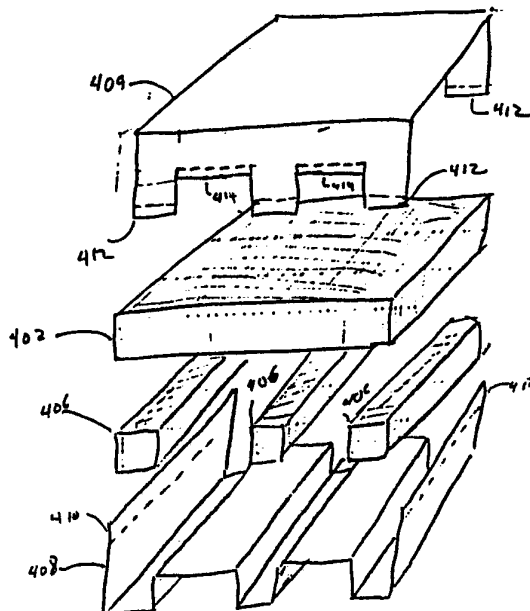




## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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(54) Title: PAPER CARGO PALLET



## (57) Abstract

The device is a pallet as might be used to support cargo during that cargo's transportation or storage. The pallet is constructed of paper. The pallet design involves a central platform or deck (402) constructed of a honeycomb filler bounded on the top and bottom surfaces by corrugated sheets (404, 408). To enhance the torsional and deflective strength of the central platform, the corrugated sheets are positioned so that the corrugations are not parallel. Additionally, the corrugated sheets may be folded over the edges (410, 412, 414) of the honeycomb core and fastened to the other side. Runners or legs (406) may be included to support the central platform.

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## PAPER CARGO PALLET

### Related Applications

This is a continuation-in-part of U.S. Ser. No. 07/635,195, filed December 26, 1990, entitled "PALLET DESIGN USING PAPER MATERIALS", the entirety of which is incorporated by notice.

### Field of the Invention

This invention is a pallet as might be used to support cargo during that cargo's transportation or storage. The pallet is constructed of paper. The pallet design involves a central platform or deck constructed of a honeycomb filler bounded on the top and bottom surfaces by corrugated sheets. To enhance the torsional and deflective strength of the central platform, the corrugated sheets are positioned so that the corrugations are not parallel. Additionally, the corrugated sheets may be folded over the edges of the honeycomb core and fastened to the other side. Runners or legs may be included to support the central platform.

### Background of the Invention

A pallet is a portable, horizontal, rigid, platform used as a base for assembling, storing, stacking, handling goods as a unit load. Conventional pallets are typically constructed of wood and are made by stapling or nailing a number of boards (known as "deckboards") at their ends to a number of continuous solid boards (known as "stringers"). The upper set and lower set (where used) of deckboards thereby form an open area defined by the thickness of the stringers. This opening is used to accommodate a fork lift or hand truck. In this way the pallet may be moved from place to place by lifting the pallet and its load off the floor.

The vast majority of all pallets used in the U.S. are constructed of

wood, but wood pallets have many disadvantages. Labor and material costs for wooden pallets have increased faster than inflation. Because of their expense, the pallets are often reused or returned to their place of origin. The cost of returning empty pallets to their owners is obviously high. Additionally, The average weight of a wooden pallet is about forty pounds. Since shipping costs are usually tied to the weight of the goods shipped, the cost of shipping is increased by the weight of the pallet. Indeed, pallets are sufficiently heavy that smaller warehouse workers are able manually to move the pallets only with some difficulty. Wooden pallets are often damaged during use and, because of the pallet cost, must be repaired if possible or disposed of. Depending upon the industry involved, pallets may be used between two and four times before they are disposed of. Disposal of any solid materials including broken pallets is an increasingly difficult and costly problem.

My invention is a pallet constructed of paper involving a central platform or deck constructed of a honeycomb filler bounded on the top and bottom surfaces by corrugated sheets. To enhance the torsional and deflective strength of the central platform, the corrugated sheets are positioned so that the corrugations or flutings are not parallel. Additionally, the corrugated sheets may be folded over the edges of the honeycomb core and fastened to the other side. Runners or legs may be included to support the central platform. In addition to the inherent strength and low cost of my pallet, by careful selection of construction materials, my design may be completely recycled as paper without separation into constituent parts.

There are a number of pallet designs which are made mostly of paper.

For instance, U.S. Pat. No. 3,661,099, to Shelor, shows a paper shipping pallet having a deck having a core section made of small strips cut from single, double, or triple wall corrugated paper board sheet stock

glued face to face. Sheets of corrugated are glued to the longitudinal edges of the composite core. The core and facing sheets are desirably of a specific size of corrugated sheets, i.e., having a size "A" flute or better. The legs of the pallet appear to be wooden blocks.

Shelor does not appear to suggest that the flutes in the facing sheets are in any relational configuration other than parallel.

U.S. Pat. No. 3,650,459, to Tucker, shows a paper pallet design involving a folded corrugate sheet as the cargo support area. That cargo deck is provided with a number of pallet feet (which operate as spacer blocks within the cargo deck) made of molded plastic material such as polystyrene. The use of a honeycomb core within the cargo support area is not disclosed.

U.S. Pat. No. 3,952,672, to Gordon *et al*, shows a disposable pallet made of a single folded corrugated sheet. The use of a honeycomb core on the cargo support area is not disclosed.

U.S. Pat. Nos. 4,867,074 and 5,001,991, to Smith, each show a pallet design in which the cargo deck is made up of a large number of girders folded from corrugated sheet and assembled with a series of cross girders. The use of a honeycomb core in the cargo support area is not disclosed.

U.S. Pat. No. 4,790,249, to Webb, shows a pallet design in which the cargo deck is made up of facing sheets separated by a number of blocks having a specific design. The block design involves a cellulosic material glued together by a bonding material (such as ureaformaldehyde) all extruded into the shape of a box beam. The boxes are positioned so to protect the deck from the tines on a fork lift.

Netherlands Patent Application 83-00024 shows an interesting design for a paper pallet. The cargo support deck appears to be constructed of a number of loops of paper glued together at a number of sites within the deck and also glued to a periphery forming the edge of

the deck. Neither the use of a honeycomb core nor the use of corrugated sheet in the cargo deck support area is disclosed.

There are few disclosures showing the use of honeycomb materials in the core of the cargo support deck.

One such disclosure is Published U.K. Patent Application 2,213,462-A to Green et al. This published application shows a paper pallet design in which the cargo deck is made up of two face sheets of, e.g., corrugated cardboard and having a an open structure such as a paper or card honeycomb between them. It is said that the deck may be raised from the floor using feet of similar construction. The deck core is made to be penetrable by the tines of a fork lift. There is no suggestion that the corrugated sheets on alternate sides of the core should be positioned so that the flutes are not parallel. Furthermore, the disclosure is silent on the use of a corrugated sheet folded over the edge of the central core and fastened to the opposite side.

U.S. Pat. No. 4,319,530, to Moog, discloses a pallet, said to be disposable, having a cargo supporting deck area made up of a central core of a honeycomb made of laminated corrugate. The core is faced with one or more corrugated sheets glued to the core. The facing on the cargo support surface of the central core may be made up of multiple layers of corrugated sheets. Although these multiple facing layers are said to be positionable so to permit "cross laminating where the flutes of the different sheets are oriented at right angles", there is no suggestion that use of corrugated sheets on alternate sides of the core positioned so that the flutes are not parallel is useful. Further, the disclosure is silent on the use of a corrugated sheet folded over the edge of the central core and fastened to the opposite side nor, obviously, is any benefit accorded such a folded sheet.

None of these disclosures show a pallet constructed of paper involving a central platform or deck constructed of a honeycomb filler

bounded on the top and bottom surfaces by corrugated sheets nor do these disclosures show the features of increased torsional and deflective strength of the central platform via the use of carefully positioned corrugated sheets such that the corrugations or flutings in those face sheets are not parallel.

#### BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is an exploded drawing of the components of the basic configuration of the invention.

Figure 2 is an exploded drawing of the components of a variation of the invention.

Figure 3 is a drawing showing a variation of the invention using runners instead of feet to support the cargo deck.

Figure 4 is an exploded drawing of another variation of the invention.

Figure 5 is a perspective drawing of a four-way entry pallet made according to the invention.

#### SUMMARY OF THE INVENTION

In general, this invention is a pallet as might be used to support cargo during that cargo's transportation or storage. The pallet is constructed of paper. The pallet design involves a central platform constructed of a honeycomb filler bounded on the top and bottom surfaces by corrugated sheets. To enhance the torsional and deflective strength of the central platform, the corrugated sheets are positioned so that the corrugations are not parallel. Additionally, the corrugated sheets may be folded over the edges of the honeycomb core and fastened to their opposite side. Runners or legs, particularly those utilizing honeycomb or corrugate cores and corrugate skins and adapted so that the skins overlap up on to the edges of the central platform, may be

included to support that central platform.

Although the invention may be made of a variety of materials, I prefer to construct the pallet from materials which may be readily recycled using commercially available technology. For instance, the various sheet material is desirably from kraft paper or other similar paper stock. Of course, depending upon the service into which the pallet is placed, other materials may be selected, e.g., MYLAR, polyethylene, polypropylene (clear or fibrous paper product), or the like is acceptable. Some thermosetting polymeric materials are not currently widely recyclable and may not be the best of choices for the pallet from that viewpoint. However even with nonrecyclable materials the improvements of the pallet design will be apparent. Choice of materials and methods to join together the various components of the pallet may also be made on the basis of recyclability. For instance, most water-based glues, e.g., hide glue, mucilage, etc. are glues compatible with the kraft paper recycling processes. Heat sealing thermoplastic materials such as polypropylene is an expedient using no adhesive.

Figure 1 is an exploded diagram showing the components of the basic configuration of the invention. In this configuration, the central core (100) comprises an expanded honeycomb material. Joined to this core on the upper and lower faces of the core are two facing sheets (102, 104). If the method for joining the two facing sheets to the core is properly carried out, the cells within the core are isolated from each other. The core strength is enhanced by the formation of these closed cells and imparts an amount of springiness and shock absorbing capabilities to the core.

Attached to the facing sheets (102, 104) are two corrugated sheets (106, 108). The flutes on the respective corrugated sheets are depicted such that the flutes on sheet (106) are not parallel to the flutes on sheet (108). The angle between the respective flutes may be between



about 30° and 90° although for a very practical pallet from the vantage of strength, versatility, and ease of construction, an included angle between the flutes of about 90° is desirable.

Attached to the outer edges of the fluted, corrugated sheets (106, 108) are sheets (110, 112).

Clearly, the combination of facing sheet (104), corrugated sheet (108), and sheet (112) and the combination of facing sheet (102), corrugated sheet (106), and sheet (110) are commonly available articles of commerce which may be employed in the invention.

This invention is not limited to the basic variation shown in Figure 1. Additional sheets of corrugated material may be added to the upper and lower faces of the combination shown in that Figure if additional strength is needed for some particular purpose. Addition of a sheet on the upper (or load-bearing face) is preferable to enhance the impact resistance of the pallet deck.

As will be discussed below, addition of runners, legs, etc. to make a practical pallet is desirable but the basic components of the invention are shown in Figure 1.

The pallet may be coated with a material which will harden or waterproof or dustproof the pallet. These materials may be chosen to meet whatever criteria are appropriate for the pallet use. For instance, if used in a humid atmosphere or used outside or are moved between refrigerated and non-refrigerated areas, waterproofing is desirable. Known water-based and oil-based materials may be applied as needed.

Additionally, the cargo face of the deck may be covered with or coated with a suitable material to prevent slippage of the cargo.

Figure 2 shows an exploded drawing of a variation of the invention. Beginning with the basic combination shown in Figure 1, the variation in Figure 2 involves a honeycomb core (200). The lower sheet (202) is a combination corrugated sheetstock (similar to a combination of

sheet 102, corrugated sheet 106, and sheet 110 shown in Figure 1). It is approximately the size of the lower face of honeycomb core (200). The upper sheet (204) is configured so that it may be folded over the edge of the honeycomb core (200) and overlapped onto and fastened to the lower sheet (202). As with the Figure 1 variation, the flutes in the upper sheet (204) are not parallel to the corrugated flutes in the lower sheet (202). This feature, in addition to the provision of the tabs (206) adhesively fastened to lower sheet (202), provides additional strength to the pallet cargo support platform.

Additionally, the pallet may have feet of the construction shown in Figure 2. The legs may have a center block (208) made preferably of a honeycomb material similar to the core (200). They may also be made of an assembly of corrugated sheet if so desired. The center block is covered with a skin of a corrugated material (210) having a number of tabs which may be folded as shown (212) and glued together to form the foot (214). It may be seen from Figure 2 that foot (214) has tabs which are then adhesively fixed to the outside corners of the cargo support decking made of core (200), upper sheet (204), and lower sheet (202). Of course, if a foot is desired in the middle of a side of the decking two extended tabs are not necessary; one will do. The tabs on the feet on the outside periphery of the cargo support decking are desirable since they prevent the feet from being separated from the decking by a misplaced tine on a forklift.

Figure 3 shows a pallet made according to the invention. It is made of a top deck covered by a top sheet (302) of a corrugate sheet. It has an expanded honeycomb core (304) and an adhering lower skin (306) also of a corrugate sheet. The runners (308) are made up of a corrugate tray (310) enclosing a portion of expanded honeycomb core (312). The runners (308) are adhesively secured to the underside skin (306). The runners utilize tabs (314) to allow sturdy attachment of the

runners to the top deck assembly.

The Figure 3 embodiment is a design known as a two-way entry pallet. The wide slots between the runners on the underside of the cargo deck permit entry of forklift or hand truck tines from either of opposite ends.

When the pallet of this invention is used in conjunction with roller conveyer systems, a hard paperboard (316) may be glued to the bottom of the runner trays (310). The paperboard is typically one-fourth to one-half inch in thickness and made from thin sheets of paper glued and compressed together to give a hard surface to the bottom of the runners. The hard surface prevents the bottom of the corrugate trays from depressing around the conveyer roller and thereby preventing the load-bearing pallet from rolling easily down the conveyer. The hard paperboard provides adequate hardness for reducing the compressibility of the runner bottom and therefore reduces the drag on the pallet.

Figure 4 shows a variation of the pallet shown in Figure 3 but in which the lower corrugate sheet is integrated with the runner tray to enhance the overall strength of the runners. In this variation, the deck includes an expanded honeycomb core (402) and an upper face (404) of corrugate. The runners and the lower deck facing are made of a set of runner cores (406) of expanded honeycomb or multilaminated corrugate and a lower folded corrugate sheet (408). The lower corrugated folded sheet (408) adheres to and encloses the runner core blocks (406). It also has tabs (410) which may be folded over and allow it to adhere to the cargo (or upper) surface of the upper corrugate face (404). Similarly, the upper corrugate face (404) adheres to the honeycomb core (402) by use of adhesives, glue, or solvents and also has tabs (412) which may be folded under the runner core blocks (406) and tabs (414) which may be folded under the honeycomb core (402). The runners obviously cannot be separated from the deck without the virtually complete destruction of

the pallet.

Figure 5 shows a four-way pallet made according to the invention. As with the variations discussed above, the pallet incorporates a cargo deck (502) made up of an upper and lower skin surrounding a honeycomb core. The deck is supported by a lumber of legs (504) each having gussets reaching up onto the edge of the cargo deck. Placement of the legs in the manner shown allows entry of forklift or hand truck tines beneath the cargo deck from any side, e.g., into the slots shown via directions "x" and "y".

#### EXAMPLE

This example demonstrates the strength of the pallet deck made according to the invention by comparison to decks made in other ways. In this example a series of pallet decks were constructed using expanded honeycomb as a core. The core was glued to the core using an industrial mucilage, approved by the FDA for use with foodstuffs. Each core was about four foot by four foot. The core was a 1-1/2 " thick expanded honeycomb of 33 lb. paper arranged into 1/2" cells.

The first deck (Deck "A") was made using a good grade of paper, i.e., 42 lb. kraft paper, as the upper and lower skins on the core. The paper did not cover the edge of the core.

A second set of two identical decks (Decks "B" and "C") was made using corrugate skins (200 lb. test corrugate) in which the flutes in the skins were parallel to each other. The skins were glued to the honeycomb core. The edges of the core were not covered.

A fourth deck (Deck "D") was made in the same fashion as Deck "C" using corrugate skins in which the flutes were at right angles to each other. The edges of the core were not covered. This deck is in accord with the invention.

A fifth deck (Deck "E") was made also in accord with this invention

in the same fashion as Deck "D" except that one skin was wrapped around the edge of the core and glued to the other skin.

Each of the decks was mounted on a testing table. The approximately two feet of the decks overhung the edge of the table. The end of the deck on the table was securely clamped to the table. The edge overhanging the floor was loaded with increasing weights until the deck bent at the edge of table and sustained a 15° bend. The two decks with parallel flutes in the corrugate skins (decks "B" and "C") were tested with so that flutes were either perpendicular to the table edge or parallel to the edge.

The results of the tests were as shown in the table.

TABLE				
Deck	Skin Type	Parallel Flutes?	Edge Cover?	Failure Weight (lbs)
A	paper	--	no	26
B	corrugate	yes	no	90*
C	corrugate	yes	no	72**
D	corrugate	no	no	81
E	corrugate	no	yes	88

\* flutes tested parallel to table edge

\*\* flutes tested perpendicular to table edge

A comparison of the failure weight of Decks "B" and "C" shows that these identical decks have a significant variation in the failure level as a function of the direction. The two inventive decks "D" and "E" are each stronger than the weaker direction of the Deck "B"/"C" and inventive Deck "E", with its covered edge is substantially the same strength as the strongest of the decks with the non-covered edge.

The invention has been described by description and by example. The examples are just examples and are not to be used to limit the scope of the invention in any way. Additionally, one having ordinary skill in this art will recognize variations and equivalents within the invention as described which will not necessarily be within the scope of the appended claims.

## I CLAIM AS MY INVENTION:

1. A pallet comprising:
  - a deck of a honeycomb core having an upper face, lower face, and edge;
    - upper and lower facing sheets adherent respectively to the upper and lower faces of the honeycomb core,
    - upper and lower corrugated sheets having flutes and adherent respectively to the upper and lower facing sheets and positioned so that the upper and lower flutes are not parallel to each other,
    - upper and lower sheets adherent respectively to the upper and lower corrugated sheets.
2. The pallet of claim 1 where the composition of one or more of the honeycomb core, upper and lower facing sheets, upper and lower corrugates, and upper and lower sheets is selected from paper, MYLAR, polyethylene, polypropylene (clear or fibrous paper product).
3. The pallet of claim 2 where the composition of one or more of the honeycomb core, upper and lower facing sheets, upper and lower corrugates, and upper and lower sheets is selected from paper.
4. The pallet of claim 1 where at least one of the combination of upper facing sheet, upper corrugate, upper sheet or combination of lower facing sheet, lower corrugate, lower sheet are folded over and adherent to the edge of the honeycomb core and to the opposite sheet.
5. The pallet of claim 1 where the honeycomb core is adhesively to the facing sheets so a substantial portion of cells within the honeycomb core are sealed.
6. The pallet of claim 1 where the deck also comprises additional

corrugate adherent to one or more of the upper and lower sheets.

7. The pallet of claim 1 also comprising two or more runners adhesively attached to the deck.

8. The pallet of claim 7 where the runners comprise a honeycomb runner core.

9. The pallet of claim 8 where the honeycomb runner core is substantially enclosed in a runner tray having outer skins.

10. The pallet of claim 9 where portions of the outer skins of one or more of runners are adherent to the edge of the honeycomb core.

11. The pallet of claim 1 also comprising four or more feet adhesively attached to the deck.

12. The pallet of claim 11 where the feet comprise a honeycomb foot core.

13. The pallet of claim 12 where the honeycomb foot core is substantially enclosed by foot outer skins.

14. The pallet of claim 13 where portions of the foot outer skins of one or more feet are adherent to the edge of the honeycomb core.



15. A paper pallet comprising:

a deck of an expanded paper honeycomb core having an upper face, lower face, and edge;

upper and lower facing sheets adherent respectively to the upper and lower faces of the honeycomb core;

upper and lower corrugated sheets having flutes and adherent respectively to the upper and lower facing sheets and positioned so that the upper and lower flutes are not parallel to each other;

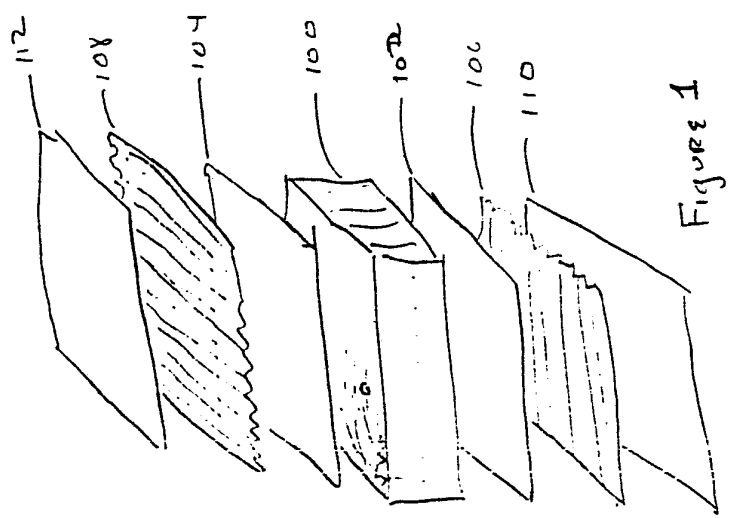
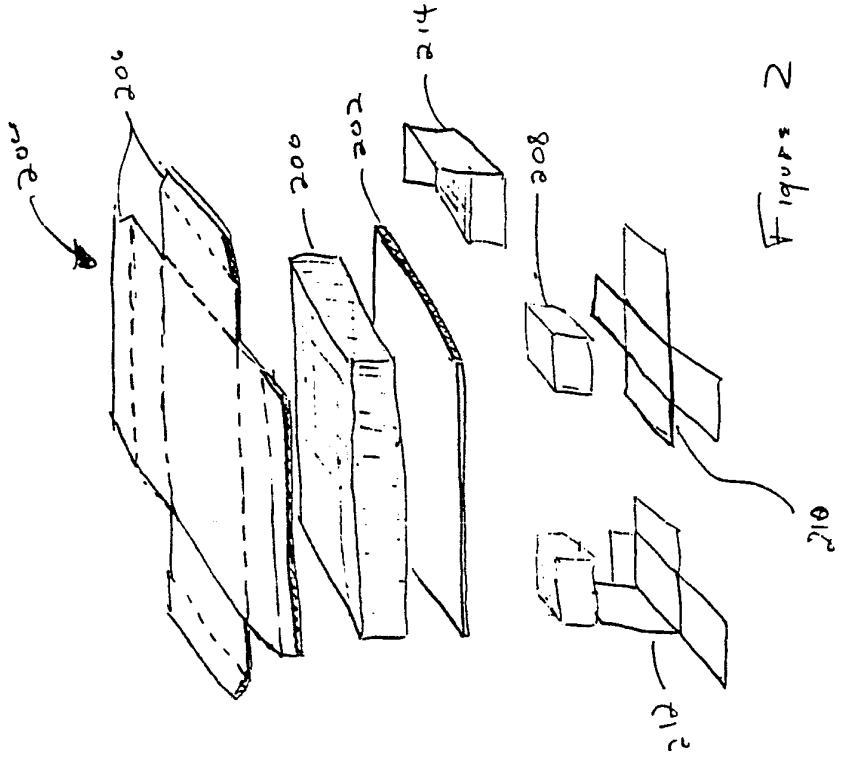
upper and lower sheets adherent respectively to the upper and lower corrugated sheets,

where at least one of the combination of upper facing sheet, upper corrugate, upper sheet or combination of lower facing sheet, lower corrugate, lower sheet are folded over and adherent to the edge of the honeycomb core and to the opposite sheet.

16. The pallet of claim 15 where the honeycomb core is adhesively to the facing sheets so a substantial portion of cells within the honeycomb core are sealed.

17. The pallet of claim 15 also comprising two or more runners adhesively attached to the deck.

18. The pallet of claim 15 also comprising four or more feet adhesively attached to the deck.



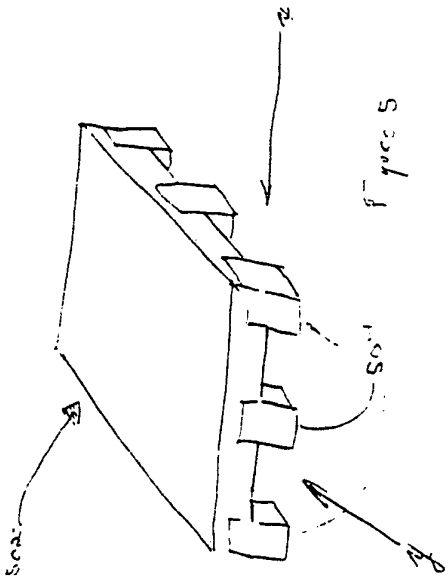


Figure 5

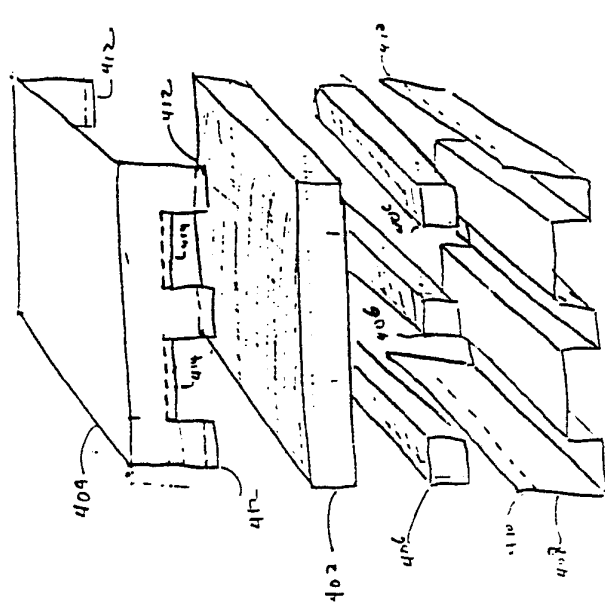


Figure 4

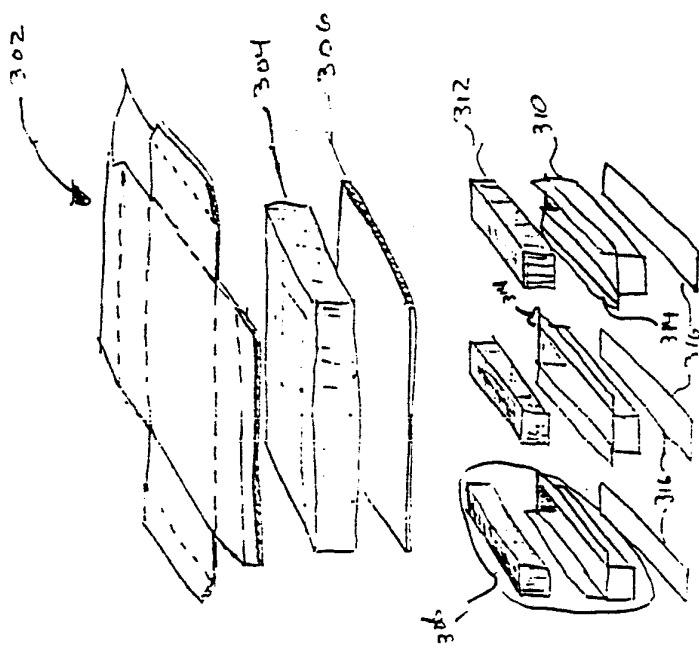


Figure 3

# INTERNATIONAL SEARCH REPORT

International Application No. PCT/US91/09545

<b>CLASSIFICATION OF SUBJECT MATTER</b> (if several classifications apply, indicate all) <sup>6</sup> International Patent Classification (IPC) or to both National Classification and IPC (Int. Cl.): B65D 19/00 U.S. Cl.: 108/51.3, 51.1				
<b>FIELDS SEARCHED</b> Minimum Documentation Searched <sup>7</sup>				
Classification System	Classification Symbols			
U.S.	108/51.3, 51.1, 56.3; 206/386, 600			
Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched <sup>8</sup>				
<b>DOCUMENTS CONSIDERED TO BE RELEVANT</b> <sup>9</sup>				
Category <sup>10</sup>	Citation of Document, <sup>11</sup> with indication, where appropriate, of the relevant passages <sup>12</sup>	Relevant to Claim No. <sup>13</sup>		
Y	US, A, 2,432,295 (DONAHUE) 09 DECEMBER 1947 See entire document.	1-18		
Y	US, A, 2,446,914 (FALLART ET. AL.) 10 AUGUST 1948 See entire document.	1-18		
A	US, A, 2,503,240 (CAHNERS) 11 APRIL 1950 See entire document.	-		
A	DE, B, 1,131,148 (STEMPEL) 07 JUNE 1962 See entire document.	-		
A	US, A, 3,661,099 (SHELOR) 09 MAY 1972 See entire document.	-		
A	US, A, 3,709,161 (KAUFFMAN) 09 JANUARY 1973 See entire document.	-		
A	US, A, 3,982,057 (BRIGGS ET. AL.) 21 SEPTEMBER 1976 See entire document.	-		
A	US, A, 4,378,743 (MCFARLAND) 05 APRIL 1983 See entire document.	-		
A,T	US, A, 5,076,176 (CLASEN) 31 DECEMBER 1991 See entire document.	-		
<table style="width: 100%; border: none;"> <tr> <td style="width: 50%; border: none; vertical-align: top;"> <sup>10</sup> Special categories of cited documents:                      "A" document defining the general state of the art which is not considered to be of particular relevance                      "E" earlier document but published on or after the international filing date                      "L" document which may throw doubts on priority claims; or which is cited to establish the publication date of another citation or other special reason (as specified)                      "O" document referring to an oral disclosure, use, exhibition or other means                      "P" document published prior to the international filing date but later than the priority date claimed                 </td> <td style="width: 50%; border: none; vertical-align: top;">                     "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention                      "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step                      "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.                      "&amp;" document member of the same patent family                 </td> </tr> </table>			<sup>10</sup> Special categories of cited documents: "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier document but published on or after the international filing date "L" document which may throw doubts on priority claims; or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art. "&" document member of the same patent family
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<b>IV. CERTIFICATION</b>				
Date of the Actual Completion of the International Search 17 MARCH 1992		Date of Mailing of this International Search Report 18 APR 1992		
International Searching Authority ISA/US		Signature of Authorized Officer <i>Nguyen Ngoc Ho</i> For JOSE V. CHEN NGUYEN NGOC-HO INTERNATIONAL DIVISION		