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(54) **PLASTIC PALLET WITH REINFORCEMENTS FOR REDUCING BENDING**

(57) The invention relates to a plastic pallet comprising reinforcements, such as inserts, which is moulded from a thermoplastic material and has a high resistance to bending caused by the load when these pallets are being moved using conveying and handling mechanisms, such as when the pallet is subjected to racking load. The plastic pallet with reinforcements of the invention is reinforced with inserts which are positioned strategically on the cover of the pallet in order to increase the stiffness of the general structure of the pallet and which are completely embedded in the plastic foam material that is injected into the columns of the plastic pallet, thereby preventing the inserts from moving or being removed. In addition, the plastic pallet with reinforcements is lighter compared to conventional pallets, including other reinforced pallets, and offers improved structural support characteristics. At the end of its useful life the pallet of the invention can be fully recycled, thereby reducing the environmental impact caused by the disposal of these types of plastic pallets.

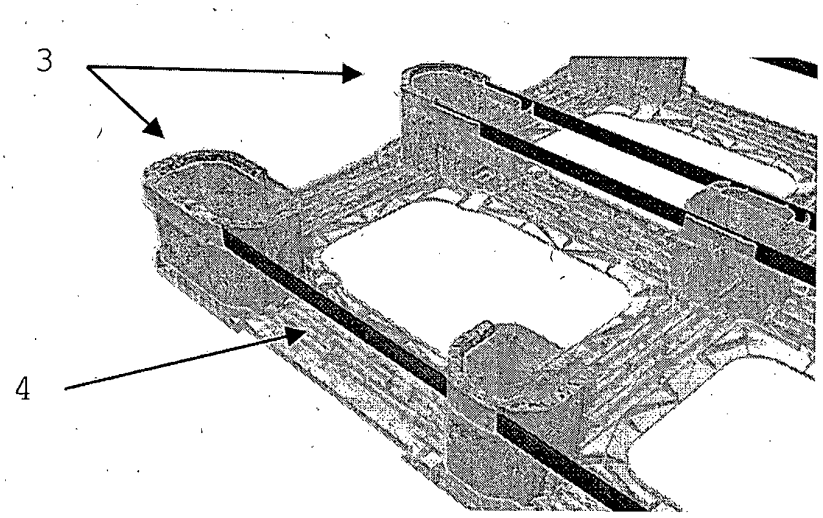

FIGURE **3**

EP 2 987 740 A1

Description

Field of the invention

[0001] The present invention is related to the field of plastic racks used for transporting and loading merchandise and/or products. Specially, the invention is related to racks also known as pallets, having reinforcements within their structure, such as inserts, which provide a larger resistance to flection, which originates by applying the load of the products to be transported.

Background of the invention

[0002] At the time, there are within the industry several ways to transport and load merchandise and/or products, which are generally piled onto plastic pallets to be moved by lifts. In this regard, the structure of the plastic pallet is bent while being lift with the probes of said lifts in the ends farther to the probes, and furthermore when the plastic pallet is stored in a system of several levels or racks, such pallet is likewise bent on its central part. Thereby, the damage to the plastic pellets are very frequent and most of them result in the disposal thereof and with this, the replacement rate of such pallets is generally high, which affects in some form the operation cost of the industries. This without counting the damage caused to the stored load.

[0003] In this regard, several attempts have been carried out in order to provide plastic pallets more resistant to bending by designing a suitable structure that invariably increases the weight of the pallet and in consequence the cost; or including several kinds of reinforcements to the structure of the plastic pallet, although the strength and the weight thereof, will depend on the material of such reinforcements.

[0004] The reinforcements are normally arranged between the base and the cover of the structure of the plastic pallet, thus the extraction of such elements is not limited unless the manufacturing process of the plastic pallet comprises a method to prevent this to happen, which in most of the times is expensive and/or hard to accomplish, since it is neither desirable that the general weight of the pallet increases excessively.

[0005] This problem subsists in the industry and there is the need of a reinforced plastic pallet that, due to its structure, provides a great resistance to bending, achieving thereby that the plastic pallet can be lifted by the lift or that is under racking load without excessive bending and furtherly, that the reinforcements within the structure of the plastic pallet are integrated to it in such way that it results practically impossible to extract them, keeping a reasonably low weight and increasing its mechanical features.

[0006] At the moment, there is no plastic pallet capable to provide a structural resistance to bending large enough to prevent bending while being lifted by the lift or while under racking load.

[0007] In order to solve the aforementioned problems, several attempts have been made to provide plastic pallets with further resistance to bending, thus there are documents related to this kind of reinforced plastic pallets, per example, the US Patent No. 5, 868, 080 to Wyler, discloses the assembly and building method of a plastic pallet with bars that can have the top and bottom surface exposed. In this pallet, which also works as a reinforcement element, the exposed surfaces of the bars comprise an anti-sliding surface to maintain the position of the load in the pallet and facilitate the transport of the load tray, per example, through an elevator or an automatized transport system. Preferably such bars comprise structural members comprised by plastic reinforced with fiberglass fabricated by a pultrusion method. The invention disclosed in the Wyler document, has the disadvantage that the bars to reinforce the plastic pallet are dismountable, allowing the extraction thereof in any moment, and thus very susceptible to steal to recover the plastic material.

[0008] On the other hand, the US Patent No. 7, 841, 281 to Valentinsson, discloses a pallet for transporting merchandise and/or products comprising several pieces united amongst them, (the load surface, the reinforcement section, the central section for the mounting and the floor frame). The load section comprises a load surface and a reinforcement section, the latter being arranged under the load surface and conformed by steel profiles of the rectangular section. The invention disclosed in the Valentinson document, has the disadvantage that the plastic pallet comprises several pieces united between them and that the material of the reinforcements provides larger resistance to the pallet, but also making it much heavier.

[0009] Likewise, US Patent No. 6, 807, 911 to Carson, discloses a single piece continuous hollow pallet having structural components under the surface, providing support and bearing when a load is arranged over the pallet or when a side thereof is impacted by some object. The structural components included are inner holes, lateral impact reducers and dismountable steel inserts between the cover and the bottom part of the wall. The manufacture process of the pallet is through rotomoulding. The invention disclosed in the Carson document has the disadvantage that the metallic inserts of the pallet are dismountable and that the material of such inserts makes the pallet heavier.

[0010] On the other hand, the US Patent No. 6, 935, 249 to Moore, discloses the structure of a pallet comprising: a reinforcement structure, a base to the floor ant a reinforcement disposed in mechanical communication with both of the mentioned parts. The reinforcement structure comprises "I" or "Z" shaped profiles arranged under the cover sustained

by a frame, the material thereof can be any ferrous material such as steel, stainless steel, aluminum, titanium, etc. the invention disclosed in the Moore document has the disadvantage that the resistance and the weight of the plastic pallet depends completely on the material being used. Likewise, the cut of the inserts for the reinforcement structure reduces their strength since it has to use other techniques to limit the movement and maintain the profiles joined.

[0011] Likewise, the US Patent No. 4, 735, 154 to Hemery, discloses a reinforced load pallet and the process to reinforce it. Such pallet is comprised by two elements, base and cover, which are coupled; such elements contain five canals partially positioned in the columns, where the reinforcements are arranged consisting in rectangular cross section bars which provide larger resistance to the structure. The invention disclosed in the Hemery document has the disadvantage that the number of reinforcements within the plastic pallet provides a larger resistance to the structure thereof, but at the same time, it makes the pallet much heavier.

[0012] In consequence, there is a need to increase the resistance to bending of the plastic pallet, either to the transport of merchandise and/or products or when the plastic pallet is under racking load, without affecting in a significant manner the weight thereof and without allowing the reinforcements to be retired easily to recover the plastic material in the pallet theft.

Summary of the invention

[0013] The main object of the present invention is to provide a plastic pallet with reinforcements with a great resistance to bending caused by the placing of mechanisms used for transport and storage thereof, such as those caused by racking load.

[0014] Another object of the present invention is to provide a plastic pallet with reinforcements such as inserts, which support a larger load compared with the conventional pallets without substantially incrementing the total weight.

[0015] Yet another object of the present invention is to provide a pallet with reinforcements such as inserts, strategically placed in the cover of the pallet to provide a larger rigidity and that the support is optimal.

[0016] A further object of the present invention is to provide a pallet with reinforcements such as not dismountable inserts to avoid the material extraction and facilitate the recovery of materials in the pallet theft.

[0017] Another object of the present invention is to provide a plastic pallet reinforced with reinforcements such as inserts, having a lighter weight compared with the conventional plastic pallets with reinforcements.

[0018] It is a further object of the present invention to provide a plastic pallet with reinforcements, having a low cost compared with the conventional pallets and providing better features regarding structural support.

[0019] A further object of the present invention is to provide a plastic pallet with reinforcements, that is 100% recyclable regarding the materials used for its manufacture, but not in a simple manner to avoid theft.

Brief description of the figures of the invention

[0020]

Figure 1 shows a cut perspective view of the plastic pallet with reinforcements according to the present invention.

Figure 2A shows an upper view of the complete plastic pallet with reinforcements according to the present invention, wherein the embodiment using four reinforcements is represented. }

Figure 2B shows an upper view of the plastic pallet with reinforcements without the cover according to the present invention, representing the embodiment of the invention using four reinforcements.

Figure 3 shows a detailed view of the preferred location of the inserts, preferably metallic in the columns of the plastic pallet with reinforcements according to the present invention, in the embodiment of the invention using four reinforcements.

Figure 4A shows a detailed view of the pallet with the metallic aluminum inserts according to the present invention, after the high impact tests.

Figure 4B shows a detailed view of the plastic pallet with the thermosetting plastic resin inserts from a pultrusion process according to the instant invention after the high impact tests.

Detailed Description of the Invention

[0021] The present invention relates to a plastic pallet with reinforcements to reduce the bending during the transport

and load of merchandise and/or products, molded with a thermoplastic material; which has a great resistance to bending caused by load when it is moved with the mechanisms for transporting and manipulation thereof, such as those caused when it is under racking load. Likewise, the plastic pallet with reinforcements according to the present invention provides a low expense and weight compared with the conventional pallets and provides better features regarding structural support.

[0022] According to the present invention, the plastic pallet with reinforcements, as shown in Figure 1, comprises a base (1) and a cover or top (2) with rectangular form, which when joined provides hollow spaces in the columns (3) which will be filled later with an injection of thermoplastic foamed material. In figure 2A, an upper view of the plastic pallet is shown, i.e. the base (1) and the cover (2) joined with reinforcements according to a preferred embodiment of the present invention using 4 reinforcements. Figure 2B is shown in an upper view of the plastic pallet with reinforcements wherein the base (1) is shown without the cover or top (2) according to an embodiment of the present invention using four reinforcements, so as to clearly show the arrangement of the inserts (4) in the inner structure of the pallet.

[0023] Thereby, several configurations to place the inserts in the plastic pallet with reinforcements can exist, forming an inner structure in the pallet as a screed, but always being lied on the holes that will be later injected with thermoplastic foam; this with the object that the thermoplastic foam serves as support to the inserts and to anchor thereof.

[0024] As an example, one of these configurations is to use four inserts strategically placed in the cover of the pallet, as shown in Figure 3, one in each end of the long side, of the base (1) and the cover or top (2) assembled; two more at the center, also in the long side, placed longitudinally to the cover and in parallel to the wall of the hollow columns (3). This preferred configuration of the inserts in the plastic pallet with reinforcements according to the present invention is shown in Figures 2A and 2B.

[0025] Another embodiment of the plastic pallet with reinforcements according to the present invention has a configuration of the inserts from six inserts, wherein one is placed in each end of the longest side of the cover (2) and two at the center thereof, longitudinally placed and in parallel to the wall of the hollow columns (3), equal to the previous example and two further inserts on each end of the shortest side of the base and cover assembled. For both cases, the hollow columns (3) of the cover (2) are designed to contain such inserts (4).

[0026] In this regard, the material of the inserts (4) can be any metal such as steel, stainless steel, aluminum, titanium, etc. or can be manufactured in thermosetting through a pultrusion process or any other plastic material either thermosetting or thermoplastic.

[0027] Such inserts (4), have the object to provide larger rigidity to the structure of the plastic pallet avoiding that this is bent, as in the case of the conventional pallets, when several mechanisms are used to transport them and manipulate them, and when they are under racking load.

[0028] Said hollow columns (3), with the inserts already placed within them will be filled with the injection of a foamed thermoplastic material, accomplishing the setting of the inserts on its position and allowing an optimal performance, in such way that the extraction of the inserts results practically impossible, keeping a low weight and incrementing its mechanical features.

[0029] On the other hand, the plastic pallet with reinforcements according to the present invention obtains a longer useful life compared with the conventional pallets, since the continuous impacts do not move the inserts off its place and at the end of its useful life, the components of the pallet can be easily recycled and at 100%, only by the trituration of the pallet of the injected thermoplastic material and of the inlaid inserts and lately separate by density the materials forming the pallet.

[0030] Likewise, the plastic pallet with reinforcements according to the present invention has a better sustainability, due to the use of larger percentages of recycling, reducing thereby the ecologic impact of disposing such pallets.

[0031] Likewise, the plastic pallet according to the present invention provides the advantage of providing that the extraction of the inserts which provide the structural reinforcement to said pallet is almost impossible, due to the complete integration between the insert and the foamed thermoplastic material or sinking said insert in the foamed thermoplastic material, carried out in the inner structure of the pallet, making the separation of these two elements practically unachievable, which also helps preventing the theft of the inserts, which is the common problem when valuable metallic elements are used to reinforce structures without knowing the technology disclosed by the present invention, i.e. the way it is done conventionally.

[0032] With the intention of showing the advantages presented by the plastic pallet with reinforcements according to the present invention, in comparison with the conventional pallets and even in comparison with other pallets that have been also reinforced and in order to show the punctual evidence giving support to the differences between the invention currently claimed as unique and non-obvious, three pallets were analyzed: the plastic pallet with reinforcements such as metallic inserts of aluminum with a preferred embodiment according to the present invention (T1), a plastic pallet with inserts of thermosetting resin from a pultrusion process (T2) and a conventional plastic pallet without reinforcements serving as a witness (T3).

[0033] The three pallets were submitted to a load of 7 stows, with 8 boxes each, resulting on a total weight of 1,270 kilograms, which produces a bending exertion.

[0034] This total weight is applied to the whole surface of the pallet, but the measurements were carried out in the points that they are needed on its structural features due to be strategic load points, such points are: 1) the large side of the pallet, having a length from one end to the other (from point L1 to point L2); 2) the short side of the pallet, having a length from end to end of 40" (from the point L1' to the point L2') and; c) the center of the pallet (C). It is to be mentioned that the pallet without reinforcements serving as a witness (T3) was molded in polypropylene, since if it was molded from high density polyethylene, the bending would have been excessive over it, resulting in an unproportioned comparison. Likewise, it is to be noted that the pallets with reinforcements (T1 and T2) were molded with high density polyethylene (PEHD), which is a more flexible material and therefore, with better impact features. Likewise, the base and the top of the pallets were cold at the moment of the foaming and thus they were already contracted.

[0035] The data reported of deformation due to bending were taken 24 hours after applying the load. Thus, the following results were obtained:

T1 - Pallet of PEHD with aluminum reinforcements			
Total load 1,270 kg (2800 lb)	Measurement in the point L1 or L1', respectively	Measurement in point C	Measurement in point L2 or L2', respectively
Long side bending 48"	10 mm	14 mm	10 mm
Short side bending 40"	9 mm	12 mm	8 mm

T2 - Pallet of PEHD reinforced with pultruded inserts			
Total load 1,270 kg (2800 lb)	Measurement in the point L1 or L1', respectively	Measurement in point C	Measurement in point L2 or L2', respectively
Long side bending 48"	13 mm	18 mm	14 mm
Short side bending 40"	11 mm	15 mm	10 mm

T3 - PP Conventional Pallet			
Total load 1,270 kg (2800 lb)	Measurement in the point L1 or L1', respectively	Measurement in point C	Measurement in point L2 or L2', respectively
Long side bending 48"	18 mm	24 mm	19 mm
Short side bending 40"	16 mm	22 mm	15 mm

[0036] Likewise, in order to prove that the weight of the pallet with reinforcements of aluminum according to the present invention, besides providing a better resistance to bending does not substantially increase its weight in comparison with the other pallets, the following measurements were made to support the benefits provided to the invention.

	Conventional pallet without reinforcements	Pallet with aluminum reinforcements	Pallet with pultrusion reinforcements
Weight	Kg	Kg	Kg
Base	9.17	9.17	9.17
Cover	9.75	9.75	9.75
Foam	2.68	2.604	2.604
Long reinforcements	-	1.181	0.949
Short reinforcements	-	0.567	0.409

(continued)

	Conventional pallet without reinforcements	Pallet with aluminum reinforcements	Pallet with pultrusion reinforcements
Total	21.6	23.27	22.88

[0037] Figure 4A shows the plastic pallet with aluminum metallic inserts according to the present invention, after the high impact tests, while Figure 4B shows a detailed view of the plastic pallet with the plastic thermoset resin inserts from a pultrusion process according to the present invention after the high impact essays.

[0038] With these results it is concluded that when a plastic pallet with traditional size of 40" by 48" without reinforcements is used, it has to be manufactured with a rigid material such as polypropylene (PP), in such way that when the load is applied, the pallet is not bent excessively. On the other hand, if the load is high (beyond 1000 kg), there is always a risk of failure due to bending on room temperature above 30°C.

[0039] On the other hand, polypropylene does not have a good resistance to impact, furthermore at low temperatures. Therefore, in cold chambers (as in the case of meat), the polypropylene pallets are excessively breakable.

[0040] High Density Polyethylene (PEHD), besides being cheaper than PP, has the best resistance to impact, however, it bends further to load. Therefore, molding a pallet in PEHD and providing it resistance to bending through inserts is a known and valid form; however, doing so without incrementing in an important manner the weight of the pallet is a challenge.

[0041] In this regard, the reinforced pallets according to the present invention show an excellent result to bending with a high load of 1,270 Kg or 2,800 pounds and with an increase in weight of only around 1.5 Kg in comparison with the other pallets that are less resistant, wherein an evaluation of production cost and weight against resistance and durability, the pallet according to the present application obtains results much better than those of any other existing pallet.

[0042] After the invention has been described, the content of the following claims is pursued as property:

Claims

1. A plastic pallet with reinforcements, **characterized in that** it comprises a base and a cover, both with rectangular form, that when united, form hollow spaces in the columns of said pallet, which are injected with foamed thermoplastic material; and wherein the reinforcements are inserts that are arranged in said hollow spaces that are formed in the pallet columns, so as to embed them in the foam formed by the thermoplastic material, which is injected once it is cooled and that are strategically arranged longitudinally on the cover or top part of the pallet and in parallel form to the wall of the columns, in order to considerably increase the mechanical properties of the pallet, particularly the resistance to bending, which is produced due to racking load under which said pallets are submitted during stowage and merchandise transport.

2. The plastic pallet with reinforcements according to claim 1, **characterized in that** said reinforcements are inserts whose material of manufacture can be any metal such as steel, stainless steel, aluminum, titanium or can be manufactured of thermoset plastic resin from pultursion method or any other plastic material either thermosetting or thermoplastic.

3. The plastic pallet with reinforcements according to claim 1, **characterized in that** the reinforcements are integrated in the structure of the pallet in such way that this integration prevents movement during the use of the pallets and likewise prevents them to be easily retired from the body of the pallet.

4. The plastic pallet with reinforcements according to claim 1, **characterized in that** the total weight of the pallet is not increased counterproductively even taking into account the weight of the structurally inlay inserts as well as the weight of the injected foamed thermoplastic material.

5. The plastic pallet with reinforcements according to claim 1, **characterized in that** the structurally inlay inserts increase its useful life considerably due to the increase of its mechanical properties that the synergy produced of the strategic conjunction of said inserts completely sank on the foamed thermoplastic material, provides to the structure of the pallet.

6. The plastic pallet with reinforcements according to claim 1, **characterized in that** it is possible to recycle it 100%

through trituration of the pallet of injected thermoplastic material and of the embedded inserts, and lately separating by densities all the materials conforming the pallet.

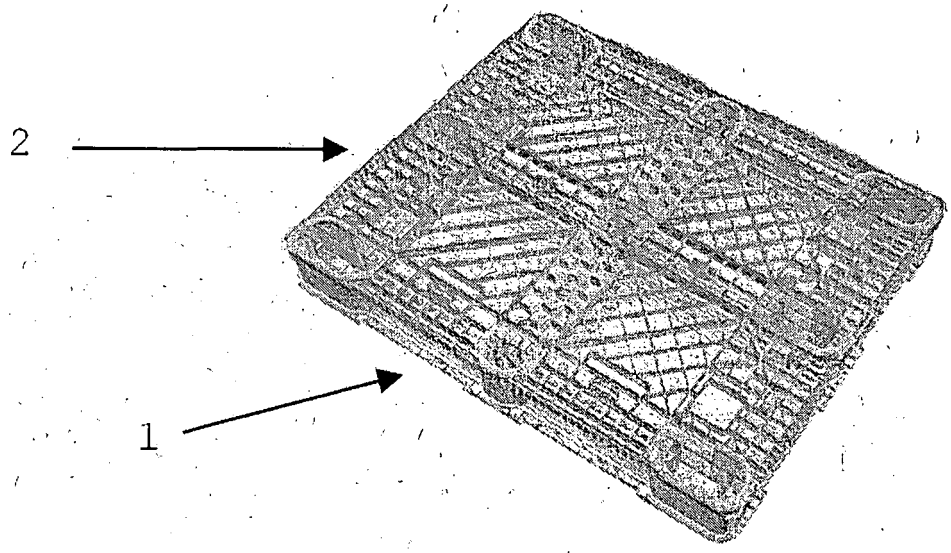

FIGURE **1**

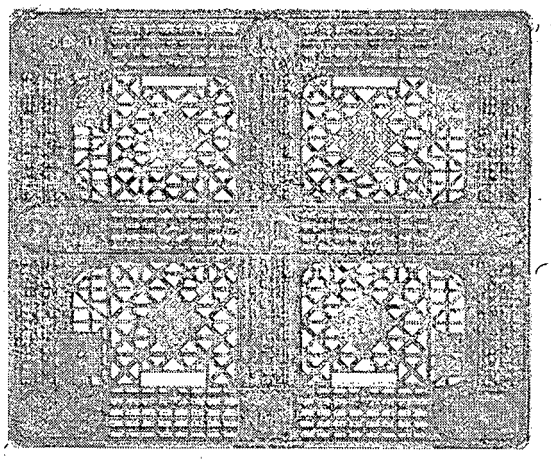

FIGURE **2A**

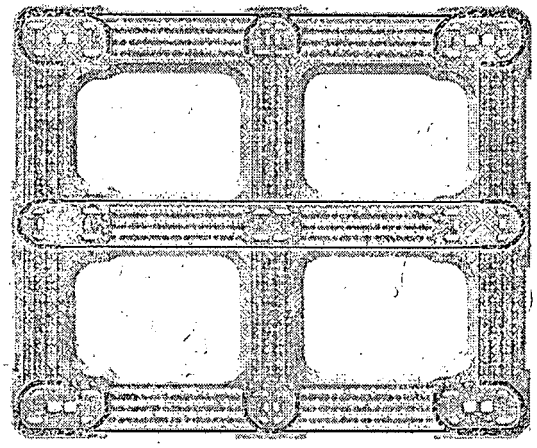

FIGURE **2B**

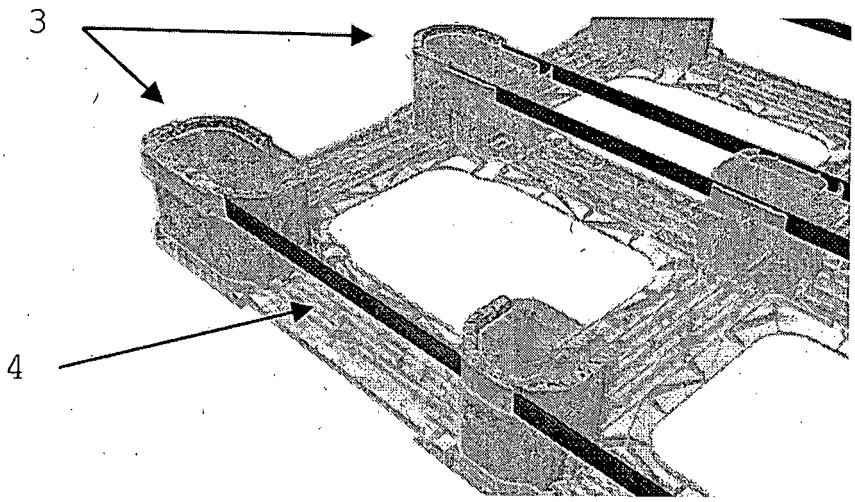

FIGURE 3

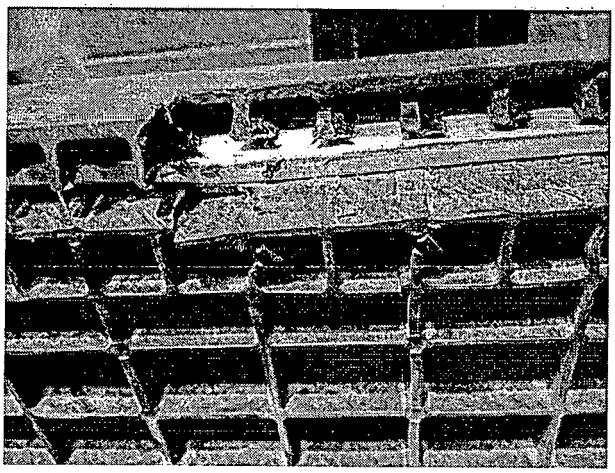

FIGURE 4A

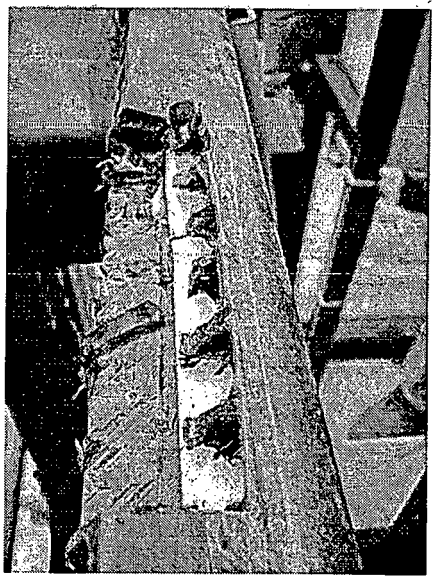

FIGURE 4B

INTERNATIONAL SEARCH REPORT

International application No.
PCT/MX2013/000049

A. CLASSIFICATION OF SUBJECT MATTER

B65D19/32 (2006.01)

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)
B65D

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)

EPODOC, INVENES, WPI.

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 6173657 B1 (ESPEJO GILBERT B) 16/01/2001, column 2, line 28 - column 6, line 13; figures 1 - 11.	1-3, 6
X	US 6216608 B1 (WOODS MARTIN E ET AL.) 17/04/2001, column 6, line 9 - column 17, line 28; figures 1 - 25.	1-3, 6
X	US 2003079657 A1 (PREISLER DARIUS J PREISLER DARIUS J ET AL.) 01/05/2003, paragraphs[0033 - 0079]; figures 1 - 3.	1-3, 6
A	US 5672412 A (PHARES RANDY LEE ET AL.) 30/09/1997, column 2, line 53 - column 3, line 54; figures 1 - 3.	1-3, 6

☒ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* 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 claim(s) 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 when the document is taken alone
"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 documents , such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
12/12/2013	**(17/12/2013)**
Name and mailing address of the ISA/ OFICINA ESPAÑOLA DE PATENTES Y MARCAS Paseo de la Castellana, 75 - 28071 Madrid (España) Facsimile No.: 91 349 53 04	Authorized officer E. Álvarez Valdés Telephone No. 91 3498419

Form PCT/ISA/210 (second sheet) (July 2009)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/MX2013/000049

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☒ Claims Nos.: Claims 4, 5
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

Claims 4 and 5 do not provide a clear definition of the subject matter for which protection is sought (PCT Article 6). The features that define the plastic pallet with reinforcements are not specified clearly, and it is therefore not possible to examine these claims for novelty and inventive step.

3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.

2. ☐ As all searchable claims could be searched without effort justifying additional fees, this Authority did not invite payment of additional fees.

3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.

☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.

☐ No protest accompanied the payment of additional search fees.

Form PCT/ISA/210 (continuation of first sheet (2)) (July 2009)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/MX2013/000049

C (continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of documents, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 6123032 A (OHANESIAN HAROUT) 26/09/2000, column 3, line 13 - column 8, line 28; figures 1 - 13.	1-3, 6

Form PCT/ISA/210 (continuation of second sheet) (July 2009)

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.
PCT/MX2013/000049

Patent document cited in the search report	Publication date	Patent family member(s)	Publication date
US2003079657 A1	01.05.2003	WO03037733 A1	08.05.2003
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		US6748876 B2	15.06.2004
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