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(54) **MOLDED PLASTIC STACKABLE SHIPPING STRUCTURE FOR EV BATTERY PACKS**

(57) A molded plastic shipping structure which can be used for EV battery packs wherein the structure is provided with corner posts that allow for stacking loaded structures in aligned configurations and unloaded/empty structures to be stacked in a staggered, lower volume configuration.

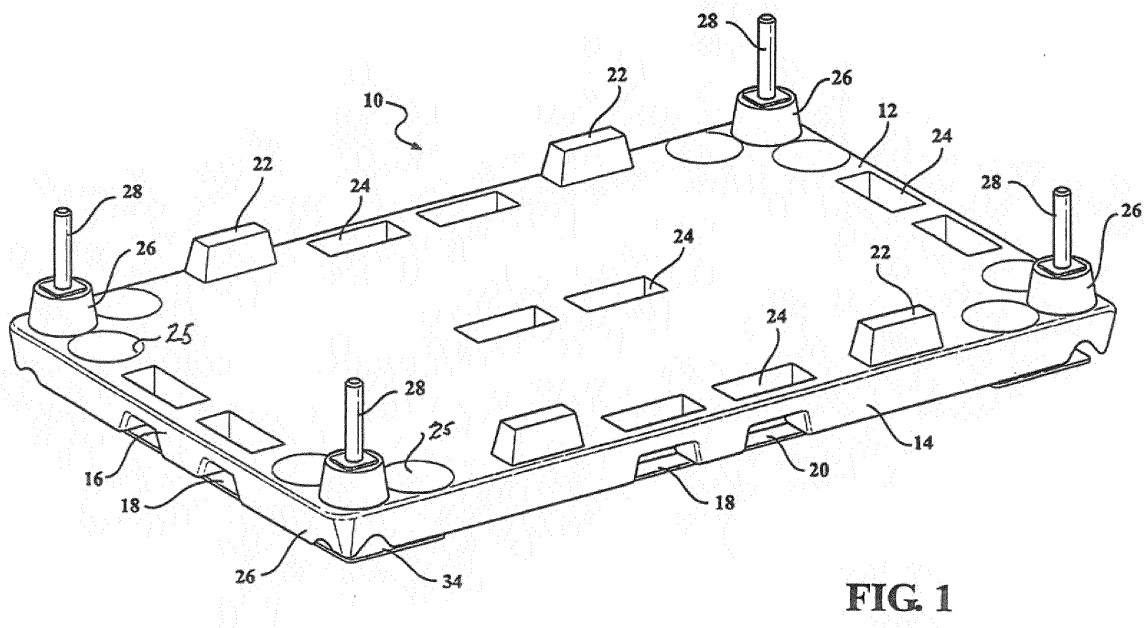

FIG. 1

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Description

CROSS-REFERENCE TO RELATED APPLICATION

[0001] This application claims priority to Provisional Application Serial No. 63/530,604 filed August 3, 2023, the entire content of which is incorporated herein by reference.

TECHNICAL FIELD

[0002] This document describes a stackable molded plastic shipping structure particularly useful for the shipment of EV battery packs and similarly configured loads.

BACKGROUND

[0003] Shipping structures such as pallets are commonly made of durable plastic so that they can be reused for multiple transits between a loading point and a use destination and back again. The structures may be loaded with goods to be shipped and sent by truck or rail to a use destination. Thereafter the structures are sent back empty to the loading point.

SUMMARY OF THE INNOVATION

[0004] The structure here described includes a pallet like body made in part of a durable plastic and structured for repeated use. In the example herein described the body is intended for EV battery packs but the innovative principles described herein can be used for many other types of goods. The bodies are molded in such a way as to provide a cargo bed that may be of rectangular configuration. The bodies are provided with upwardly-extending spacer posts, typically made of steel, that fit into overlying bodies in two different ways The specific stacking feature here disclosed allows the loaded bodies to be stacked in aligned and vertically spaced apart configuration for loaded transit to a use destination after which the empty bodies can be stacked in a staggered and lowered height configuration thereby reducing the overall volume of the stacked arrangement for return shipment and/or storage.

[0005] In general, the bodies use peripherally located raised corner structures that receive vertically extending posts that allow for stacking the bodies both in aligned and staggered orientations without need for removing the posts and packaging them separately for handling and transit. In a specific example hereinafter described, the pallet bodies are rectangular and posts are provided with flanges, one of which is located at the bottom of a post and another located substantially midway between the top and bottom. The bottom flanges are preferably attached with backing plates and screws to bottom surfaces of the molded shipping structures and the midway flanges are attached, again with backing plates and screws, to the interior surfaces of the raised plastic corner structures so that the posts extend upwardly through the tops of the raised corners structures by a distance that provides the desired stacking height of the bodies in the aligned configuration. The bottom flanges are provided with socket like features that receive the top ends of posts in structures below in the aligned arrangement.

[0006] The molded plastic structures are also provided with holes that are offset from the corner structures so that two or more structures can be stacked in mutually contacting and non-aligned configuration thereby reducing the height and volume of the stacked bodies for return/empty transit or storage.

BRIEF DESCRIPTION OF THE DRAWINGS

[0007] The following figures illustrate an embodiment of the invention intended for use in transporting EV battery packs:

FIG. 1 is a perspective side view of a plastic molding with steel corner posts for stacking;
FIG. 2 is a perspective view of a steel corner post with top and bottom mounting flanges;
FIG. 3 is a perspective view of the FIG 1 embodiment loaded with battery packs;
FIG. 4 is perspective view of two battery carriers stacked together in aligned condition with only the lower carrier loaded;
FIG. 5 is a perspective end view of several empty carriers stacked in staggered condition for return shipment;
FIG. 6 is a sectional view of a stacking post in the installed condition; and
FIG. 7 is a partial side view showing how carriers are stacked in aligned condition.

DETAILED DESCRIPTION OF THE ILLUSTRATIVE EMBODIMENT

[0008] FIG. 1 shows a representative structure to comprise a three dimensional generally rectangular pallet type body 10 molded of high-density polyethylene (HDPE) having a generally flat top cargo bed surface 12 bounded by shallow side rails 14 and end rails 16, all of which have forklift openings 18 with integral bottom straps 20. Dimensions for a representative embodiment are about 125 by 80 by 6 inches but can vary with the application and desired load.

[0009] In this document the bodies 10 are also referred to as "pallets".

[0010] Hollow cargo locator/retainer bosses 22 are molded into the top surface 12 adjacent the side edges. Walled recesses 24 and 25 with floors are formed into the top surface 12 at strategic locations to provide rigidity. Recesses 25 are cup shaped. Adjacent the recesses on a short are holes 41 to allow a post 28 from a lower pallet to extend through when the pallets are stacked in a staggered, non-aligned condition. Integral raised corner

structures 26 are molded into body at each of the four corners and rise above the surface 12 from about 8 inches to provide peripheral mounting locations for steel stacking posts 28 shown in detail in FIGS. 2, 6 and 7. The posts 28 provide the stacking features shown in FIGS. 4 and 5 as described below.

[0011] Each post 28 includes a solid cylindrical steel pin 30 with an integral flange 32 midway along the length of the post pin so as to underlie the inner top surface of a corner structure 26 when the post is fully installed in a hole in structure 26. As shown in FIG. 6 a steel backing plate 35 is placed against the top surface of each structure 26 with screw holes in alignment with screw holes in the flanges 32 to accept screw fasteners that securely join the sandwiched structures together. An integral L-shaped bottom flange 34 on each pin 28 has wing portions that extend out at 90 degrees from one another so as to underly the floors of cylindrical recesses 25 in the molded pallet structure located adjacent each side of each corner structure 26 of the rectangular structure. Metal plates 40 are placed on the upper inside surfaces of the depressions with screw holes aligned with screw holes in the flanges 34 to create a sandwich structure that secures the flanges 34 of the posts 28 to the molded pallet structure. The posts 28 can be of any length need to achieve the stacking height desired; examples are from 6 to 16 inches in overall length.

[0012] FIG. 3 shows an EV battery pack assembly 36 resting on the top surface of structure 10. While this description and the currently intended use is for EV battery structures, it is to be understood that the inventions may be used to carry and ship any suitably shaped product or assembly of products that generally conform to the illustration of FIG. 2.

[0013] FIG. 4 shows two structures, 10A and 10B stacked in an "aligned" configuration by means of the corner posts 28. By "aligned" we mean that the structure 10 B is directly over the structure 10 A so that the stacked structures have a common footprint and the top ends of the posts on the lower structure fit into the sockets 37 in the flanges 34 on the bottoms of the posts 26 in the uppermost structure 10 in the stack. The term "staggered" means that the stacked structures are not vertically aligned but are offset sideways from one another as shown in FIG. 5. As shown in this Figure, the pallets 10 are offset along the direction of the shorter sides of the pallets and every other pallet is offset in a direction opposite to the offset of the pallets immediately above and below it. And there are only two posts extending up from an underlying pallet that go through the holes 41 in the pallet above. In this fashion the stagger is not cumulative.

[0014] FIG 7 shows the pallets stacked in the aligned configuration wherein the tops of the posts 28 in the lowermost pallet fit into the sockets 37 in the base flanges 34 of the posts 28 in the uppermost pallet structure 10.

[0015] As shown in FIGS 5 and 7, holes 41 formed in a side surface of the cup-shaped recesses 25 on a short side of a pallet 10 allow two or more pallets to be stacked in top-to-bottom contacting and offset or "staggered" condition when empty. In this condition the tops of the corner structures 26 of the lower pallet 10 are contacted by the bottoms of the uppermost pallet 10. While the stagger is shown only along the short sides of the pallets, the holes may be relocated along the longer sides to achieve a stagger along the long sides if desired.

[0016] By way of review, the durability of the HDPE structures is such that they are "recycled"; i.e., sent back empty from a battery unloading and/or installation location (for example) to the battery loading/shipping point where the battery packs are placed on the pallets and the pallets are stacked. To reduce the height and volume taken up by empty structures, they are assembled together in offset and "staggered" relationship such that the tops of the posts 28 in a lower structure do not line up with or go through the holes or sockets 37 in the post structures immediately above. Instead, two of the lower post pins extend through offset holes 41 in the plastic bodies in the cylindrical recesses 25 thereby allowing the bottom of each upper structure to come to rest directly on the top of the corner structure 26 of the body 10 immediately below. This arrangement prevents the empty pallets from sliding sideways relative to one another and generally holds them together. The offsets are preferably staggered alternately as shown in FIG. 5 so that the offsets are not cumulative, but, rather, alternating as between each set of two stacked bodies.

[0017] The pallet body 10 can be manufactured by thermoforming pliable sheet HDPE material in a press assembly including upper and lower dies with conjugal surface features that form the various plastics parts and contours of the shipper body when the dies are installed in a press and brought together in alignment. The forklift openings are cut into the structure after it is taken from the forming dies. The floors of the molded-in recesses 24 and 25 add surface area to the bottom of the body 10. An exemplary body with attached posts and a plastic thickness or "gauge" of about .300 can weigh about 200 lbs and is capable of supporting a battery pack/assembly of about 1700 lbs. The pallets can be reinforced with steel in various locations such as the pallet bottom surface wherein, for example, a steel plate is trapped between layers of molded plastic in a so-called twin sheet structure. All dimensions given herein are for example only as the size and load capacity of the structure can vary over a wide range

[0018] It is to be understood that the invention is shown and described with respect to an illustrative embodiment and that various changes in shape and size can be made to accommodate a particular load configuration while still utilizing the elements of the present invention. The posts 26 can be on the order of 16 inches but this dimension can vary with the application.

Claims

1. A returnable cargo-bearing shipping structure comprising:

   a body made of durable plastic having a cargo bed surface;
   a plurality of posts having top ends; said posts being attached peripherally to the body and extending upwardly from the cargo bed surface;
   the posts having exposed bottom features underlying the cargo bed surface with sockets located to receive therein the top ends of posts from an underlying and aligned second said cargo-bearing structure whereby multiples of said cargo-bearing structures can be stacked in an aligned and vertically spaced configuration.

2. A shipping structure as defined in claim 1 wherein the body has molded-in raised corner structures extending above said cargo bed surface configured to provide mounting locations for said posts wherein the posts extend through and above said corner structures.

3. The shipping structure defined in claim 1or 2 wherein the body is provided with a set of holes that are offset from the posts whereby two or more structures can be stacked in a non-aligned staggered configuration with the posts of a lowermost structure extending through said holes to reduce the volume occupied by the stacked non-aligned structures relative to the volume occupied by structures stacked in the aligned configuration.

4. The shipping structure as defined in one of the preceding claims wherein the posts comprise a cylindrical metal pin with a top and bottom wherein each pin has a first mounting flange attached to the post at the bottom and second mounting flange attached to the post midway between the top and bottom of the posts;
   the flanges being arranged in abutting contact with vertically spaced surfaces on the mold plastic body and secured to said surfaces in substantially permanent relationship therewith.

5. A shipping structure as defined in one of the preceding claims further comprising backing plates attached to the molded plastic bodies in juxta position relative to the mounting flanges and secured thereto by screws or the like.

6. A shipping structure as defined in one of the preceding claims wherein the body is substantially rectangular and the posts are arranged at the corners thereof.

7. A shipping structure as defined in one of the preceding claims wherein the pallet has molded in raised corner structures with closed tops and the post extend through and above said tops.

8. A returnable pallet type cargo-bearing shipping structure comprising:

   a generally rectangular molded plastic body having a cargo bed surface with a plurality of retainer bosses formed along at least two peripheral sides thereof;
   said body further having integral raised corner structures formed peripherally at the corners thereof;
   a plurality of metal posts mounted to said corner structures and extending through and above said structures, each post having flanges underlying respective surfaces of said body;
   one of said flanges being located at the bottom of a post and providing a socket that can receive the top of a post of a second, underlying cargo bearing structure onto which the structure is stacked in an aligned and vertically spaced apart configuration.

9. A returnable pallet type shipping structure comprising:

   a molded plastic body defining a cargo bed surface with a plurality of spaced and upwardly extending peripheral structures integral with said body;
   a plurality of metal posts mounted in said raised structures and extending above said cargo bed;
   means for interconnecting two or more of said bodies in aligned and vertically spaced relationship, and, alternatively, in a non-aligned and mutually contacting relationship.

10. A returnable shipping structure comprising:

    a molded plastic body defining a cargo loading deck;
    a plurality of posts mounted to and extending upwardly from the body at peripherally spaced locations;
    the body having first means for stacking two or more loaded bodies in an aligned and first vertically spaced relationship via said posts; and
    the body having second means for stacking two or more unloaded bodies in a staggered and a second vertically spaced relationship via said posts wherein said second vertically spaced relationship is less vertically spaced than said first relationship.

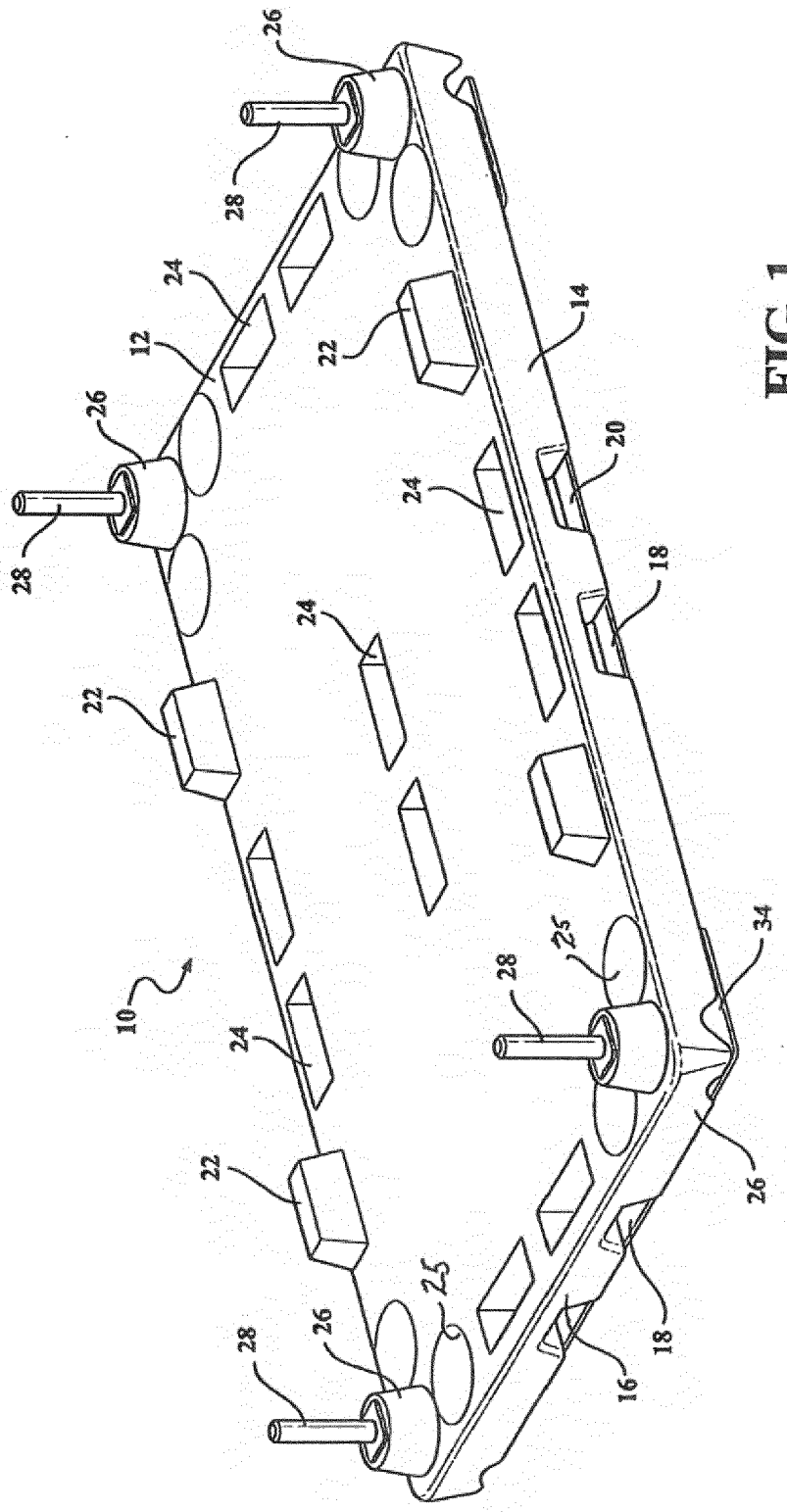
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FIG. 1

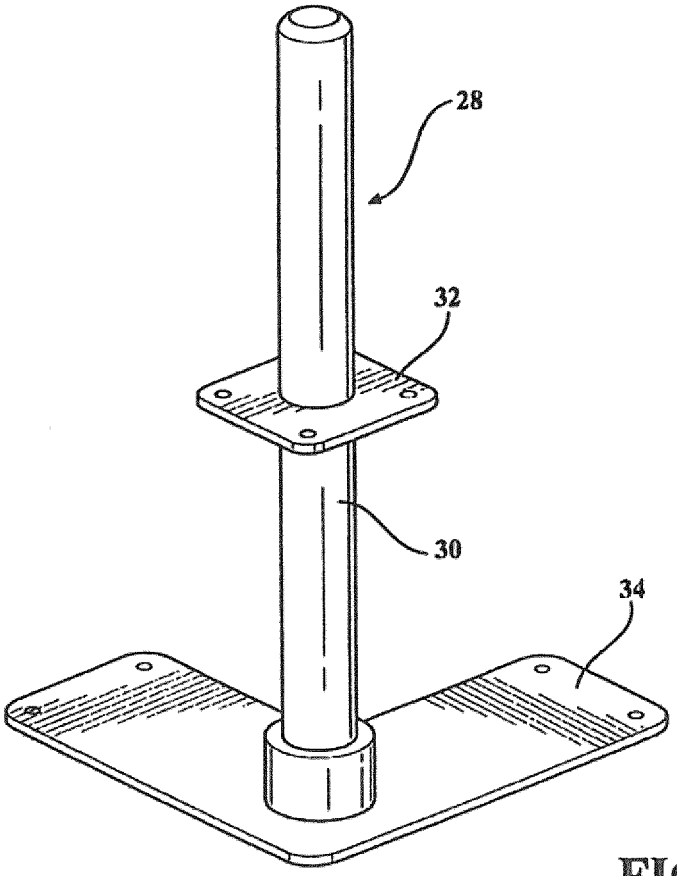

FIG. 2

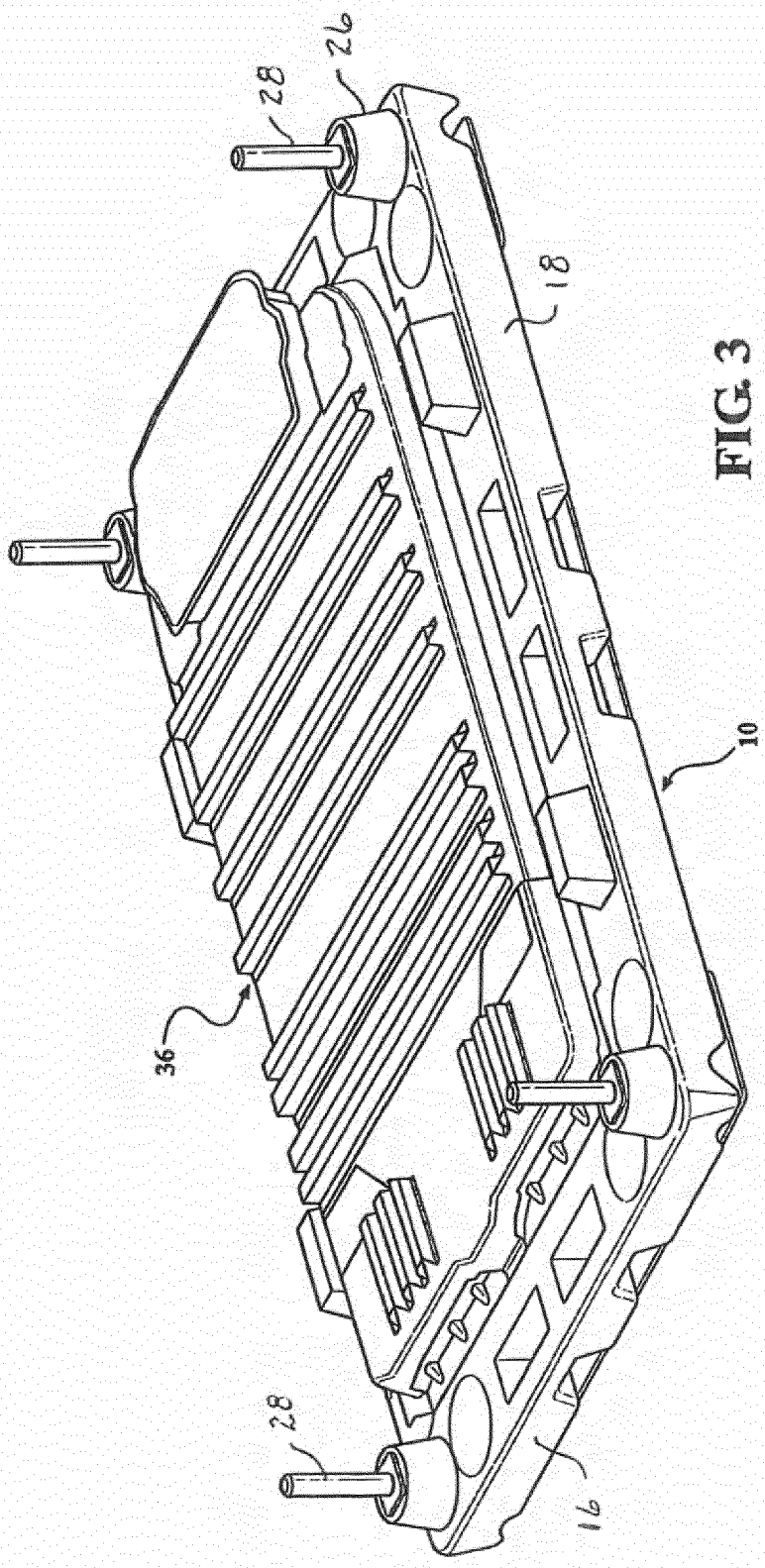

FIG 3

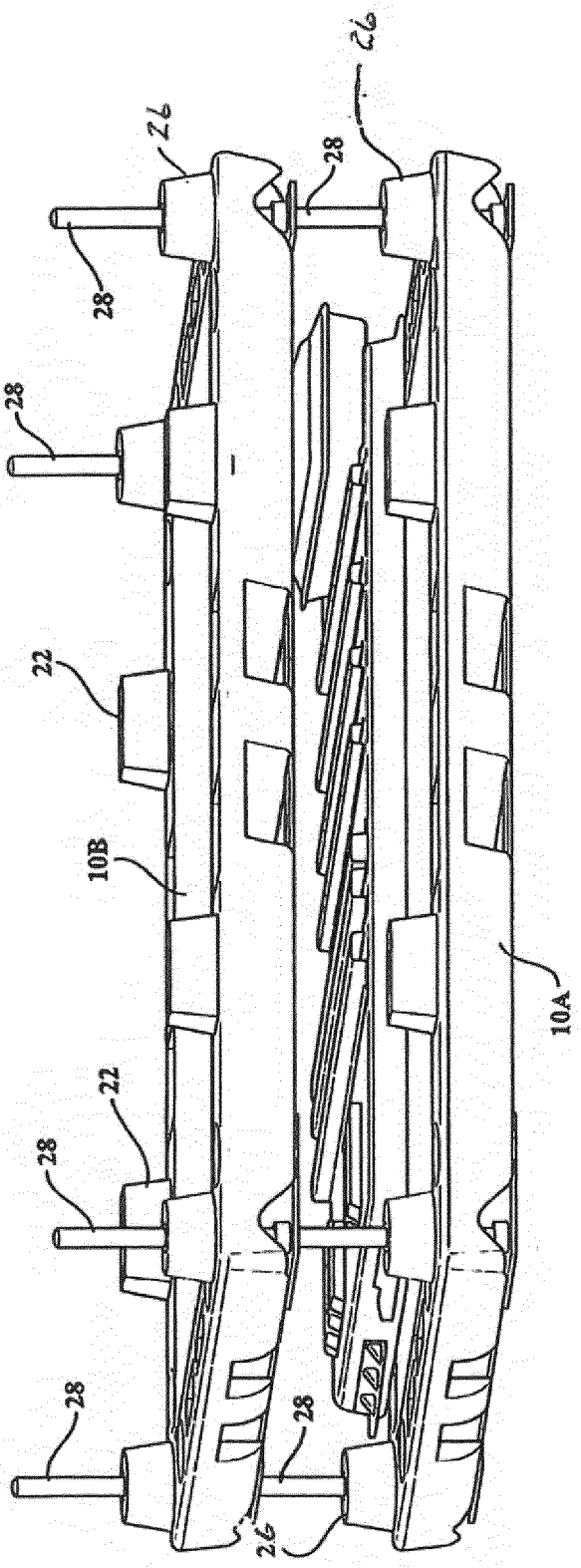

FIG. 4

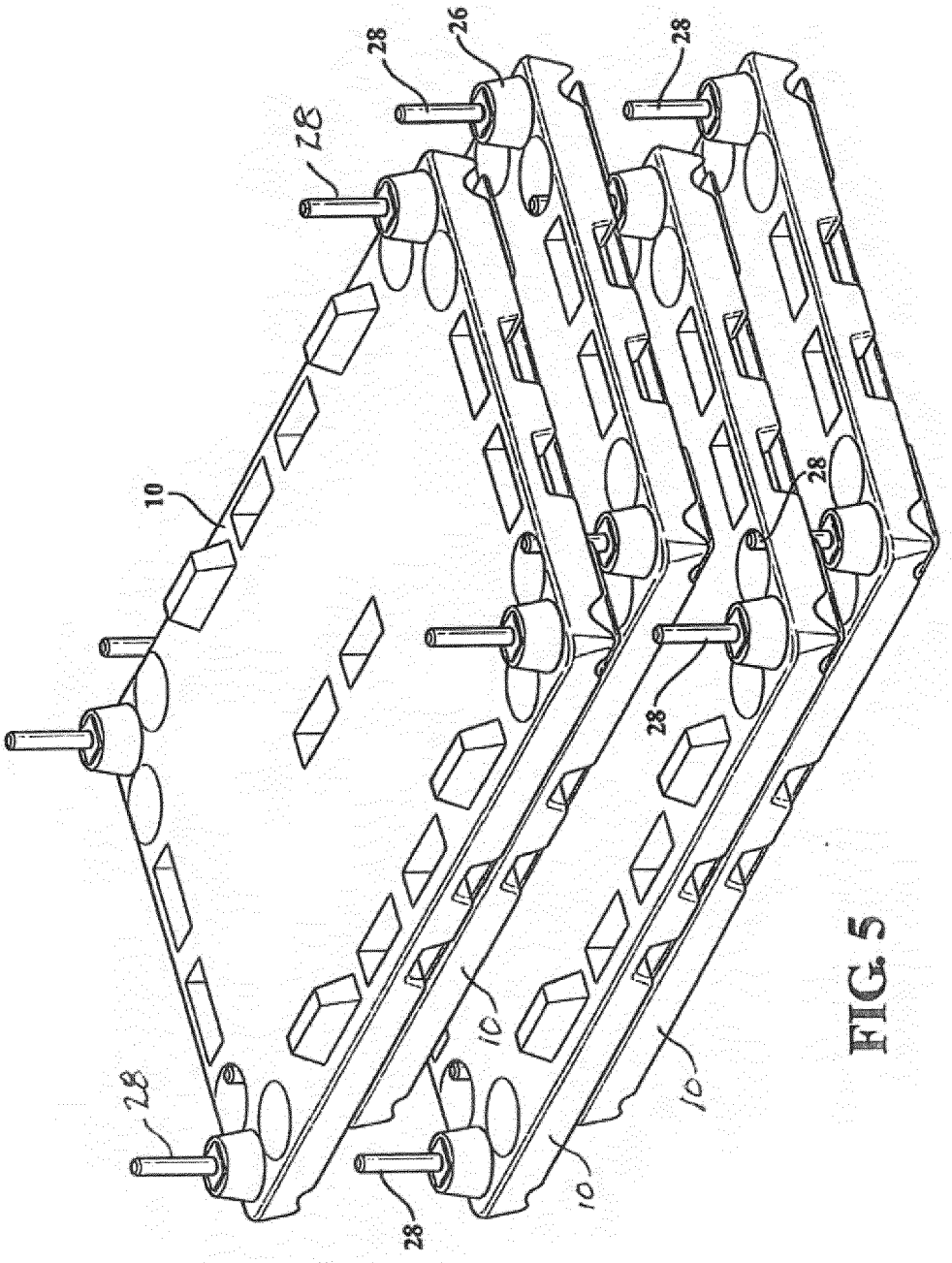

FIG 5

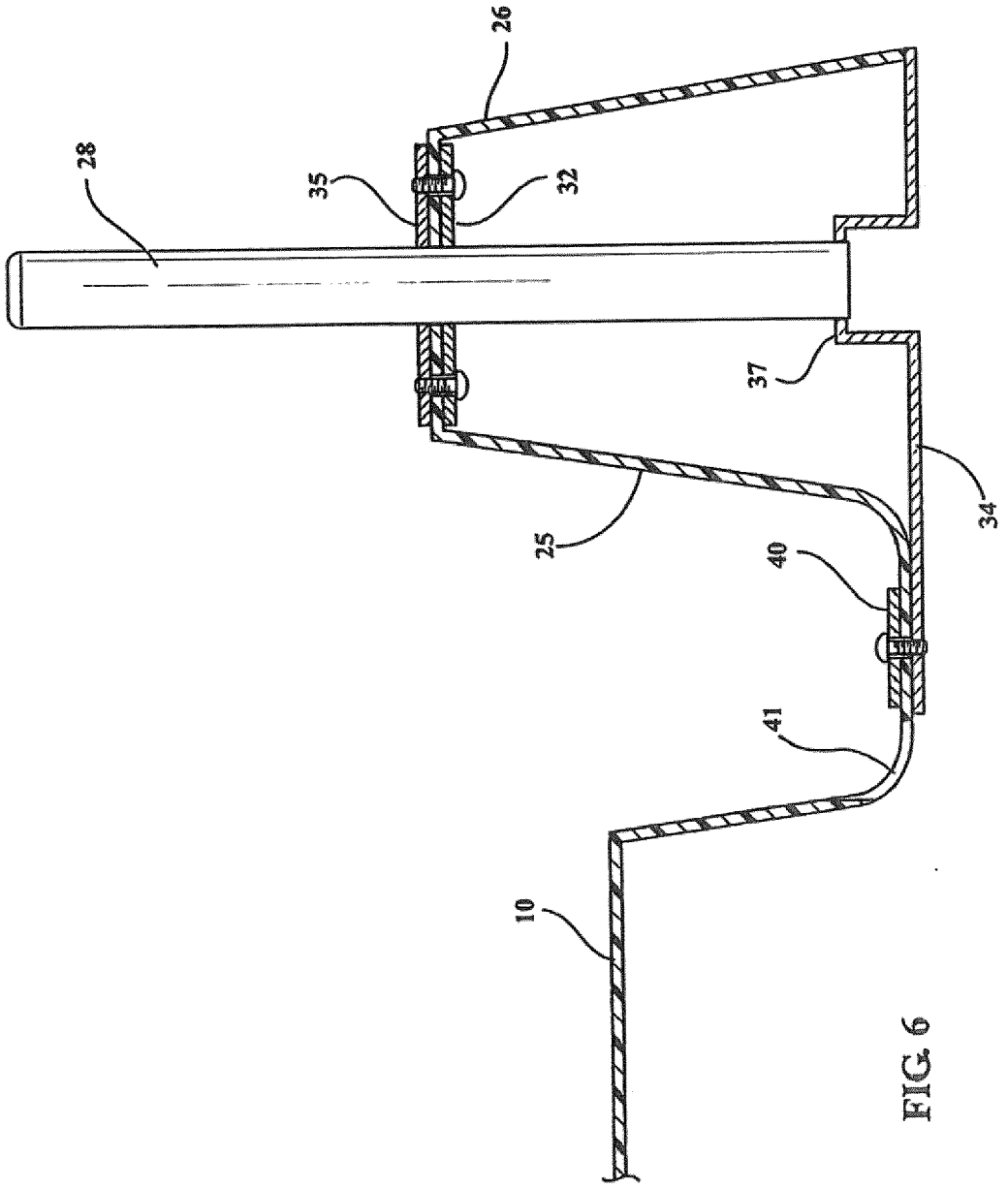

FIG 6

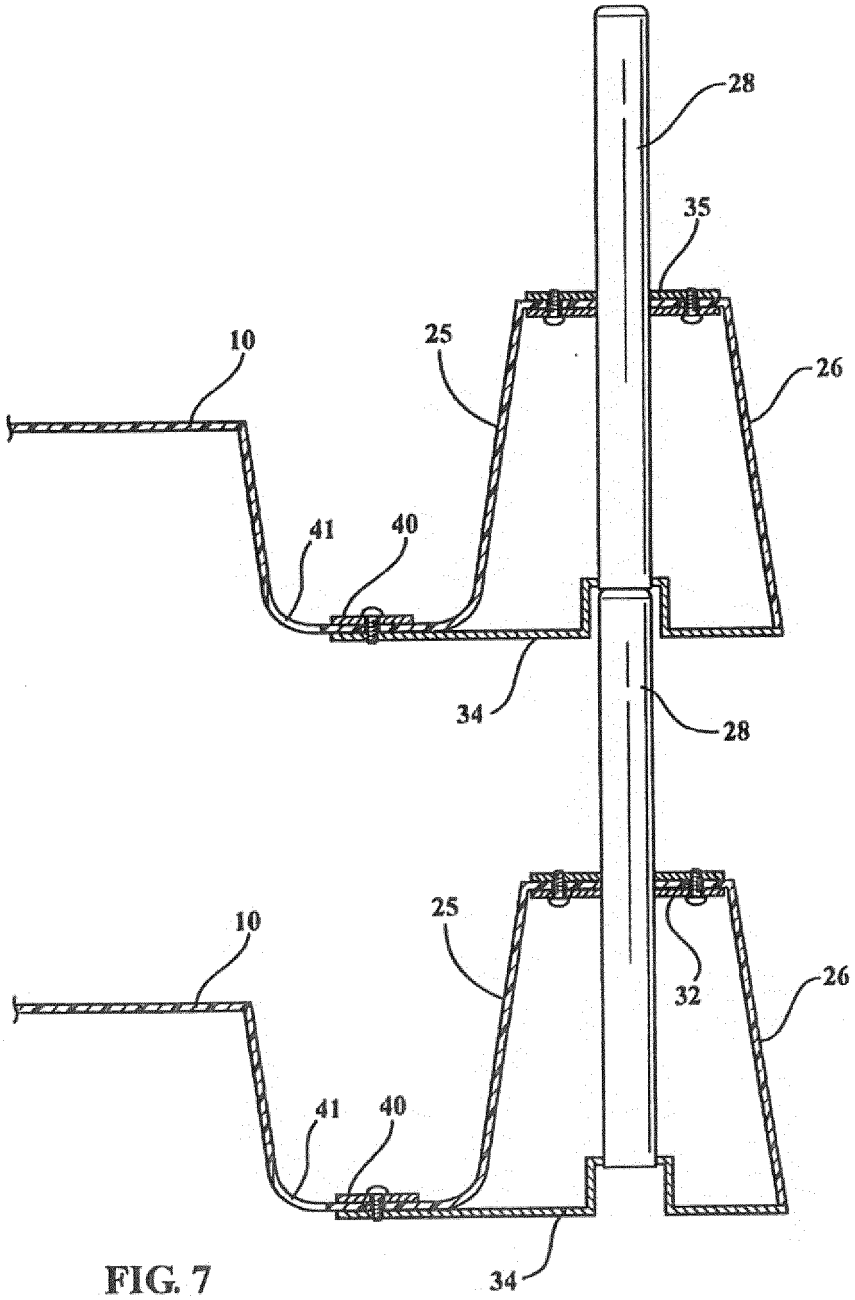

FIG. 7

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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