An air cargo pallet includes a base metal sheet and extruded edge rails. A metal reinforcing strip is attached to a top surface of the metal base sheet and can run substantially across the entire width of the base sheet. The reinforcing strip divides the unsupported area of the base sheet, thereby reducing the effects of “oil canning” on the base sheet. Lower cost metals may be used for forming the base sheet.
FIG. 6

FIG. 7
REINFORCED AIR CARGO PALLET

BACKGROUND

[0001] Air cargo pallets are commonly used to support and secure cargo during transportation via aircraft, ground vehicles, and ships. A widely used air cargo pallet is made of a base sheet of aluminum with edge rail extrusions at each side or edge.

[0002] The base sheet of a typical air cargo pallet is often subjected to service-induced “oil canning.” Oil canning is a condition where an otherwise substantially flat metal sheet becomes slightly deformed. Oil canning can result from residual stresses induced or redistributed during production, slitting, perforating, forming, or fabrication of the metal sheets. Improper handling, as well as routine service, can also cause oil canning. Oil canning of the base sheet of an air cargo pallet can be detrimental to the pallet’s operation. After a certain degree of deformation occurs, the pallet becomes unusable.

[0003] Oil canning of the base sheet of an air cargo pallet often results from stresses induced on the bottom surface of the base sheet that occur during repetitive service cycles. Air cargo pallets, and the containers that they support, are typically used to transport up to 15,000 pounds (or more) of cargo, and are generally conveyed over a variety of conveying surfaces and devices. For example, air cargo pallets may be conveyed on roller ball conveyors. These conveyors make rolling point contact with the bottom surface of the base sheet. This rolling point contact induces bending stresses in the bottom surface of the base sheet, which may eventually lead to permanent deformation of the base sheet as the yield strength of the base sheet is exceeded by the compressive forces applied by the roller balls.

[0004] To reduce the effects of oil canning, the bottom sheets of air cargo pallets are often made from a high strength aluminum alloy, such as aluminum alloy 7075T6. While this high strength aluminum alloy has been relatively effective at preventing substantial oil canning in a pallet’s base sheet, it is typically expensive and/or in short supply. Thus, durable air cargo pallets may be relatively expensive to manufacture. A need exists for a more cost-effective, durable air cargo pallet.

SUMMARY OF THE INVENTION

[0005] An air cargo pallet includes one or more reinforcing strips attached to a top surface of the base sheet of the pallet. The reinforcing strip divides the unsupported area of the base sheet into two substantially equal sections. This reduces the effects of “oil canning” on the base sheet, and allows the use of lower-cost metals for forming the base sheet. The reinforcing strip may run substantially across the width and/or the length of the base sheet.

[0006] Other features and advantages of the invention will appear hereinafter. The features of the invention described above can be used separately or together, or in various combinations of one or more of them. The invention resides as well in sub-combinations of the features described.

BRIEF DESCRIPTION OF THE DRAWINGS

[0007] In the drawings, wherein the same reference number indicates the same element throughout the several views:

[0008] FIG. 1 is a plan view of an air improved cargo pallet.

[0009] FIG. 2 is an enlarged view of one corner of the air cargo pallet shown in FIG. 1.

[0010] FIG. 3 is a section view taken along line 3-3 of FIG. 2.

[0011] FIG. 4 is a top plan view of a base sheet of an air cargo pallet including a reinforcing strip, according to one embodiment.

[0012] FIG. 5 is a section view, taken along section A-A, of the reinforcing strip shown in FIG. 4.

[0013] FIG. 6 is a partial plan view of a reinforcing strip used to reinforce one or more base sheets of an air cargo pallet.

[0014] FIG. 7 is a top plan view of one of two base sheets of an alternative air cargo pallet.

DETAILED DESCRIPTION OF THE DRAWINGS

[0015] As shown in FIGS. 1-3, an air cargo pallet 10, according to one embodiment, includes a base sheet 14, with an edge rail extrusion 12 riveted onto each of the four edges of the base sheet 14.

[0016] The air cargo pallet 10 typically has a length L of approximately 100 to 150 inches, and a width W of approximately 80 to 100 inches. The pallet may also be made to a standard size with a length of approximately 108 inches or 125 inches, and a width of approximately 88 or 96 inches.

[0017] Referring to FIG. 4, the base sheet 14 generally has a width X that is about 7 inches less than the entire width of the pallet (including the edge rails). The width X is accordingly generally about 81 or 89 inches. The base sheet 14 similarly has a length Y that is about 7 inches less than entire length of the pallet (including the edge rails). The length Y is accordingly generally about 101 to 118 inches.

[0018] A reinforcing strip 30 is attached to the upward-facing, or top, surface of the base sheet 14 via screws 32, rivets, or other suitable fastening means. The reinforcing strip 30 in the design shown is located substantially at or near the longitudinal centerline L of the base sheet 14 (or pallet 10), and runs substantially across the entire width X of the base sheet 14. The reinforcing strip is preferably made of metal, such as aluminum or steel, but may also be made from another material. The reinforcing strip 30 may be a tie bar, or any other suitable reinforcing device or structure. The reinforcing strip or strips generally are parallel to the shorter sides of the pallet.

[0019] Oil canning of a metal sheet, in general, is inversely proportional to the yield strength of the metal sheet, and is directly proportional to the sheet’s unsupported surface area, its moment of inertia (i.e., the cube of its thickness), and the loads applied. The reinforcing strip 30 divides the unsupported surface area of the base sheet 14 into two sections. As a result, oil canning of the base sheet 14 is reduced by approximately one half (assuming that all
other factors are equal). This can in principle effectively double the service life of the base sheet 14.  

[0020] Oil canning also tends to deform the base sheet. This can cause the edge rails to lift up, making the pallet unusable. With the base sheet 14 divided into two pieces, the tendency for the edge rails to lift up is reduced. This prolongs the service of the pallet.  

[0021] In addition, pallet designs including a reinforcing strip allow for the use of lower strength, lower cost, and more readily available aluminum alloys as the base sheet material. For example, the base sheets of many conventional air cargo pallets are made from heat-treated aluminum alloy 7075T6, with a thickness of approximately 0.160 inches. By including a reinforcing strip 30 on the base sheet 14, similar resistance to oil canning can be achieved using other aluminum alloys having lower yield strength, with only a slightly greater base sheet thickness.  

[0022] Other aluminum alloys are typically significantly less costly than aluminum alloy 7075T6 and is also more easily obtained (regardless of cost). Thus, the use of other aluminum alloys provides substantial cost savings, particularly when several air cargo pallets are being produced. Since other aluminum alloys have lower strength in comparison to aluminum alloy 7075T6, base sheets made of other aluminum alloys can be made slightly thicker, to achieve equivalent strength. This increase in thickness, however, does not also result in a proportional increase in weight, because other aluminum alloys typically weigh less than aluminum alloy 7075T6. As one example, a base sheet of aluminum alloy 5083H24P is used instead of aluminum alloy 7075T6. The 5083H24P base sheet is 8% thinner than the 7075T6 base sheet. The aluminum alloy 5083H24P, however, is approximately 4.5% lighter than aluminum alloy 7075T6. Accordingly, using the lower cost and more abundant aluminum alloy 5083H24P as the base sheet increases the overall weight by only approximately 3.5%. This is relatively insignificant compared to the considerable cost savings that are realized by using the lower cost alloy. Various other examples using lower cost aluminum alloys can also be made. The term other aluminum alloys as used here means aluminum alloys having a yield strength less than the yield strength of 7075T6 aluminum alloy.  

[0023] In an alternative embodiment, the overall base sheet structure of the air cargo pallet 10 includes two coplanar smaller base sheets 14', as illustrated in FIG. 5. This design may be advantageous in some circumstances, since two smaller sheets of aluminum, or of another metal material, are often less costly than one large sheet having the same surface area as the two smaller sheets combined. Moreover, the smaller sheets may be more readily available than the larger sheets. For example, two sheets of 0.081 inch aluminum alloy 7075T6 cost less (typically about 25% less) than a single sheet of 0.120 inch aluminum alloy 7075T6. Thus, cost savings can often be realized by using two smaller base sheets, as opposed to using a single larger base sheet.  

[0024] FIG. 7 illustrates a first smaller base sheet 14', which may have a width Y that is substantially equal to one half the length Y of the base sheet 14 described above (e.g., approximately 60 inches versus approximately 120 inches). A second smaller base sheet 14' (not shown) can have the same dimensions as the first smaller base sheet 14'. Accord-
significantly reduces oil canning in the base sheet(s). As a result, the service life of the base sheet, and the pallet itself, may be dramatically increased. Furthermore, lower cost materials, having a lower yield strength than conventional base sheet materials, may be used to form the base sheet(s), thus significantly reducing the total cost of the air cargo pallet.

[0030] The preferred dimensions and materials of the various components of the air cargo pallet 10 may vary depending on specific design requirements. Accordingly, any pallet having one or more base sheets having a reinforcing strip or element is within the scope of the invention.

[0031] While embodiments and applications of the invention have been shown and described, it will be apparent to one skilled in the art that other modifications are possible without departing from the inventive concepts herein. The invention, therefore, is not to be restricted except to the following claims and their equivalents.

What is claimed is:

1. In a cargo pallet of the type having a base sheet and edge rails attached at edges of the base sheet, the improvement comprising:

   at least one reinforcing strip attached to a top surface of the base sheet and extending substantially across the width of the base sheet, and with the base sheet having a yield strength less than aluminum alloy 7076T6.

2. The cargo pallet of claim 1 with the base sheet having a thickness of about 0.16 to about 0.25 and with the reinforcing strip having a thickness greater than the thickness of the base sheet.

3. The cargo pallet of claim 1 with the base sheet divided into two separate sections, and with the separate sections attached together via the reinforcing strip.

4. The cargo pallet of claim 3 wherein the separate sections have equivalent dimensions.

5. The cargo pallet of claim 4 wherein the reinforcing strip runs substantially across the length of each of the base sheet sections and with the sections abutting each other.

6. The cargo pallet of claim 3 wherein reinforcing strip has angled or radiused sides.

7. The cargo pallet of claim 1 with the reinforcing strip extending parallel to the shorter edges of the pallet.

8. The cargo pallet of claim 1 wherein the reinforcing strip is located substantially at the lengthwise midpoint of the first base sheet.

9. The cargo pallet of claim 1 wherein a plurality of reinforcing strips are attached to a top surface of the base sheet.

10. The cargo pallet of claim 9 wherein the plurality of reinforcing strips are substantially equidistantly spaced from one another.

11. The cargo pallet of claim 1 wherein the reinforcing strip runs substantially across the length of the base sheet.

12. A cargo pallet, comprising:

   a first metal base sheet;

   a second metal base sheet abutting to the first base sheet; and

   a reinforcing strip attached to a top surface of the first base sheet and to a top surface of the second base sheet; and

   first and second edge rail extrusions attached to outer edges of the first base sheet, and third and fourth edge rail extrusions attached to outer edges of the second base sheet.

13. The cargo pallet of claim 12 wherein the reinforcing strip runs substantially across the length of each of the first and second base sheets where the first base sheet abuts the second base sheet.

14. The cargo pallet of claim 12 with the first and second metal base sheets comprising an aluminum alloy having a yield strength less than alloy 7076T6 and having a thickness greater than about 0.16 inches.

15. The cargo pallet of claim 12 wherein the first and second base sheets are riveted to the edge rails and to the reinforcing strip.

16. The cargo pallet of claim 12 wherein the first and second base sheets each have approximately the same length and width.

17. In a cargo pallet of the type having a base sheet and edge rails attached to the edges of the base sheet, the improvement comprising:

   the base sheet comprising an aluminum alloy having a yield strength less than aluminum alloy 7076T6; and

   reinforcement means for reinforcing the base sheet, with the reinforcement means attached to a top surface of the base sheet.

18. The cargo pallet of claim 17 with the reinforcement means dividing the base sheet into two or more substantially equal areas.

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