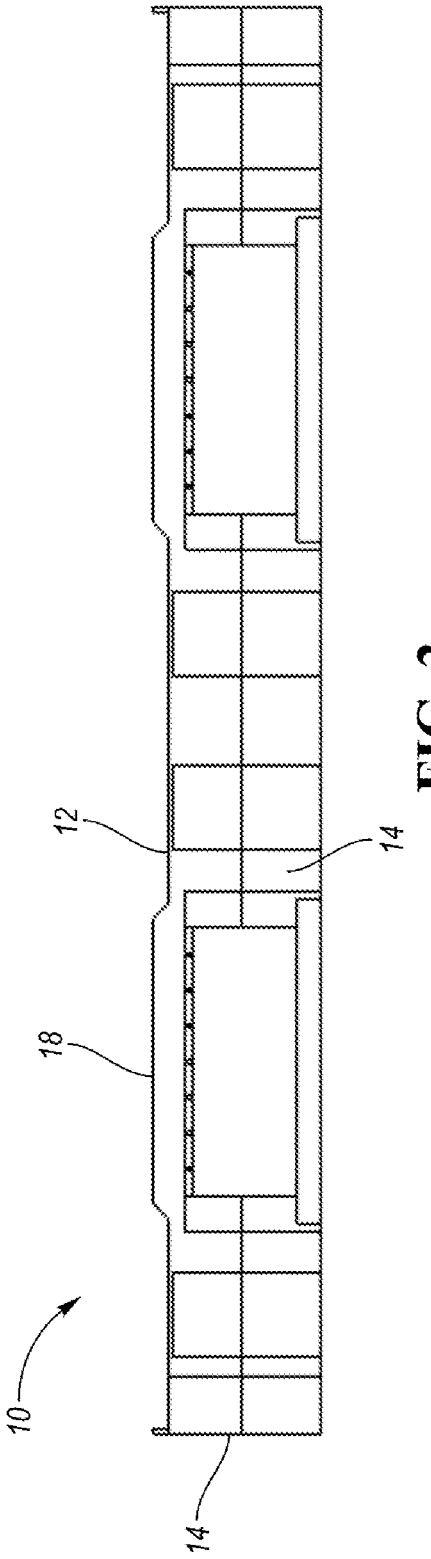


FIG. 2

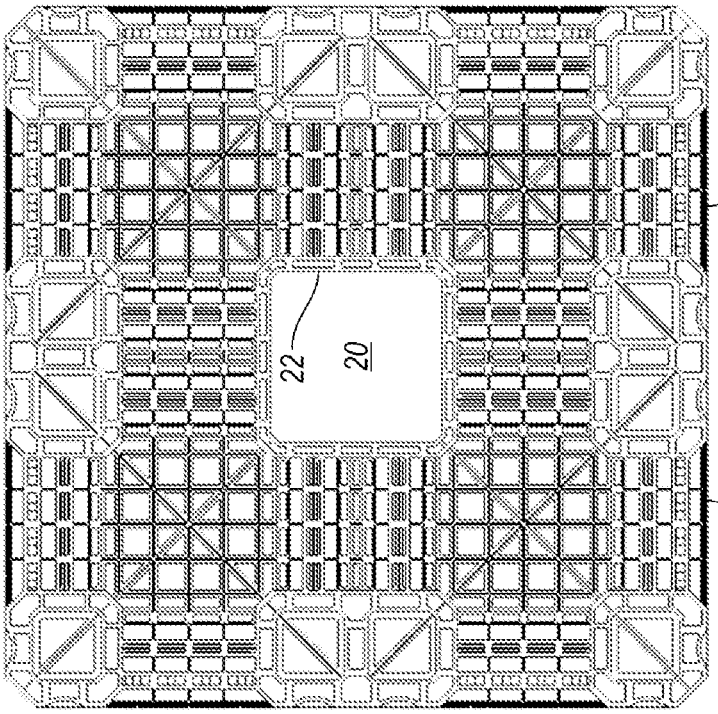


FIG. 4

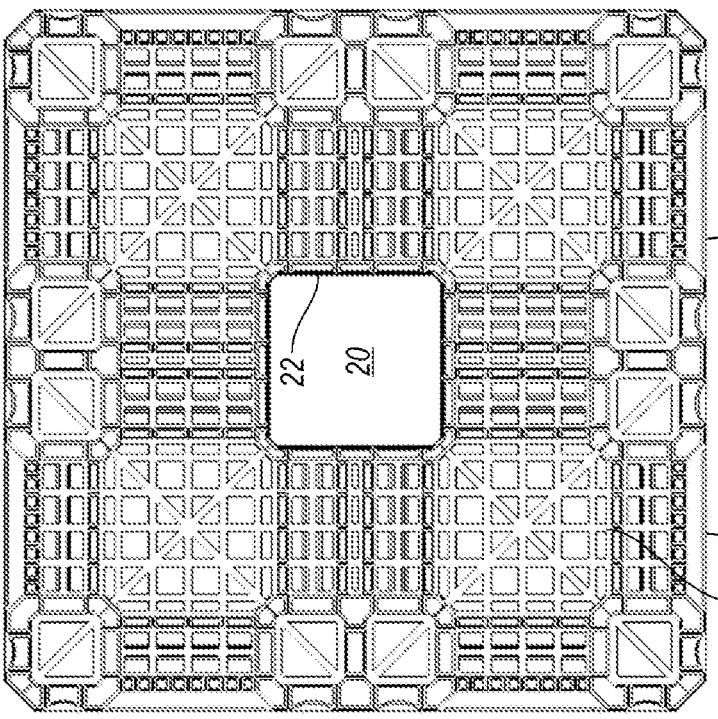
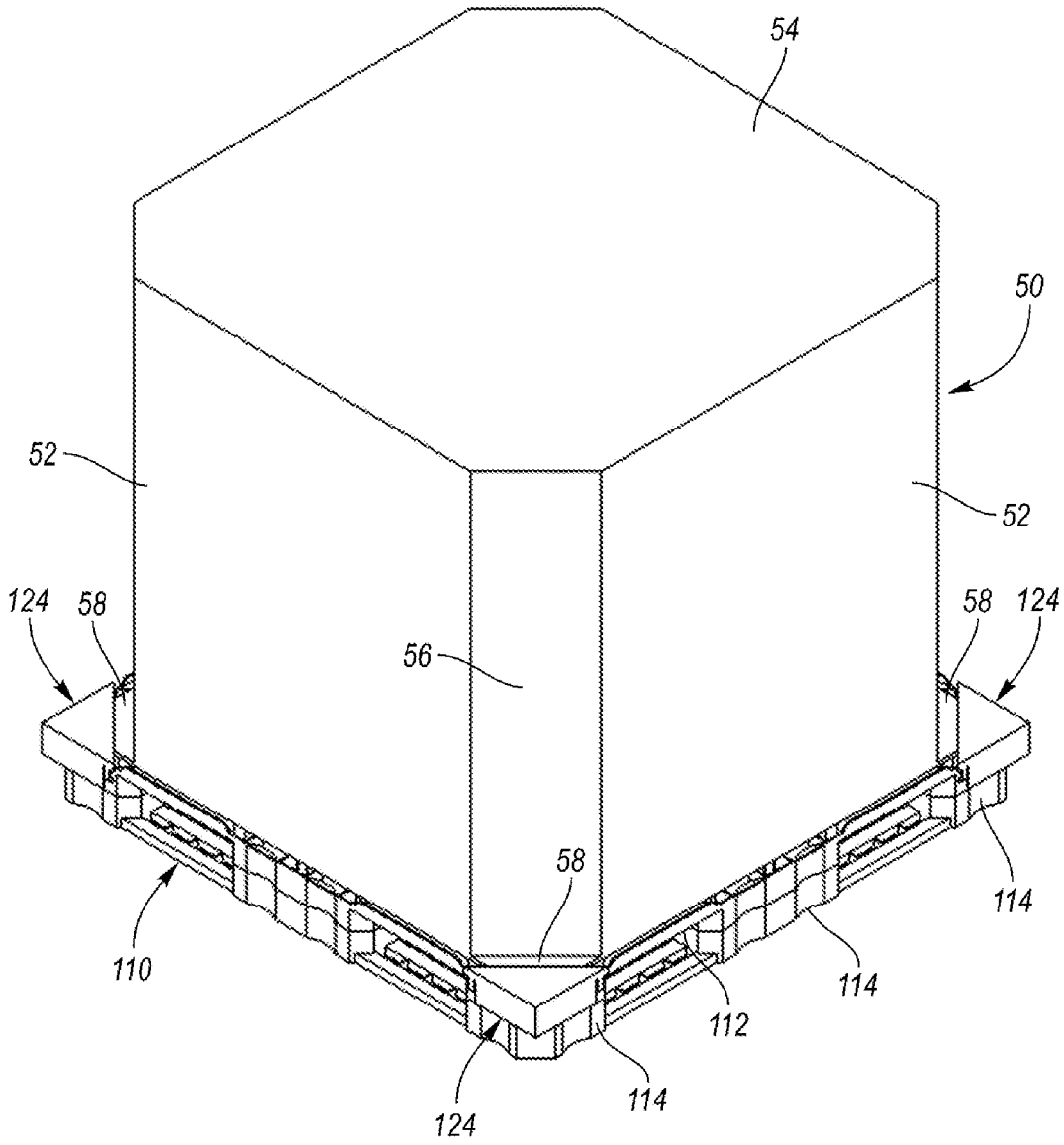


FIG. 3



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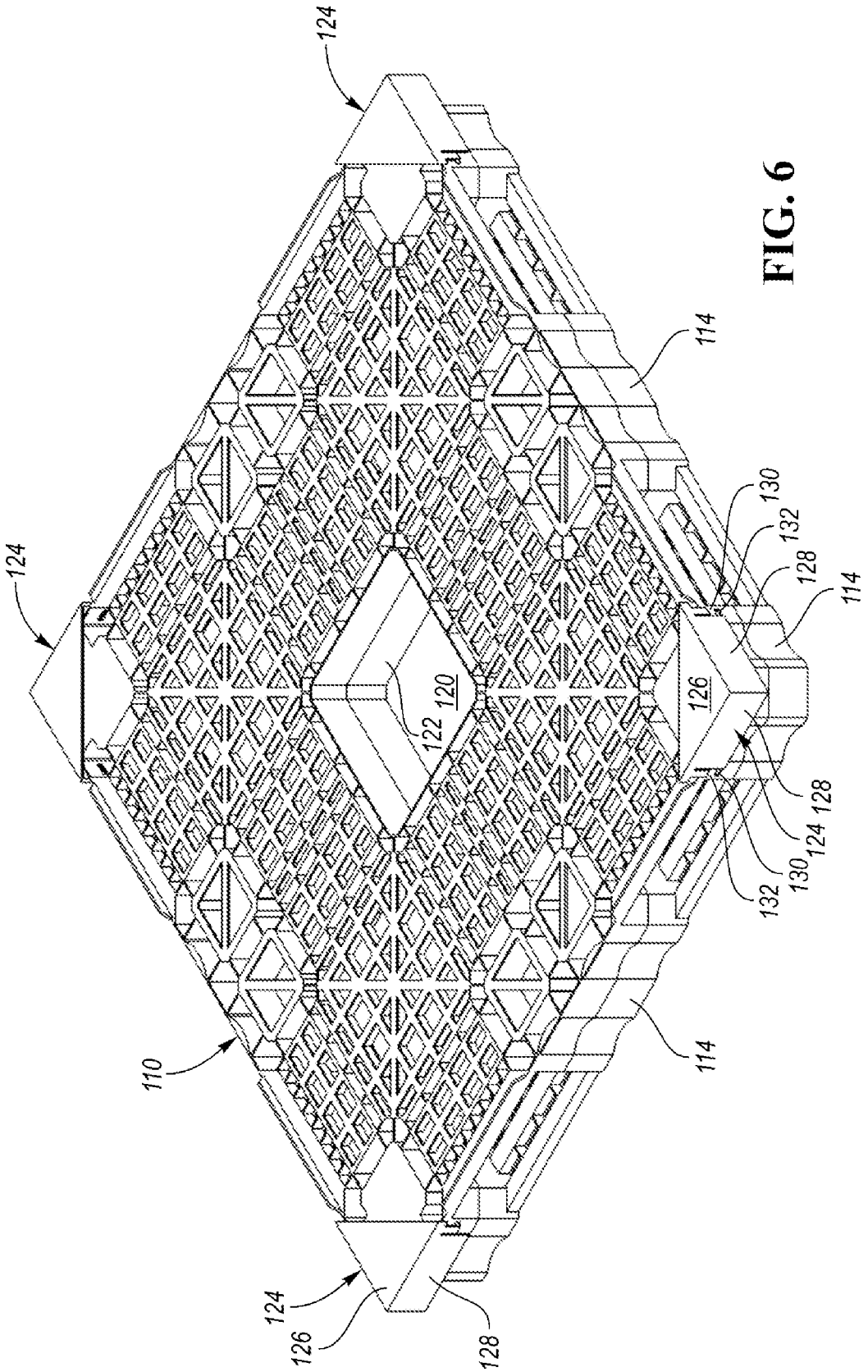
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FIG. 6

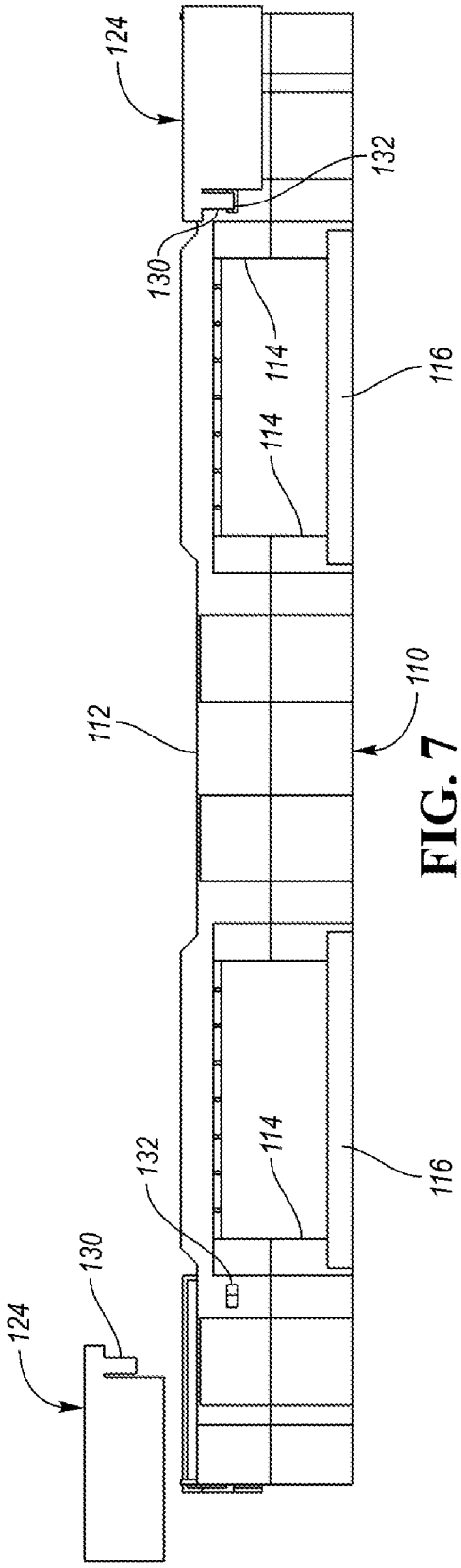
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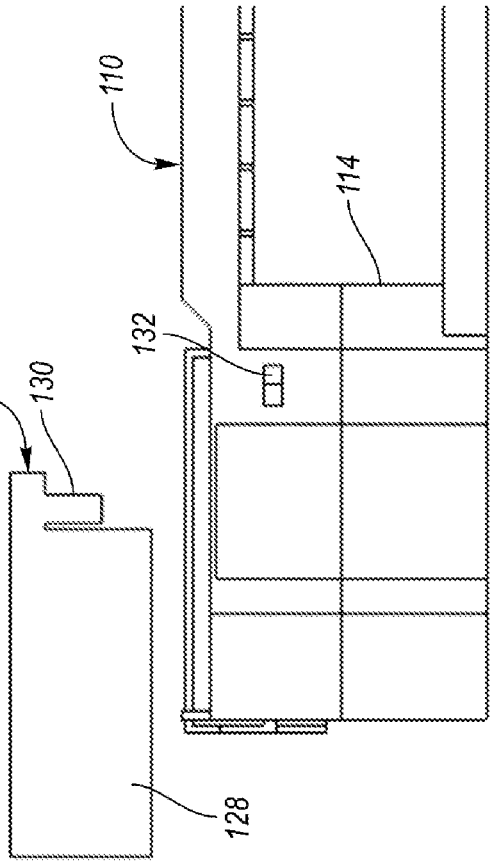
FIG. 7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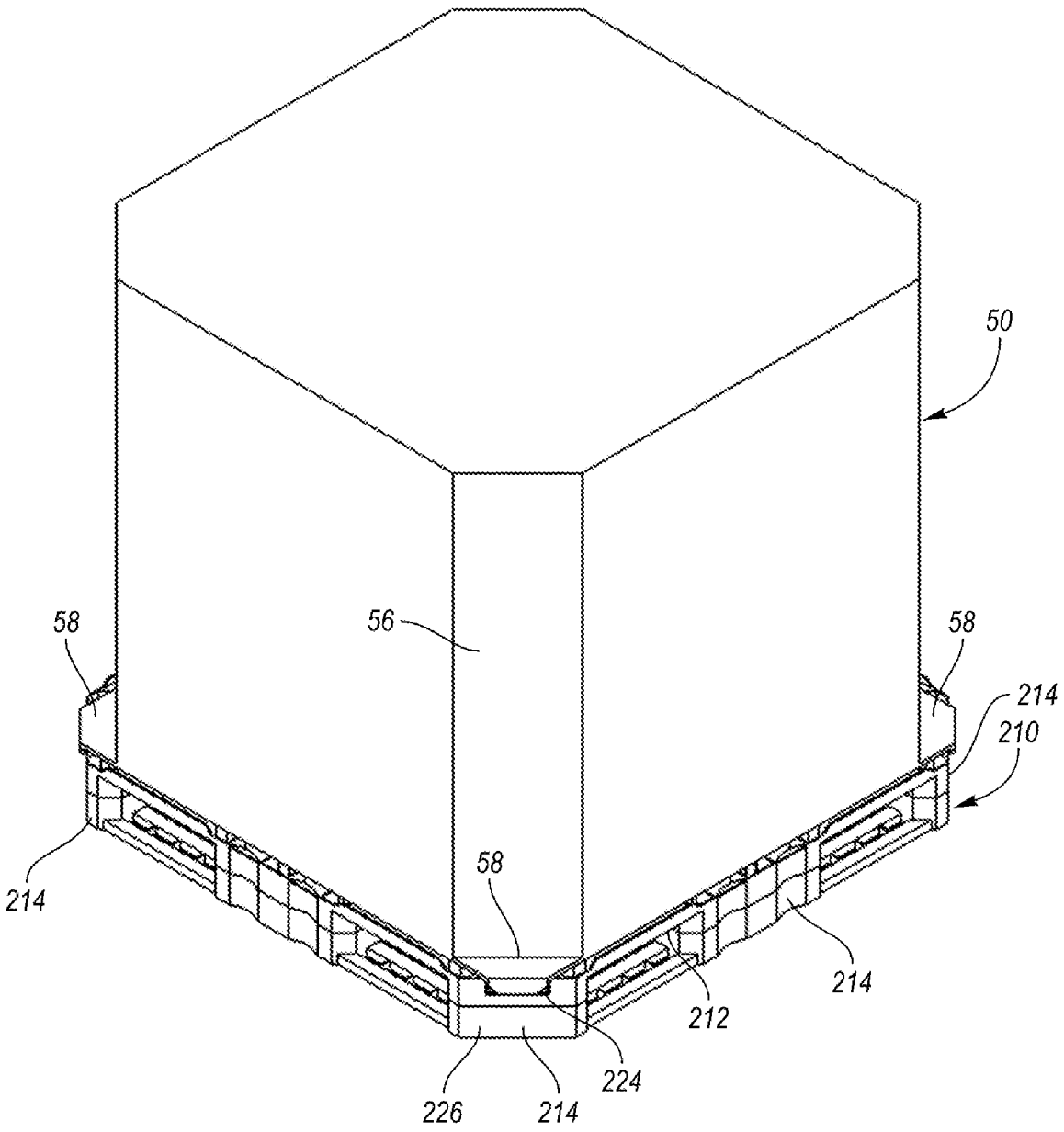

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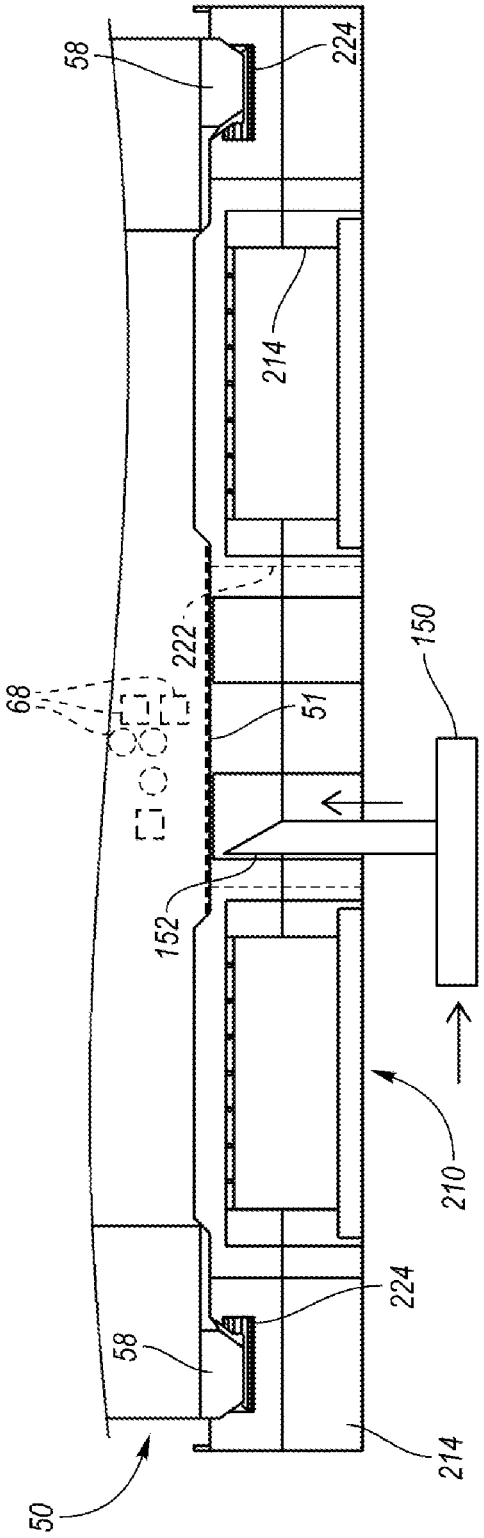
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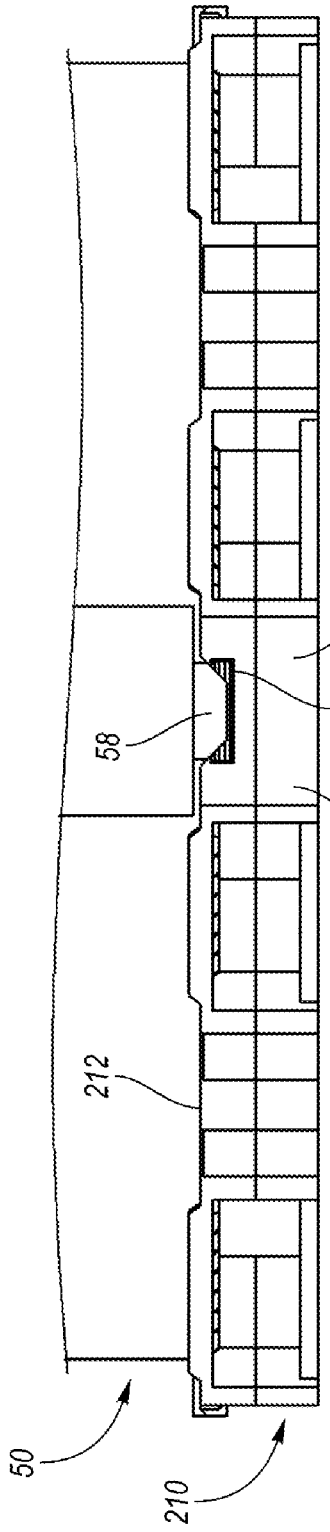
FIG. 10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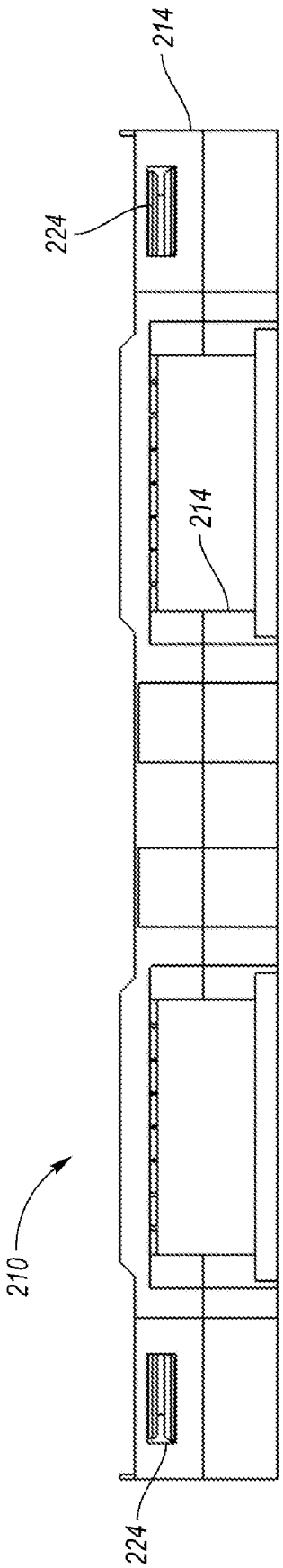

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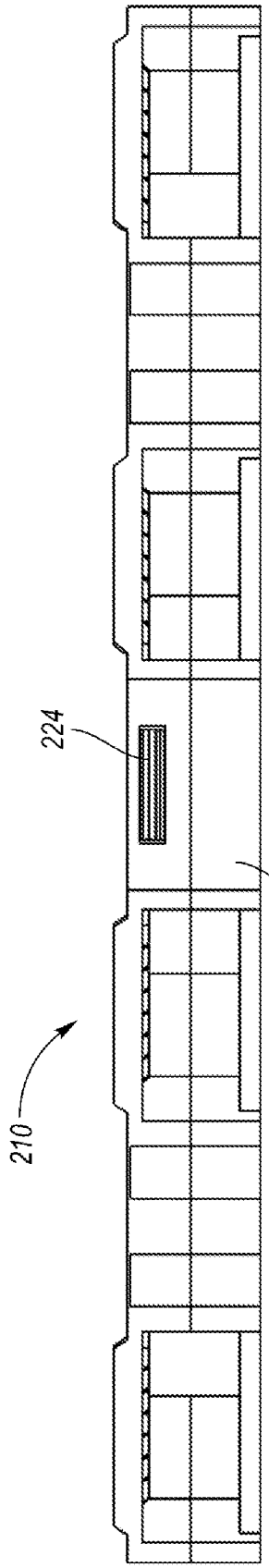
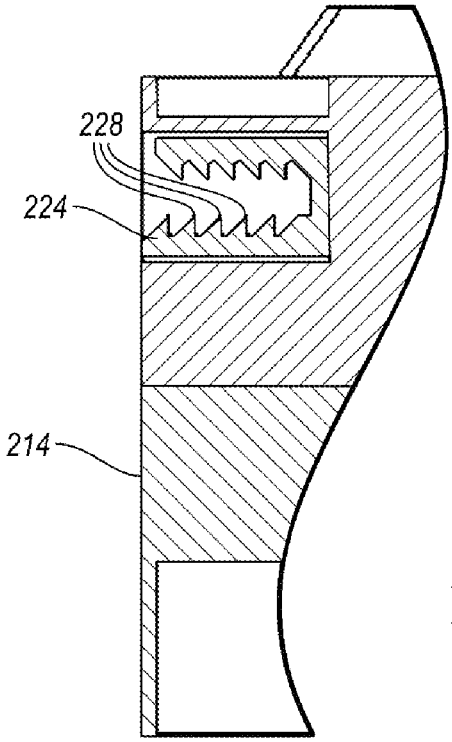


FIG. 13



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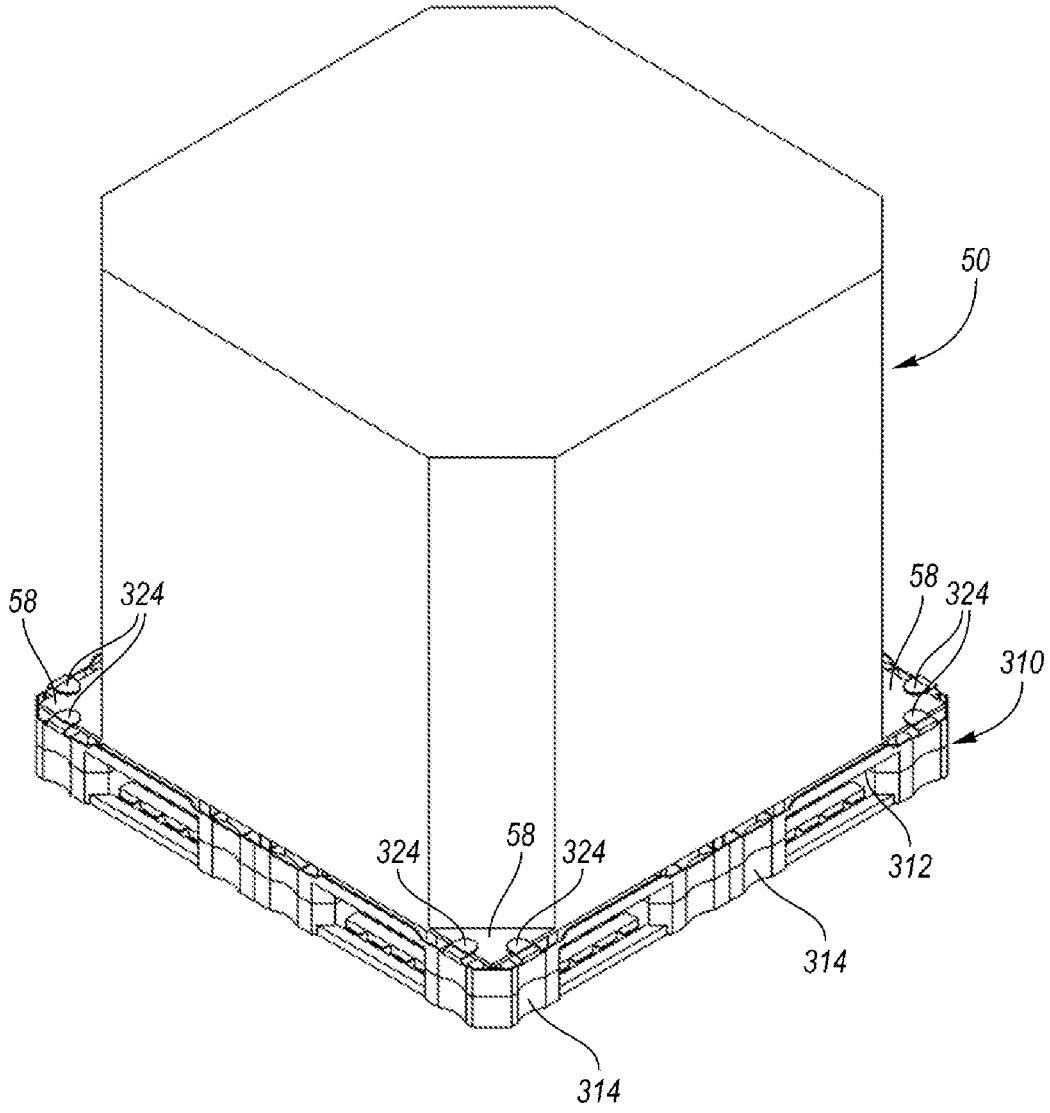

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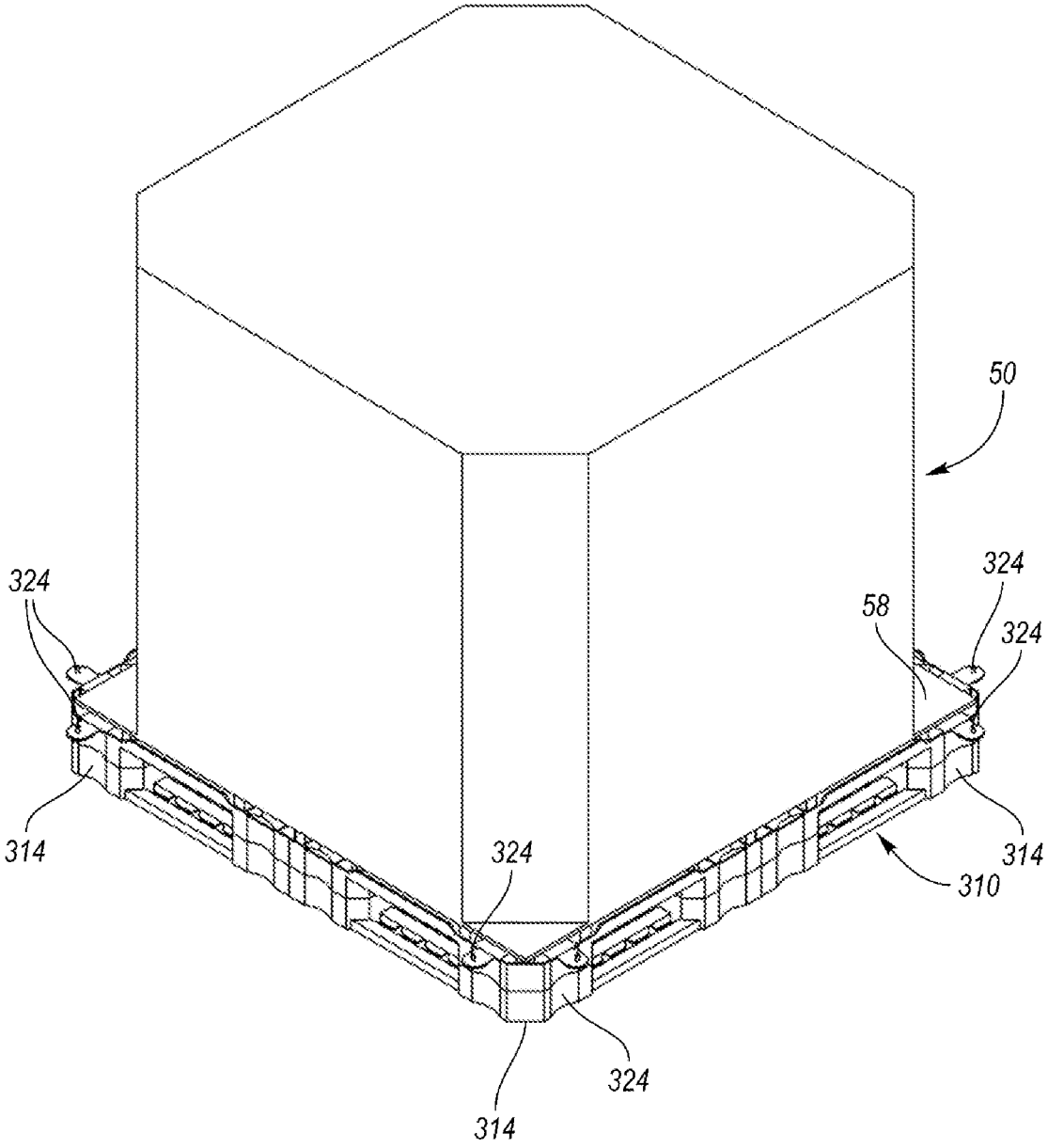

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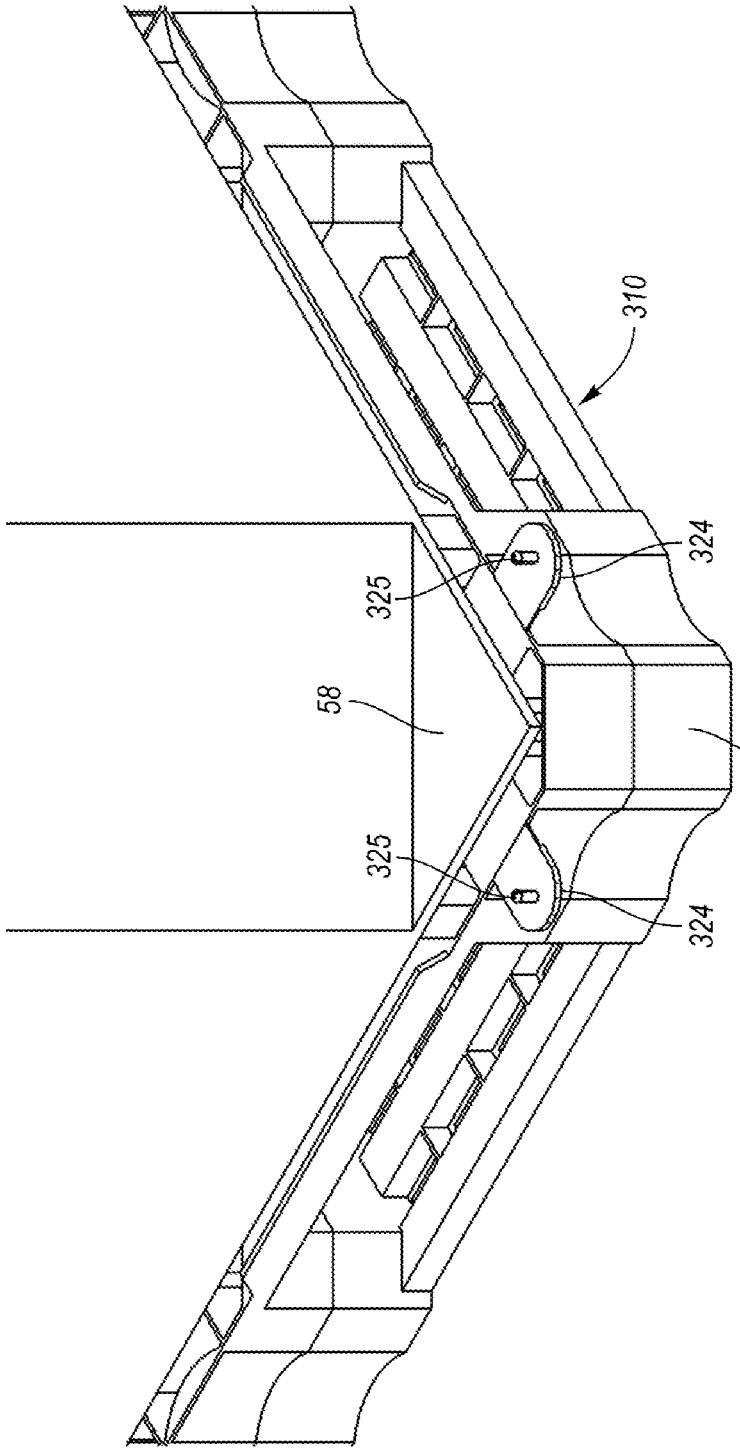

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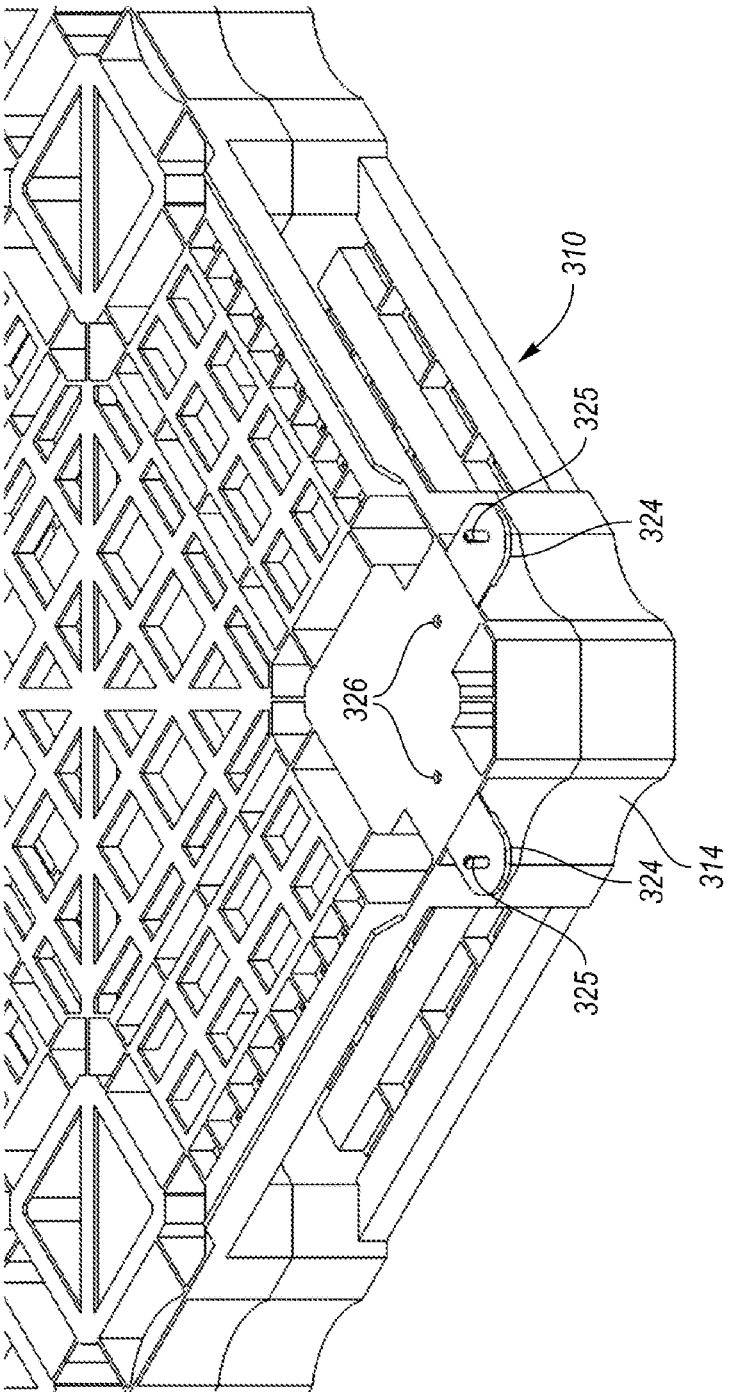

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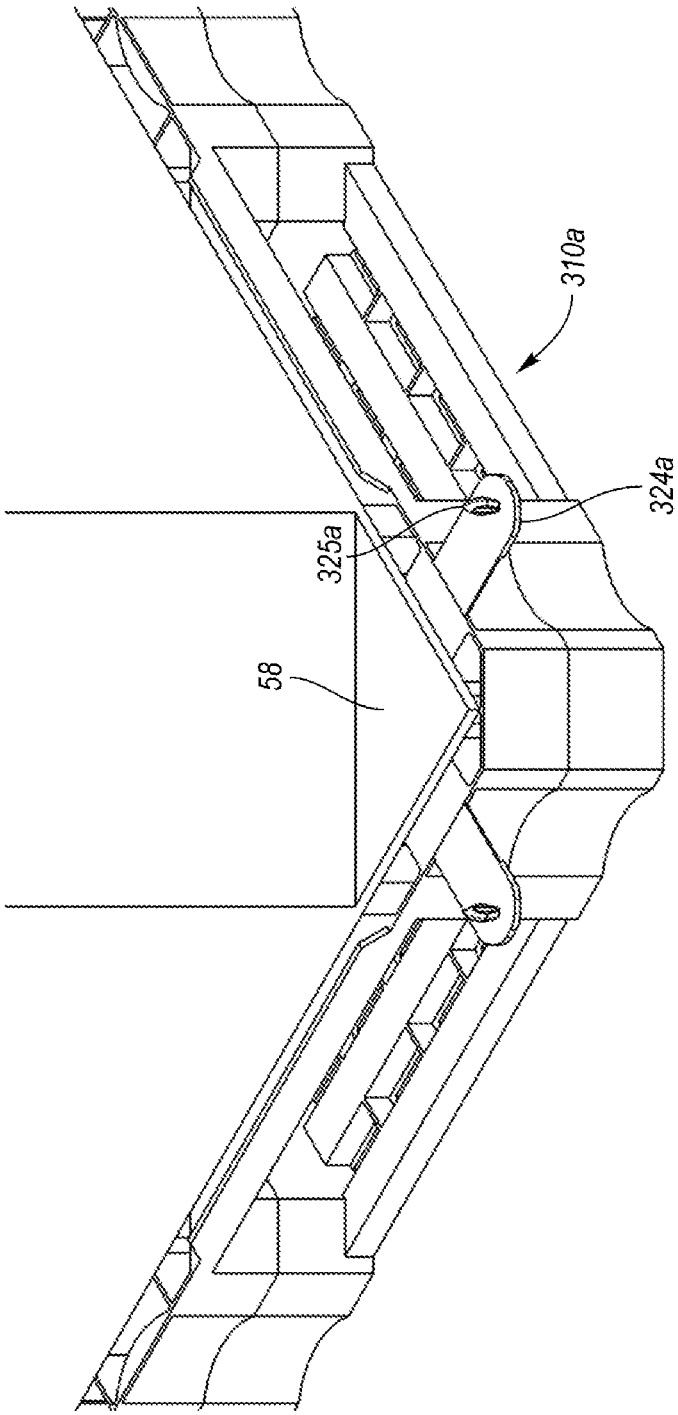

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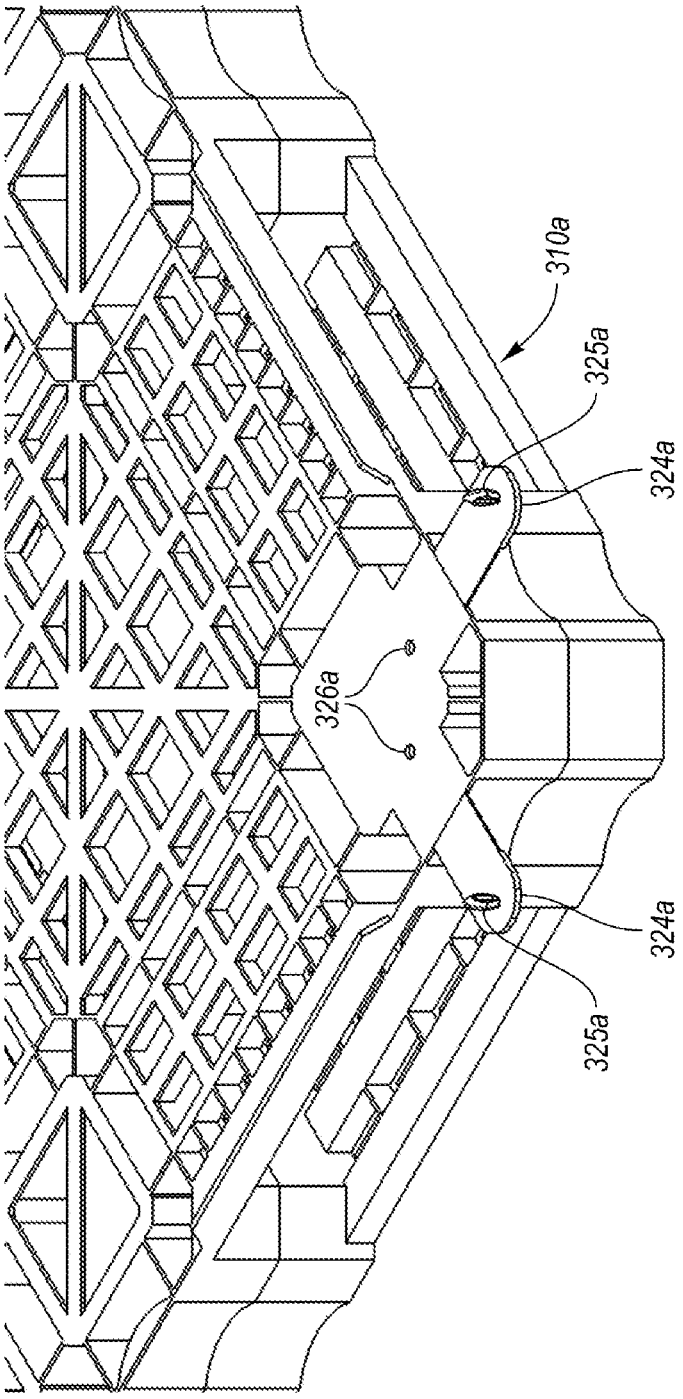

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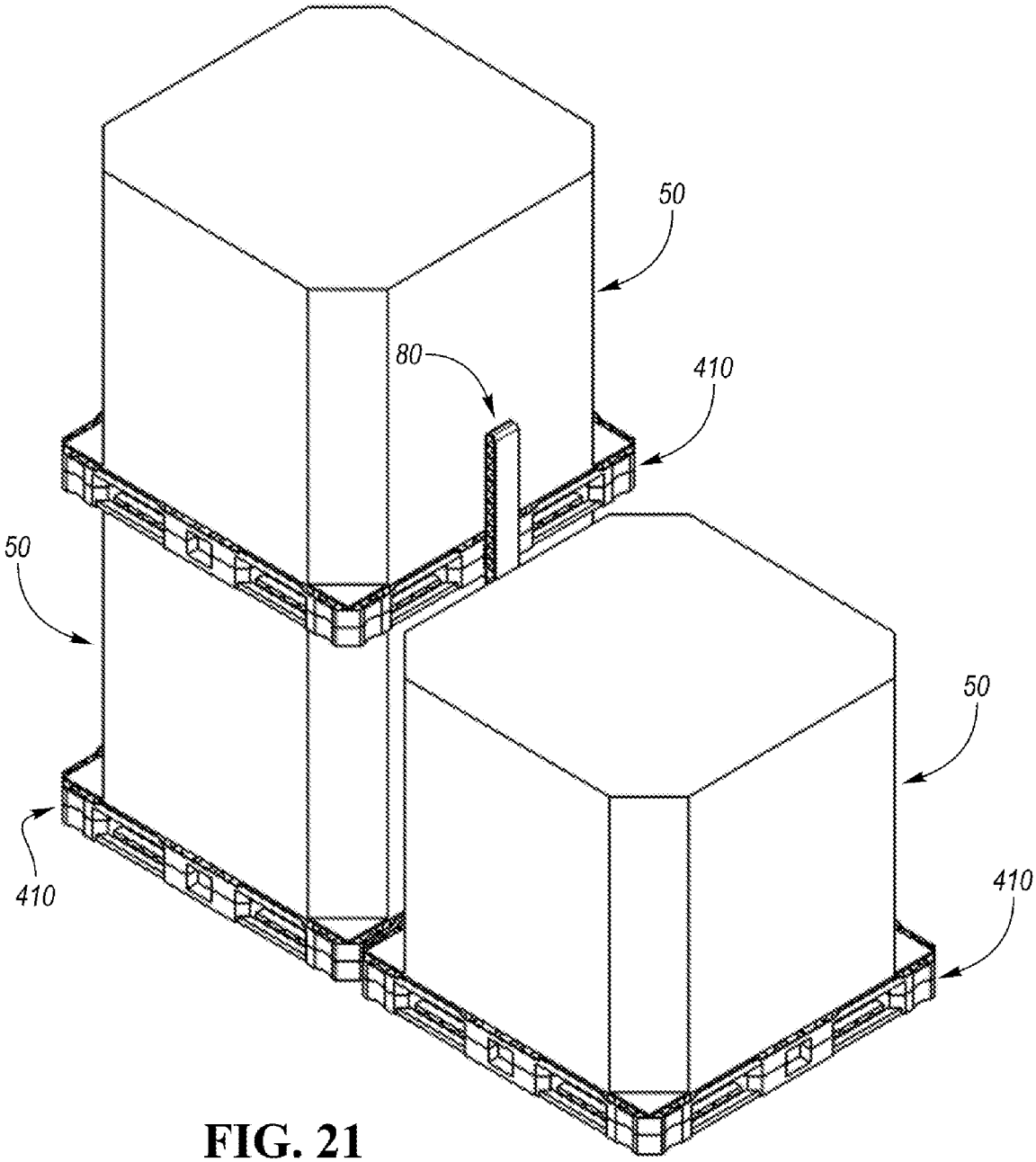
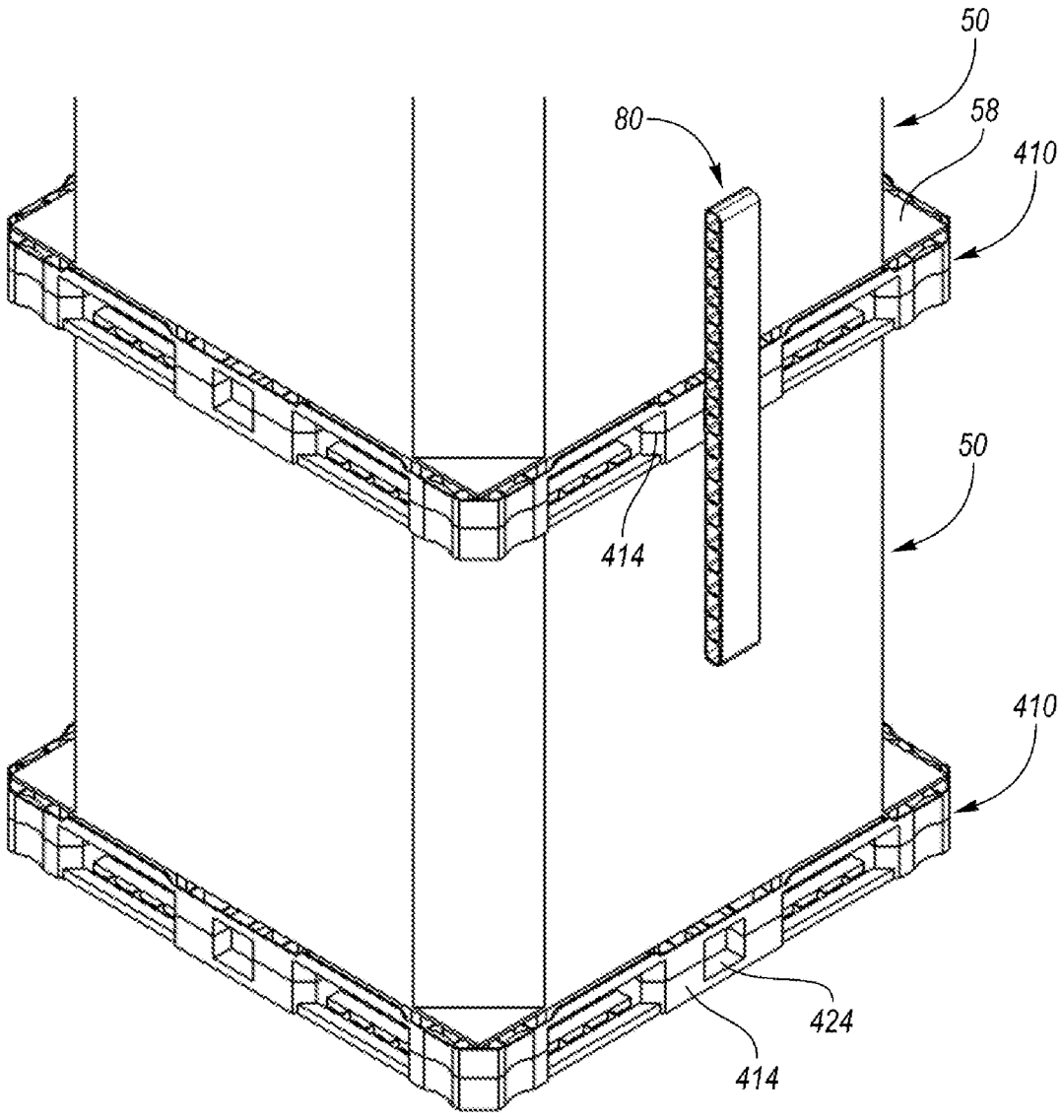


FIG. 21



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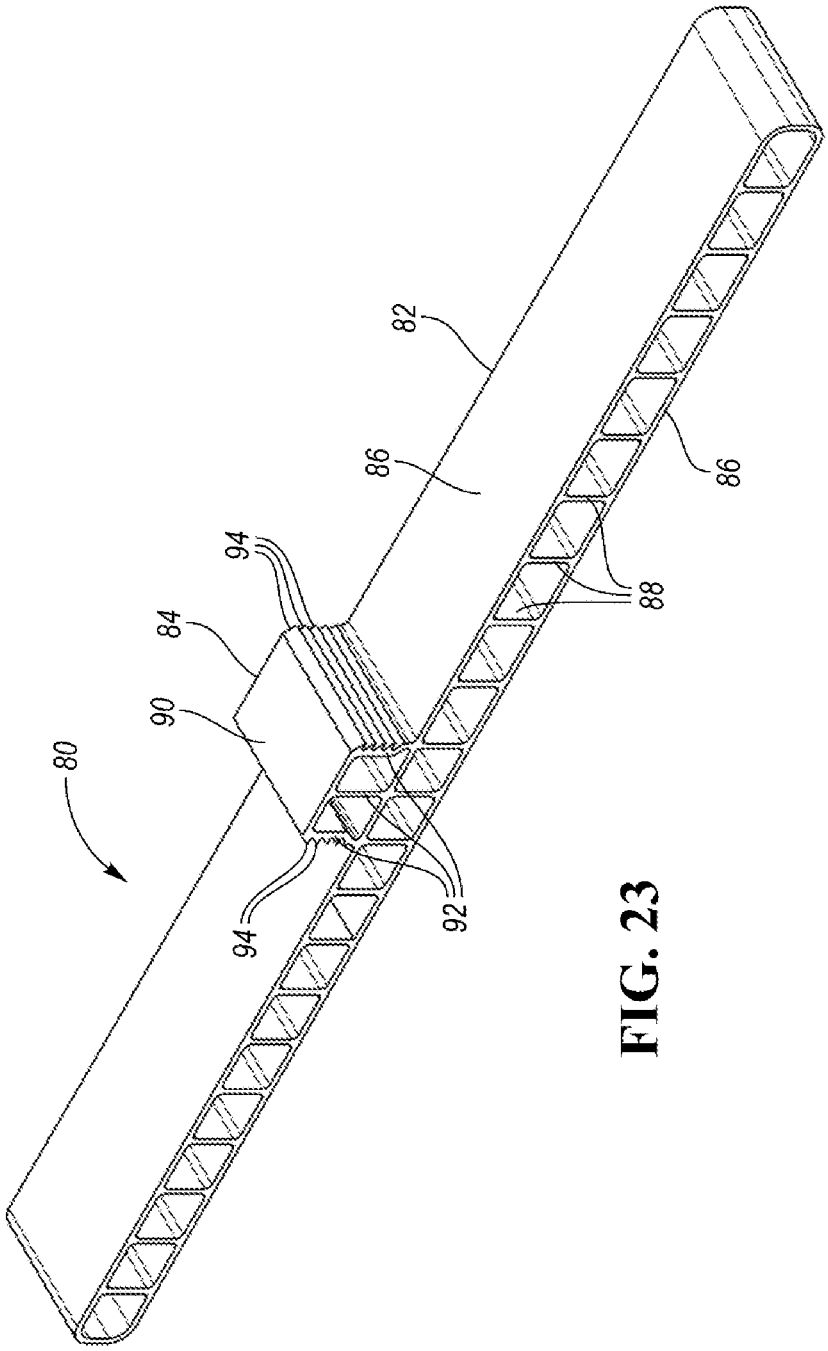
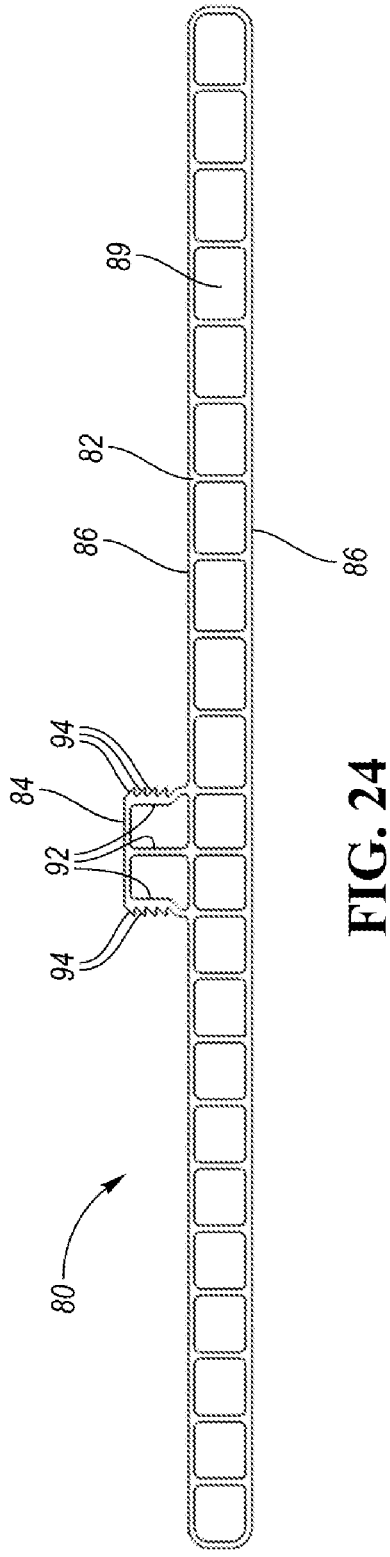


FIG. 23



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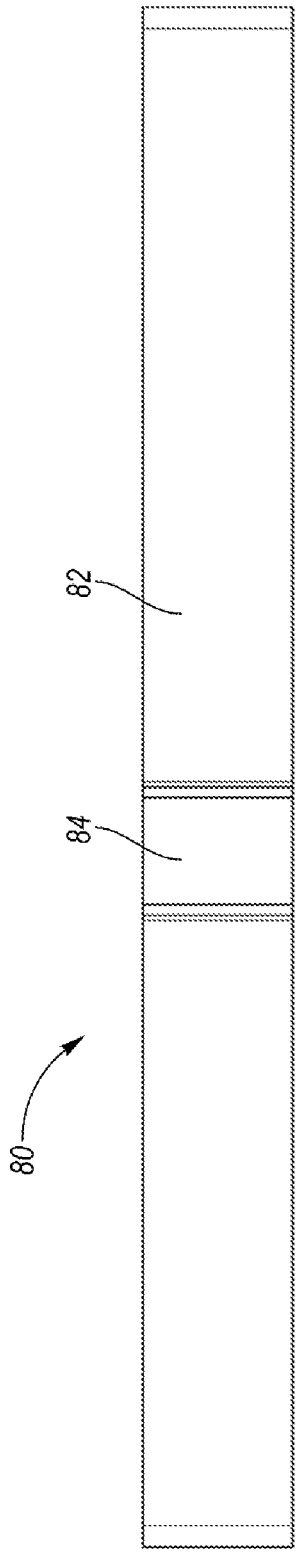

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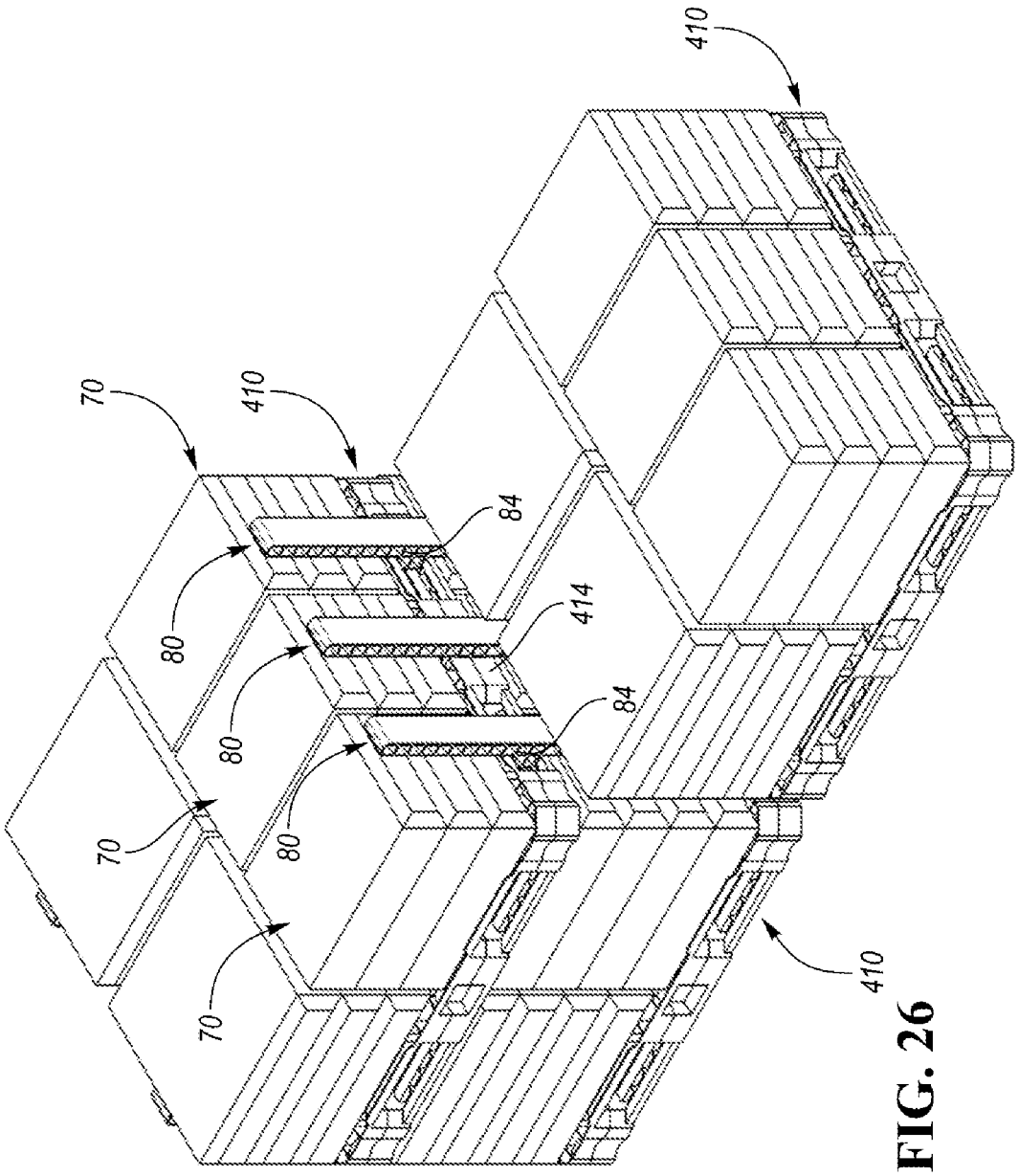

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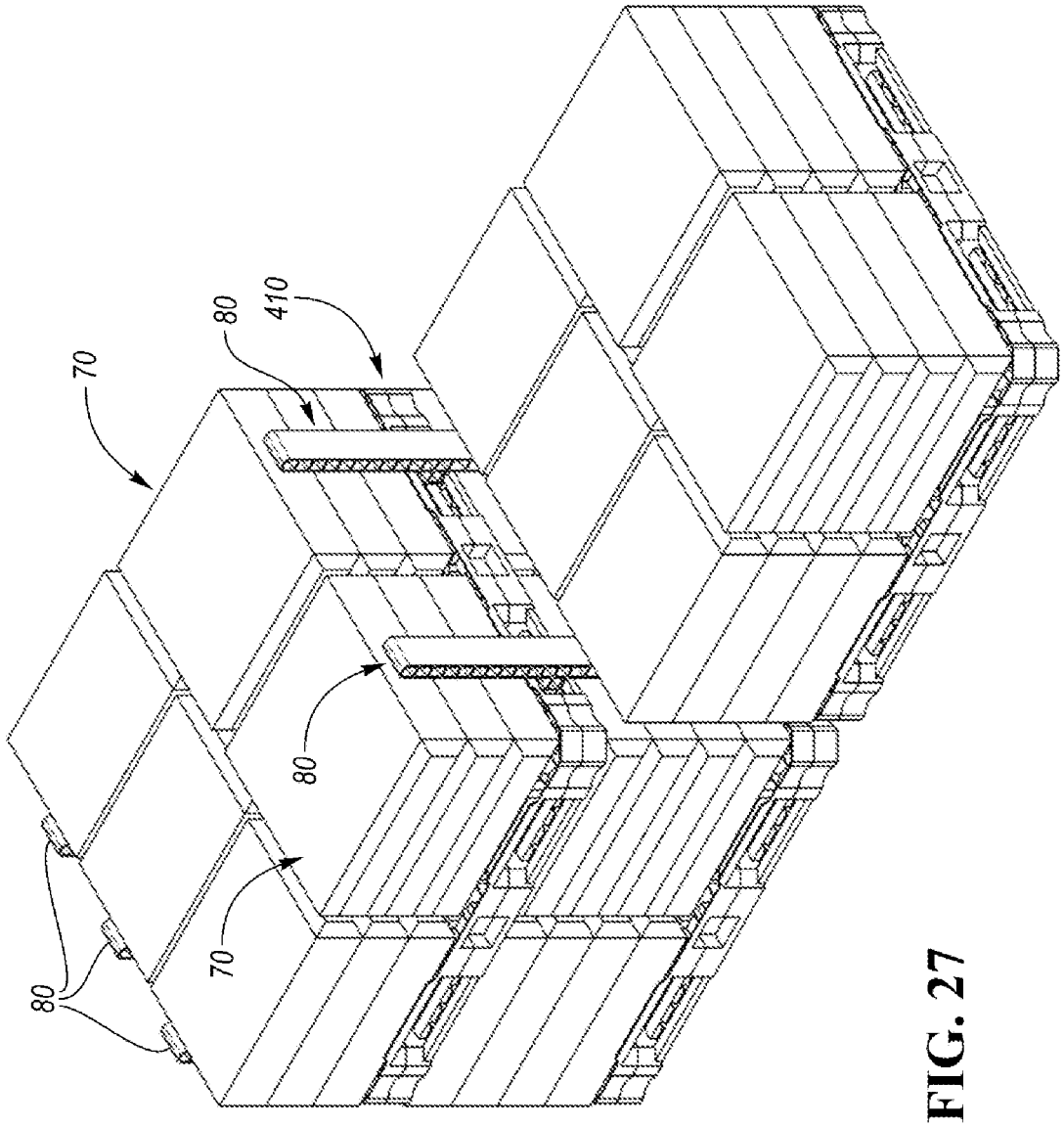

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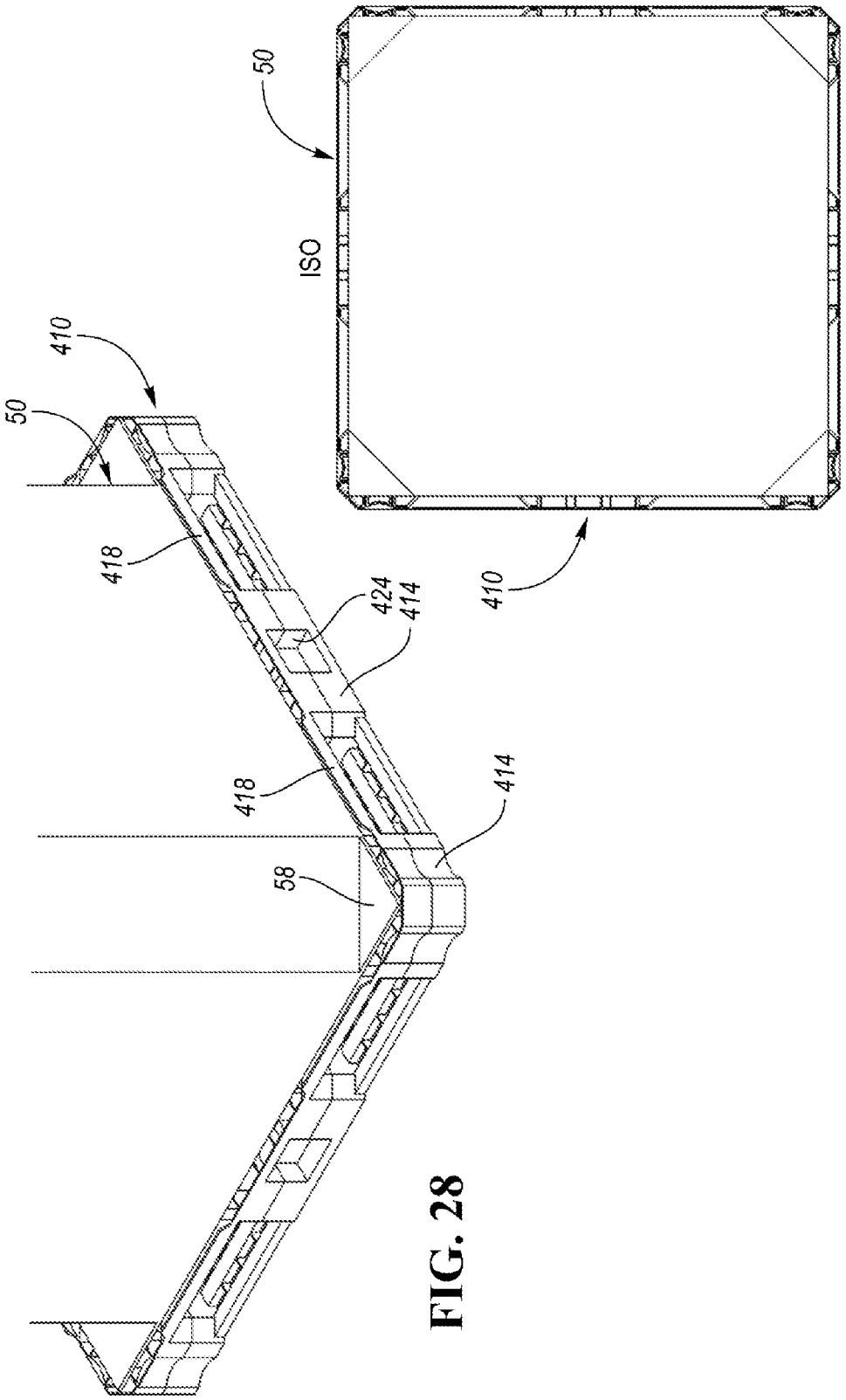
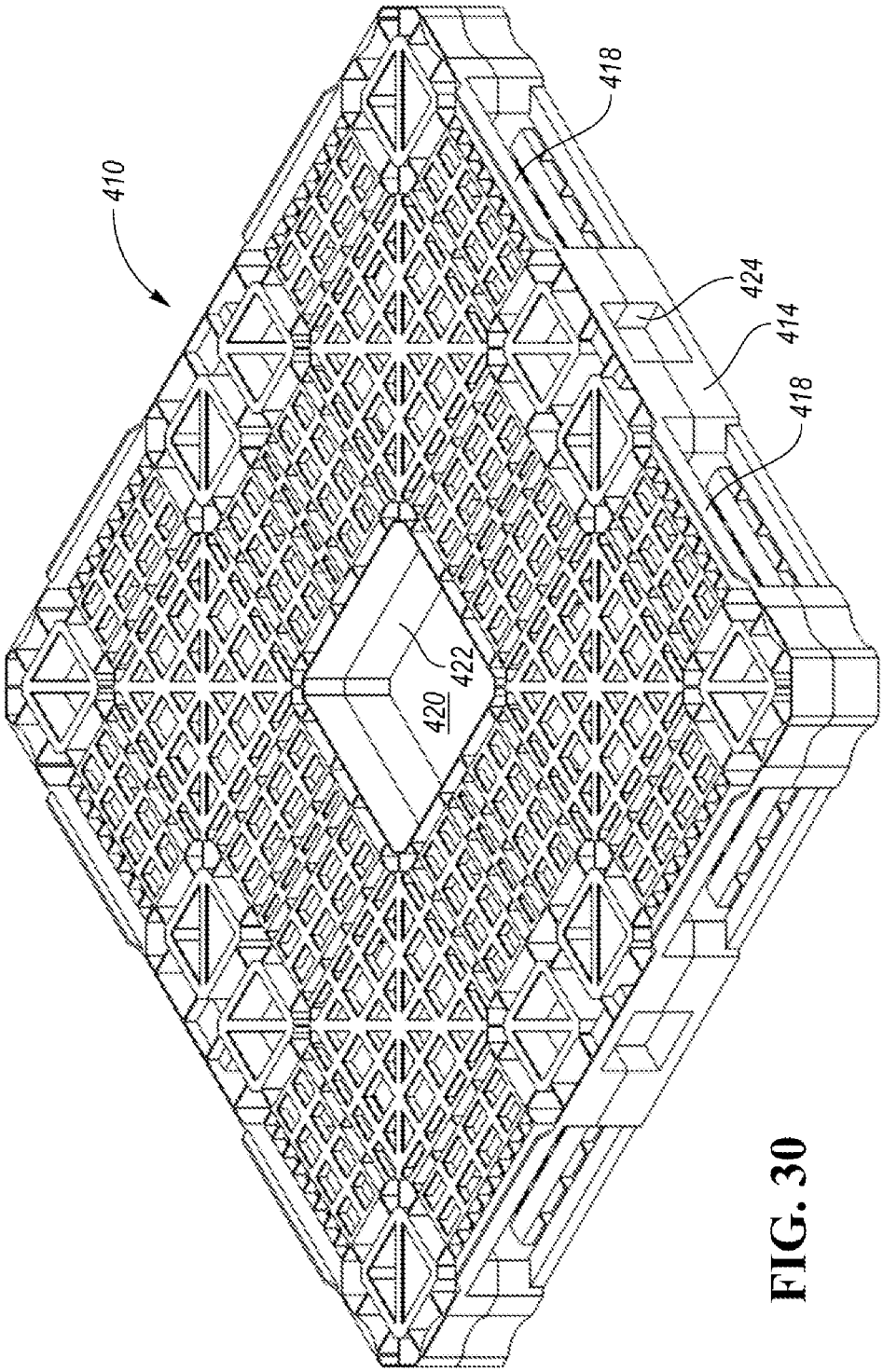


FIG. 28

FIG. 29



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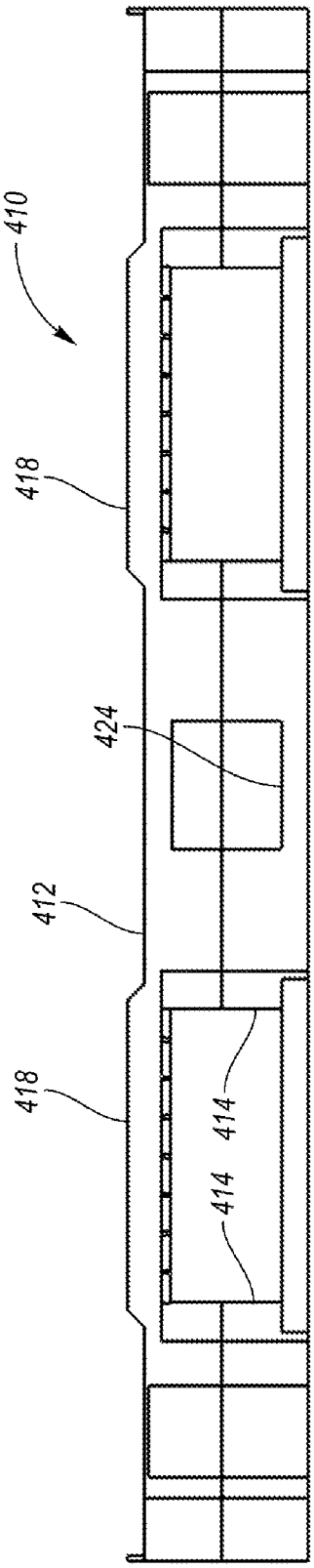

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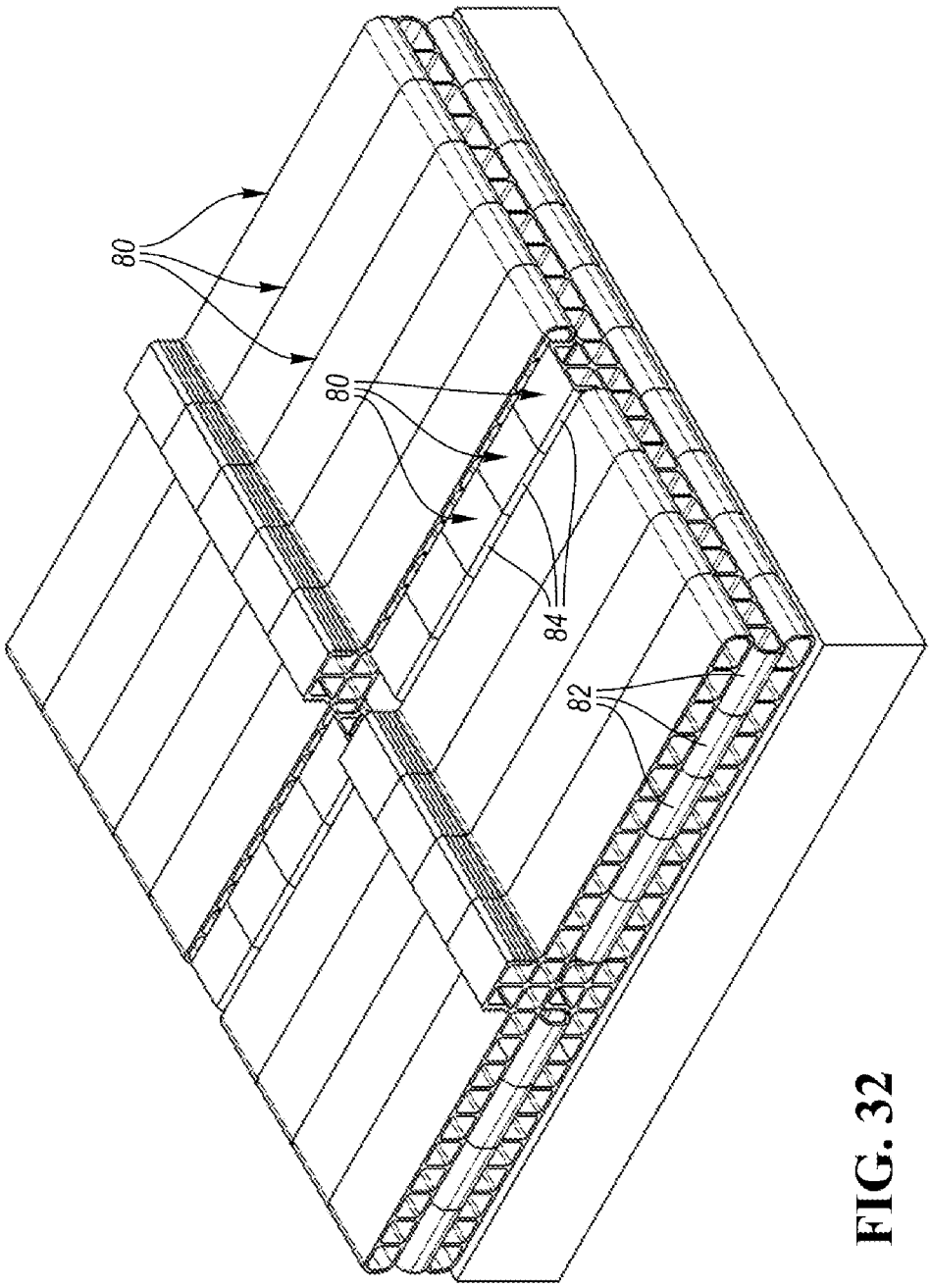

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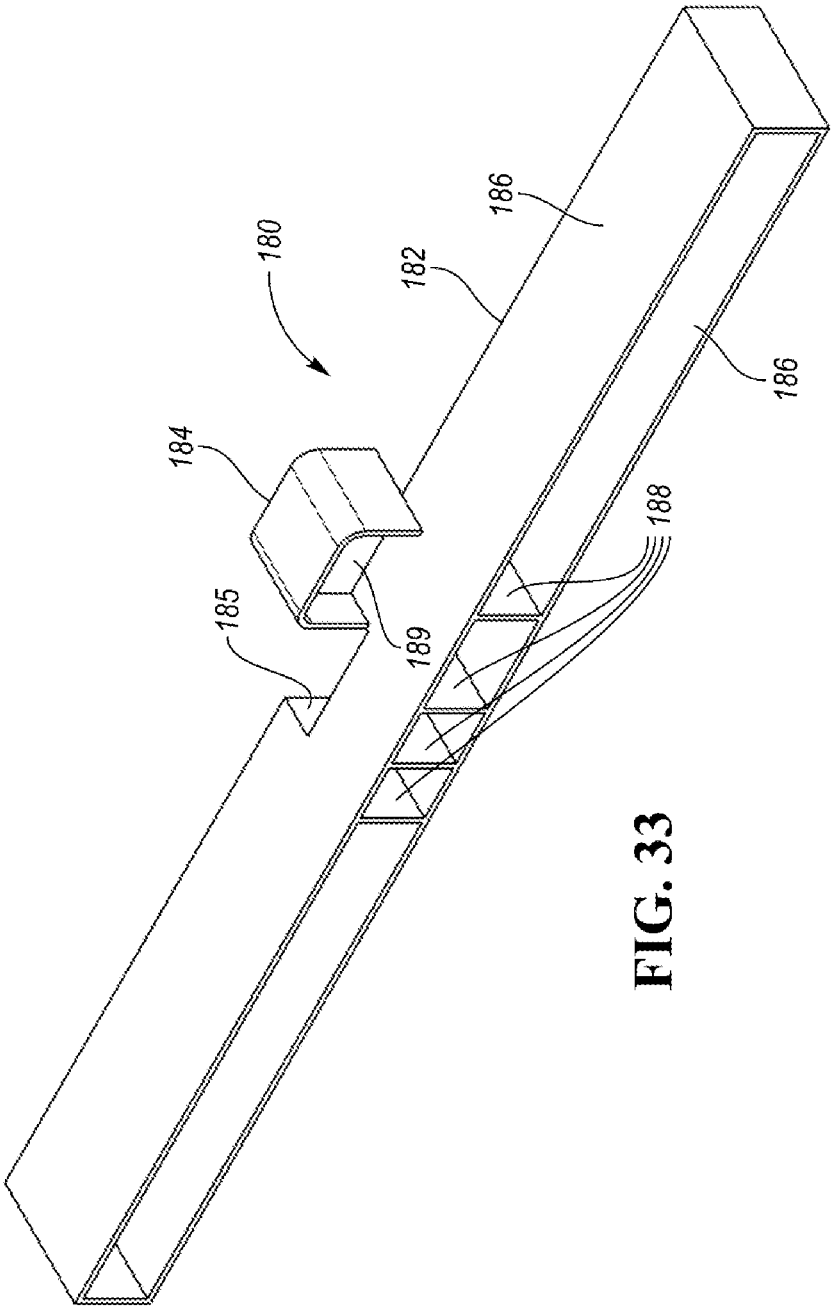

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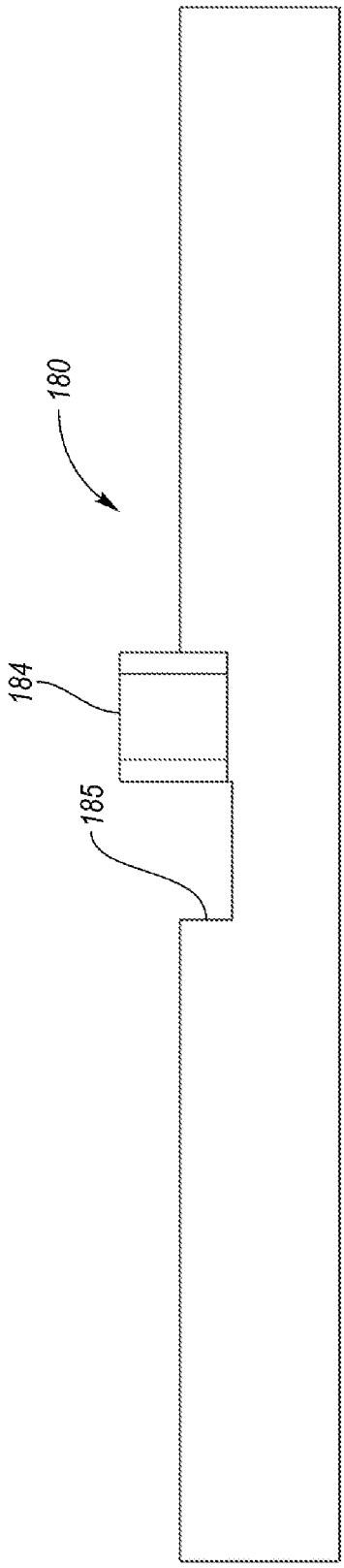

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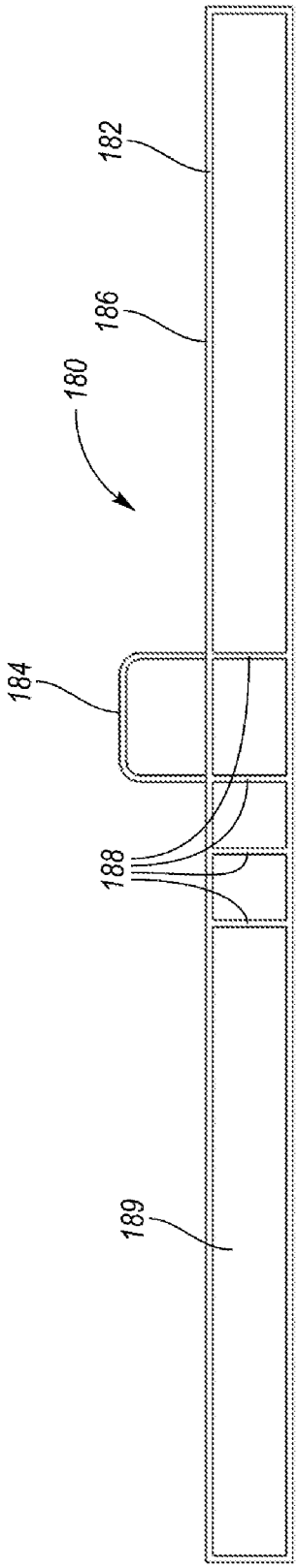

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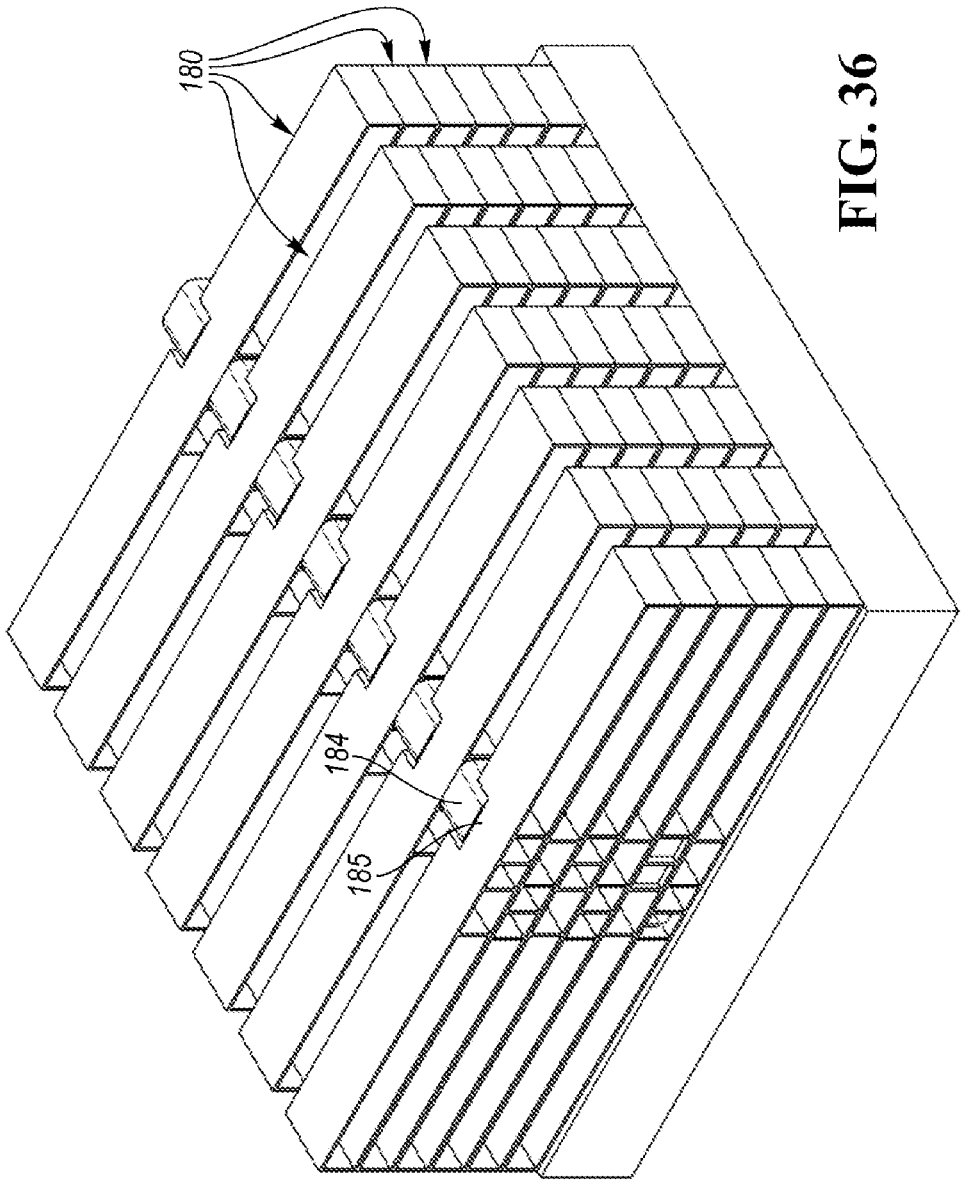

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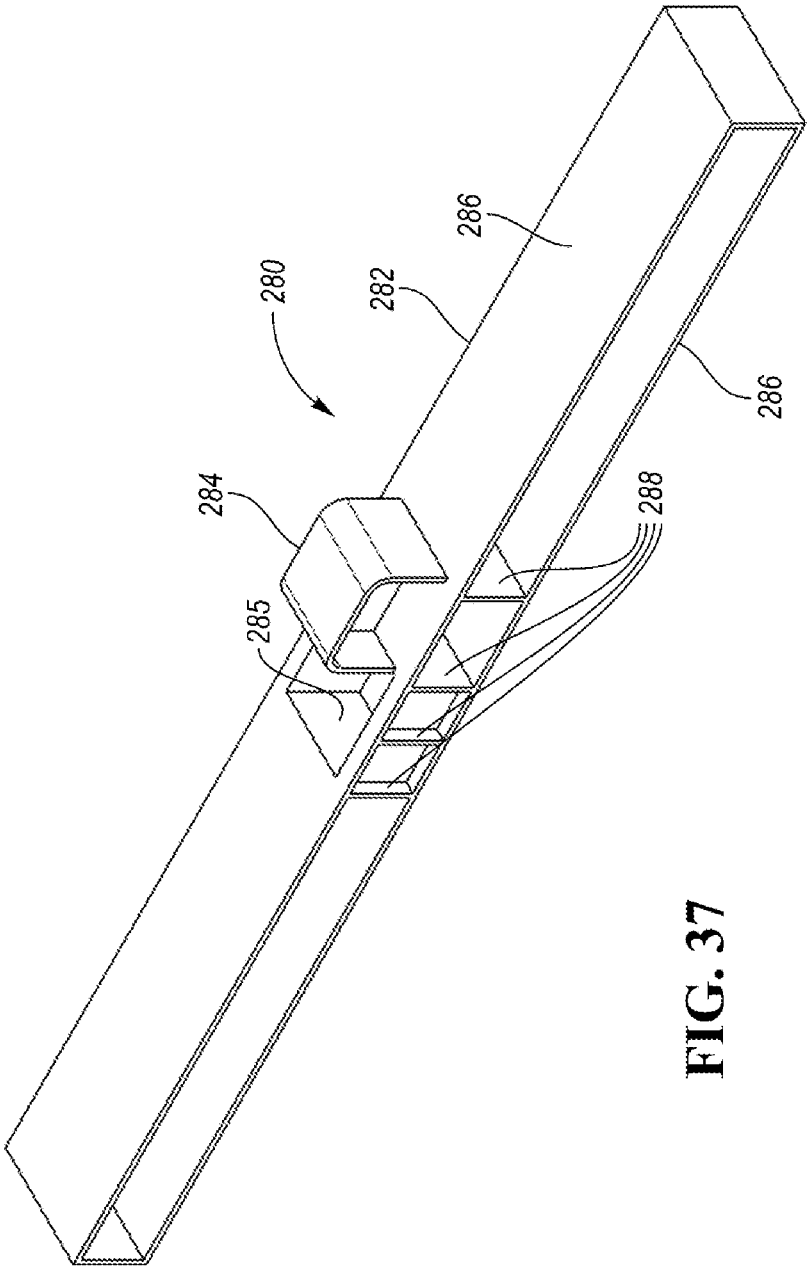

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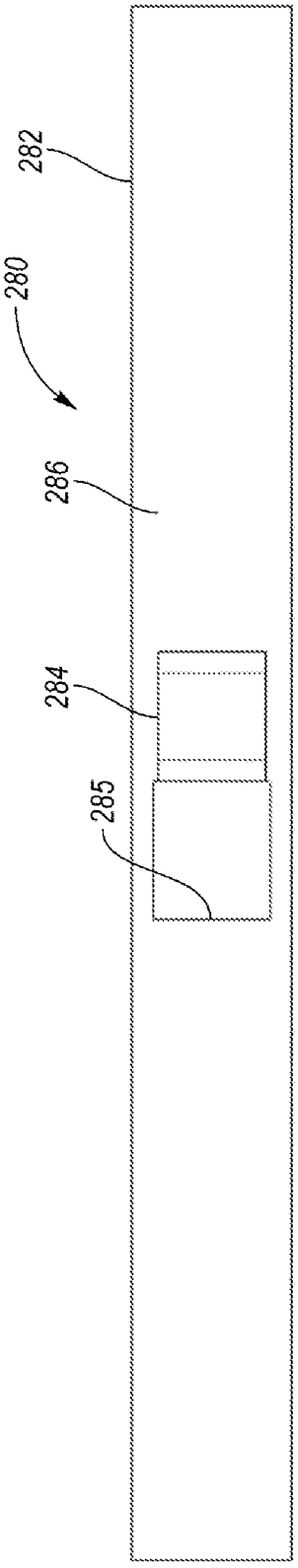

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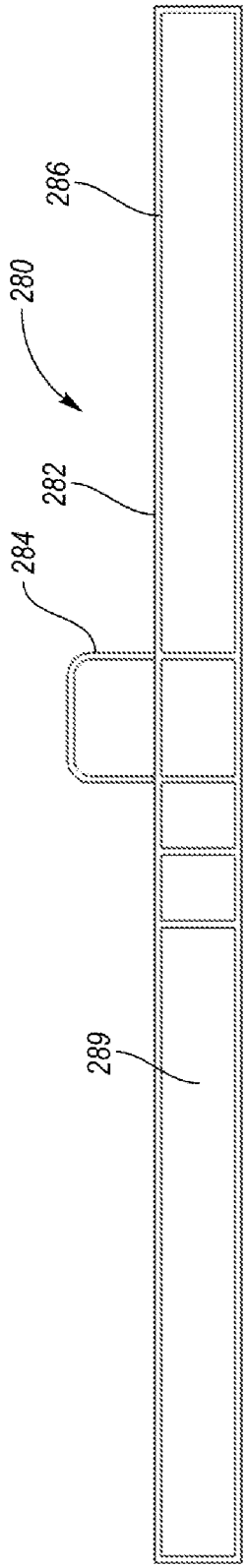

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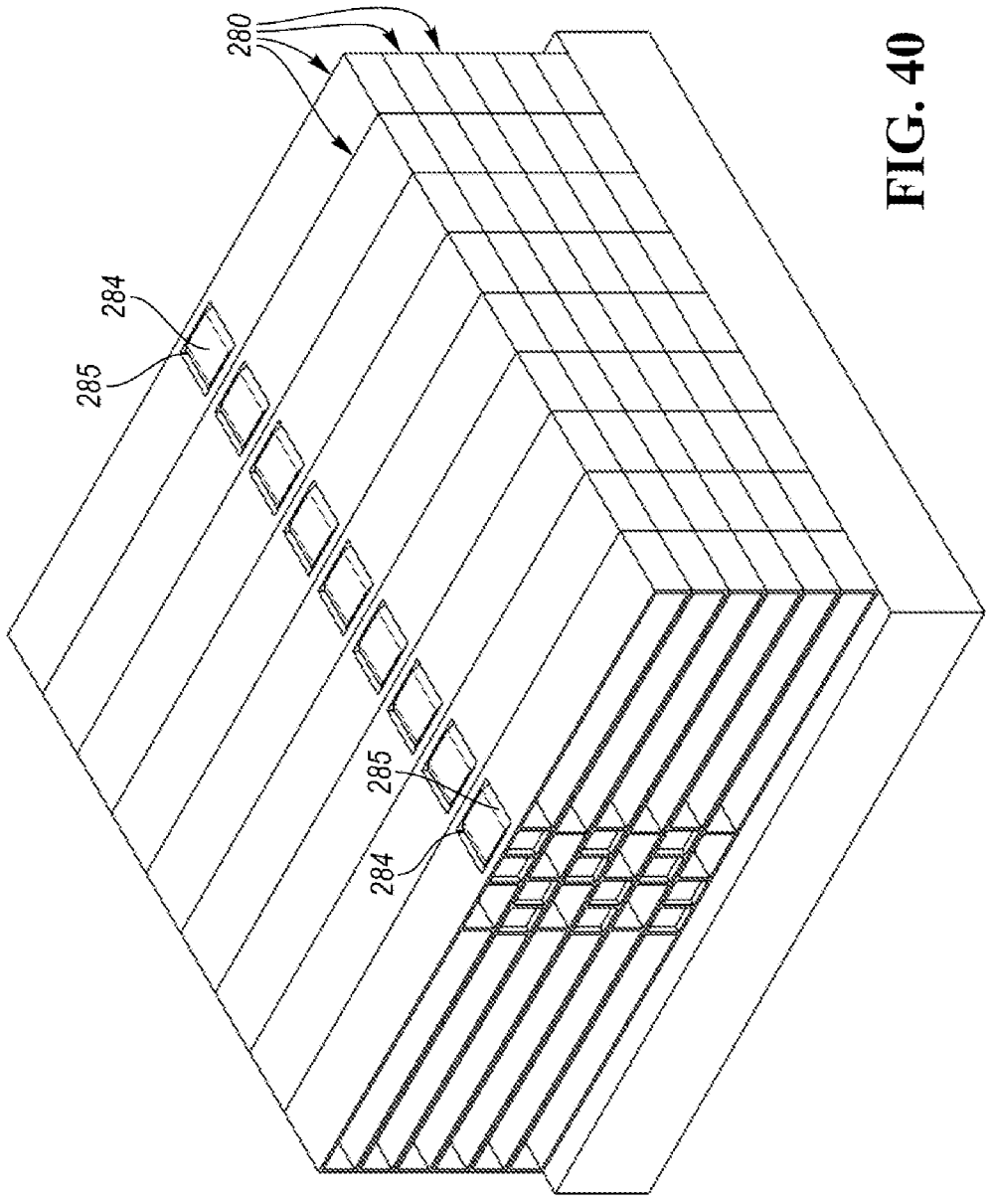

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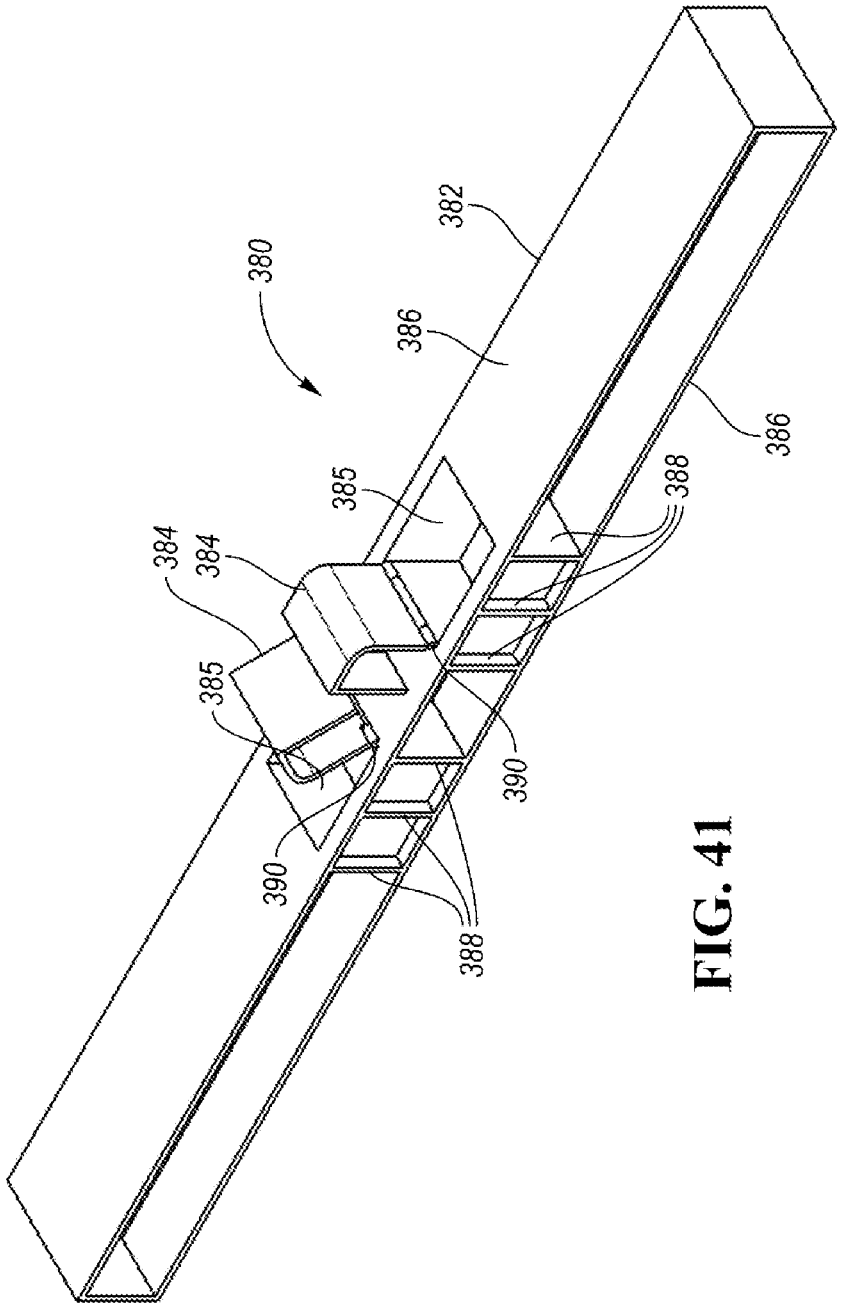

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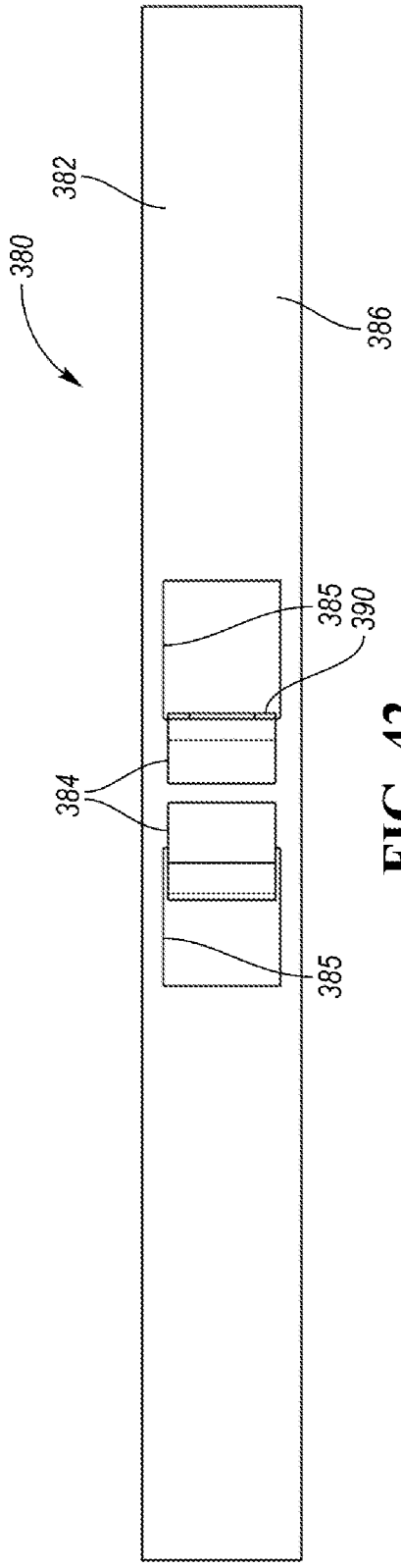

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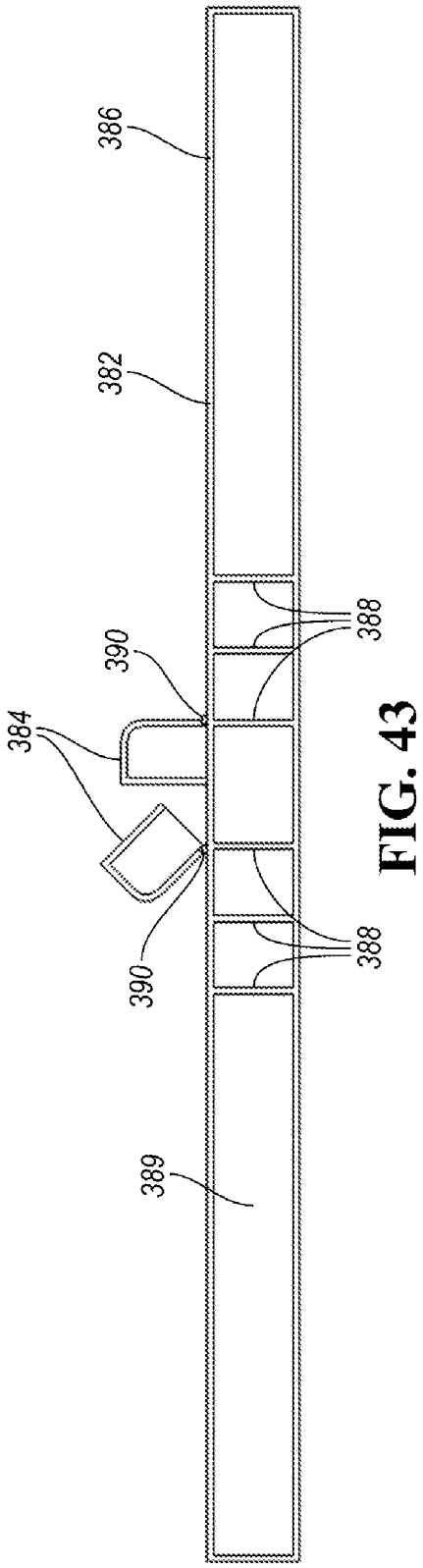

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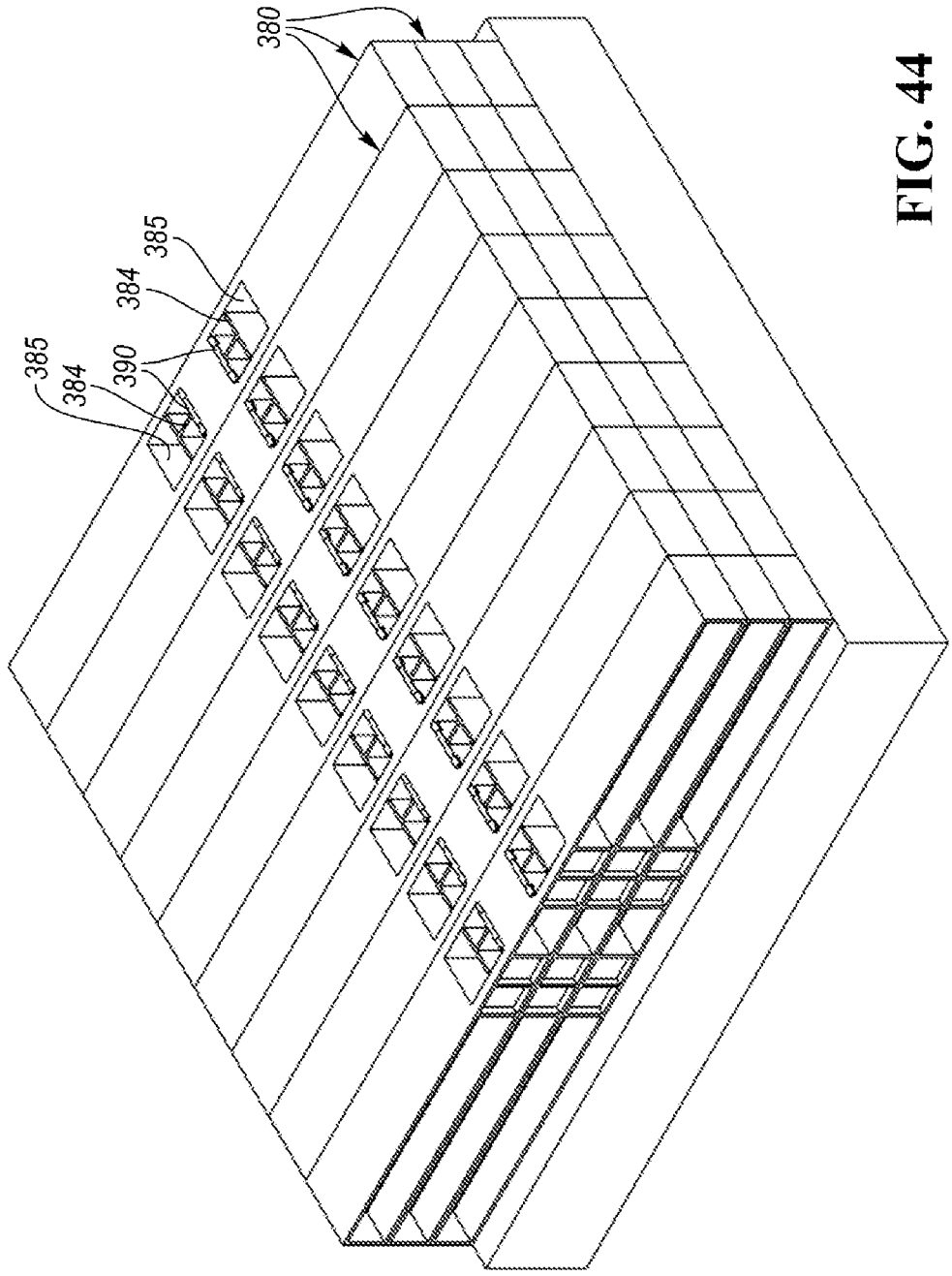

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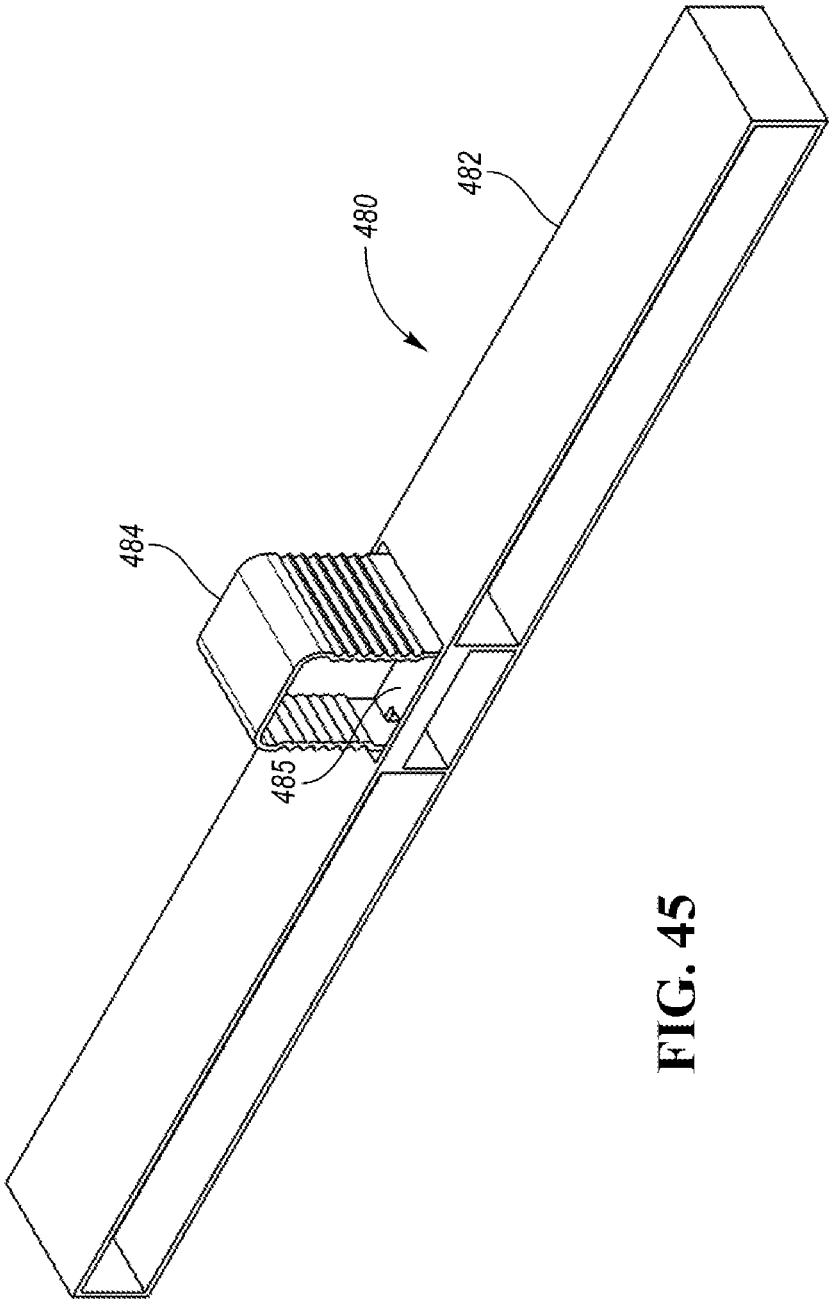

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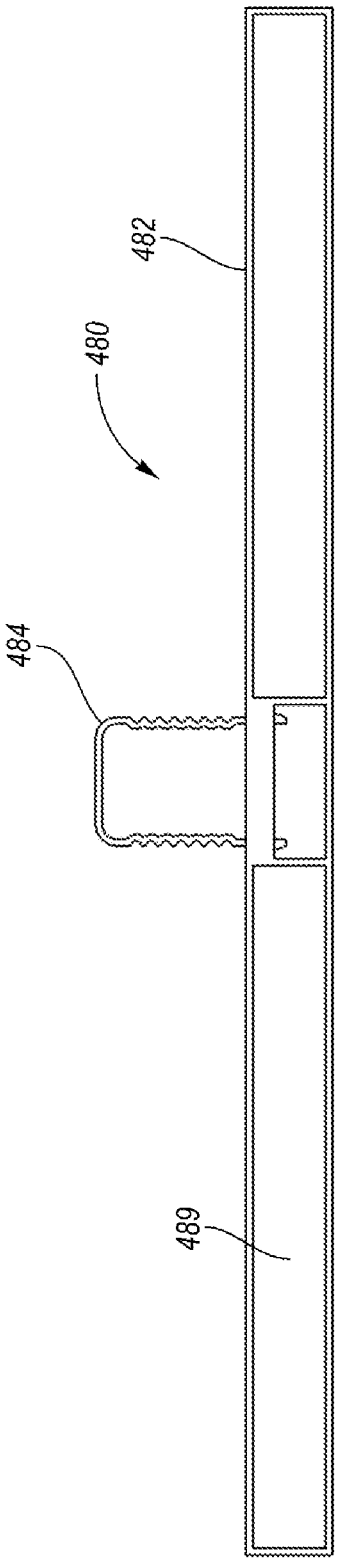
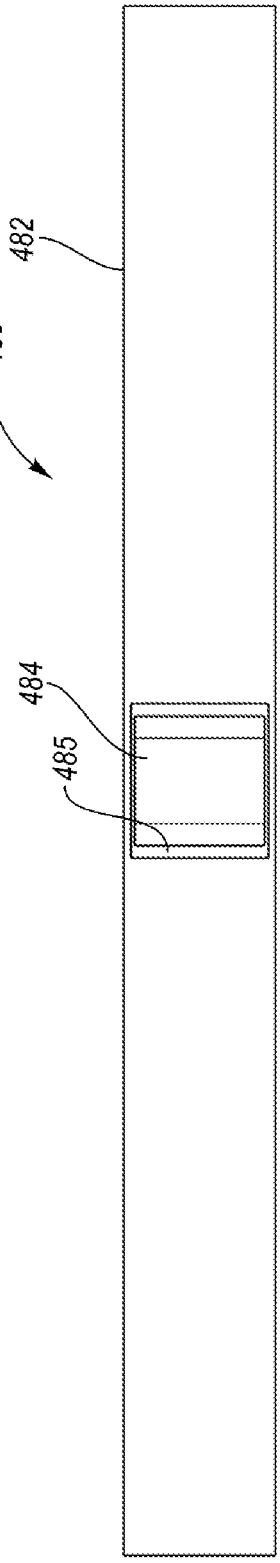


FIG. 46



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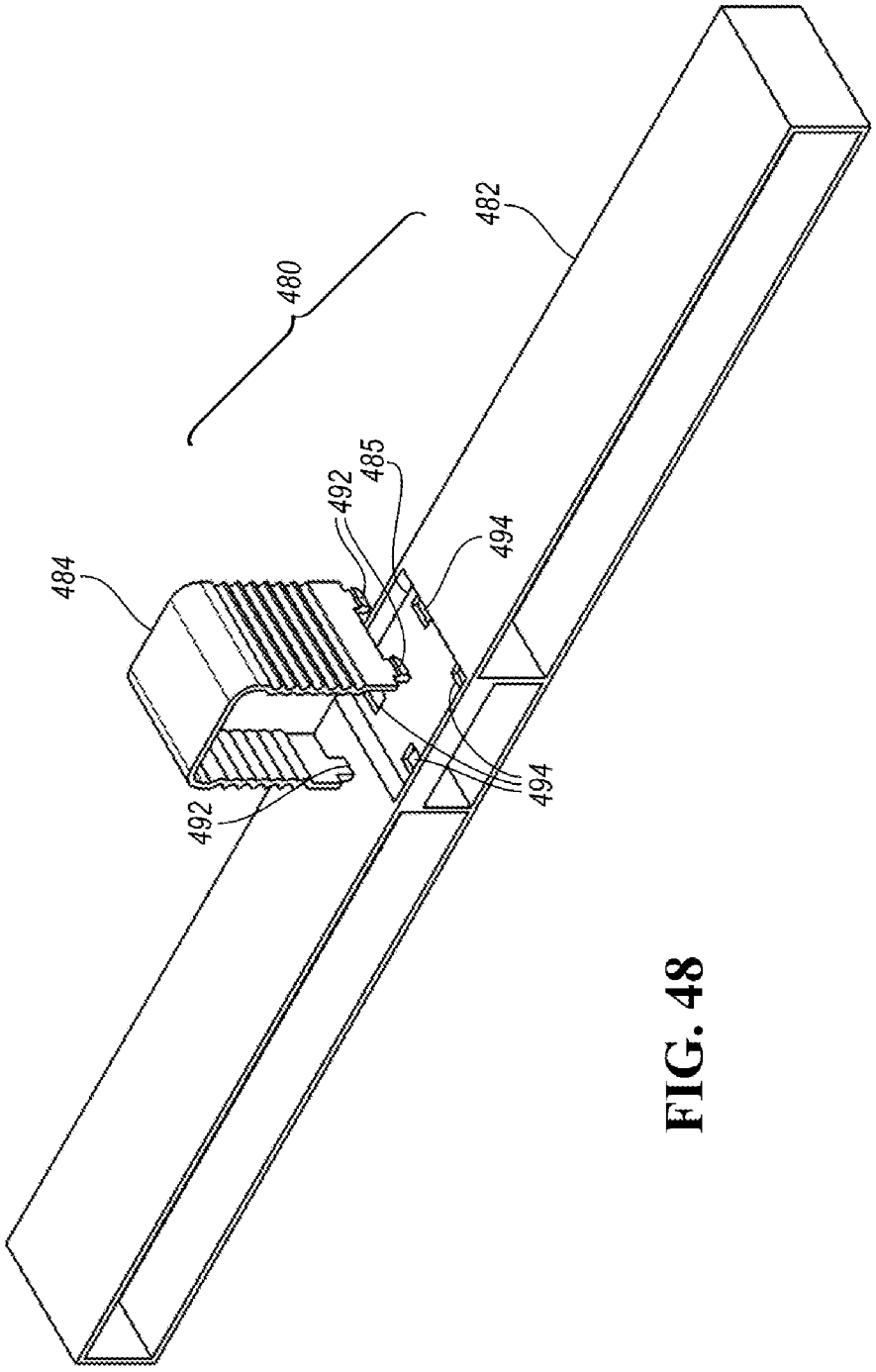

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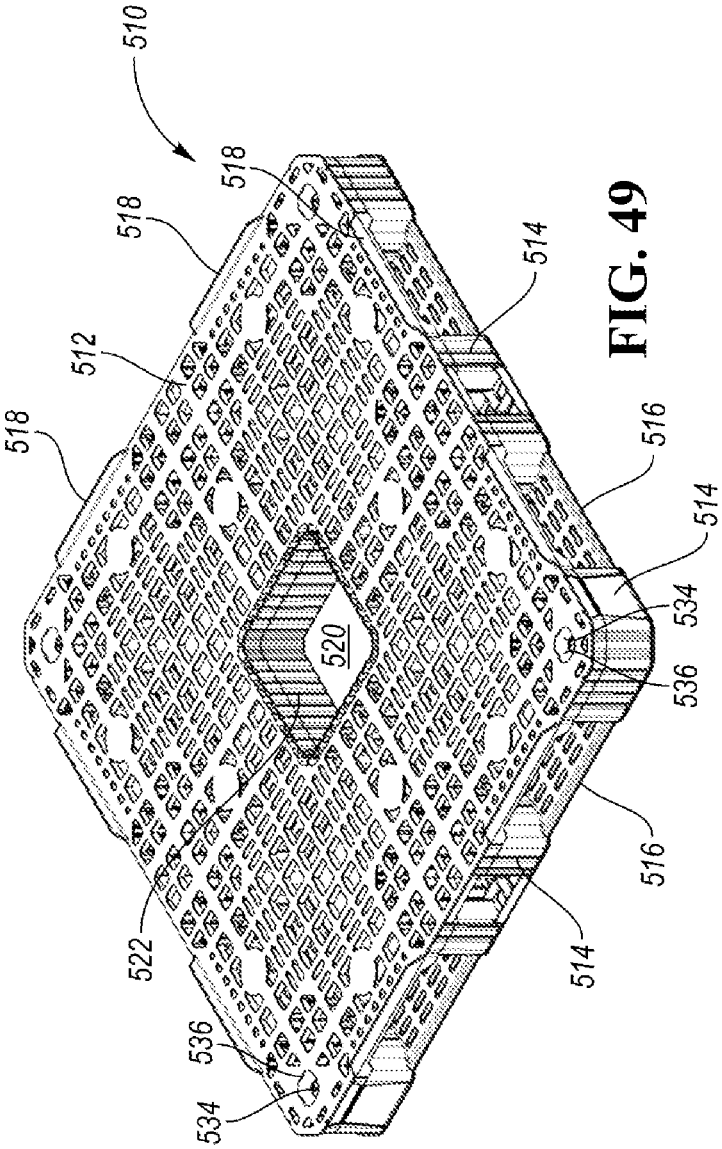
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FIG. 49

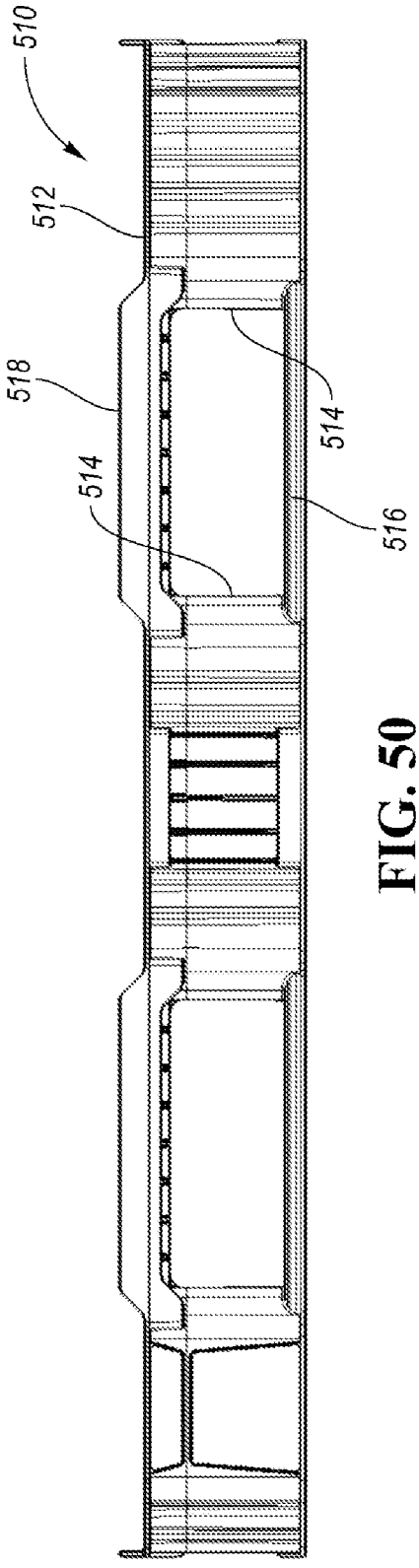
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FIG. 50

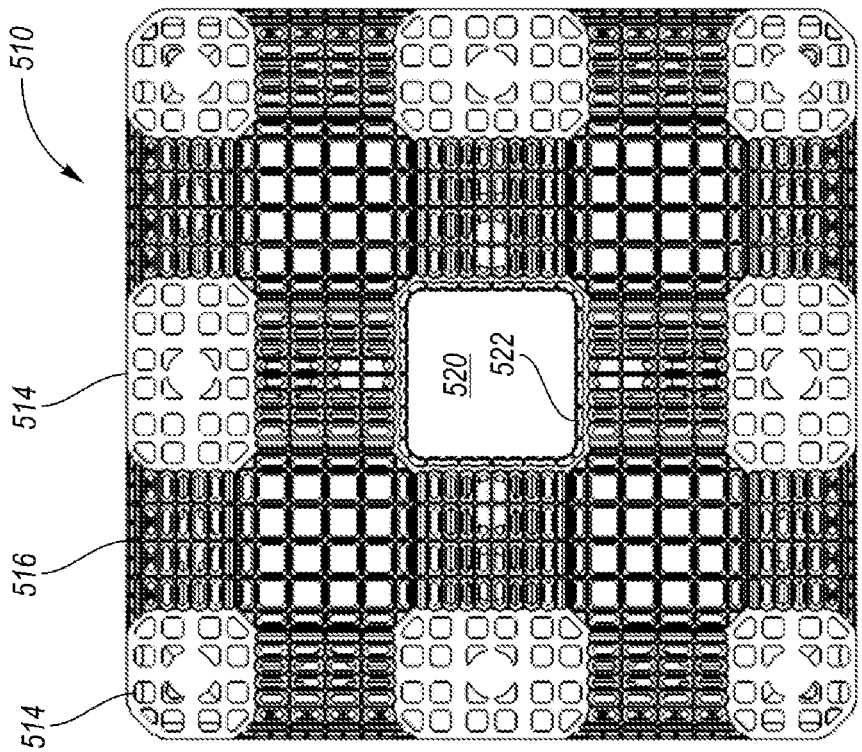

FIG. 52

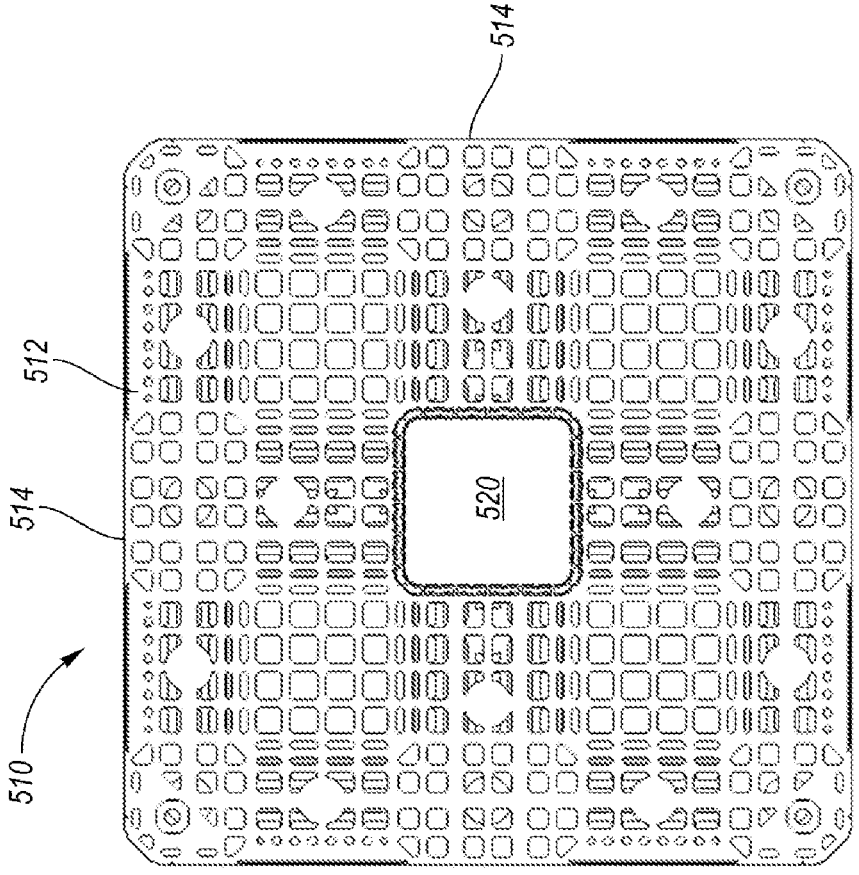

FIG. 51

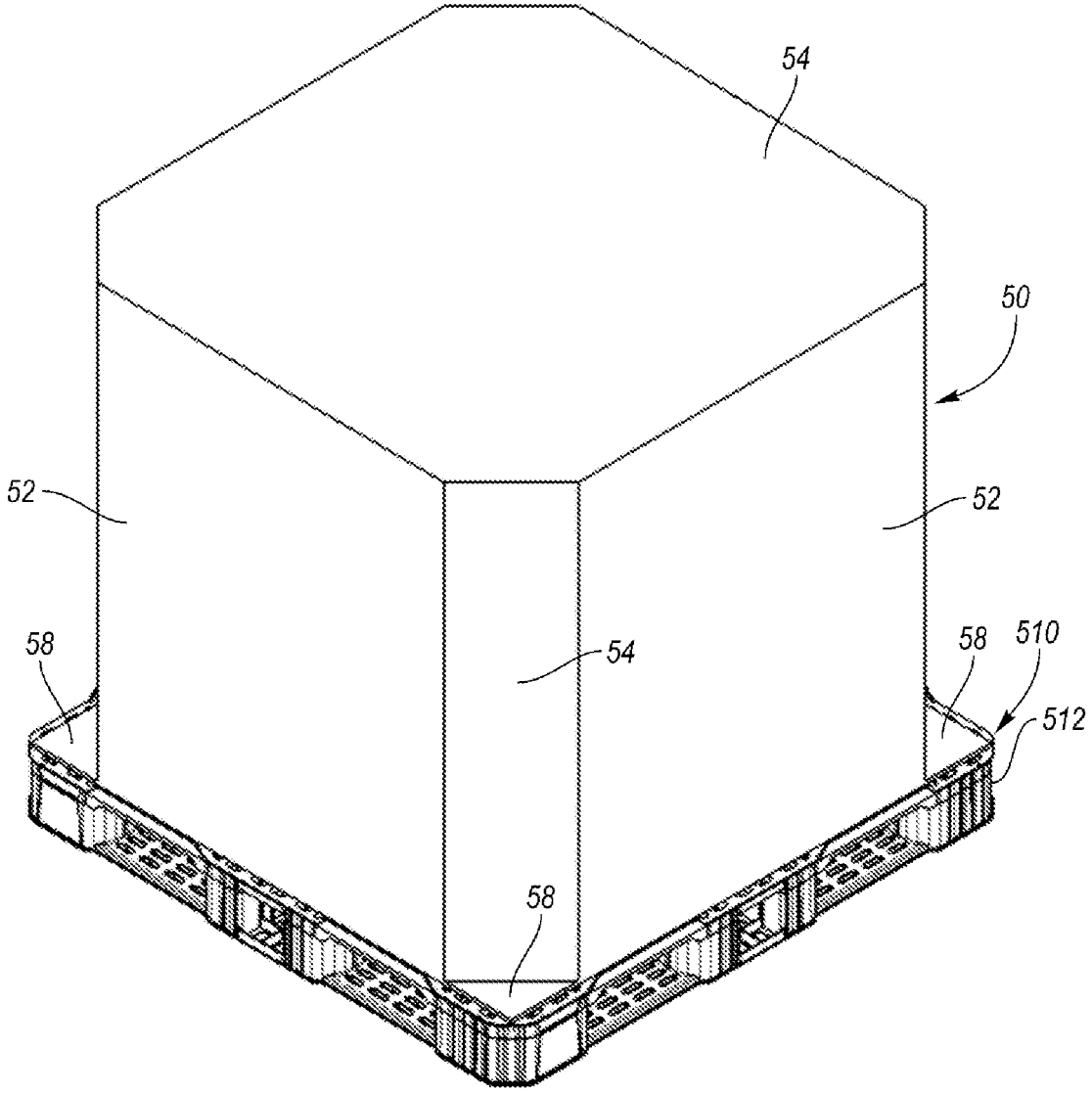

FIG. 53

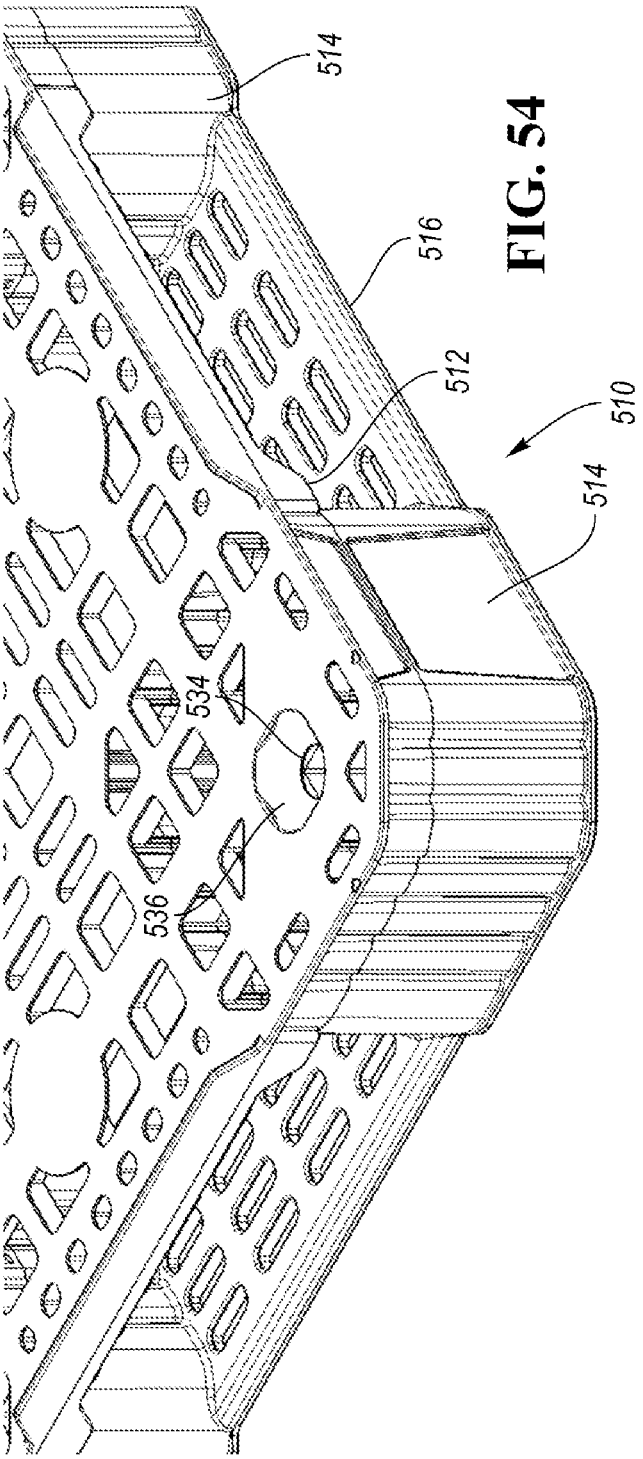

FIG. 54

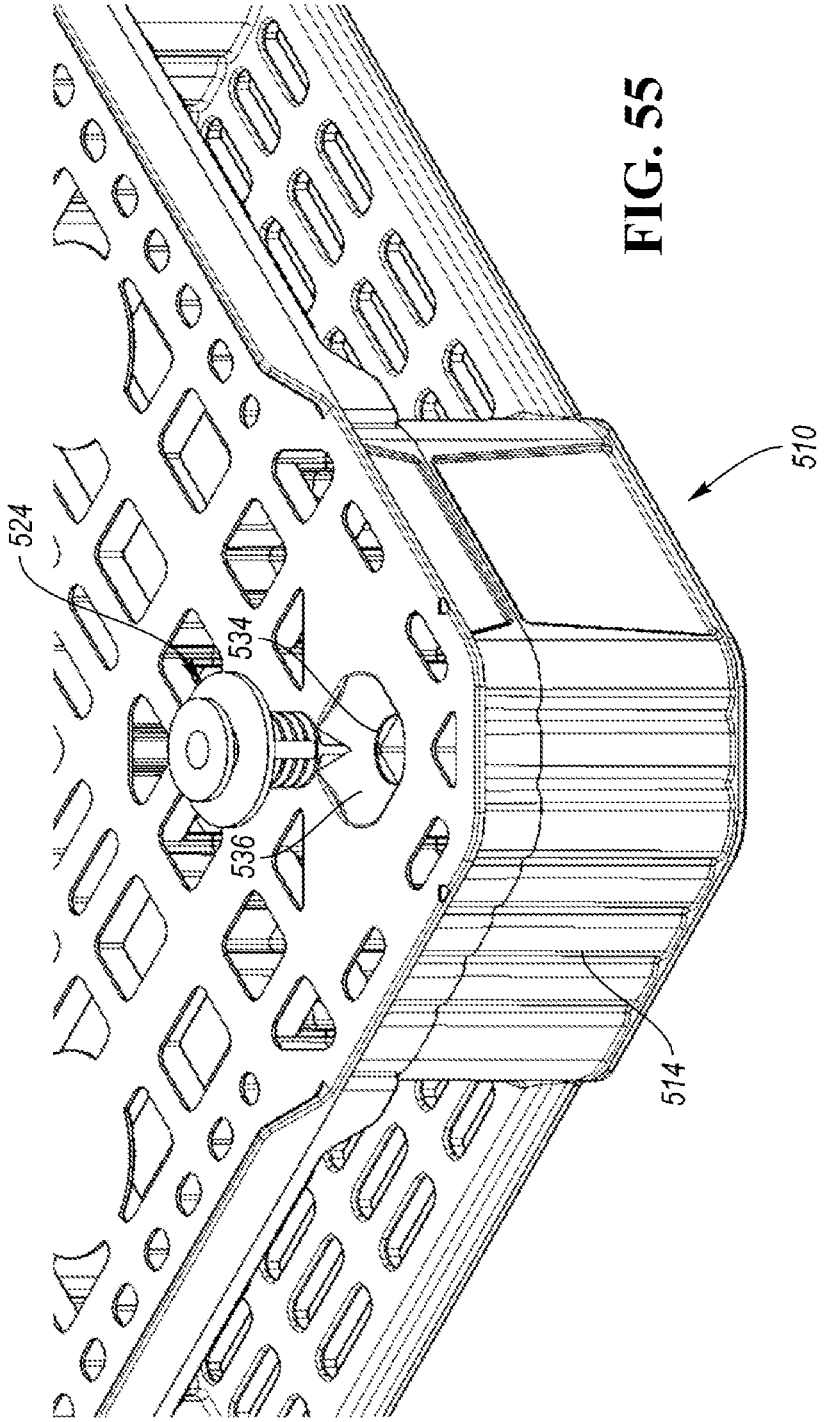

FIG. 55

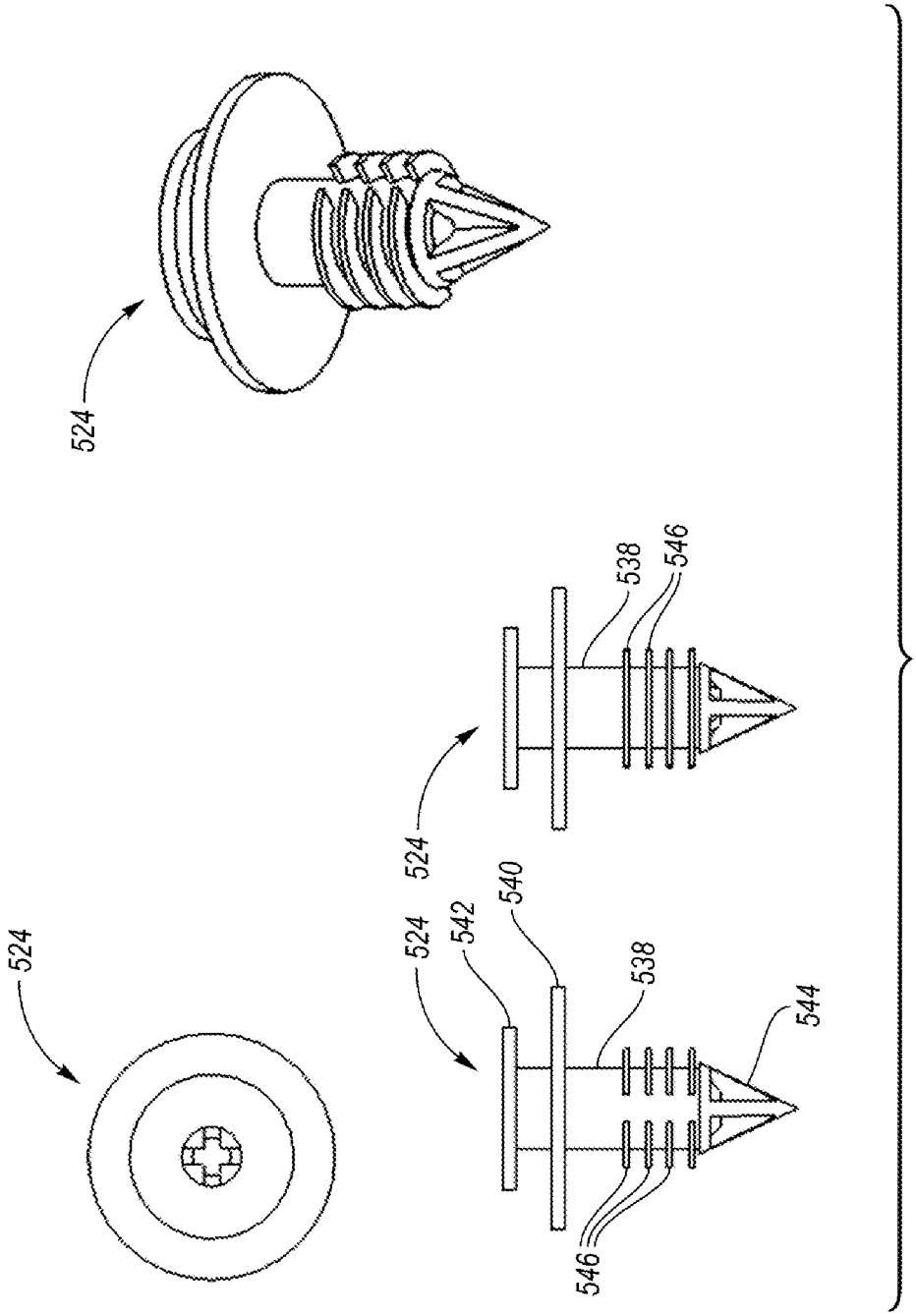

FIG. 56

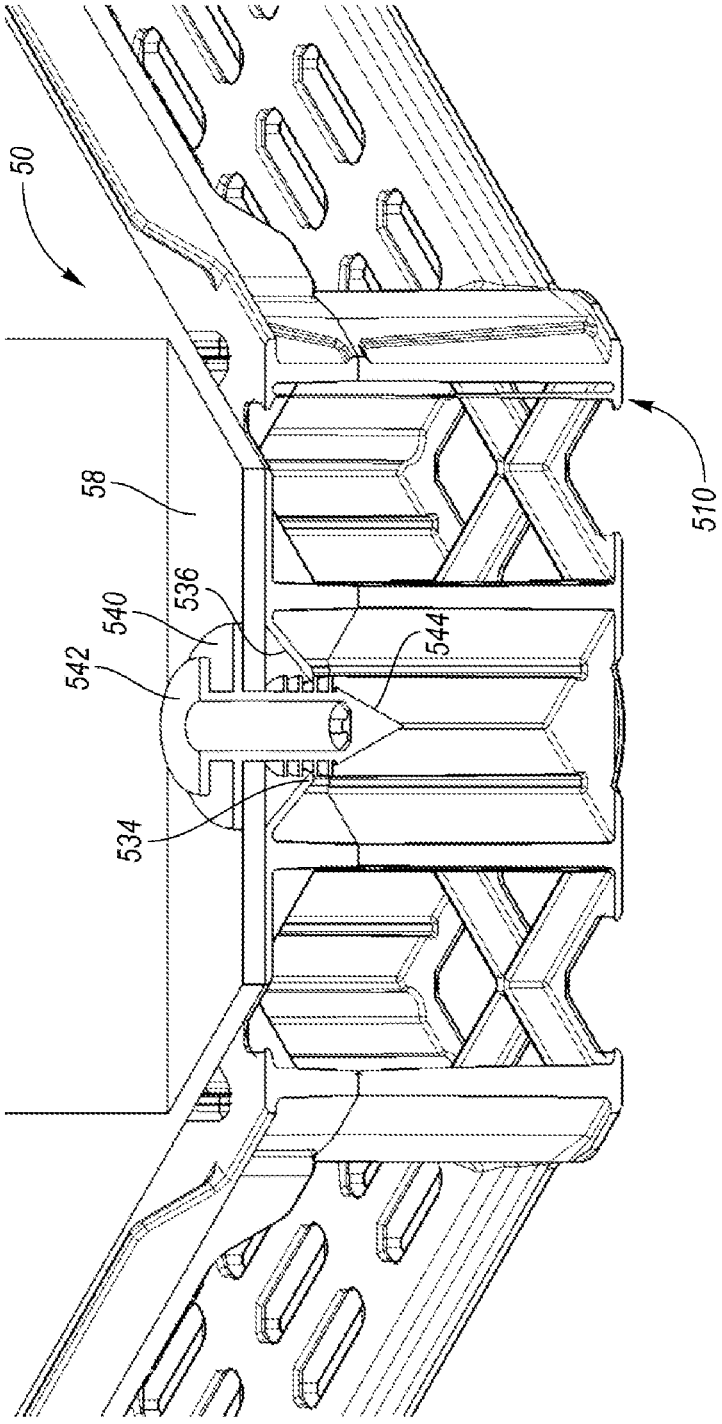

FIG. 57

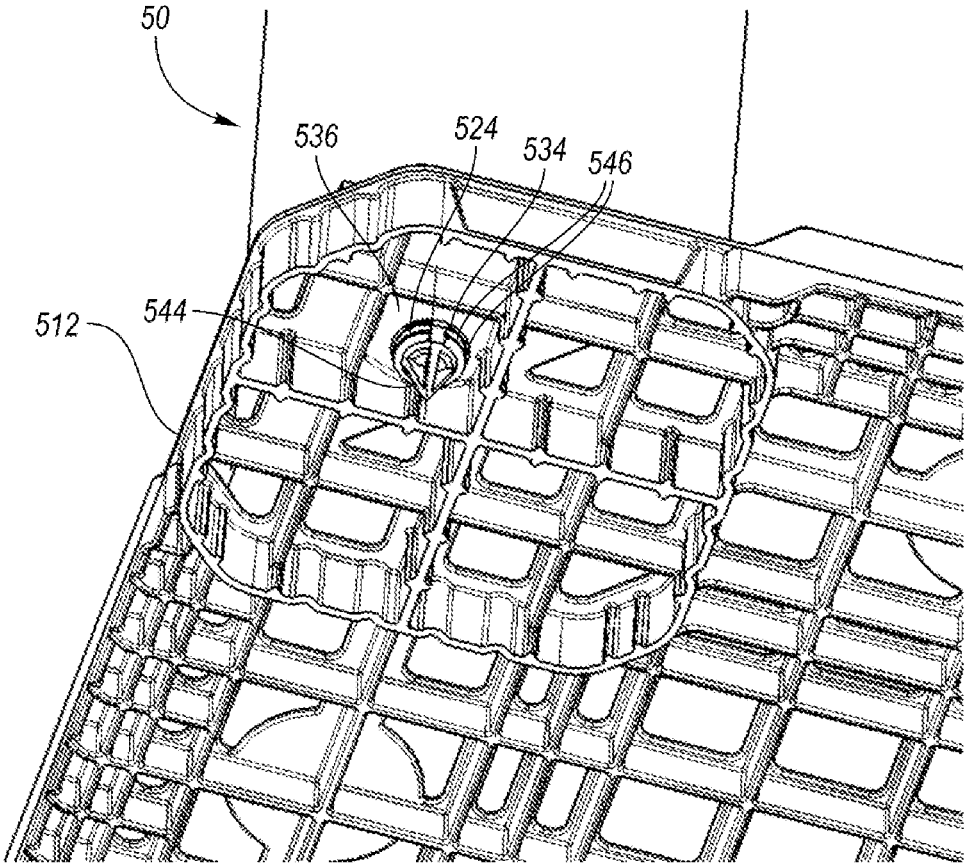

FIG. 58

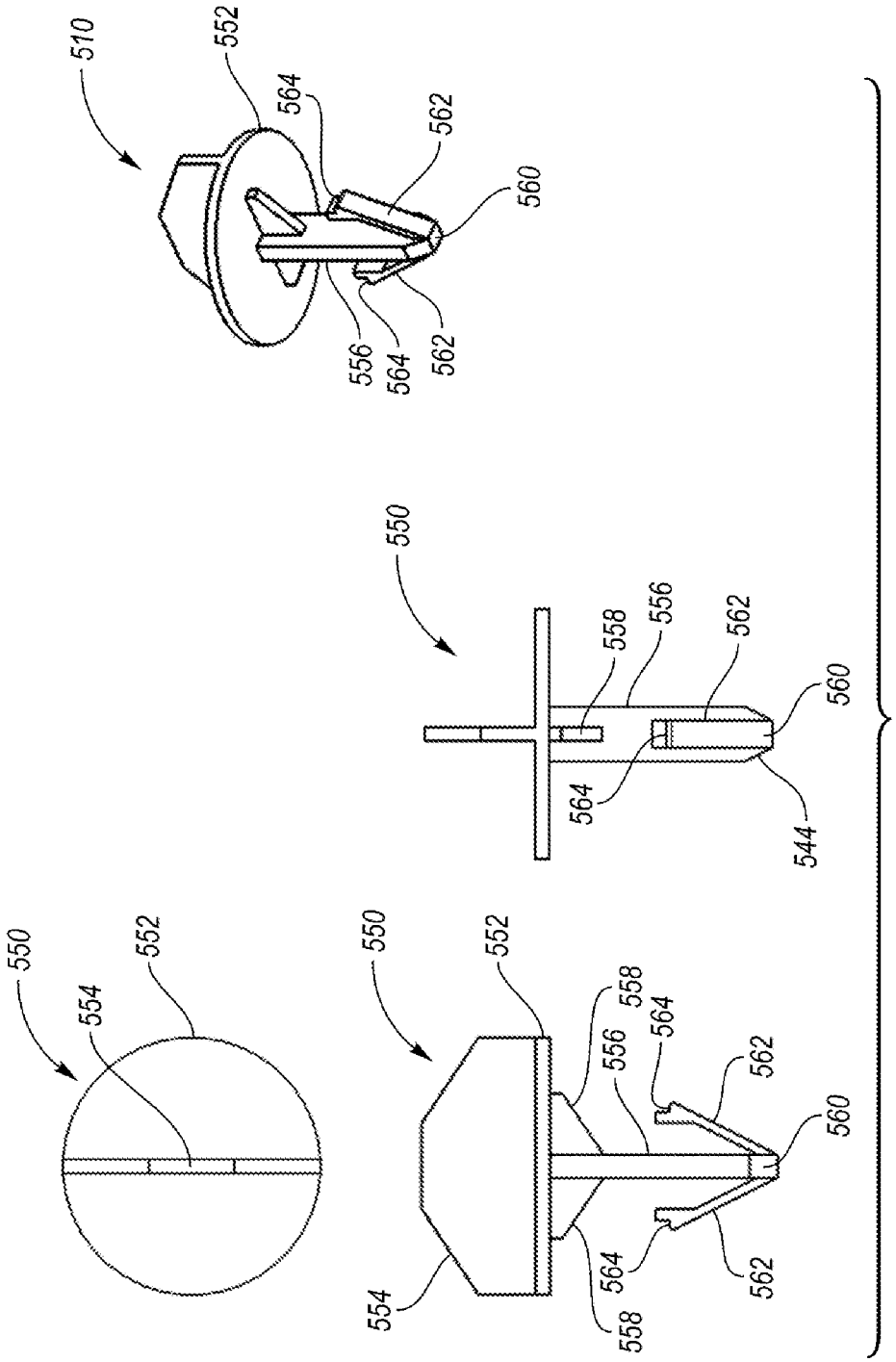
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FIG. 59

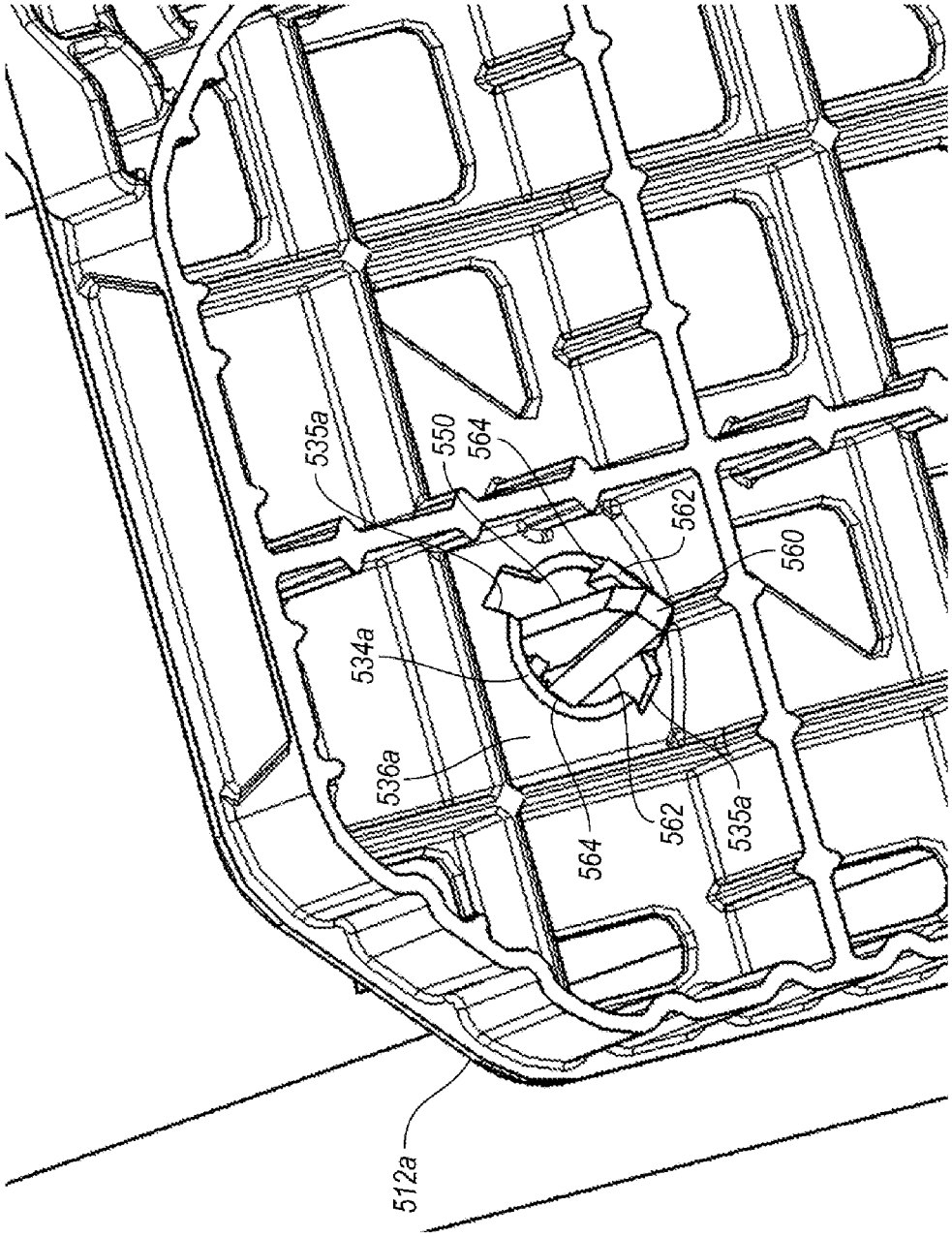

FIG. 60

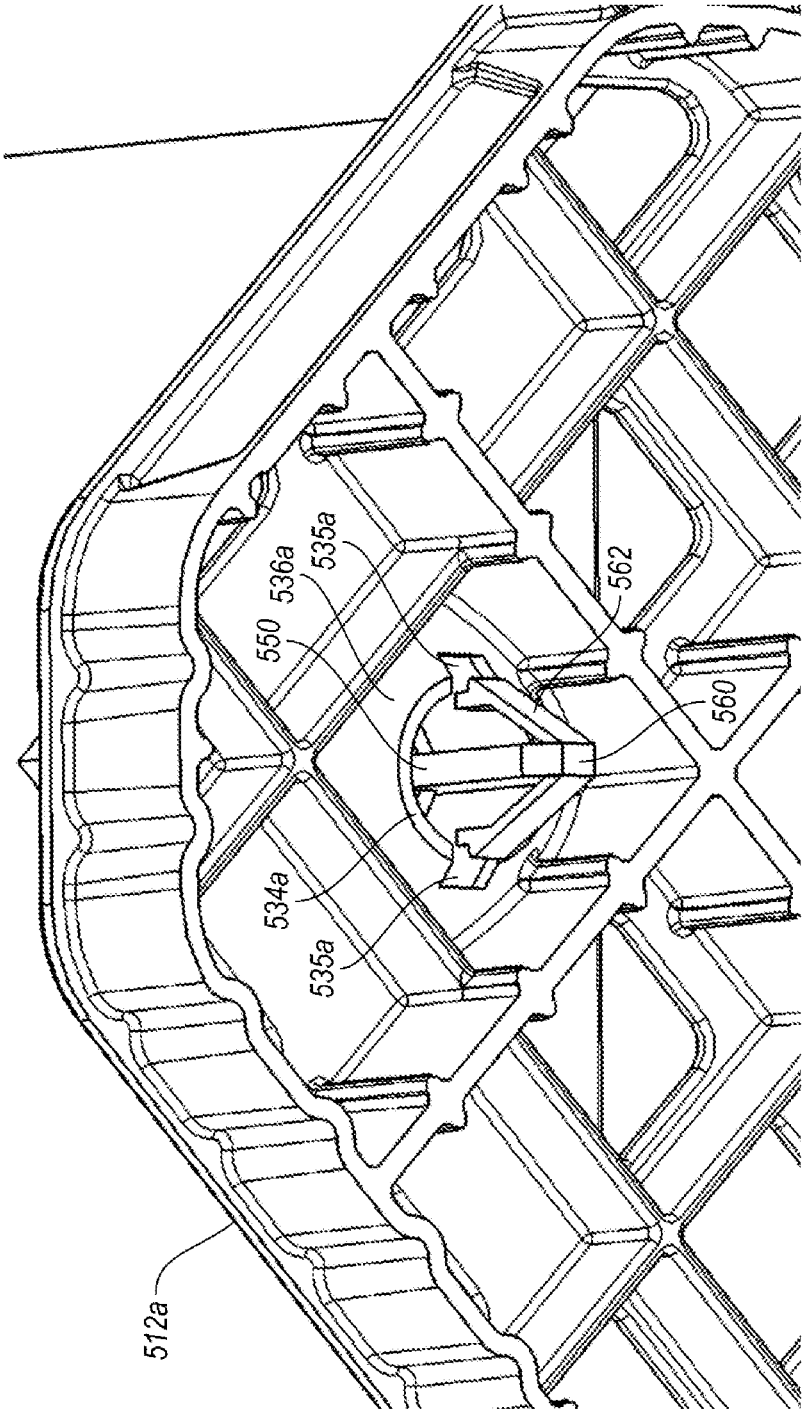

FIG. 61

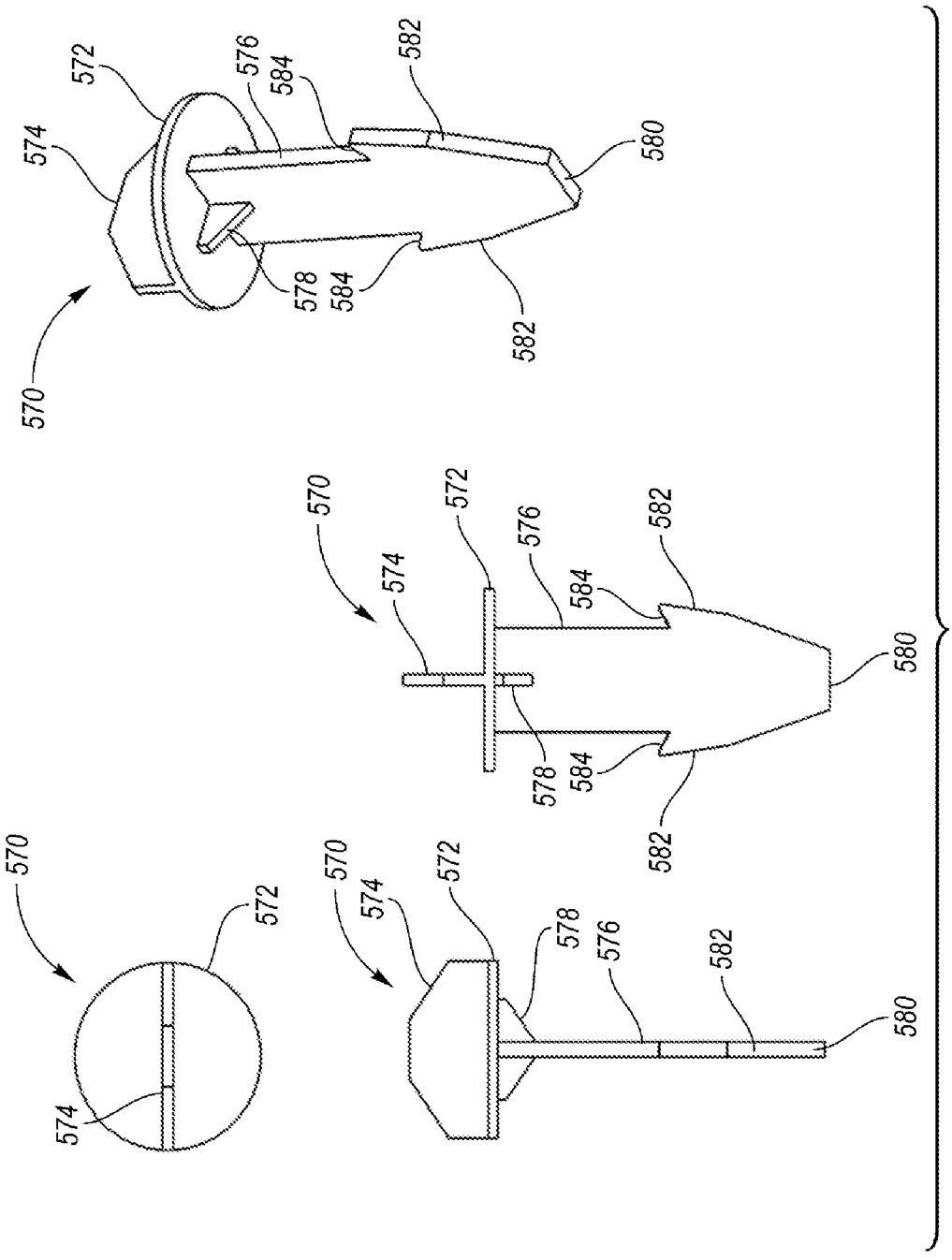

FIG. 62

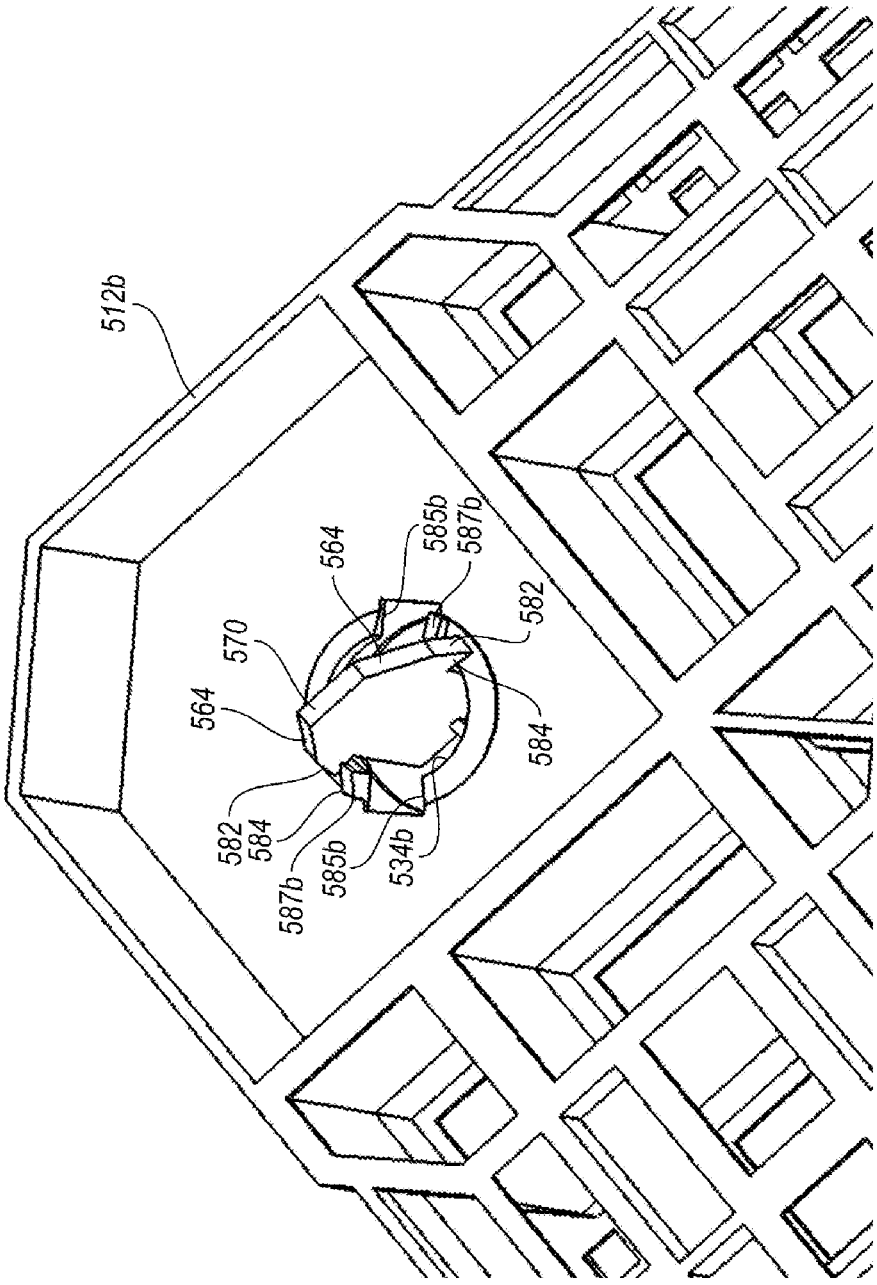

FIG. 63

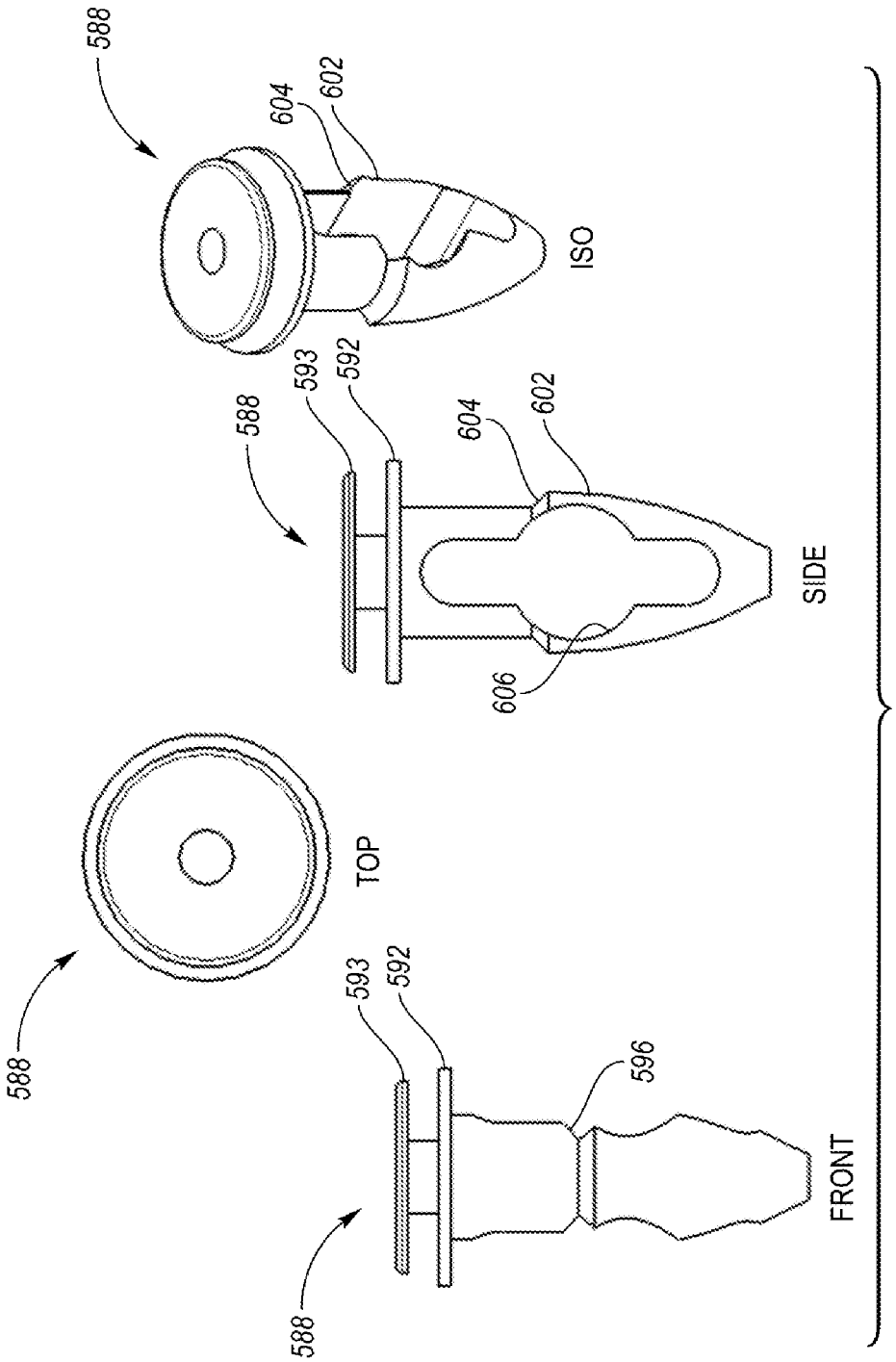
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FIG. 64

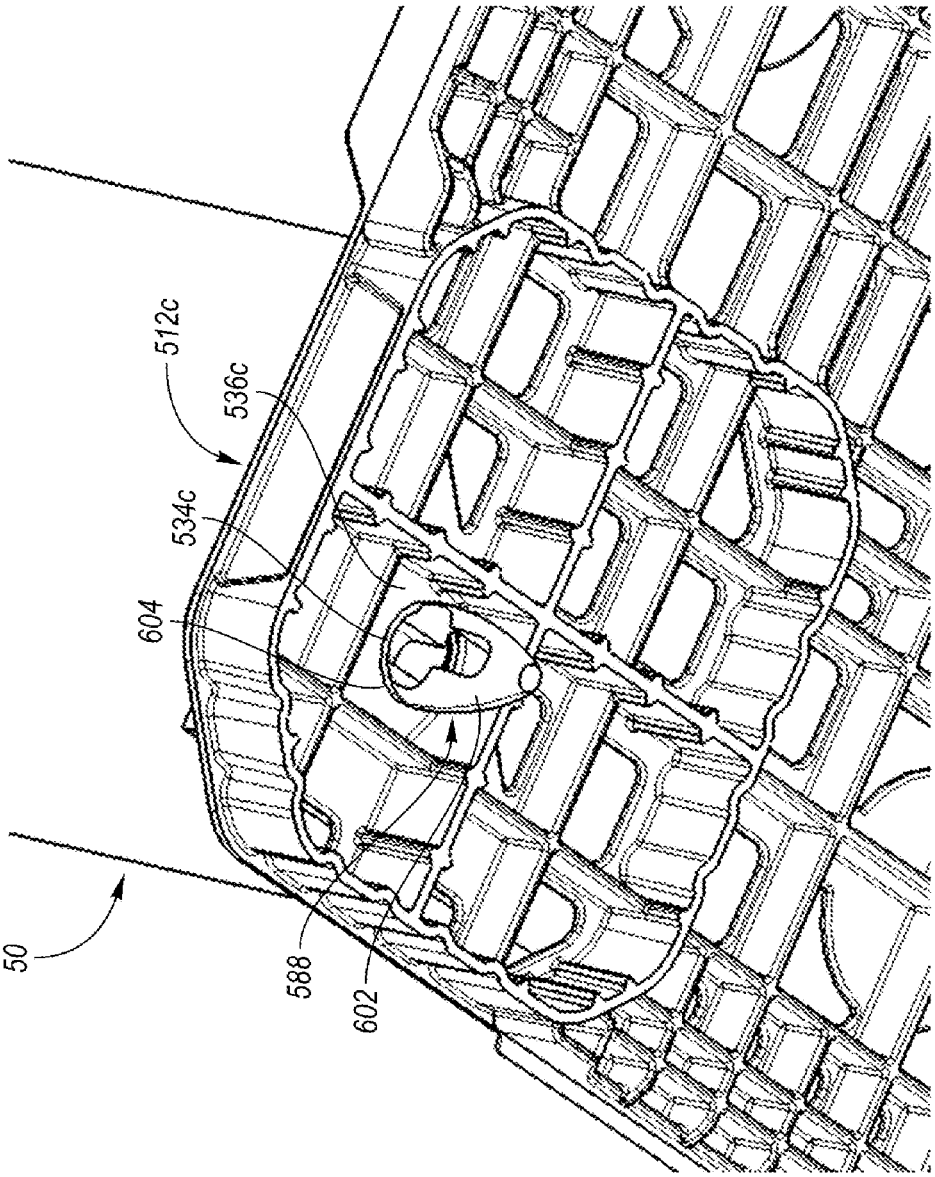

FIG. 65

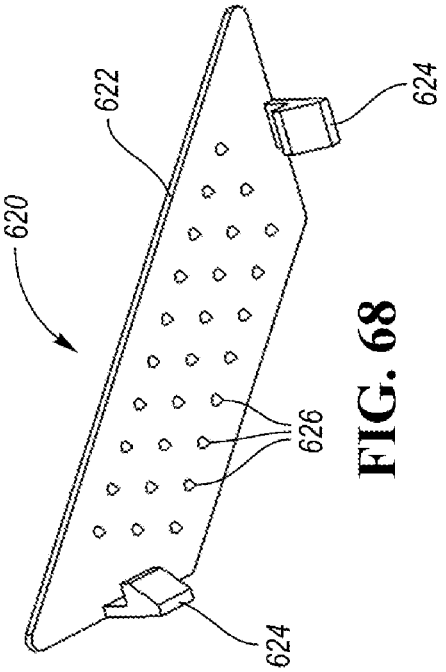

FIG. 68

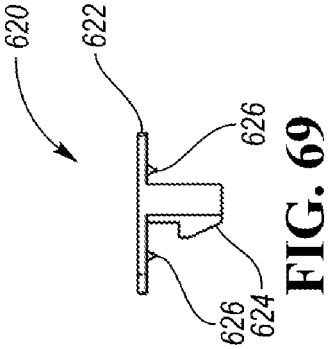

FIG. 69

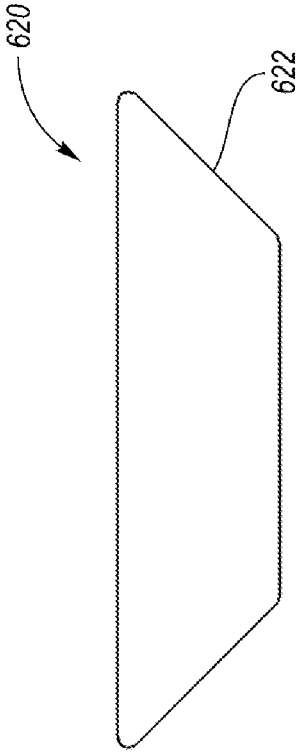

FIG. 66

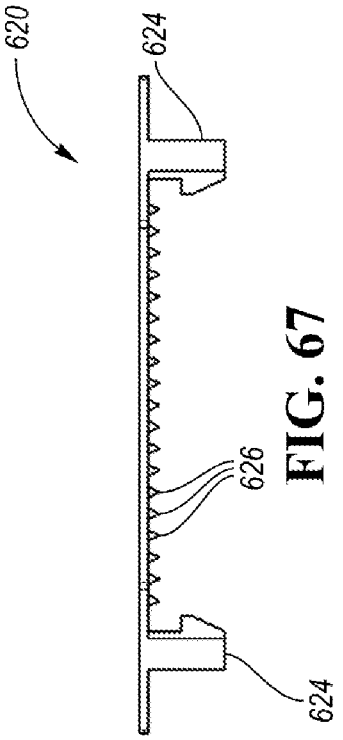

FIG. 67

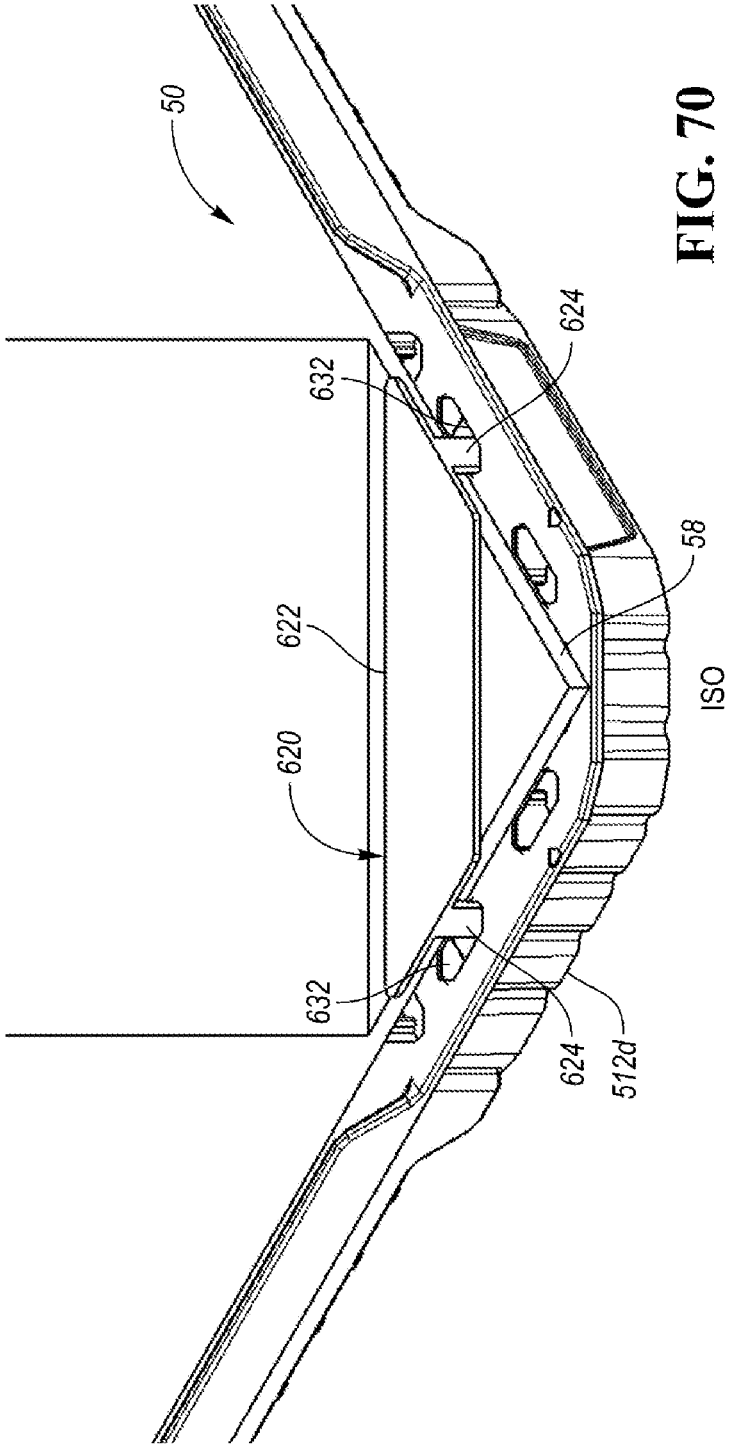

FIG. 70

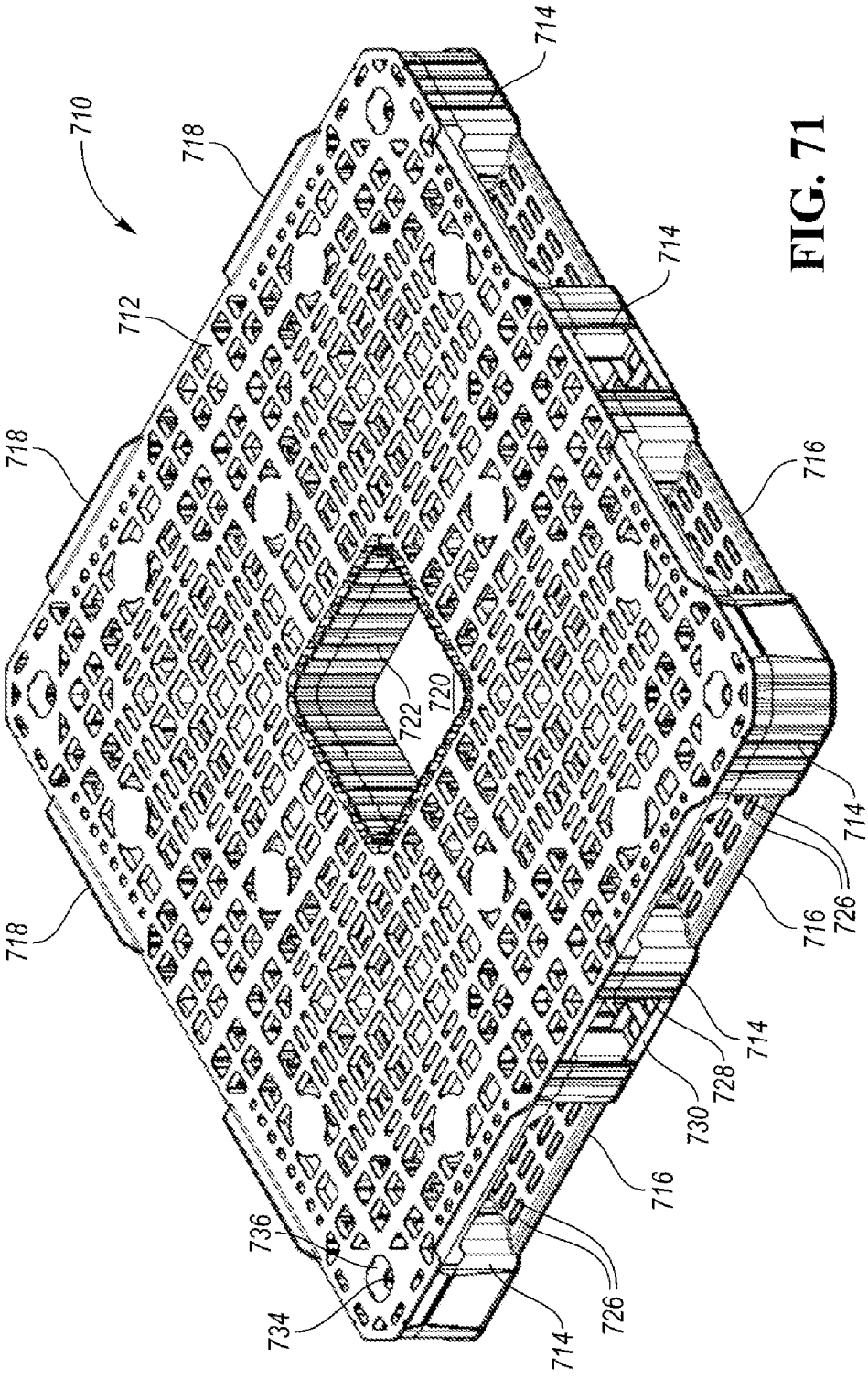

FIG. 71

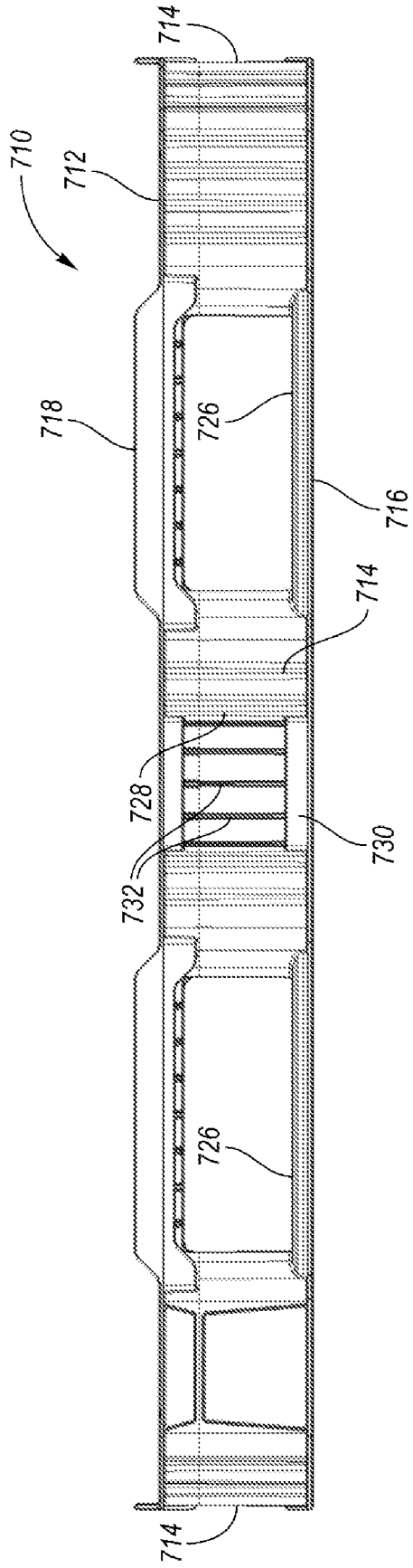

FIG. 72

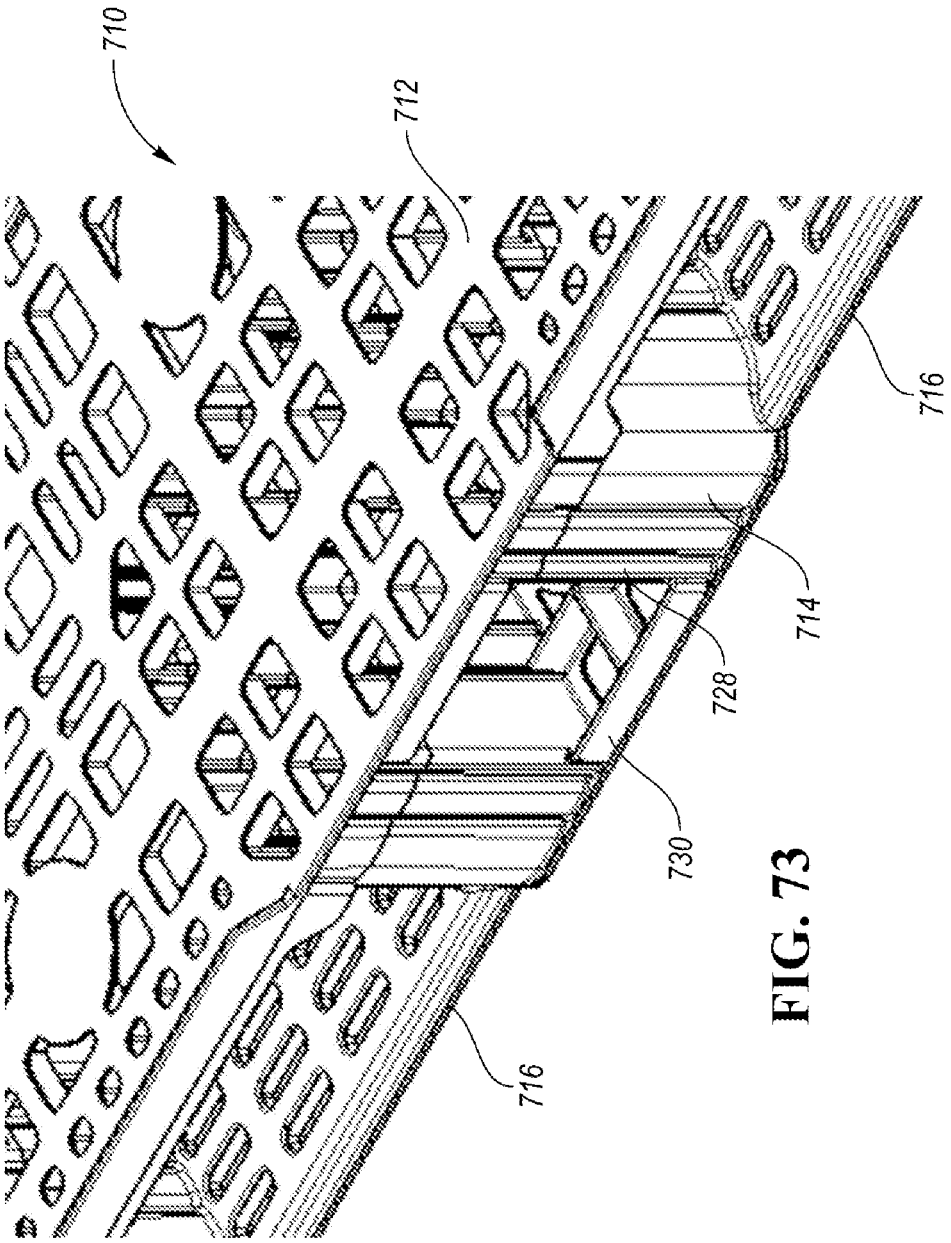

FIG. 73

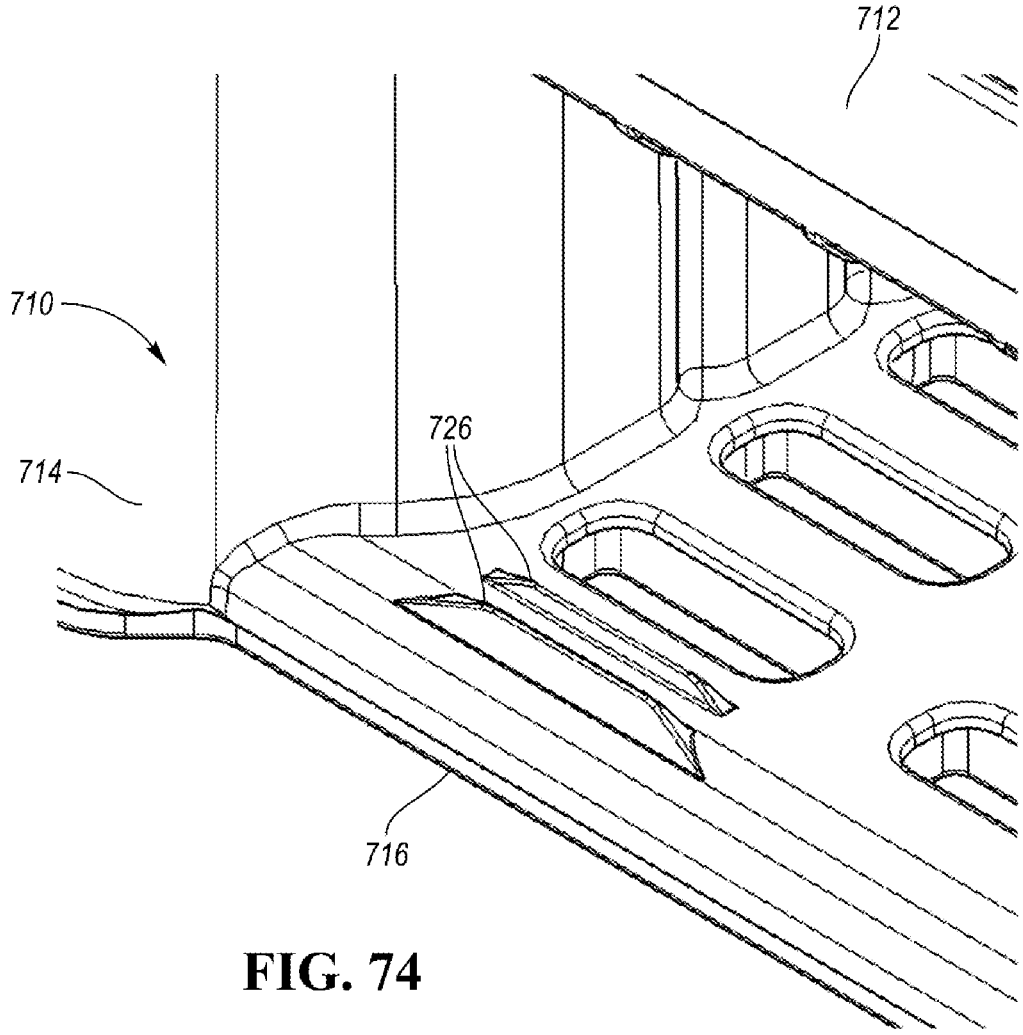

FIG. 74

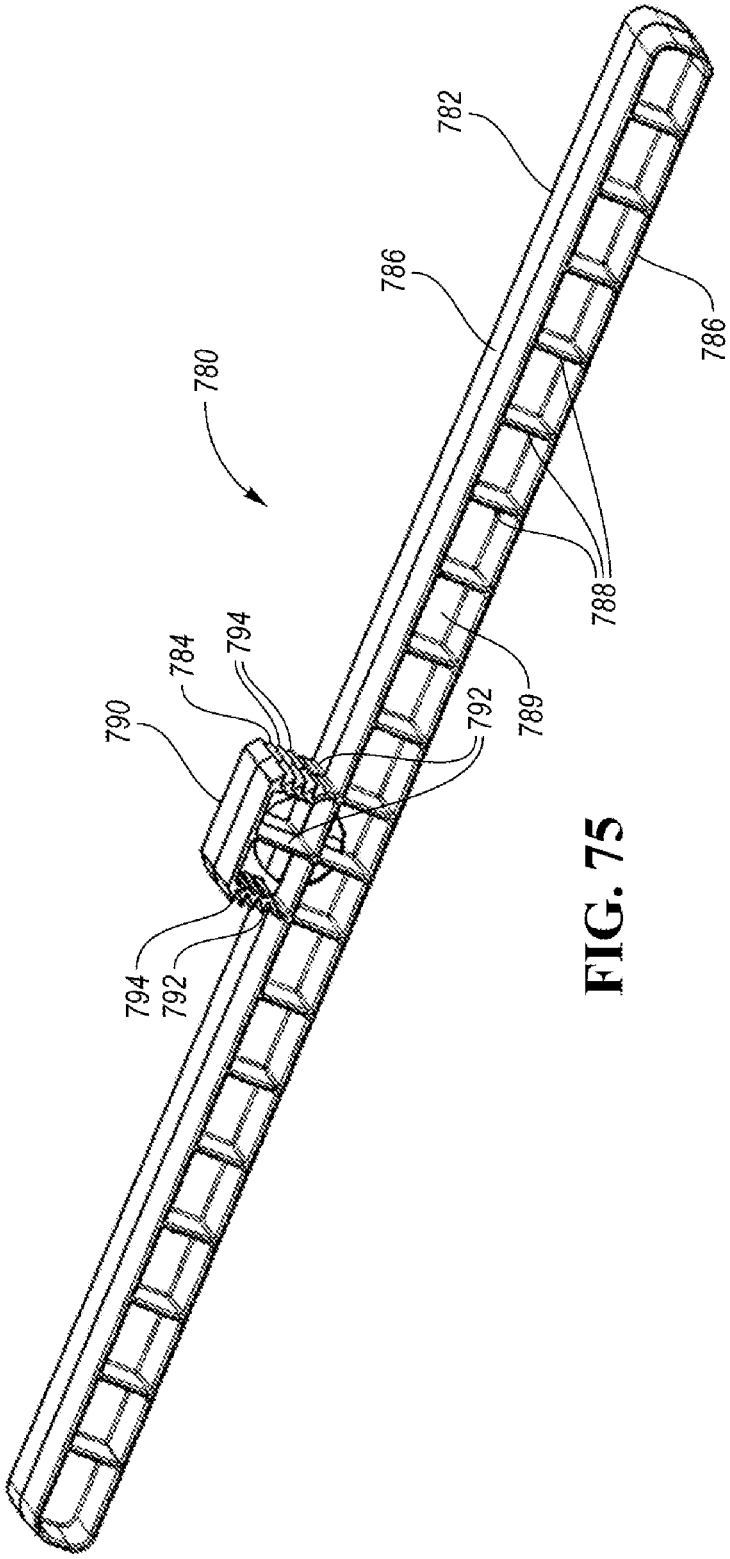

FIG. 75

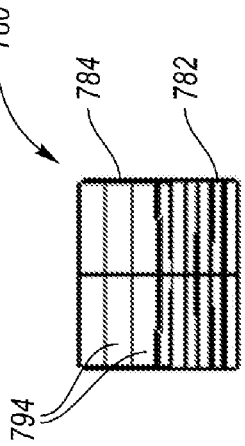

FIG. 76

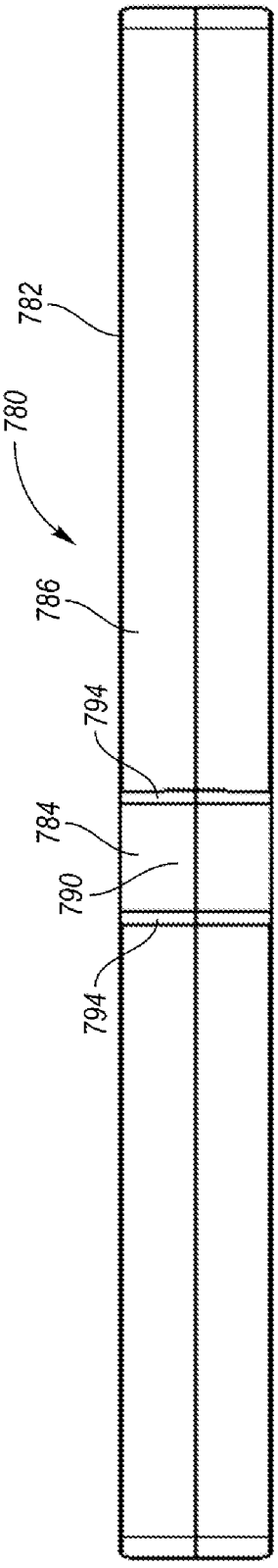

FIG. 77

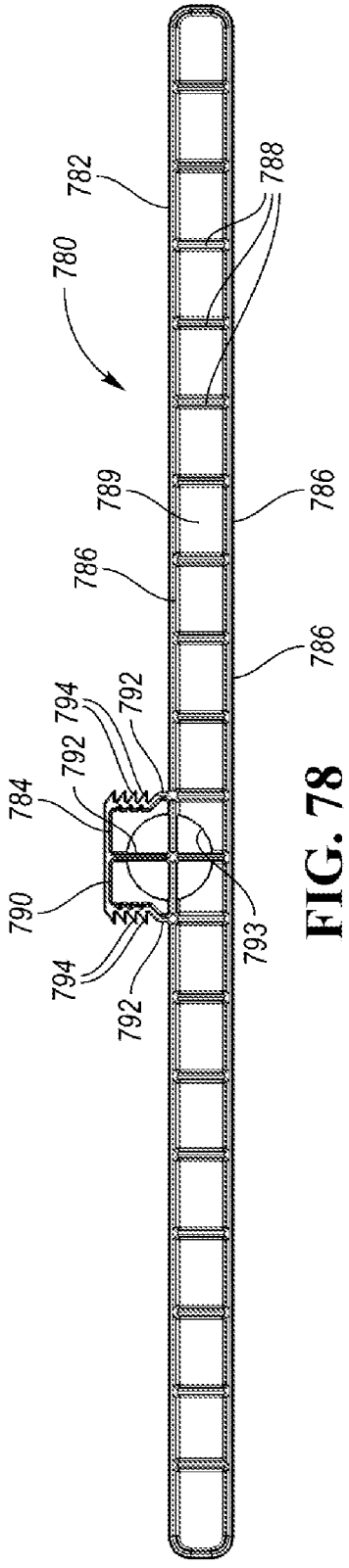

FIG. 78

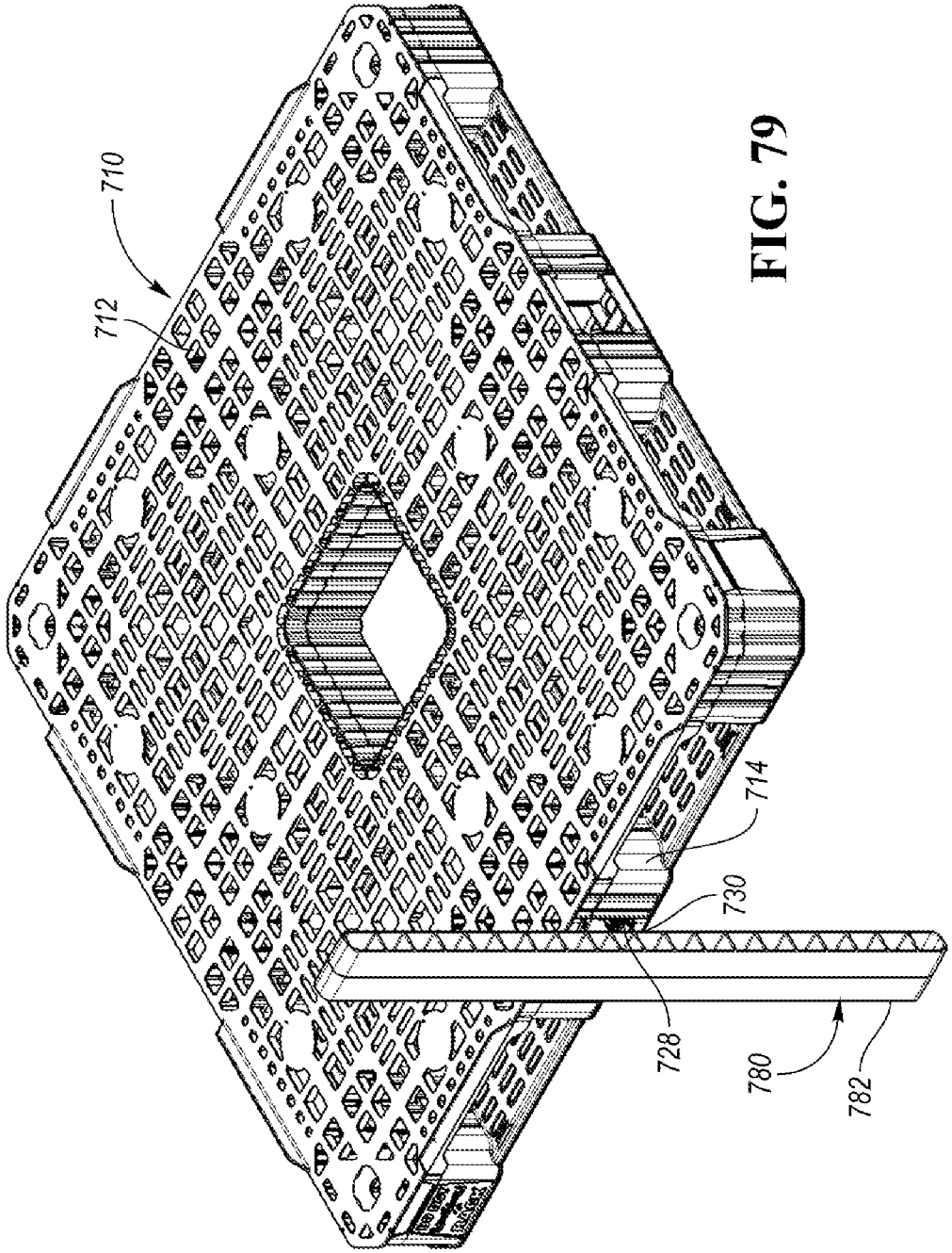

FIG. 79

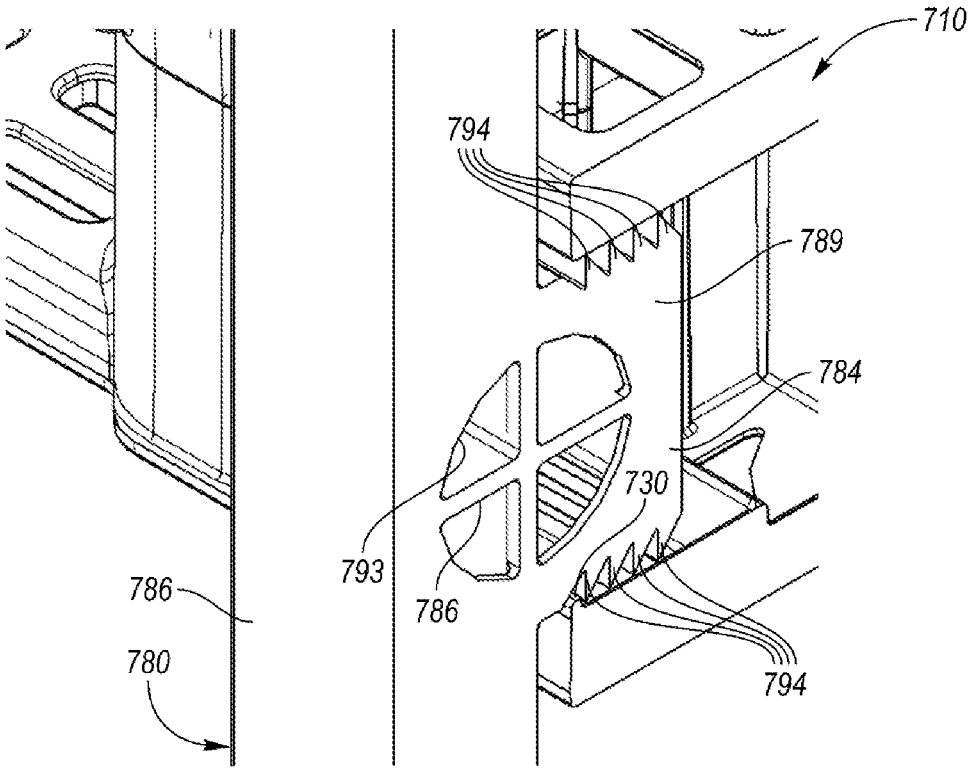

FIG. 80

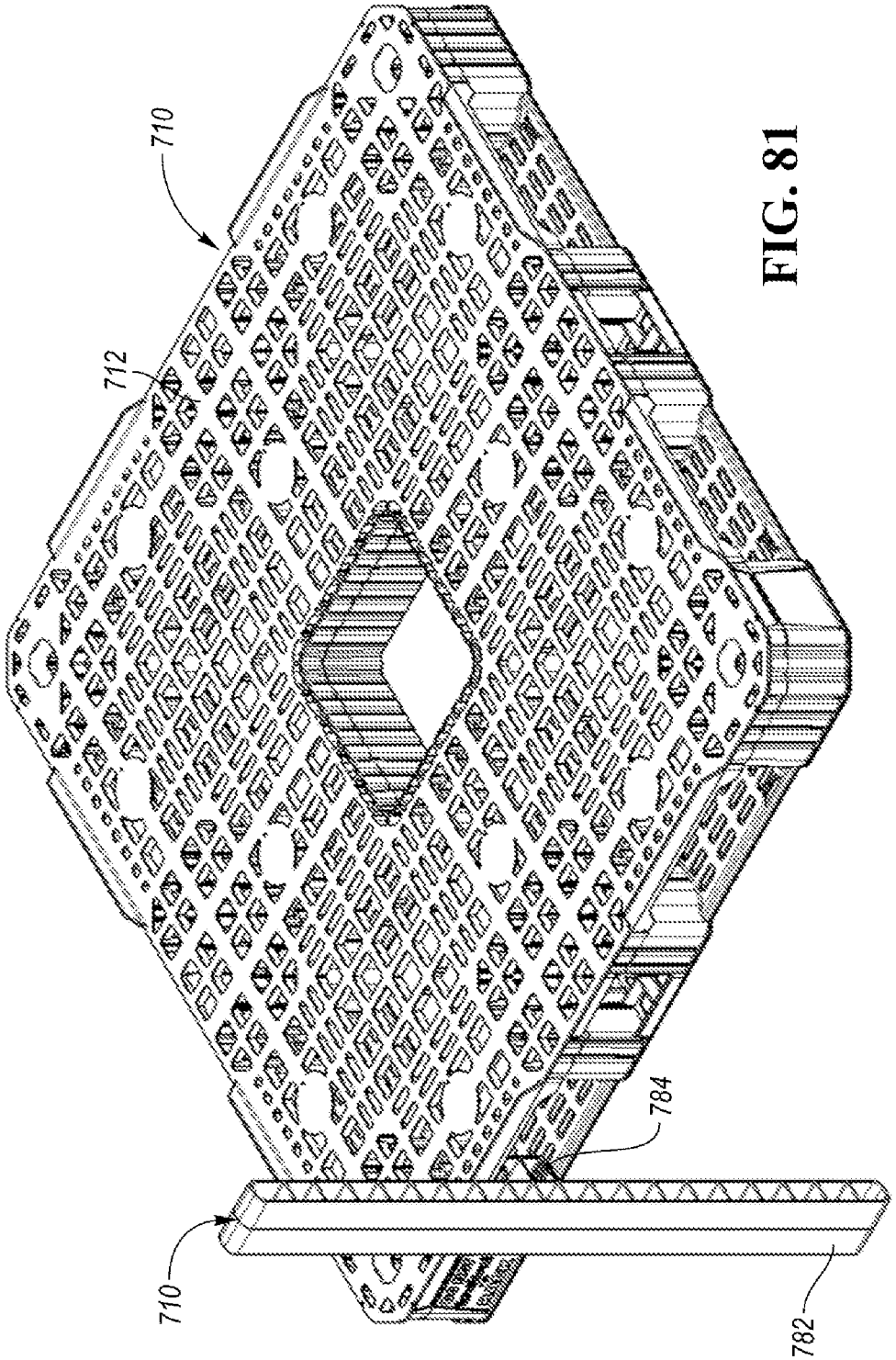

FIG. 81

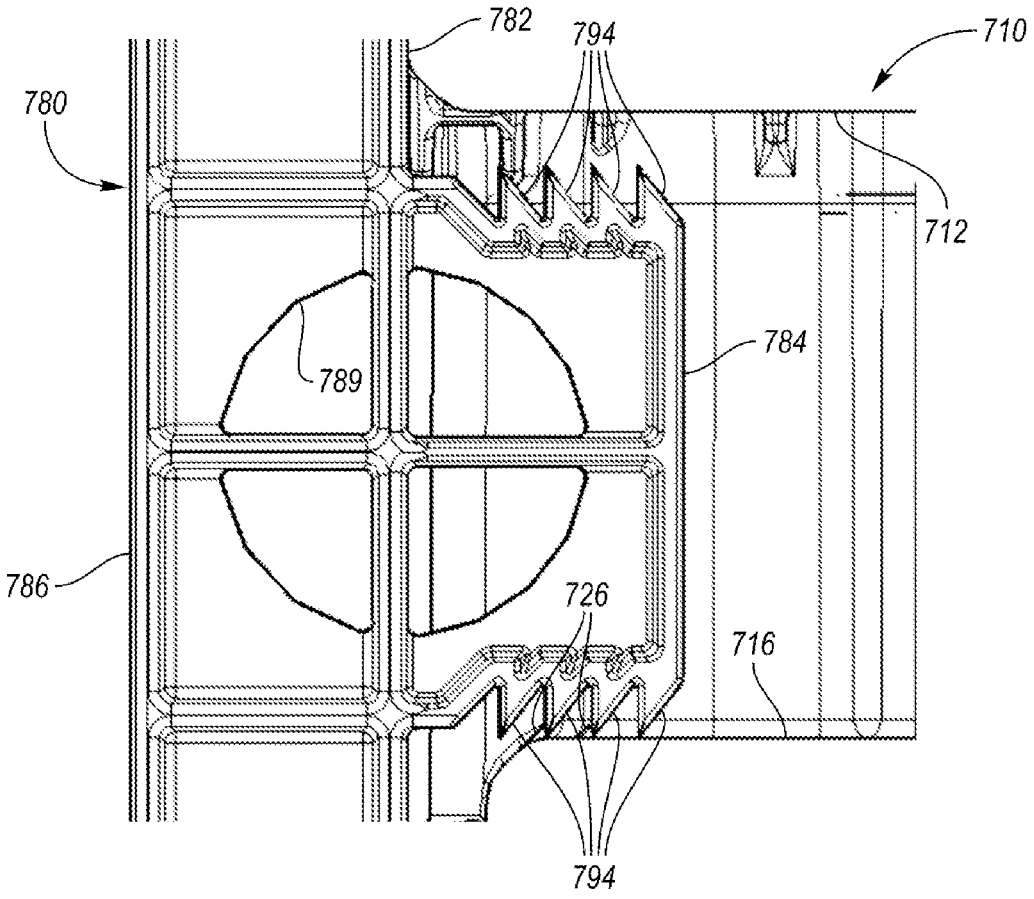

FIG. 82

PALLET WITH DECK OPENING AND BRACE

BACKGROUND

Pallets generally include a deck having an upper surface for supporting goods thereon. Columns support the deck above the floor so that fork tines or tines of a pallet jack can be inserted under the deck to lift and move the loaded pallet.

SUMMARY

A pallet according to one example disclosed herein includes a deck having an opening therethrough, such that product can be removed through the opening from a box loaded on the deck of a pallet. The opening is at least approximately ⅕ a width and at least approximately ⅕ a length of the deck. A plurality of columns support the deck.

In the example shown herein, the opening is approximately one quarter the width and length of the deck. A peripheral wall may extend downward from a periphery of the opening.

According to another feature, fasteners may secure flaps of the box in corners of the deck of a pallet. The fasteners may include corner caps configured to snap-fit to the deck and to sandwich flaps of the box to the deck.

The box may be supported on the deck over the opening. If the box contains items that are smaller than the opening, the bottom wall of the box may be opened though the opening in the deck. The items can then be removed from the box through the opening through the deck without removing the box from the pallet.

According to another feature, at least one brace includes an elongated body portion and a retainer portion extending transversely from the elongated body portion. The retainer portion can be secured to an opening of the pallet, such that the elongated body portion abuts goods that are supported on the deck. The elongated body portion may also extend downward to abut goods supported on the deck of a pallet stacked below.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a perspective view of a pallet according to a first embodiment.

FIG. **2** is a side view of the pallet of FIG. **1**.

FIG. **3** is a top view of the pallet of FIG. **1**.

FIG. **4** is a bottom view of the pallet of FIG. **1**.

FIG. **5** shows a pallet according to a second embodiment with a box thereon.

FIG. **6** shows the pallet of FIG. **5** without the box.

FIG. **7** is a side view with one of the corner caps exploded from the pallet of FIG. **6**.

FIG. **8** is an enlarged view of the corner column and corner cap of FIG. **7**.

FIG. **9** illustrates a pallet according to a third embodiment with a box thereon.

FIG. **10** is a side view of the pallet and box of FIG. **9** being engaged by a cutting instrument from below.

FIG. **11** is another side view of the pallet and box of FIG. **9**.

FIGS. **12** and **13** are side views of the pallet of FIG. **9** without the box.

FIG. **14** is an enlarged section view through the corner column of the pallet of FIG. **12**.

FIG. **15** shows a pallet according to a fourth embodiment with a box thereon.

FIG. **16** shows the pallet and box of FIG. **15** with the retainers pivoted outward in the unsecured position.

FIG. **17** is an enlarged view of one corner column of the pallet and box of FIG. **16**.

FIG. **18** shows the corner column of FIG. **17** without the box.

FIG. **19** shows an alternate pallet with a box thereon.

FIG. **20** shows the pallet of FIG. **19** without the box.

FIG. **21** shows a system including a plurality of pallets and a brace positioned between the plurality of loaded pallets.

FIG. **22** shows two of the loaded pallets and the brace of FIG. **21**.

FIG. **23** shows one embodiment of the brace of FIG. **22**.

FIG. **24** is side view of the brace of FIG. **23**.

FIG. **25** is a top view of the brace of FIG. **23**.

FIG. **26** shows a plurality of the pallets of FIG. **21** loaded with goods and with a plurality of braces similar to the brace of FIG. **23**.

FIG. **27** shows a plurality of the pallets and braces of FIG. **21** loaded with different size goods.

FIG. **28** shows one of the pallets of FIG. **21** with a box loaded thereon.

FIG. **29** is a top view of the pallet and box of FIG. **28**.

FIG. **30** is a perspective view of one of the pallets of FIG. **21**.

FIG. **31** is a side view of the pallet of FIG. **30**.

FIG. **32** shows a plurality of the braces of FIG. **23** stacked together.

FIG. **33** shows a brace according to a second embodiment.

FIG. **34** is a top view of the brace of FIG. **33**.

FIG. **35** is a side view of the brace of FIG. **33**.

FIG. **36** shows a stack of a plurality of the braces of FIG. **33**.

FIG. **37** shows a brace according to a third embodiment.

FIG. **38** is a top view of the brace of FIG. **37**.

FIG. **39** is a side view of the brace of FIG. **37**.

FIG. **40** shows a stack of a plurality of braces of FIG. **37**.

FIG. **41** shows a brace according to a fourth embodiment.

FIG. **42** is a top view of the brace of FIG. **41**.

FIG. **43** is a side view of the brace of FIG. **41**.

FIG. **44** shows a stack of a plurality of the braces of FIG. **41**.

FIG. **45** shows a brace according to a fifth embodiment.

FIG. **46** is a side view of the brace of FIG. **45**.

FIG. **47** is a top view of the brace of FIG. **45**.

FIG. **48** is an exploded view of the brace of FIG. **45**.

FIG. **49** is a perspective view of a pallet according to a sixth embodiment.

FIG. **50** is a side view of the pallet of FIG. **49**.

FIG. **51** is a top view of the pallet of FIG. **49**.

FIG. **52** is a bottom view of the pallet of FIG. **49**.

FIG. **53** shows the pallet of FIG. **49** with the box thereon.

FIG. **54** is an enlarged view of one corner of the pallet of FIG. **49**.

FIG. **55** shows the pallet of FIG. **54** and one possible fastener that could be used in the corner of the pallet.

FIG. **56** shows multiple views of the fastener of FIG. **55** in detail.

FIG. **57** shows the fastener installed through a flap of a box in the corner of the pallet of FIG. **55**, partially broken away.

FIG. **58** shows a bottom view of the deck of FIG. **57**, with lower portions of the pallet removed for illustration.

FIG. **59** shows multiple views of an alternative fastener.

FIG. **60** shows the fastener of FIG. **59** being inserted into an alternate deck.

FIG. **61** shows the fastener and deck of FIG. **60** with the fastener rotated to a position for removal.

FIG. **62** shows multiple views of an alternative fastener.

FIG. **63** shows the fastener of FIG. **62** installed in an alternative deck.

FIG. **64** shows multiple views of an alternative fastener.

FIG. **65** shows the fastener of FIG. **64** inserted into an alternate deck.

FIG. **66** is a top view of an alternate corner cap.

FIG. **67** is a front view of the corner cap of FIG. **66**.

FIG. **68** is a bottom perspective view of the corner cap of FIG. **66**.

FIG. **69** is a side view of the corner cap of FIG. **66**.

FIG. **70** shows the corner cap of FIG. **66** secured to a corner of a deck on top of one of the corner flaps of the box.

FIG. **71** is a perspective view of a pallet according to a seventh embodiment.

FIG. **72** is a side view of the pallet of FIG. **71**.

FIG. **73** is an enlarged view of a non-corner, outer column of the pallet of FIG. **71**.

FIG. **74** is an enlarged view of a tine opening of the pallet of FIG. **71**.

FIG. **75** is a perspective view of a brace according to a sixth embodiment.

FIG. **76** is an end view of the brace of FIG. **75**.

FIG. **77** is a top view of the brace of FIG. **75**.

FIG. **78** is a side view of the brace of FIG. **75**.

FIG. **79** shows the brace of FIG. **75** received in a non-corner, outer column of the pallet of FIG. **71**.

FIG. **80** is an enlarged view of the brace and pallet of FIG. **79**, partially broken away.

FIG. **81** shows the brace of FIG. **75** received in a tine opening of the pallet of FIG. **71**.

FIG. **82** is a section view of the brace and tine opening of FIG. **81**.

DETAILED DESCRIPTION

A pallet **10** according to a first embodiment is shown in FIG. **1**. The pallet includes a deck **12** having an upper surface for supporting goods thereon. The deck **12** is supported above a floor by a plurality of columns **14**, which optionally may be connected to one another by runners **16**. A peripheral lip **18** is formed at the periphery of the deck **12** and interrupted by the columns **14**. The pallet **10** is preferably injection molded of a suitable plastic, but it can be thermoformed or rotomolded.

A large central opening **20** is formed through a center portion of the deck **12** and passes entirely through the pallet **10**. The opening **20** is large, i.e. at least approximately one fifth (⅕) each of the width and length of the deck **12**. The opening **20** should be less than half each of the width and length of the deck **12**. More preferably the opening **20** should be approximately one quarter (¼) to approximately one third (⅓) each of the width and length of the deck **12**, and even more preferably approximately one quarter (¼) each of the width and length of the deck **12**. The opening **20** is approximately the same width as the non-corner outer columns **14** aligned therewith, as shown in FIG. **3**. In the example illustrated, the pallet **10** is approximately 48 inches by 48 inches and the opening **20** is approximately 12 inches by 12 inches. The opening does not have to be square, but could be elongated or rounded.

A peripheral wall **22** circumscribes the opening **20** to provide support to the center of the deck **12** as a central column. The peripheral wall **22** extends down to a plane containing the bottoms surfaces of the pallet **10** and transfers weight on the upper surface of the deck **12** to the floor.

FIG. **2** is a side view of the pallet **10**. FIG. **3** is a top view of the pallet **10**. FIG. **4** is a bottom view of the pallet **10**.

The central opening **20** in the deck **12** aids in unloading material from a box that sits on the pallet **10** without removing the box from the pallet **10**. The shape of the opening **20** can be any shape. The box can be accessed through the opening **20** from below when the pallet **10** is elevated. For example, an automation arm can engage the opening **20** to cut into the box. The box preferably contains items that are many times smaller than the opening, such as pellets, such as resin pellets. The items would fall out of the box and through the opening through the deck. The central opening **20** and the method for using the central opening **20** in a pallet **10** to access a box on the pallet can be used with any of the pallets described herein. It can also be used with other types, shapes and sizes of pallets, such as half pallets, nestable pallets, thermoformed pallets, etc.

FIG. **5** shows a pallet **110** according to a second embodiment. The pallet **110** is identical to the pallet **10** of FIG. **1** except as otherwise described or shown. The pallet **10** includes a deck **112** supported by columns **114**. A box **50**, such as a corrugated cardboard box **50**, is supported on deck **112** of the pallet **110**. The box **50** includes four sidewalls **52** and an upper wall **54**. Corner walls **56** connect the sidewalls **52** to one another and have corner flaps **58** extending horizontally outward from a lower edge thereof. A bottom wall (not visible) may seal the box **50** until it is opened (such as through the opening **120** through the pallet **110**). Corner caps **124** are snap fit onto the corner columns **114** of the pallet **110** on top of the corner flaps **58** of the box **50**. The corner caps **124** are fasteners that sandwich the corner flaps **58** to the corner columns **114** to secure the box **50** to the pallet **110**.

FIG. **6** shows the pallet **110** without the box **50**. As shown, the pallet **110** may include the large central opening **120** having the peripheral wall **122**, as previously described. FIG. **7** is a side view with one of the corner caps **124** exploded from the pallet **110**. FIG. **8** is an enlarged view of the corner column **114** and corner cap **124** of FIG. **7**. The corner caps **124** are molded of plastic separately from the pallet **110** and from one another. Each corner cap **124** includes an upper triangular wall **126** having side walls **128** extending downwardly therefrom. Snap tabs **130** extend downward from the upper wall **126** and are received into openings **132** in the corner columns **114**. In this manner, the corner caps **124** can snap fit onto the corner columns **114**. Other methods of removable securement could also be utilized.

FIG. **9** illustrates a pallet **210** according to a third embodiment. The pallet **210** is identical to the pallet **10** of FIG. **1** except as otherwise shown or described. The pallet **210** includes an upper deck **212** for supporting a box **50** thereon. Columns **214** support the deck **212** above the floor. In this embodiment, the corner columns **214** are truncated to provide a corner wall **226** parallel to the corner walls **56** of the box **50**. An opening **224** is formed in the corner wall **226** to receive the corner flap **58**. The corner flap **58** can be folded and tucked into the opening **224** of the corner wall **226** to retain the box **50** on the pallet **210**.

FIG. **10** is a side view of the pallet **210** and box **50** of FIG. **9**. The opening **222** through the pallet **210** is shown in broken lines, and again would be similar in size and location to those in FIGS. **1** and **6**. Items **68** inside the box are many times smaller than the opening **22**. In practice, such as if the

items **68** are resin pellets, they would be even smaller than shown in FIG. **10** (e.g. 2 to 5 mm).

An automated arm **150** holds a knife **152** (or other instrument capable of opening the bottom wall **51**) and may be used to open the bottom wall **51** of the box **50**. Optionally, a person holding a blade could cut the bottom wall **51** manually. When the bottom wall **51** of the box **50** is cut through the opening **222**, the items **68** can easily fall through the opening **222**. Alternatively, a wall or other seal, separate from the box can be placed across the opening **222** and subsequently removed or cut. This way the box **50** can be emptied before it is removed from the pallet **210**. Again, this method could be used for any of the pallets disclosed herein.

FIG. **11** is a corner view of the pallet **210** and box **50**, showing the flap **58** tucked into the opening **224** in the corner wall **226** of the column **214**.

FIG. **12** is a side view of the pallet **210** without the box **50**. FIG. **13** is a corner view of the pallet of FIG. **12**.

FIG. **14** is an enlarged section view through the corner column **214**. As shown in FIG. **14**, the opening **224** into the corner column **214** may include a plurality of barbs **228** extending toward one another, such that when the flap **58** is tucked into the opening **224** the barbs **228** secure the flap **58** within the opening **224** to the columns **214**.

FIG. **15** shows a pallet **310** according to a fourth embodiment. The pallet **310** is identical to the pallet **10** of FIG. **1** except as otherwise shown or described. The pallet **310** includes an upper deck **312** supported above the floor by columns **314**. In this embodiment, retainers **324** are hingably connected to each of the corner columns **314**, such as by a living hinge. The retainers **324** fold back onto the corner column **314** and snap fit to the corner column **314** over the corner flap **58** of the box **50**, thereby securing the box **50** to the pallet **310**.

FIG. **16** shows the retainers **324** pivoted outward in the unsecured position.

FIG. **17** is an enlarged view of one corner column **314** of the pallet **310**. As shown, each of the retainers **324** is formed integrally with the corner column **314** and includes a protrusion **325**. As shown in FIG. **18**, the columns **314** include corresponding apertures **326**, into which the protrusions **325** can be snap fit. In use, the protrusions **325** may puncture the flaps **58** and then snap fit into the apertures **326**. Alternatively, the protrusions **325** may be received through preformed holes through the corner flaps **58**. Alternatively, the protrusions **325** can snap fit into the apertures **326** immediately adjacent the flaps **58** with the retainers **324** protruding over the corner flaps **58**, to retain the flaps **58** to the corner columns **314**.

FIG. **19** shows an alternate pallet **310***a* having alternate retainers **324***a* with alternate protrusions **325***a*. The protrusions **325***a* are configured in a different physical shape, but can be snap fit into apertures **326***a* (FIG. **20**).

FIG. **21** shows a system including a plurality of pallets **410** and a brace **80** positioned between the plurality of loaded pallets **410**. As shown in FIG. **22**, the brace **80** is secured to a central outer column **414** of an upper pallet **410**. The brace extends upward adjacent the box **50** on the pallet **410** and the brace **80** extends downward adjacent the box **50** below the pallet **410** supported on the lower pallet **410**. The central outer columns **414** of the pallets **410** include an opening **424** to which the braces **80** can be secured.

FIG. **23** shows one embodiment of the brace **80**. The brace **80** includes an elongated body portion **82** and a retainer portion **84** protruding generally transversely away from a mid-portion of the body portion **82**. In FIG. **23**, the retainer portion **84** extends upward relative to the body portion **82** ("upward" defined only with reference to FIG. **23**). The body portion **82** includes outer walls **86** connected by perpendicular ribs **88**. The retainer portion **84** includes an outer wall **90** connected to the body portion **82** by a plurality of ribs **92** or walls. The retainer portion **84** is flexible or resiliently deformable. The outermost ribs **92** include a plurality of barbs **94**, which may be angled downward toward the body portion **82**.

FIG. **24** is side view of the brace **80**. As can be seen in FIG. **24**, the brace **80** includes a longitudinal mid-wall **89** extending from one outer wall **86** to the other and between the ribs **88**. The mid-wall **89** is perpendicular to the outer walls **86** and to the ribs **88** and is positioned approximately halfway between opposite edges of the outer walls **86**. The mid-wall **89** also extends into the retainer portion **84** between the ribs **92**. FIG. **25** is a top view of the brace **80**.

FIG. **26** shows a plurality of pallets **410** loaded with goods **70**. Three braces **80** are secured to the upper pallet **410**. The retainer portion **84** (not visible) of the center brace **80** is secured to an opening in the center outer column **414**. The retainer portions **84** of the outer braces **80** are secured in the fork tine openings of the upper pallet **410**. All three retainer portion **84** are pressed into their respective openings, somewhat deforming the retainer portions **84**, which together with the barbs **94** retains the braces **80** in this position. Additionally, the adjacent goods **70** loaded on the adjacent lower pallet **410** also keep the braces **80** in place, which in turn assists in keeping the goods **70** in place on that pallet **410**. In other words, although the braces **80** would not assist much in keeping the goods **70** on the pallet **410** by themselves, they can provide substantial support to the goods **70** on the pallet **410** once another loaded pallet **410** abuts the braces **80**.

As shown in FIG. **27**, depending upon the arrangement of the goods **70** on the pallet **410** only two braces **80** may be needed on a particular side of the pallet **410**. In FIG. **27**, the upper pallet **410** is rotated 180 degrees compared to the upper pallet **410** in FIG. **26**.

FIG. **28** shows the pallet **410** with a box **50** loaded thereon. The peripheral lip **418** helps secure the box **50** on the pallet **410**. The opening **424** is provided in the central outer columns **414** for receiving the retaining portion **84** of the braces **80** (FIG. **23**). FIG. **29** is a top view of the pallet **410** and box **50**.

FIG. **30** is a perspective view of the pallet **410**. As shown, the pallet **410** may also include the central opening **420** circumscribed by the peripheral wall **422**, as described above with respect to the earlier embodiments. FIG. **31** is a side view of the pallet **410**.

As shown in FIG. **32**, a plurality of the braces **80**, when not in use, can be stacked as shown. By alternating the orientation of the braces **80** in each subsequent row, the retaining portions **84** aligned in the lower row can fit between perpendicular braces **80** in the upper row. In this manner, these braces **80** can be shipped and stored efficiently.

FIG. **33** shows a brace **180** according to a second embodiment, which could be used identically to the brace **80** of the previous embodiment (e.g. as shown in FIGS. **21**, **22**, **26**, and **27**). The brace **180** includes an elongated body portion **182** and an offset retaining portion **184**. The retaining portion **184** is offset off the longitudinal axis of the body portion **182** and may be offset from the longitudinal center of the body portion **182** as well (i.e. toward one longitudinal end). A recess **185** may be formed through the upper wall

186 of the body portion 182 adjacent the retaining portion 184. The body portion 182 includes perpendicular ribs 188 between the walls 186.

FIG. 34 is a top view of the brace 180. FIG. 35 is a side view of the brace 180. As can be seen in FIG. 35, the brace 180 includes a longitudinal mid-wall 189 extending from one outer wall 186 to the other and between the ribs 188. The mid-wall 189 is perpendicular to the outer walls 186 and to the ribs 188 and is positioned approximately halfway between opposite edges of the outer walls 186. The mid-wall 189 also extends into the retainer portion 184.

As shown in FIG. 36, by flipping subjacent braces 180, the retaining portions 184 of one brace 180 can be received partially in the recess 185 of the adjacent brace 180. This provides efficient storage and shipping of the braces 180 when not in use.

FIG. 37 shows a brace 280 according to a third embodiment, which could be used identically to the previous embodiments (e.g. as shown in FIGS. 21, 22, 26, and 27). The brace 280 includes an elongated body portion 282 having opposed elongated walls 286 connected by ribs 288. A retaining portion 284 comprises an inverted U-shaped wall adjacent a recess 285 formed through the wall 286 of the body portion 282. FIG. 38 is a top view of the brace 280. FIG. 39 is a side view of the brace 280. As can be seen in FIG. 39, the brace 280 includes a longitudinal mid-wall 289 extending from one outer wall 286 to the other and between the ribs 288. The mid-wall 289 is perpendicular to the outer walls 286 and to the ribs 288 and is positioned approximately halfway between opposite edges of the outer walls 286. The mid-wall 289 also extends into the retainer portion 284.

Referring to FIG. 40, by flipping an upper brace 280, adjacent braces 280 have their retaining portions 284 received in the recesses 285 of the other, thereby providing a very efficient and compact storage.

FIG. 41 shows a brace 380 according to a fourth embodiment, which could be used identically to the previous embodiments (e.g. as shown in FIGS. 21, 22, 26, and 27). The brace 380 includes an elongated body portion 382 and a two-part retaining portion 384. The elongated body portion 382 includes spaced apart walls 386 connected by ribs 388. The retaining portions 384 are connected to the upper wall 386 of the body portion 382 adjacent recess 385 by hinges 390. In FIG. 41, one of the retaining portions 384 is shown in the deployed position, while the other retaining portion 384 is shown being pivoted into the retracted position in its respective recess 385. FIG. 42 is a top view of the brace 380 of FIG. 41.

FIG. 43 is a side view of the brace 380 of FIG. 41, again with one of the retaining portions in the deployed position and the other retaining portion 384 being pivoted toward the retracted position. As can be seen in FIG. 43, the brace 380 includes a longitudinal mid-wall 389 extending from one outer wall 386 to the other and between the ribs 388. The mid-wall 389 is perpendicular to the outer walls 386 and to the ribs 388 and is positioned approximately halfway between opposite edges of the outer walls 386. The mid-wall 389 also extends into the retainer portions 384.

FIG. 44 shows a plurality of the braces 380 with all of their retaining portions 384 pivoted into their respective recesses 385 about their hinges 390 to provide a very compact and efficient storage configuration.

FIG. 45 shows a brace 480 according to a fifth embodiment in which the body portion 482 and retaining portion 484 are initially formed as separate pieces. The brace 480 could be used identically to the previous embodiments (e.g. as shown in FIGS. 21, 22, 26, and 27). The retaining portion 484 is partially received in a recess 485 formed in a body portion 482 and snap fit therein.

FIG. 46 is a side view of the brace 480. As can be seen in FIG. 46, the brace 480 includes a longitudinal mid-wall 489 extending from one outer wall 486 to the other and between the ribs 488. The mid-wall 489 is perpendicular to the outer walls 486 and to the ribs 488 and is positioned approximately halfway between opposite edges of the outer walls 486. The retainer portion 284 does not include the mid-wall 489.

FIG. 47 is a top view of the brace 480. FIG. 48 is an exploded view of the brace 480. As shown, the retaining portion 484 includes a plurality of snap tabs 490 configured to snap fit into openings 494 in the recess 485.

A pallet 510 according to a sixth embodiment is shown in FIG. 49. The pallet 510 includes a deck 512 having an upper surface for supporting goods thereon. The deck 512 is supported above a floor by a plurality of columns 514, which optionally may be connected to one another by runners 516. Peripheral lips 518 are formed at the periphery of the deck 512 and interrupted by the columns 514.

A large central opening 520 is formed through a center portion of the deck 512 and passes entirely through the pallet 510. The opening 520 is large, i.e. at least approximately one fifth (⅕) each of the width and length of the deck 512. The opening 520 should be less than half each of the width and length of the deck 512. More preferably the opening 520 should be approximately one quarter (¼) to approximately one third (⅓) each of the width and length of the deck 512, and even more preferably approximately one quarter (¼) each of the width and length of the deck 512. The opening 520 is approximately the same width as the non-corner outer columns 514 aligned therewith, as shown in FIG. 51. In the example illustrated, the pallet 510 is approximately 48 inches by 48 inches and the opening 520 is approximately 12 inches by 12 inches. The opening does not have to be square, but could be elongated or rounded.

A peripheral wall 522 circumscribes the opening 520 to provide support to the center of the pallet 510 as a central column. The corner columns 514 each include an aperture 534 formed through the center of a concave upper surface 536. The concave upper surface 536 may be conical, as shown, or other self-centering shape.

FIG. 50 is a side view of the pallet 510. FIG. 51 is a top view of the pallet 510. FIG. 52 is a bottom view of the pallet 510.

The central opening 520 in the pallet deck 512 aids in unloading material from a box that sits on the pallet 510 without removing the box from the pallet 510. The shape of the opening 520 can be any shape. The box can be accessed through the opening 520 from below when the pallet 510 is elevated. For example, an automation arm can engage the opening 520 to cut into the box, as described above. The central opening 520 and the method for using the central opening 520 in a pallet deck 512 to access a box on the pallet 510 can be used with any of the pallets described herein. It can also be used with other types, shapes and sizes of pallets, such as half pallets, nestable pallets, thermoformed pallets, etc.

FIG. 53 shows the pallet 510 with the box 50, such as a corrugated cardboard box 50, supported on deck 512 of the pallet 510. The box 50 includes four sidewalls 52 and an upper wall 54. A bottom wall (not visible) may seal the box 50 until it is opened (such as through the opening 520—all as described above). Corner walls 56 connect the sidewalls 52 to one another and have corner flaps 58 extending

horizontally outward from a lower edge thereof. The corner flaps **58** are subsequently secured to the deck **512** of the pallet **510**, as will be explained below.

FIG. **54** is an enlarged view of one corner of the pallet **510**. Again, the corner columns **514** each include the aperture **534** formed through the center of the concave upper surface **536**, which is recessed relative to the support surface of the deck **512**. The concave upper surface **536** may be conical, as shown, or other self-centering shape providing surfaces that slope toward the aperture **534**.

FIG. **55** shows one possible fastener **524** positioned above the aperture **534** in the corner of the pallet **510** over one of the corner columns **514**.

FIG. **56** shows multiple views of the fastener **524** in detail. The fastener **524** includes a stem **538**, which in this example is generally cylindrical and having a lower head **540** and an upper head **542**. The upper head **542** is spaced above the lower head **540** to leave room for a pry tool, to remove the fastener **524**. In this example, the heads **540**, **542** are both annular, circumscribing the stem **538**, but other shapes would be possible. At the lower end of the stem **538** is a tapered portion **544**, which may comprise intersecting tapered ribs as shown, and which terminates in a relatively sharp point. Between the lower head **540** and the tapered portion **544** are a plurality of annular ribs **546** that can flex during insertion but are rigid enough to retain the fastener **524** in the aperture **534**. The annular ribs **546** may each include a gap, as shown.

Referring to FIG. **57**, in use, each fastener **524** is punched through one of the corner flaps **58** of the box **50** and snap fit into one of the apertures in the corners of the pallet **510**. The fastener **524** secures the corner flap **58** to the corner column **514** to secure the box **50** to the pallet **510**. The tapered portion **544** facilitates the fastener **524** punching through the corner flap **58** and together with the concave surface **536**, facilitates the fastener **524** aligning with the aperture **536**. The tapered portion **544** and at least one of the ribs **546** are inserted through the aperture **536** and the fastener **524** is retained in place by the rib **546**.

FIG. **58** shows a bottom view of the deck **512** of FIG. **57**, with lower portions of the pallet **510** removed for illustration. As shown, the tapered portion **544** and some of the ribs **546** protrude downward past the concave surface **536** through the aperture **534**. The ribs **546** retain the fastener **524** and retain the box **50** to the deck **512**.

FIG. **59** shows multiple views of an alternative fastener **550**. The fastener **550** includes a head **552** having a perpendicular handle **554** extending upward therefrom and a stem **556** extending downward therefrom. Tapered gussets **558** reinforce the connection between the head **552** and the stem **556**. A pair of flexible arms **562** extend upward and outward from a relatively sharp tapered portion **560** and terminate in a shoulder **584**.

FIG. **60** shows the fastener **550** being inserted into an alternate deck **512***a*. The tapered portion **544** of the fastener **550** is punched through the corner flap (not shown) of the box **50** and into the aperture **534***a*. The aperture **534***a* of the deck **512***a* includes opposed portions of increased diameter **535***a*. As the arms **562** pass through the aperture **534***a* of the concave portion **536***a*, the arms **562** are flexed inward toward one another by the concave wall **536***a*. Once the arms **562** extend fully past the concave wall **536***a*, the arms **562** return to their normal undeflected position, with the edges of the concave wall **536***a* received in the shoulders **584** of the arms **562**. This secures the fasteners **550** in the apertures **534***a* and secures the box **50** to the deck **512***a*.

If one wants to remove the fasteners **550**, one can rotate the fastener **550** using the handle **554** (FIG. **59**) to the position shown in FIG. **61**. By aligning the arms **562** with the portions of increased diameter **535***a* of the aperture **534***a*, the fastener **550** can be removed from the deck **512***a*.

FIG. **62** shows an alternative fastener **570**. The fastener **570** includes a head **572** having a perpendicular handle **574** extending upward therefrom and a stem **576** extending downward therefrom. Tapered gussets **578** reinforce the connection between the head **572** and the stem **576**. A pair of rigid arms **582** contiguous with the stem **576** extend upward from a relatively sharp tapered portion **580** and terminate in a shoulder **584** that is defined by an undercut in each arm **582**. In this embodiment, the stem **576** and the arms **582** are coplanar.

FIG. **63** shows the fastener **570** inserted into an alternate deck **512***b*. The fastener **570** is punched through the corner flap (not shown) of the box **50** and into the aperture **534***b*. The aperture **534***b* of the deck **512***a* includes opposed portions of increased diameter **585***b*. The arms **582** are aligned with the portions of increased diameter **585***b* during insertion. Once the arms **582** extend fully through the aperture **534***b*, the fastener **570** is rotated about 350 degrees until the arms **582** contact stops **587***b* adjacent the portions of increased diameter **585***b*, with the edges of the wall adjacent the aperture **534***b* received in the shoulders **584** of the arms **582**. This secures the fasteners **570** in the apertures **534***b* and secures the box **50** to the deck **512***b*.

If one wants to remove the fasteners **570**, one can rotate the fastener **570** using the handle **574** (FIG. **62**) to re-align the arms **582** with the portions of increased diameter **535***a* of the aperture **534***a*.

FIG. **64** shows another alternative fastener **588** having a stem **596**. A lower head **592** is spaced below an upper head **593** at an upper end of the stem **596**. The stem **596** includes a portion of increased diameter **602** and a tapered shoulder **604** at the upper end of the portion of increased diameter **602**. The stem **596** may also include a large opening **606** therethrough, extending in a direction perpendicular to the longest axis of the stem **596**.

FIG. **65** shows the fastener **588** inserted into an alternate deck **512***c*. The fastener **588** is punched through the corner flap (not shown) of the box **50** and into the aperture **534***c* formed in a concave wall **536***c*. The portion of increased diameter **602** flexes inward as it is inserted through the aperture **534***c* and then expands again, such that the shoulder **604** retains the fasteners **588** in the aperture **534***c* and secures the box **50** to the deck **512***c*. Similar fasteners **588** would be used in the other three corner flaps.

FIGS. **66-69** show an alternate corner cap **620**. The corner cap **620** is molded as a single piece of plastic. The corner cap **620** includes a trapezoidal upper wall **622** and a pair of snap-fit connectors **624** adjacent opposite side edges. A plurality of small teeth **626** project downward from the upper wall **622**.

FIG. **70** shows the corner cap **620** secured to a corner of a deck **512***d* on top of one of the corner flaps **58** of the box **50**. The snap-fit connectors **624** are snap-fit into apertures **632** in the deck **512***d*. The corner cap **620** sandwiches the corner flaps **58** to the corner column of the deck **512***d* to secure the box **50** to the pallet (not shown). Similar corner caps **620** are used to secure the other corner flaps **58** to the pallet deck **512***d*.

A pallet **710** according to a seventh embodiment is shown in FIG. **71**. The pallet **710** includes a deck **712** having an upper surface for supporting goods thereon. The deck **712** is supported above a floor by a plurality of columns **714**, which

optionally may be connected to one another by runners **716**. A peripheral lip **718** is formed at the periphery of the deck **712** and interrupted by the columns **714**. The pallet **710** is preferably injection molded of a suitable plastic, but it can be thermoformed or rotomolded.

A large central opening **720** is formed through a center portion of the deck **712** and passes entirely through the pallet **710**. The opening **720** is large, i.e. at least approximately one fifth (⅕) each of the width and length of the deck **712**. The opening **720** should be less than half each of the width and length of the deck **712**. More preferably the opening **720** should be approximately one quarter (¼) to approximately one third (⅓) each of the width and length of the deck **712**, and even more preferably approximately one quarter (¼) each of the width and length of the deck **712**. The opening **720** is approximately the same width as the non-corner outer columns **714** aligned therewith. In the example illustrated, the pallet **710** is approximately 48 inches by 48 inches and the opening **720** is approximately 12 inches by 12 inches. The opening does not have to be square, but could be elongated or rounded.

A peripheral wall **722** circumscribes the opening **720** to provide support to the center of the deck **712** as a central column. The peripheral wall **722** extends down to a plane containing the bottoms surfaces of the pallet **710** and transfers weight on the upper surface of the deck **712** to the floor.

The corners of the deck **712** each include connectors for securing the flaps of a box, such as apertures **734** with concave upper surfaces **736**, which are identical to the apertures **534** and concave upper surfaces **536** of FIG. **49**. However any of the previously described methods for securing the box could be used.

In this embodiment, teeth **726** are added to the tine openings between the columns **714**, such as on the upper surfaces of the runners **716**. Further, recesses **728** are formed through the outer walls of the non-corner outer columns **714**. The recesses **728** are sized to receive a brace, as will be explained below. Ribs **730** protrude into the recesses **728**. The ribs **730** extend in a direction extending from one adjacent column **714** to the other. The ribs **730** are preferably positioned proximate an outer edge of the runner **716**.

FIG. **72** is a side view of the pallet **710**. The recess **728** in the column **714** does not need to extend all the way through the column, but only needs to be deep enough to receive the brace. In FIG. **72**, vertical ribs **732** of the column **714** are visible beyond the recess **728**.

FIG. **73** is an enlarged perspective view of the recess **728** in the column **714**. As shown, the rib **730** may extend along the outermost edge of the recess **728**.

FIG. **74** is an enlarged perspective view of one of the tine openings. The teeth **726** protrude upward from the runner **716**. The teeth **716** are elongated in a direction parallel to the runner **716**.

FIG. **75** is a perspective view of a brace **780** according to a sixth embodiment. The brace **780** includes an elongated body portion **782** and a retainer portion **784** protruding generally transversely away from a mid-portion of the body portion **782**. The retainer portion **784** extends transversely from the body portion **782**. The body portion **782** includes outer walls **786** connected by a longitudinal mid-wall **789** and perpendicular ribs **788** that are perpendicular to the outer walls **786** and the mid-wall **789**. The mid-wall **789** is approximately half-way between the front and rear edges of the outer walls **786**.

The retainer portion **784** includes an outer wall **790** connected to the body portion **782** by a plurality of ribs **792** or walls. The retainer portion **784** is flexible or resiliently deformable. The outermost ribs **792** include a plurality of barbs **794**, which may be angled downward toward the body portion **782**.

FIG. **76** is an end view of the brace **780**. FIG. **77** is a top view of the brace **780**. FIG. **78** is a side view of the brace **780**, showing a circular opening **793** through the mid-wall **789**. The opening **793** aids in injection-molding the brace **780**.

FIG. **79** shows the brace **780** of FIG. **75** received in the recess **728** in one of the non-corner, outer columns **714** of the pallet **710** of FIG. **71**. In this embodiment, all of the non-corner, outer columns **714** have identical recesses **728** and could receive a brace **780**. Again, the brace **780** extends generally perpendicularly to the plane of the upper surface of the deck **712**.

FIG. **80** is an enlarged view of the brace **780** and pallet **710** of FIG. **79**, partially broken away. The barbs **794** of the retainer portion **784** engage the rib **730** in the recess **728** of the column **714** to help retain the retainer portion **784**. The ribs **794** on both sides of the retainer portion **784** are resiliently deformed when the retainer portion **784** is pressed into the recess **728** to further retainer the brace **780** in position.

FIG. **81** shows the brace **780** received in a tine opening of the pallet **710** of FIG. **71**. Again, the brace **780** extends generally perpendicularly to the plane of the upper surface of the deck **712**.

FIG. **82** is a section view of the brace **780** and tine opening of FIG. **81**. The ribs **794** on both sides of the retainer portion **784** are resiliently deformed when the retainer portion **784** is pressed into the tine opening to retainer the brace **780** in position. The barbs **794** engage the teeth **726** on the runner **716** to further retain the brace **780** in position.

With one or more braces **780** in any of the tine openings or recesses **728** in the center, outer columns **714**, the braces **780** are used with the pallet **710** as shown in the previous embodiments to help retain the goods in place on the pallet **710**.

In accordance with the provisions of the patent statutes and jurisprudence, exemplary configurations described above are considered to represent a preferred embodiment of the invention. However, it should be noted that the invention can be practiced otherwise than as specifically illustrated and described without departing from its spirit or scope.

What is claimed is:

1. A pallet comprising:

a deck having an upper surface for supporting goods thereon, wherein the upper surface is formed by a plurality of intersecting plastic ribs, the deck having an opening therethrough, wherein the opening is at least approximately 1/5 a width and at least approximately 1/5 a length of the deck;

a peripheral wall extending downward from the upper surface and a periphery of the opening; and

a plurality of columns supporting the deck, wherein the plurality of columns includes corner columns and non-corner outer columns, the plurality of columns defining fork tine openings on four sides of the pallet.

2. The pallet of claim **1** wherein the opening is approximately one fifth to approximately one half each of the width and length of the deck.

3. The pallet of claim **2** wherein the opening is approximately one quarter to approximately one third each of the width and length of the deck.

4. A pallet comprising:
a deck, the deck having an opening therethrough, wherein the opening is at least approximately 1/5 a width and at least approximately 1/5 a length of the deck;
fasteners removably securable to corners of the deck and each configured to secure a flap of a box to the deck; and
a plurality of columns supporting the deck.

5. The pallet of claim 4 wherein the fasteners include corner caps configured to snap-fit to the deck and to sandwich flaps of the box to the deck.

6. The pallet of claim 5 wherein the corner caps include tabs configured to be connected to the columns.

7. The pallet of claim 5 wherein the fasteners include an upper wall and side extending downward from the upper wall, wherein the side walls are configured to connect to the deck of the pallet.

8. The pallet of claim 1 wherein the deck includes a peripheral lip at the periphery of the deck.

9. The pallet of claim 1 wherein the opening through the deck is approximately the same width as non-corner outer columns aligned therewith.

10. A pallet and box comprising:
a pallet having a deck, the deck having an opening therethrough, wherein the opening is at least approximately 1/5 a width and at least approximately 1/5 a length of the deck, the pallet further including a plurality of columns supporting the deck; and
a box supported on the deck over the opening, wherein the box contains items that are smaller than the opening.

11. The pallet and box of claim 10 wherein portions of the box are secured to the deck of the pallet.

12. The pallet and box of claim 11 further including fasteners securing the portions of the box to the deck of the pallet.

13. The pallet and box of claim 12 wherein the portions of the box are flaps extending outward from the box on the deck.

14. The pallet and box of claim 13 wherein the fasteners include an upper wall and side extending downward from the upper wall, wherein the side walls are configured to connect to the deck of the pallet, and wherein the fasteners sandwich the flaps between the upper walls of the fasteners and the deck of the pallet.

15. A method for emptying items from a pallet including the steps of:
a) providing a box of items on a pallet, the pallet having a deck supported by columns and an opening through the deck; and
b) cutting a wall extending across the opening through the deck and permitting the items in the box to fall through the opening through the deck.

16. The method of claim 15 wherein the wall is a bottom wall of the box.

17. A pallet system comprising:
a pallet including a deck supported by a plurality of columns; and
at least one brace having an elongated body portion selectively secured to the pallet, such that the elongated body portion of the at least one brace is generally perpendicular to a plane of a support surface of the deck of the pallet and such that the elongated body portion of the at least one brace extends upward above the plane of a support surface of the deck of the pallet to a self-supporting upper free end of the elongated body portion the at least one brace further including a retainer portion projecting transversely from a point on the elongated body portion away from the upper free end to a retainer free end, wherein the retainer is configured to be retained in an opening formed in the pallet below the deck—has been inserted after "portion".

18. The pallet system of claim 17 wherein the elongated body portion extends downward below a plane containing lowermost surfaces of the deck to a lower free end of the elongated body portion.

19. A pallet system comprising:
a first pallet including a deck supported by a plurality of columns;
a second pallet loaded with goods, wherein the first pallet is stacked on the goods on the second pallet; and
at least one brace having an elongated body portion selectively secured to the first pallet, such that the elongated body portion of the at least one brace is generally perpendicular to a plane of a support surface of the deck of the first pallet and such that the elongated body portion of the at least one brace extends upward above the plane of a support surface of the deck of the first pallet, the elongated body portion of the at least one brace abutting the goods on the second pallet.

20. The pallet system of claim 19 further including a third pallet loaded with goods adjacent the second pallet, wherein the goods on the third pallet abut the elongated body portion of the at least one brace.

21. The pallet system of claim 19 further including goods on the first pallet, wherein the elongated body portion abuts the good on the first pallet.

22. A pallet comprising:
a deck; and
a plurality of columns supporting the deck, the plurality of columns including corner columns and non-corner outer columns, wherein tine openings are defined between each corner column and an adjacent non-corner outer column, at least one opening in at least one of the non-corner columns below the deck, each of the at least one openings configured to receive a retainer portion of a brace.

23. The pallet of claim 22 wherein the opening includes at least one rib or barb for retaining the retainer portion of the brace.

24. A brace for use with a pallet, the brace comprising:
an elongated body portion including outer walls connected to one another by ribs; and
a retainer portion protruding generally transversely from the body portion, the retainer portion including barbs configured to secure the retainer portion in an opening.

25. The pallet of claim 4 wherein the fasteners include corner caps configured to snap-fit to the deck or a plurality of tapered stems each extending downward from an enlarged head to a relatively sharp end or retainers hingeably connected to the deck and including protrusion configured to snap-fit to the deck.

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