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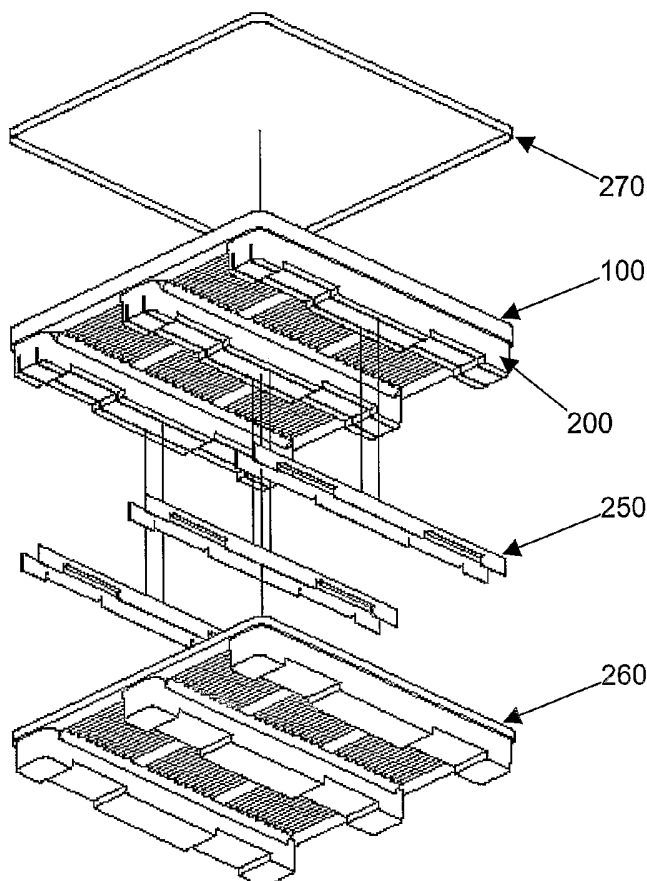
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(54) Title: EXPANDED POLYSTYRENE PALLET AND ITS METHOD OF MANUFACTURE



(57) Abstract: A pallet, and its method of manufacture, is made from a first material such as expanded polystyrene (EPS) and the pallet is encased in a second material that is more rigid than the first material. The second material can be selected from high impact polystyrene (HIPS), acrylonitrile butadiene styrene (ABS), and acrylonitrile styrene acrylate to provide rigidity, impact resistance and good UV resistance. The pallet is formed of a first element (100) to receive a load and second element or legs (200) to support the first element. The first element (100) can have an upwardly projecting lip, a drainage channel, a plurality of recesses to hold barrels or boxes, and have a surface to reduce slipping. The second element can have longitudinal slots (230) for receiving stiffening ribs (250). The first and second elements have complimentary grooves (110) to allow coupling and to increase the torsional and flexural strength of the pallet.



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EXPANDED POLYSTYRENE PALLET AND ITS METHOD OF MANUFACTURE.Technical Field

5 The present invention relates to improvements in pallets used in storage and transportation of goods, and their manufacture.

Background Art

10 Pallets of the type which can be loaded with goods and transported by fork lift trucks are widely used in many different areas of industry, including agriculture, engineering, brewing, retail and distribution.

Traditionally, pallets have been constructed of wood, or, more recently, of solid plastics material. Wooden pallets, while cheap and relatively easy to produce, degrade relatively quickly, particularly in wet conditions, and can be dangerous to
15 handle due to the presence of nails and splinters. Additionally, they may not meet the stringent standards required by pallets used to transport foodstuffs. Hardwood pallets are quite heavy and may weigh between 35kg and 50kg depending on their exact size, construction and materials. This weight can add 2 Tonnes to a truck load of freight, and thus increases transport and fuel costs. Softwood pallets may be used
20 as a lighter alternative, but lack the strength of hardwood pallets and tend to break more easily. They also provide shelter and a food source for insects and are considered unhygienic. Timber pallets are not now generally used to transport foodstuffs due to infestations of insects, mould, bacteria and even splinters of wood from the pallet penetrating the food packaging.

25 Also, given the ever increasing need to recycle waste products, obsolete pallets are not readily recycled and many simply end up in landfill waste sites, where they are slow to degrade, and may persist for many years.

30 Plastic pallets, which are generally injection or rotational moulded, are as heavy as, or even heavier than, wooden pallets. They tend to have slippery surfaces and are prone to damage in use. The damage usually takes the form of chipping, caused by rough contact with a fork lift truck. There is a danger that the loose chips of plastic can find their way into transported foodstuffs, so plastic pallets are not generally

approved for use with food. If damaged, the plastic pallets can leave sharp and jagged surfaces, rendering them dangerous and difficult to handle.

Plastic pallets also tend to be expensive compared to wooden pallets, are not easily recyclable and may pose even greater problems in landfill waste sites than wooden pallets.

The present invention seeks to ameliorate the disadvantages associated with prior art solutions.

Summary of the Invention

In a first broad form, the present invention provides a method of manufacturing a pallet, including the steps of: selecting a first pallet element from a plurality of first pallet elements substantially composed of a first material and arranged to receive a load; selecting one or more second pallet elements from a plurality of second pallet elements, substantially composed of the first material, arranged to support said first pallet element, wherein said one or more selected second pallet elements are arranged to couple with said selected first pallet element to form an intermediate pallet assembly; and, encasing said intermediate pallet assembly in a second material, wherein said second material is more rigid than said first material.

Preferably said coupling of said first and second elements is achieved through use of complimentary interlocking parts on said first and second elements.

Preferably, the interlocking parts include a plurality of projections and corresponding recesses for receiving said projections.

According to a particular aspect, said second element is provided with a longitudinal slot for receiving a stiffening rib.

According to another particular aspect, a stiffening rib is inserted into said longitudinal slot before the step of encasing said intermediate assembly.

According to another particular aspect, said step of encasing includes the step of encasing an upper surface of the intermediate pallet assembly and the step of encasing a lower surface of the intermediate pallet assembly.

- 5 In a second broad form, the present invention provides a pallet including: a first load receiving pallet element; at least one second pallet element adapted to couple to and support said first pallet element; and, wherein the first and second pallet elements provide an intermediate pallet assembly substantially formed from a first material, and the intermediate pallet assembly is encapsulated within a second material more
10 rigid than the first material.

According to a particular embodiment, said first or second element includes a stiffening rib for providing additional strength to the pallet

- 15 According to another particular aspect, said stiffening rib is primarily formed from said second material.

Preferably, said first material is Expanded Polystyrene (EPS).

- 20 Preferably, said second material is one of: High Impact Polystyrene (HIPS); Acrylonitrile Butadiene Styrene (ABS); and Acrylonitrile Styrene Acrylate.

- According to another particular aspect, the first element is provided with a drainage channel running substantially adjacent the perimeter of the upper surface of said first
25 element.

- According to yet another particular aspect, the drainage channel includes one or more outlets for allowing accumulated liquid to be run out of the channel and away from the pallet.

- 30 According to another particular aspect, an upper surface of the first element is provided with a camber to encourage any liquid on the surface of the pallet to run towards the drainage channel.

According to another particular aspect, the first element is provided with an upwardly projecting lip running around the periphery of its upper surface.

According to another particular aspect, an upper surface of the first element is provided with a plurality of recesses, for securing and at least partially restraining a particular item placed on the pallet.

According to another particular aspect, the pallet is provided as two pallets fastened together to form a composite pallet such that the two major surfaces of the composite pallet each includes a plurality of recesses.

Brief Description of the Drawings

For a better understanding of the present invention and to understand how the same may be brought into effect, the invention will now be described by way of example only, with reference to the appended drawings in which:

Figure 1 shows a perspective view of a load supporting element forming part of a pallet according to an embodiment of the invention;

Figure 2 shows a support member for attachment to the load supporting element of Figure 1 and according to an embodiment of the invention;

Figure 3a shows an intermediate pallet assembly according to an embodiment of the invention;

Figure 3b shows an exploded view of a completed pallet;

Figures 4a-c show various views of an alternative embodiment of the invention featuring 4-way access;

Figures 4d and 4e show top and underneath perspective views of a further alternative embodiment of the invention featuring 4-way access;

Figure 5a shows an alternative embodiment of the invention featuring a plurality of recesses for receiving barrels;

Figure 5b shows a composite pallet including two of the pallets shown in Figure 5a;

Figure 6 shows several of the pallets of Figure 5b in use;

Figure 7 shows a pallet according to an embodiment of the invention including a drainage channel;

Figure 8 shows a pallet according to an embodiment of the invention including a raised lip surrounding the upper surface of the pallet; and

Figure 9 shows the pallet of Figure 8 used in conjunction with a sealed box or container.

Detailed Description of the Preferred Embodiments

Figure 1 shows a first element used in the construction of a pallet according to an embodiment of the invention. The load supporting element or 'top' element 100 is formed from expanded polystyrene, also known as EPS. Techniques used for moulding articles from EPS are well known in the art. The basic steps include: preparation of a mould which includes a cavity which describes the eventual shape of the finished moulded article; adding polystyrene beads to the mould and applying steam under pressure to expand the beads such that they fill the cavity in sufficient density to create the required moulded article.

Figure 1 shows pallet surface element 100 from the rear such that the actual upper surface which will receive a load is not shown in this view. The load receiving surface is generally a flat planar surface, but other surfaces may be desirable and will be described in more detail later.

The lower surface which is visible in Figure 1 includes a plurality of parallel grooves or recesses 110 which run across the entire length of the pallet under-surface. These grooves 110 are formed by the configuration of the cavity in the mould. In alternative

embodiments, the grooves may be formed by the selective removal of excess EPS by a suitable milling or routing machine.

5 The grooves are provided to allow the placement and coupling of one or more load supporting elements or legs. The grooves also increase the torsional and flexural strength of the finished pallet. Figure 2 shows a suitable leg 200 which may be coupled to pallet top 100.

10 Leg 200 includes a plurality of protruding members 210 which are dimensioned and positioned so as to interlock and couple with the plurality of grooves 110 in the underside of the pallet top 100. The grooves 110 may be arranged to have an essentially U-shaped cross-section, and the projections 210 may be arranged correspondingly. In other embodiments, the grooves 110 and projections 210 may be arranged to dovetail together allowing for a more robust attachment to take place.

15 Leg 200 is constructed in a similar manner to the pallet top 100, and is composed of the same or similar materials.

20 Figure 3a shows an intermediate pallet assembly 300 which is comprised of a pallet top 100 and three legs 200. Each of the legs 200 has been coupled to the top 100 via use of the interlocking grooves 110 and co-operating projections 210.

25 Manufacturing pallet top 100 and leg 200 from EPS results in lightweight but relatively fragile components. A pallet comprised of solely these materials would be unlikely to withstand the rigours to which it would be exposed.

30 To ensure that pallets according to embodiments of the invention benefit from the lightweight properties of EPS, it is necessary to encapsulate the intermediate pallet assembly 300 shown in Figure 3a in a further material which provides greater resistance to general wear and tear and strengthens the overall assembly.

To strengthen the intermediate pallet assembly 300, and provide the finished pallet with a greater strength to withstand the rough handling it is likely to experience in use, it is encapsulated in a shell of High-Impact Polystyrene (HIPS). In other

embodiments of the invention, other shell materials may be used. Other such materials include: Acrylonitrile Butadiene Styrene (ABS), which has a high rigidity, good impact resistance, good UV resistance, and can be applied with a variety of different surface finishes, such as stipple, sand blast and leather grain; Acrylonitrile Styrene Acrylate (ASA) which has high rigidity, good impact resistance and good resistance to weathering.

HIPS, ABS and ASA all belong to the styrene family and have a similar molecular structure which enables them all to be recycled as a single unit, including the shell and the EPS core of the pallet.

Other strengthening features may be provided in addition to the outer shell, and may be added before the outer shell is added to intermediate assembly 300. Leg 200 may be provided with one or more longitudinal slots 230. The slots are provided to receive a relatively stiff longitudinal rib. The intention of the rib is to introduce extra strength to the lower surface of the leg 200 where it contacts the ground or a racking system. In the case of a racking system particularly, the entire weight of the load on the pallet is concentrated at the recessed portions 220 of the legs 200. In the absence of a stiffening rib in slot 230, the pressure exerted on the EPS core of the pallet may result in damage. The stiffening rib better distributes the weight and so protects the EPS core of the pallet.

Another strengthening feature is a stiffening rib which may be inserted into a suitable aperture in a portion 120 of the pallet top 100. Portions 120 are not grooved, and may be provided with an aperture which runs substantially along the entire length of the portion for receiving a stiffening rib.

A stiffening rib may be constructed from any suitable rigid material, but in a preferred embodiment the rib is manufactured from HIPS, ABS or ASA. In this way, the entire pallet is constructed from only styrene family compounds, which facilitates easy recycling when the pallet eventually reaches the end of its lifecycle. In other embodiments, the rib may be constructed from a different plastics material or a metal.

A stiffening rib may be configured to have a cross section suitable for withstanding a force applied thereto. There are many configurations possible and some of the possible cross-sectional profiles include V-shaped, U-shaped, Z-shaped and I-shaped.

5

The coating of the intermediate assembly 300 is essentially a two-stage process. The upper and lower surfaces of the pallet are coated in HIPS individually. Either surface may be coated first.

10 The intermediate assembly 300 is placed into a Vacuum Thermo-forming machine. A sheet of HIPS is positioned above the intermediate assembly 300, where it is softened or partially melted by the introduction of a suitable heat source. In the next stage, the softened HIPS material is vacuum formed to conform with the load bearing upper surface of the pallet.

15

After the HIPS has been applied, any waste material around the periphery of the pallet surface is removed. The partially coated assembly is then turned over in the vacuum forming machine, and the process of applying the HIPS coating is repeated for the underside of the pallet. Again, any excess HIPS material is removed and the
20 final result is a lightweight, durable pallet suitable for a variety of different uses.

The finished pallet weighs of the order of 5kg and is ready for use straight away, with no further treatments or finishing operations required. A particular benefit of pallets according to embodiments of the invention is the savings in transport costs
25 associated with lightweight pallets. As mentioned previously, a full freight load can include approximately 2 Tonnes of pallets, which contributes a substantial amount to the fuel costs of the entire consignment. If lightweight pallets are used instead, the associated fuel costs can be significantly reduced. This provides particular benefits when used in conjunction with consignments sent via air-freight where shipping costs
30 are considerably higher than for other forms of transport.

To address particular needs in more specialised fields of use, it is possible to customise the elements of the pallet so that the final pallet can more readily address the needs of a particular intended use.

In the example shown in Figure 3a, the pallet is intended for general use and is provided with legs 200 which enable the pallet to be picked up using a fork lift truck from opposite sides of the pallet only (known as 2-way entry). The recesses 220
5 provided in the lower surface of the legs are provided to allow the entire pallet plus its load to be rack mounted for convenient storage, with the recesses being arranged to coincide with support elements of the rack storage system.

Figure 3b shows an exploded view of the completed pallet. Clearly visible is the
10 pallet top 100 to which are attached the pallet legs 200. Inserted into the grooves 230 on the legs are stiffening ribs 250 – a total of six stiffening ribs in total.

Also clearly visible are the upper 270 and lower 260 skins of the pallet. In practice, it is not possible to disassemble the pallet as shown in Figure 3b, as the upper and
15 lower skins 260, 270 are firmly connected by action of the vacuum-thermo-forming process.

In other examples, the legs may be provided without the recesses, for example if the
20 pallet is not intended to be rack-mountable.

In another embodiment, the legs can be configured to allow fork-lift access from all sides of the pallet (known as 4-way entry). Such a configuration is shown in Figures 4a-c, where Figure 4a shows an isometric view of the final pallet 400 comprised of a pallet top 410 combined with three legs 240a, 240b and 240c. Figures 4b and 4c
25 show side and end views respectively. Note that this embodiment provides a non-rackable solution. The central interior leg 240b in this particular embodiment is arranged to be wider than the two exterior legs. Other configurations are possible depending on the particular specification of the required pallet.

Figure 4a shows that each side of the pallet 400 is provided with access points for the tines of a fork lift truck, enabling a truck to approach from any direction and lift the pallet off the ground. The final general configuration of pallet 400 may also be
30 arrived at by using differently shaped legs.

The process for manufacturing the pallet 400 of Figure 4a is identical to the process described earlier, with the substitution of alternative legs 240 for legs 200. In effect, any different number of different pallet configurations can be produced through use of different starting elements combined and coated with HIPS as described. A wide
5 variety of differently shaped legs to those presented in the drawings can be utilised.

This flexibility of starting materials allows a manufacturer to use the same vacuum forming machinery to prepare pallets constructed from any combination of different elements. Figures 4d and 4e illustrate a further example of a pallet 450. Figure 4d
10 shows a top perspective view of pallet 450 provided with recesses 470. Figure 4e shows an underneath perspective view of pallet 450 with leg portions 460.

Other specialised functions may be supported through different pallet configurations. One such use is in the brewing business where barrels of beer and/or other
15 beverages require transportation from a brewery to bars and hotels, possibly via intermediate distribution centres.

Prior art pallets cannot generally be used to transport beer kegs or barrels as they are not able to retain the kegs to prevent them from falling from the pallet when it is
20 lifted by a fork lift truck.

Figure 5a shows an embodiment of the invention where the upper surface of the pallet top 500 has been pre-formed to provide a plurality of circular indentations 510. In the particular embodiment shown, there are nine circular recesses, but this
25 number can be varied depending on the respective sizes of the pallet and barrels to be transported.

This particular configuration of upper surface allows individual barrels to sit in a suitable shaped recess, and prevents the barrel from sliding about the pallet.

30 In a further development, Figure 5b shows a composite pallet which is composed of two pallets of the type shown in Figure 5a, whereby the legs of a first pallet 520 are fastened to the legs of the other pallet 530 by means such as a strong adhesive. In this way, a composite pallet is produced which has two load-receiving surfaces, each

of which is provided with a plurality of indentations 510 for receiving barrels. This particular configuration allows a load consisting of a plurality of layers of barrels to be transported in a single load. This is not possible using prior art pallets.

5 Referring to Figure 6, the barrels 600 are positioned in a 3x3 arrangement in the recesses provided on a lower pallet 610. A further pallet 620 is then positioned on top of the barrels 600. Since the composite pallet 620 has barrel-receiving recesses on its upper and lower surfaces, the upper pallet 620 effectively locks the barrels 600 in position, and allows a further layer of barrels 630 to be positioned on the upper
10 surface of the further pallet 620.

To secure the second layer of barrels 630 in position, a third pallet 640 may be placed atop the second layer of barrels 630.

15 In certain uses, wet goods may be placed on a pallet or alternatively, the pallets plus goods may be exposed to precipitation. In either situation, it may be desirable to provide drainage such that water does not accumulate on the pallet around the goods.

20 Figure 7 illustrates a pallet 700 provided with a drainage channel 710 running around the periphery of the pallet surface. The drainage channel comprises a shallow groove adjacent the outer rim of the pallet surface. In use, any liquid which falls on the pallet surface will tend to run into the drainage channel. This process may be further improved by providing the pallet surface with a slight camber such that water
25 runs towards the drainage channel 710.

To provide an escape passage for water or other liquid accumulated in the channel 710, there is provided an outlet point 720 which allows any accumulated liquid to run off and away from the pallet. An outlet 720 may be provided in each side of the pallet
30 to facilitate efficient water removal.

Such a pallet may find uses in the transport of food product such as fresh fish, which is routinely packed in ice. Another use may be transport of plants where frequent

watering may leave a surplus of water which needs removing to prevent waterlogging the plants.

The drainage channel 710 may also be used to secure a sheet to the surface of the pallet. Such a sheet may have certain desirable properties such as being non-stick, insulated or fire proof. The sheet may be rigid or semi-rigid and shaped to lie within the area on the upper pallet surface defined by the drainage channel 710. To secure it in position, the sheet is provided with one or more projections which are shaped to slot into the drainage channel such that the sheet is held securely in place.

Pallet 700 is of a 4-way rackable design, meaning that it can be picked up by a fork-lift truck from any side and deposited on a racking system. The fork-lift access point on the front side of the pallet 700 can have a slightly higher clearance than the fork-lift access point on the left side of the pallet. This is so that once the pallet 700 has been picked up using the front access point, it can be deposited on the racking system and the tines of the fork-lift truck can be easily withdrawn without fouling on the racking system.

Note that each corner of the pallet 700 has a small hook 730 formed in its surface. This hook allows netting or shrink-wrapping to be secured to cover the load during transit.

The construction of such a pallet 700 follows essentially the same steps as described previously. The EPS core of the pallet is provided with a groove for drainage and outlet apertures as needed. The EPS core is coated with HIPS on both sides and the only further step is the manual piercing of the HIPS coat to open the drainage outlets.

Use of this manner of manufacture allows simple changes to the pallet legs to be made to produce either a 2-way rackable design, a 4-way non-rackable design or a 4-way rackable design.

In a further embodiment of the invention, a pallet is provided which enables a load to be more securely stored. Figure 8 shows a perspective view of a pallet 800 which

includes a raised lip 810 which runs around the periphery of the pallet surface. The raised lip prevents goods placed on the pallet from slipping off in normal use.

The method of manufacture of pallet 800 again follows essentially the same steps as have been described already. The EPS core is configured to have a raised peripheral lip, and once the choice of legs has been added and the entire intermediate assembly coated with HIPS, the peripheral lip defines a shallow recess in the upper surface which can prevent boxes and other goods from slipping beyond the edge of the pallet.

In a particular adaptation of the pallet 800 of Figure 8, Figure 9 shows the pallet 800 in use in conjunction with a custom container 910 which is dimensioned to fit snugly within the raised lip 810 of the pallet. The box 910 may be constructed from any suitable material, but in a preferred embodiment is formed from HIPS coated EPS as per the pallet itself. In other embodiments, the box may be formed from wood, metal or a plastics material. The box may be hinged, or alternatively, have a semi-permanent closure requiring glue, nails or similar to be used to close it.

In an adaptation of embodiments of the present invention, surface detail may be provided on the upper load-bearing surface of the pallet top 100 before encapsulation. In a particular embodiment, a series of parallel grooves may be formed either by moulding or by routing after moulding, such that a more non-stick surface may be provided. In an alternative embodiment, a logo or other indicia may be provided in the surface of the pallet top for identification purposes.

The invention may also be said to broadly consist in the parts, elements and features referred to or indicated herein, individually or collectively, in any or all combinations of two or more of the parts, elements or features, and where specific integers are mentioned herein which have known equivalents in the art to which the invention relates, such known equivalents are deemed to be incorporated herein as if individually set forth.

Although the preferred embodiment has been described in detail, it should be understood that various changes, substitutions, and alterations can be made herein

by one of ordinary skill in the art without departing from the scope of the present invention.

What is claimed is:

1. A method of manufacturing a pallet, including the steps of:
 - 5 selecting a first pallet element from a plurality of first pallet elements substantially composed of a first material and arranged to receive a load;
selecting one or more second pallet elements from a plurality of second pallet elements, substantially composed of the first material, arranged to support said first pallet element, wherein said one or more selected second pallet elements are
10 arranged to couple with said selected first pallet element to form an intermediate pallet assembly; and,
encasing said intermediate pallet assembly in a second material, wherein said second material is more rigid than said first material.
- 15 2. The method as claimed in claim 1, wherein said coupling of said first and second elements is achieved through use of complimentary interlocking parts on said first and second elements.
3. The method as claimed in claim 2, wherein the interlocking parts include a
20 plurality of projections and corresponding recesses for receiving said projections.
4. The method as claimed in any one of the preceding claims, wherein said second element is provided with a longitudinal slot for receiving a stiffening rib.
- 25 5. The method as claimed in claim 4, wherein a stiffening rib is inserted into said longitudinal slot before the step of encasing said intermediate assembly.
6. The method as claimed in any one of the preceding claims, wherein said step of encasing includes the step of encasing an upper surface of the intermediate pallet
30 assembly and the step of encasing a lower surface of the intermediate pallet assembly.
7. A pallet including:
a first load receiving pallet element;

at least one second pallet element adapted to couple to and support said first pallet element; and,

wherein the first and second pallet elements provide an intermediate pallet assembly substantially formed from a first material, and the intermediate pallet assembly is encapsulated within a second material more rigid than the first material.

8. The pallet as claimed in claim 7, wherein said first or second pallet element includes a stiffening rib for providing additional strength to the pallet.

9. The pallet as claimed in claim 8, wherein said stiffening rib is primarily formed from said second material.

10. The pallet as claimed in any one of claims 7 to 9, wherein said first material is Expanded Polystyrene (EPS).

11. The pallet as claimed in any one of claims 7 to 10, wherein said second material is selected from the group of: High Impact Polystyrene (HIPS); Acrylonitrile Butadiene Styrene (ABS); and Acrylonitrile Styrene Acrylate.

12. The pallet as claimed in any one of claims 7 to 11, wherein the first pallet element is provided with a drainage channel running substantially adjacent the perimeter of the upper surface of said first pallet element.

13. The pallet as claimed in claim 12, wherein the drainage channel includes one or more outlets for allowing liquid to run out of the channel and away from the pallet.

14. The pallet as claimed in either claim 12 or 13, wherein an upper surface of the first pallet element is provided with a camber to encourage any liquid on the surface of the pallet to run towards the drainage channel.

15. The pallet as claimed in any one of claims 7 to 11, wherein the first pallet element is provided with an upwardly projecting lip running around the periphery of the upper surface of the first pallet element.

16. The pallet as claimed in any one of claims 7 to 11, wherein an upper surface of the first pallet element is provided with a plurality of recesses, for securing and at least partially restraining a particular item placed on the pallet.

5 17. The pallet as claimed in claim 16, provided as two pallets fastened together to form a composite pallet such that the two major surfaces of the composite pallet each includes a plurality of recesses.

10 18. The pallet as claimed in either claim 16 or 17, wherein the recesses are adapted to hold barrels.

19. The pallet as claimed in claim 15, wherein the upper surface of the first pallet element is adapted to hold a box or container.

15 20. The pallet as claimed in any one of claims 7 to 19, wherein the upper load-bearing surface of the first pallet element is provided with surface features to reduce slipping of goods.

20 21. The pallet as claimed in any one of claims 7 to 20, wherein the pallet is a 2-way or 4-way, rackable or non-rackable, pallet.

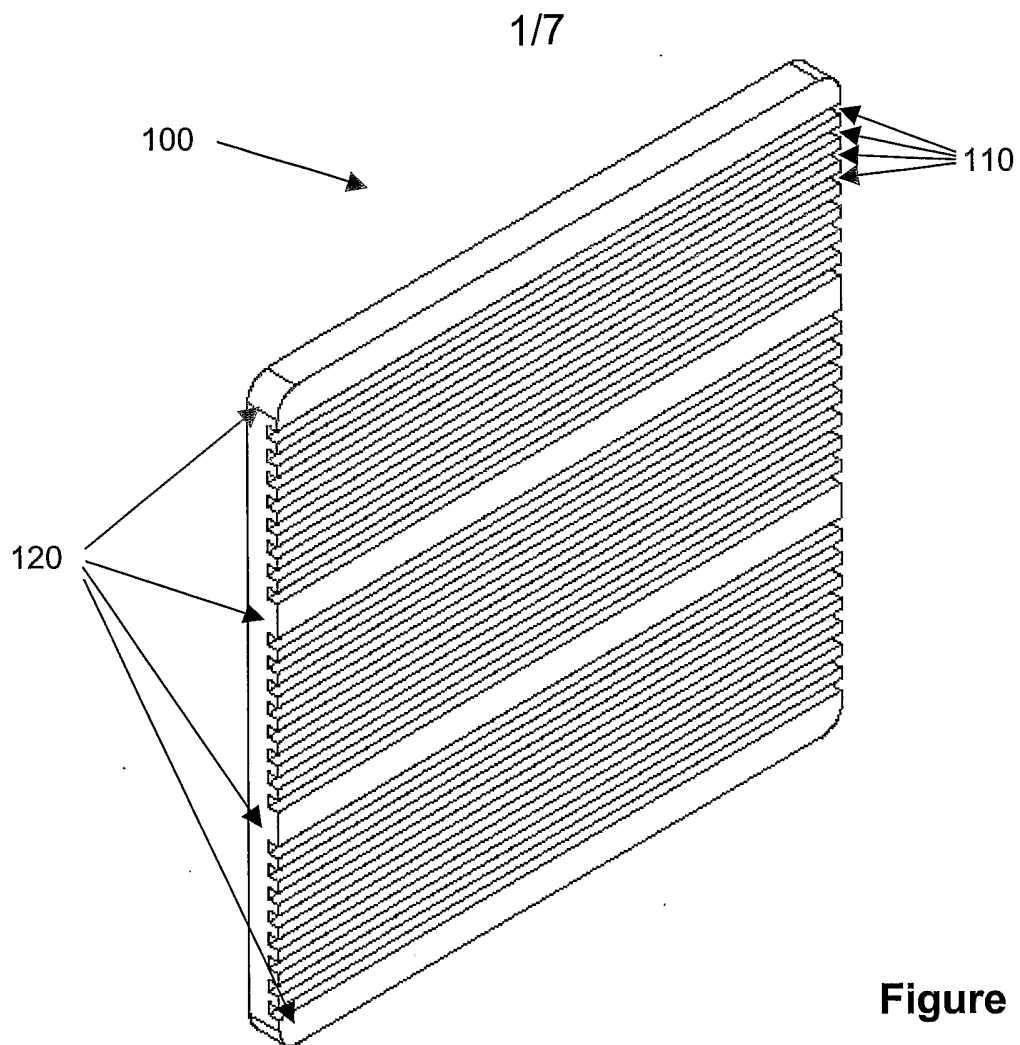


Figure 1

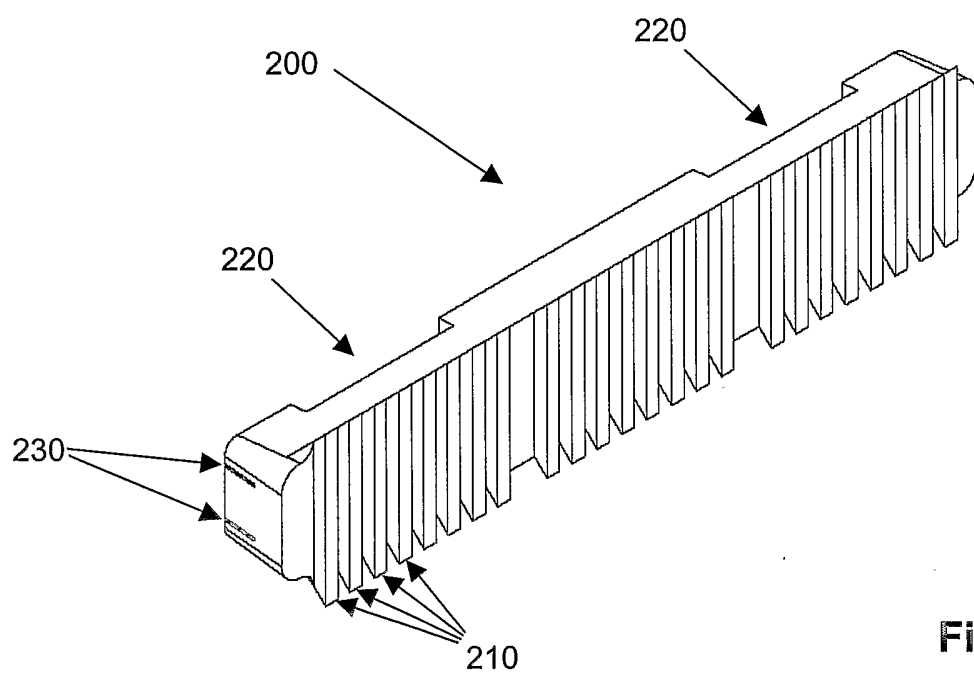


Figure 2

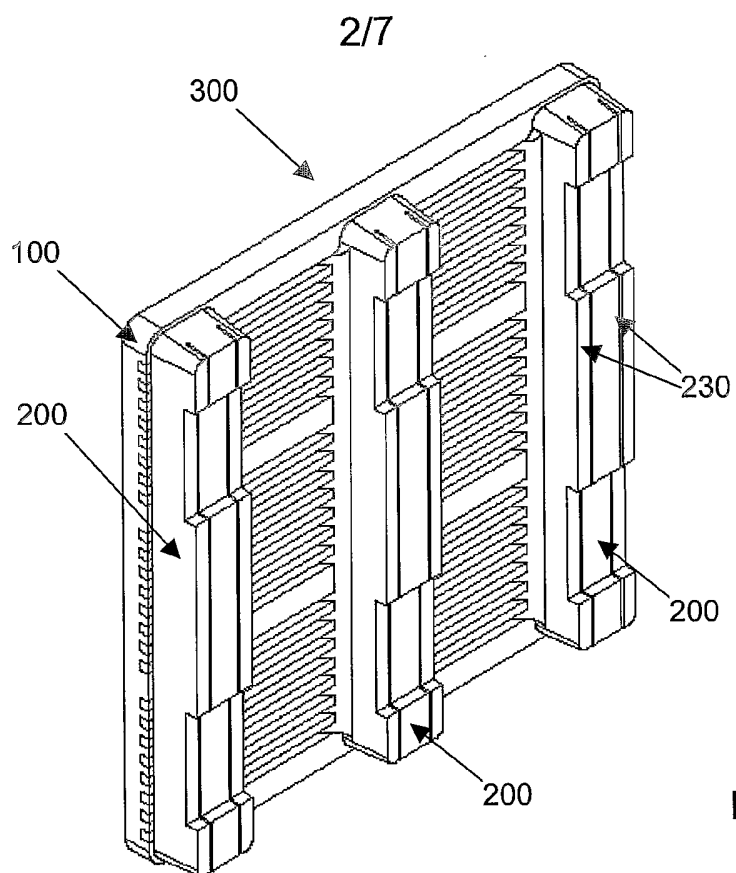


Figure 3a

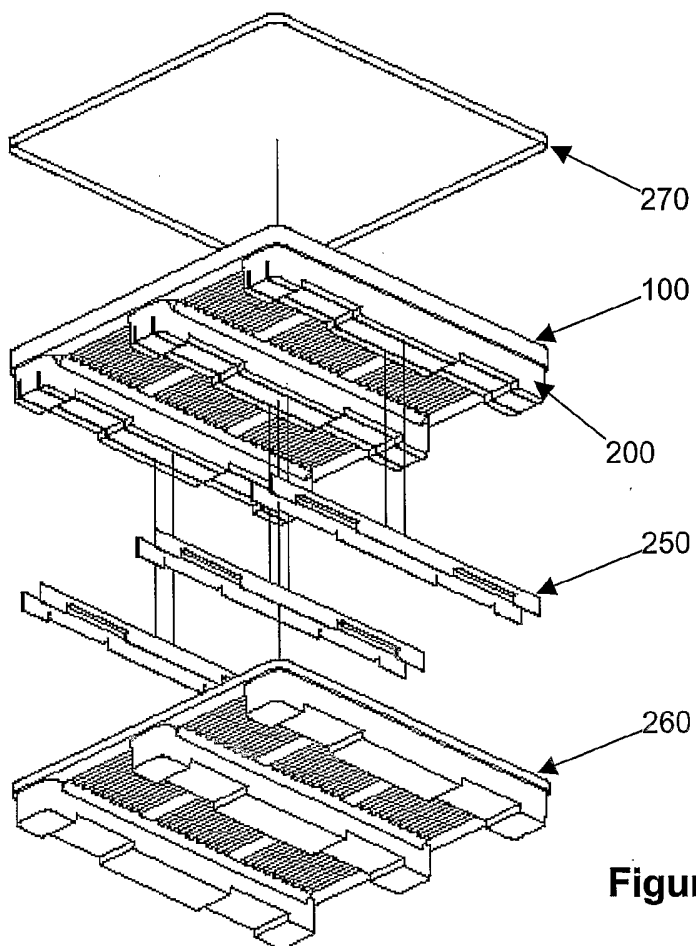


Figure 3b

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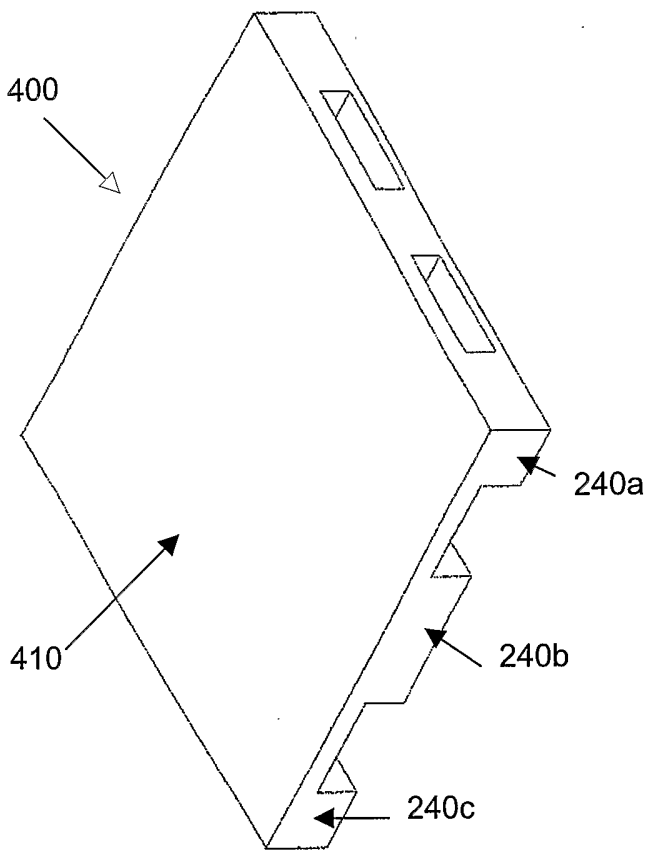


Figure 4a

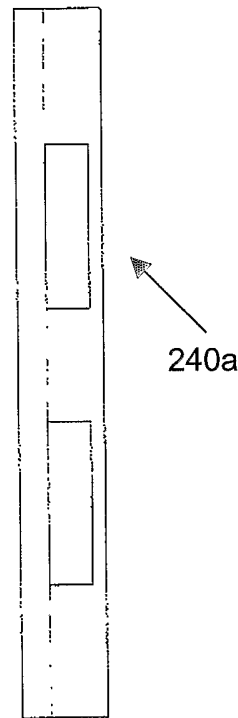


Figure 4b

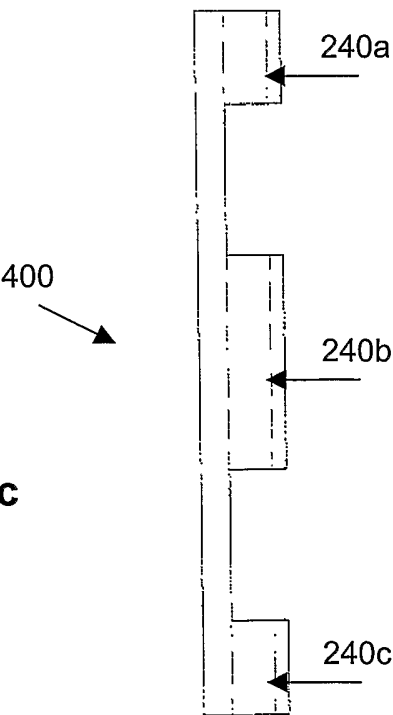
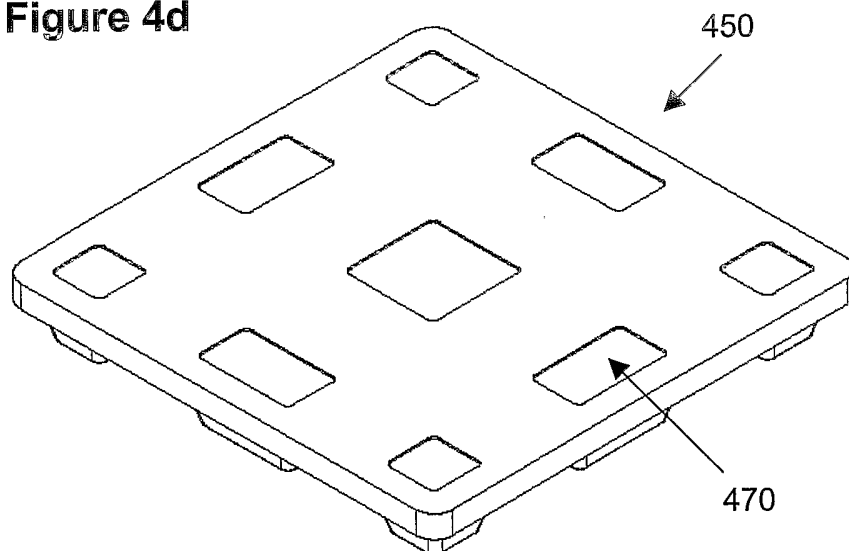
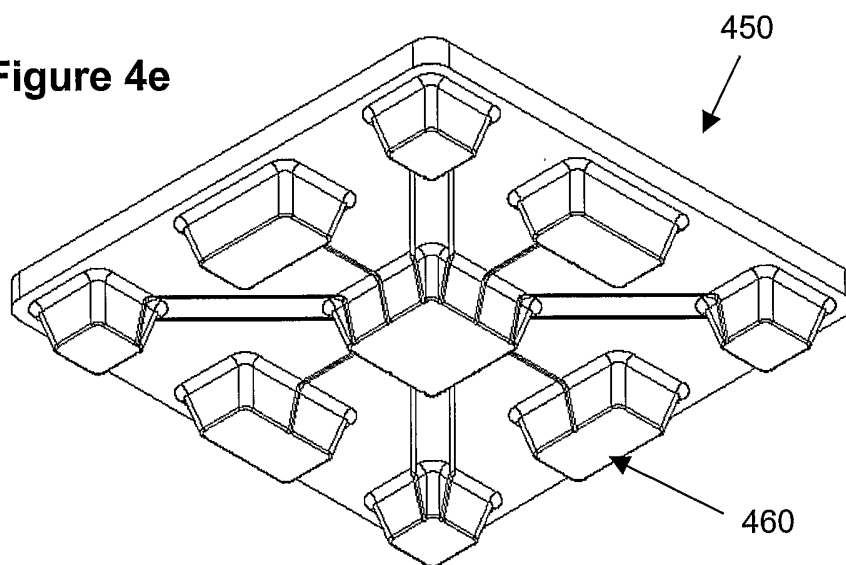


Figure 4c

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Figure 4d**Figure 4e**

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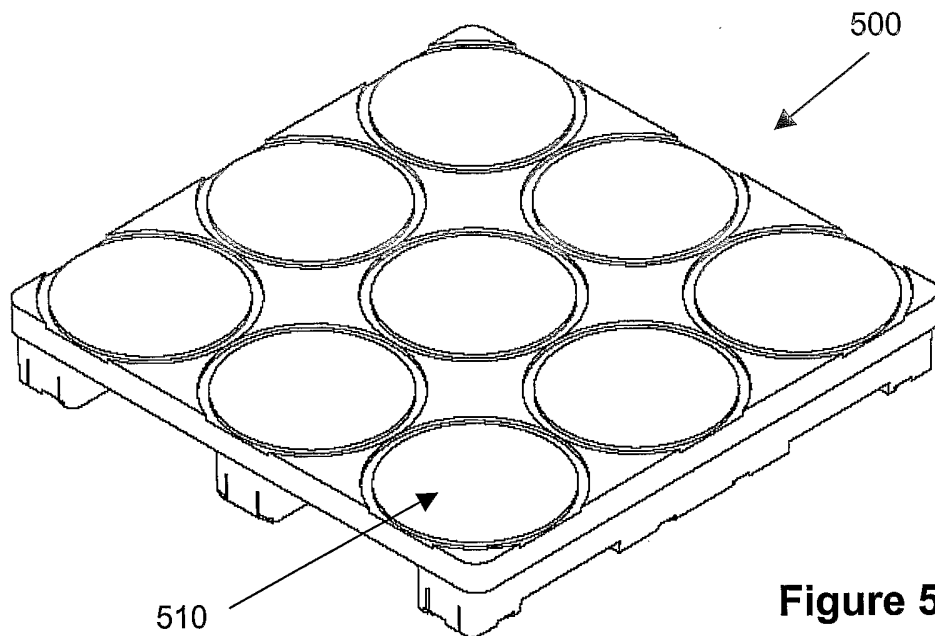


Figure 5a

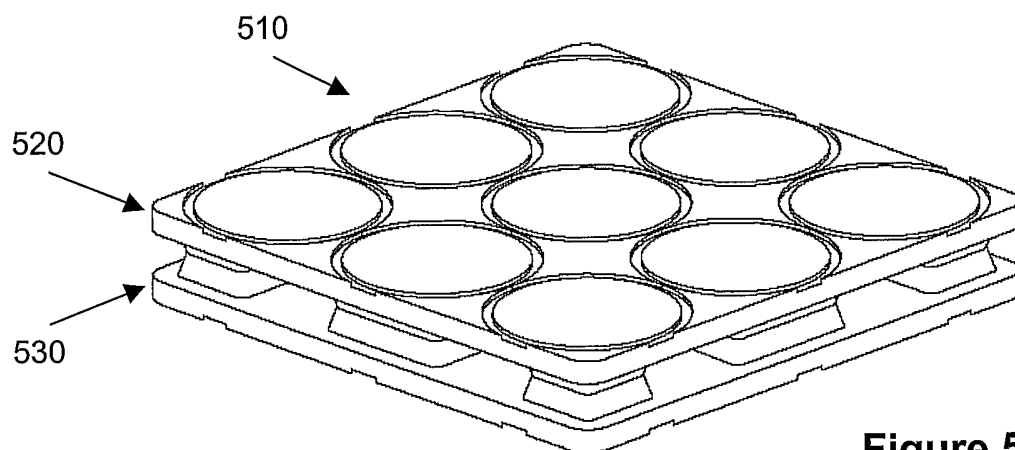


Figure 5b

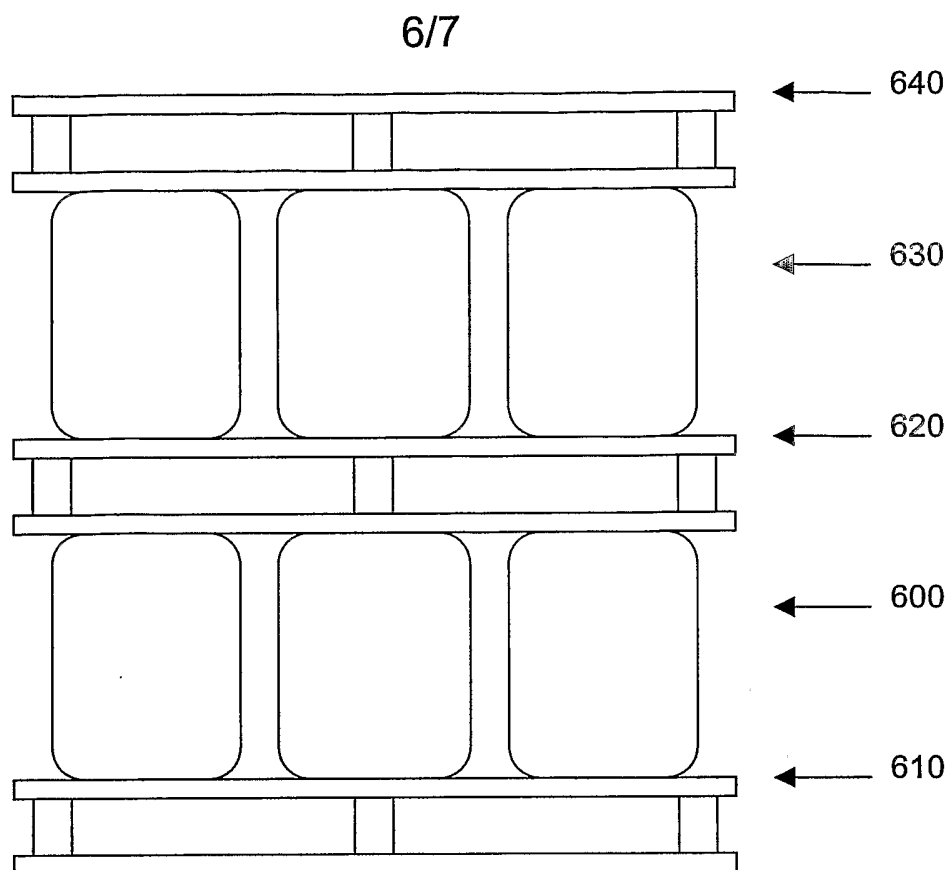


Figure 6

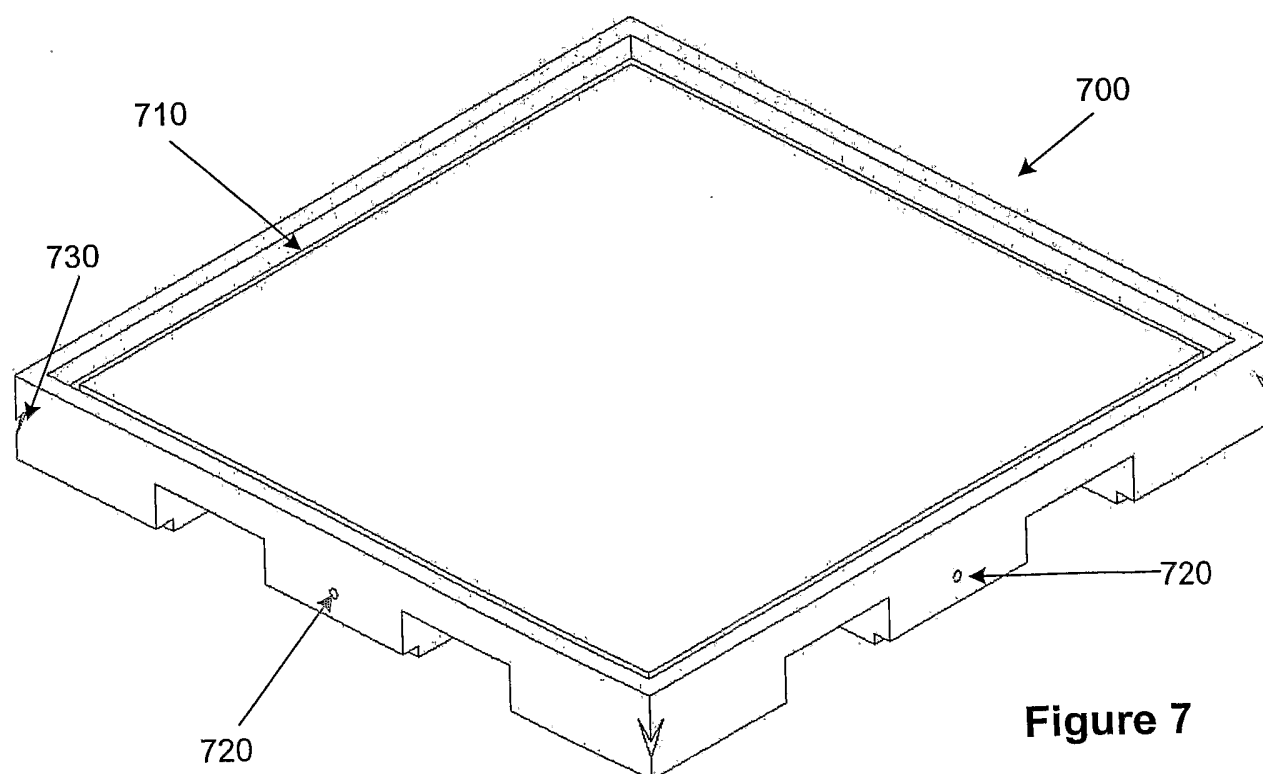
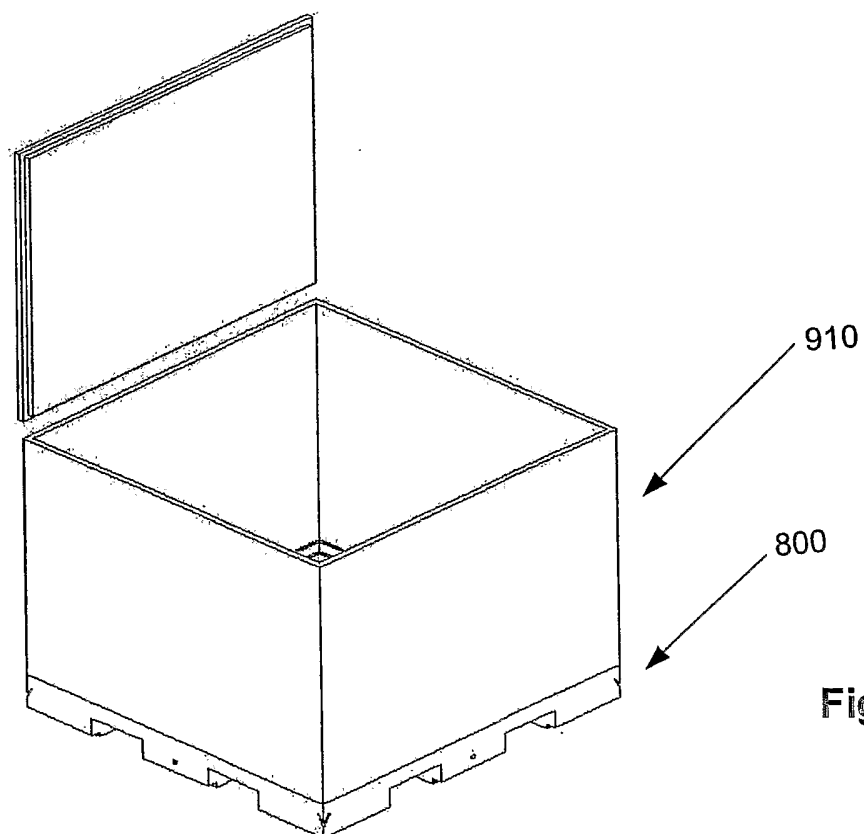
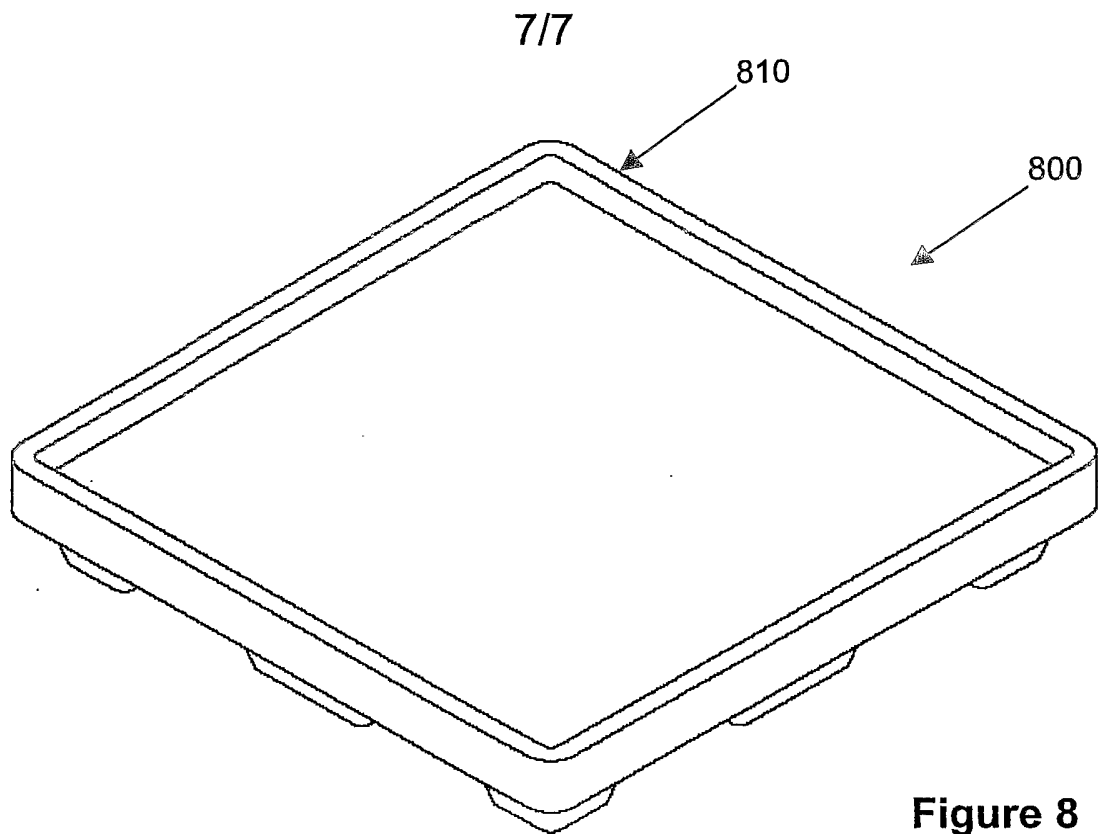


Figure 7



INTERNATIONAL SEARCH REPORT

International application No.

PCT/AU2004/000527

A. CLASSIFICATION OF SUBJECT MATTER

Int. Cl. ⁷: B65D 19/32, 19/38, 19/18

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
DWPI IPC B65D 19/-, B32B 23/-, 31/-, 33/-, & keywords: PALLET, SUPPORT, FEET, ENCASE, ENCAPSULATE, COATING, LIGHTWEIGHT, COUPLE, JOIN, PROTECT, FIRM, STIFF, STYRENE, FOAM, DRAIN, OUTLET and similar terms.

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
P, X	AU 2003100046 A4 (BEADLE et al.) 17 July 2003 See whole document	1-21
X	WO 1998/057860 A1 (BACK) 23 December 1998 See whole document	1-21
Y	See whole document	11
X	WO 1992/012061 A1 (WHEELLOCK) 23 July 1992 See whole document	1-21
Y	See whole document	11

☒ Further documents are listed in the continuation of Box C

☒ See patent family annex

* "A"	Special categories of cited documents: document defining the general state of the art which is not considered to be of particular relevance	"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
"E"	earlier application or patent but published on or after the international filing date	"X"	document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"L"	document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"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
"O"	document referring to an oral disclosure, use, exhibition or other means	"&"	document member of the same patent family
"P"	document published prior to the international filing date but later than the priority date claimed		

Date of the actual completion of the international search
2 July 2004

Date of mailing of the international search report

14 JUL 2004

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INTERNATIONAL SEARCH REPORT

International application No.

PCT/AU2004/000527

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
	GB 1335688 A (OWENS-ILLINOIS INC.) 31 October 1973	
X	See whole document	1-21
Y	See whole document	11
	WO 1996/019386 A1 (HANSEN et al.) 27 June 1996	
X	See whole document	1-21
Y	See whole document	11
	US 5687652 A (RUMA) 18 November 1997	
X	See whole document	1-21
Y	See whole document	11
	WO 2000/015507 A2 (INNOVATIVE COATINGS CORPORATION) 23 March 2000	
X	See whole document	1-21
Y	See whole document	11
	WO 1999/062779 A1 (GENERAL ELECTRIC PALLET) 9 December 1999	
Y	See whole document - High impact polystyrene	11

INTERNATIONAL SEARCH REPORT

International application No.
PCT/AU2004/000527

This Annex lists the known "A" publication level patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent Document Cited in Search Report		Patent Family Member			
AU	2003100046	NONE			
WO	1998/057860	AU	80496/98	SE	9702324
WO	1992/012061	AU	49918/93	AU	91686/91
		CA	2099114	CA	2139126
		EP	0564585	EP	0647196
		US	5230291	US	5269219
GB	1335688	BR	9107190	BR	9107190
		CN	1084132	CN	1084132
		NO	932331	NO	932331
		WO	9400355	WO	9400355
		DE	2048219	DE	2048219
		FR	2064441	FR	2064441
WO	1996/019386	CA	940065	CA	940065
		ZA	7006577	ZA	7006577
WO	1996/019386	AU	42982/96	AU	42982/96
US	5687652	NONE			
WO	2000/015507	AU	61558/99	US	2002088379
WO	1999/062779	EP	1087892	EP	1087892
Due to data integration issues this family listing may not include 10 digit Australian applications filed since May 2001.					
END OF ANNEX					