A wood pallet is disclosed. The pallet includes a top deck for receiving a load, a bottom deck, at least two spaced-apart stringers extending longitudinally between the ends of the pallet, and a plurality of spacer blocks attached to the stringers. The stringers and the spacer blocks are situated between the top deck and the bottom deck to maintain the decks in a spaced relationship. The plurality of spacer blocks comprise laminate blocks of glued wood components. The glue lines of the laminate spacer blocks are substantially perpendicular to the stringers and the grain of each of the wood components runs in the same direction as one another and against the width dimension of the spacer block.
PALLET WITH LAMINATE BLOCKS

BACKGROUND OF THE INVENTION

[0001] Pallets are extensively used in the loading, stacking and storing of articles. A typical pallet includes spaced, parallel horizontal top and bottom decks attached to two or more longitudinally extending, transversely spaced apart stringers or stringerboards interposed between the decks, to which are attached a plurality of spacer blocks to maintain space between the top and bottom decks. Loaded pallet units are typically conveyed by means of fork lifts having tines that are inserted at spaced locations between the top and bottom decks of the pallet. Although pallets are designed to withstand shock and heavy loads, because of damage due to rough handling they often have limited lives.

[0002] The spacer blocks used in pallets have heretofore primarily been solid timber. However, solid timber spacer blocks are subject to several drawbacks. For example, a fork lift's tines may on occasion inadvertently ram the spacer blocks of the pallet instead of being received into the spaces of the pallet designed to receive the tines.

[0003] Furthermore, solid timber may be difficult to thoroughly dry without causing splitting at the perimeter of the timber block. This results in the possibility of season checks through which moisture is relieved from the wood, creating large weak points that can cause pre-mature failure of the spacer block, and hence the pallet. The presence of moisture in the timber also creates the possibility for mold growth, which may be undesirable, particularly in pallets used by the food industry for storing and transporting food.

[0004] U.S. Pat. No. 4,240,358 to Munroe discloses spacer blocks made from a plurality of plywood layers attached together with nails driven through the multiple layers of plywood. However the plywood blocks taught in Munroe are oriented such that the faces of the plywood run parallel with the top and bottom decks.

[0005] U.S. Pat. No. 6,003,448 to Skuse teaches laminated stringers made from a plurality of wood strips, in which the stringers themselves maintain the space between the top and bottom decks. Skuse teaches that the glue lines and the wood grain of the laminate stringers and is parallel to the decks.

[0006] These pallets have decreased strength compared to pallets constructed with timber spacer blocks and other deficiencies.

SUMMARY OF THE INVENTION

[0007] Accordingly, it may be desirable to have a wood pallet that has increased strength and which overcomes these and other deficiencies found in prior art wood pallets.

[0008] An illustrative embodiment of the invention is a wood pallet that comprises a top deck for receiving a load, a bottom deck, at least two spaced-apart stringers extending longitudinally between the ends of the pallet, and a plurality of spacer blocks attached to the stringers, the stringers and the spacer blocks situated between the top deck and the bottom deck to maintain the decks in a spaced relationship. The plurality of spacer blocks comprise laminate blocks of glued wood components, the wood components having a height, a length, and a width, wherein the glue lines of the laminate spacer blocks are substantially perpendicular to the stringers and wherein the grain of each of the wood components runs in the same direction as one another and against the width dimension of the spacer block.

[0009] Additional aspects, features and advantages of the present invention will be more apparent when considered in light of the following detailed description of exemplary embodiments of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010] FIG. 1 shows a perspective view of a wood pallet according to an exemplary embodiment of the invention.

[0011] FIG. 2 shows a cross-sectional view of the wood pallet of FIG. 1 along line II- II.

[0012] FIG. 3 shows a cross-sectional view of the wood pallet of FIG. 1 along line III-III.

[0013] FIG. 4 shows a perspective view of an exemplary embodiment of a laminate arrangement of a spacer block for use with a wood pallet according one exemplary embodiment of the invention.

[0014] FIG. 5 shows a perspective view of an exemplary embodiment of a laminate arrangement of a spacer block for use with a wood pallet according another exemplary embodiment of the invention.

[0015] FIG. 6 shows a perspective view of an exemplary embodiment of a laminate arrangement of a spacer block for use with a wood pallet according to another exemplary embodiment of the invention.

DETAILED DESCRIPTION OF EXEMPLARY EMBODIMENTS

[0016] The invention is directed to a wood pallet that provides several advantages over prior wood pallets that use timber and other structures as spacer blocks to maintain a space between top and bottom decks of a wood pallet. The wood pallet comprises a top deck for receiving a load, a bottom deck, at least two spaced-apart stringers extending longitudinally between the ends of the pallet and a plurality of spacer blocks attached to the stringers, the stringers and the spacer blocks situated between the top deck and the bottom deck to maintain the decks in a spaced relationship. The plurality of spacer blocks comprise laminate blocks of glued wood components, the wood components having a height, a length, and a width, wherein the glue lines of the laminate spacer blocks are substantially perpendicular to the stringers and wherein the grain of each of the wood components run in the same direction as one another and against the width dimension of the spacer block.

[0017] The height of the spacer block runs substantially perpendicular to and between the top and bottom decks. The length of the spacer block runs in the same longitudinal direction as the stringers, while the width of the spacer block is the direction that is transverse to the stringers. The glue line refers to the visible portion of the interfacial plane between adjacent wood components of the spacer block and which is substantially parallel with the height dimension of the spacer block.

[0018] The spacer blocks used in pallets according to exemplary embodiments of the present invention overcome many deficiencies found in prior art pallets. Laminate blocks
cut from beams manufactured from smaller wood components are used as spacer blocks. When used in the pallet, the glue lines of the laminate spacer blocks are oriented perpendicular to the pallet decks. The grain of each of the wood components of the laminate spacer blocks all runs in the same direction, transverse to the width direction of the block and thus also perpendicular to the pallet deck. Using these spacer blocks to construct wood pallets results in pallets that have greater compression and impact strength than timber blocks and laminate blocks that have glue lines oriented parallel to the pallet decks. Additionally, using smaller wood components to create a laminate block instead of using a timber block permits the spacer blocks to be manufactured from scrap wood, and or finger jointed components, which may reduce costs associated with procuring timber and reducing waste.

Because each of the multiple wooden pieces used as components of the laminate spacer block has smaller dimensions compared to a single timber spacer block, season checking may be reduced or even eliminated. This corresponds to a spacer block with fewer inherent weak points.

Also, as the thinner pieces of the laminate block can be dried individually, the resulting laminate spacer block may have a lower overall moisture content than normally found in a timber spacer block. This greatly reduces the likelihood of mold growth and the pallets can be used for a wider variety of applications, including the storage and transportation of food stuff. American Lumber Standards require a moisture content for kiln dried timbers of less than 26%. Pallets according to exemplary embodiments of the invention that use laminate spacer blocks instead of timber spacer blocks may have less than about 19% moisture, preferably about 16% moisture, without the increased potential for splitting, and hence weakening, associated with timber blocks having this low moisture content.

Any wooden pieces smaller than timber may be used as components in laminate spacer blocks according to exemplary embodiments of the present invention. In certain exemplary embodiments, reference will be made to different types of lumber. As will be appreciated by those of ordinary skill in the art, lumber may generally be categorized as either a “board,” “dimension,” or “timber.” As used herein, a “board” refers to any piece of wood having a nominal thickness equal to or less than about 1 ½ inches or an actual dress thickness equal to or less than about 1 ⅛ inches. “Dimension” refers to any piece of wood having a nominal thickness greater than 1 ½ inches up to about 4 inches. “Timber” refers to any piece of wood having a nominal thickness of 4 inches or greater. For example, a 2×4 or 2×8 would be considered “dimension” while a 1×4 or 1×6 falls under the category of a “board.”

FIG. 1 shows a pallet 1 in accordance with one exemplary embodiment of the invention. The pallet comprises a top deck 4 and a bottom deck 6. The top deck 4 and the bottom deck 6 are spaced apart by stringer boards 40 that extend longitudinally between the ends of the pallet 1 and a plurality of spacer blocks 50, 80 attached to the stringer boards 40.

As shown, in FIG. 1, the pallet 1 has three stringer boards 40 equally spaced from one another. The pallet 1 comprises end spacer blocks 50 attached at either end of each stringer board 40 and intermediate spacer blocks 80 attached somewhere between the ends of the stringer board 40. As shown in FIG. 1, there is a single intermediate spacer block 80 for each stringer board 40 located approximately at the midpoint of each stringer board 40, although there may be more than one intermediate spacer block 80 between each set of end spacer blocks 50.

The intermediate spacer blocks 80 have the same width and height dimensions of the end spacer blocks 50. As shown in FIG. 1, the intermediate spacer blocks 80 are shorter in length, though they need not be.

The top deck 4 may comprise any number of wooden planks attached in a transverse manner to the stringer boards 40. As shown in FIG. 1, the top deck comprises a lead deck board 10, a butted leading board 20 adjacent the lead deck board 10, and a plurality of intermediate deck boards 30. The intermediate deck boards 30 are preferably equally spaced between the two butted leading boards 20 to evenly distribute a load placed on the top deck 4 of the pallet 1.

Likewise, the bottom deck 6 may comprise any number of wooden planks attached in a transverse manner to the stringer boards 40. As shown in FIG. 1, the bottom deck 6 comprises a chamfered bottom lead deck board 60 on each end of the stringer boards 40 parallel with the lead deck board 10. In FIG. 1, the bottom deck 6 is completed by attaching three chamfered bottom deck boards 70 in a longitudinal manner parallel to the stringer boards 40.

The spacer blocks 50, 80 are attached between the stringer boards 40 and the bottom deck boards 70. The spacer blocks are a glued, laminate block made from smaller wood components and are attached so that the glue lines 58 of the spacer blocks are perpendicular to the stringer boards 40. The wood components are of nominal dimensions and may be of any length, preferably between about 2 feet and 16 feet to produce a laminate beam which is then cut to produce laminate spacer blocks of a desired length for use as the end and intermediate spacer blocks 50, 80.

The pallet is assembled using fasteners 90, typically nails, to attach the top and bottom decks 4, 6 to the stringer boards 40 and spacer blocks 50, 80 and complete construction of the pallet. Any variety of fastener size and type may be used.

It should be appreciated that while the exemplary embodiment of the pallet shown in FIG. 1 is described with respect to the use of boards in its construction of the top and bottom decks and the stringers, these parts may equally be manufactured from dimension or a combination of boards and dimension.

The wooden pieces that are the components of the laminate spacer block may be placed in various arrangements. FIG. 4 shows an exemplary embodiment of a spacer block 50 with an arrangement in accordance with a preferred embodiment of the invention. Wooden pieces 51-55 having nominal dimensions are glued together to form a laminate such that when a wood pallet is assembled using the laminate as a spacer block, the glue lines 58 of the laminate spacer block run perpendicular to the decks of the pallet. Additionally, the grain of each of the wood components are arranged to all run in the same direction in the laminate, such that the grain runs substantially perpendicular to the width
dimension of the spacer block and parallel to the height dimension. It should be appreciated that wood grain has the characteristic such that it does not necessarily run in a single linear direction, and that knots and various other grain defects may be present. However, those of ordinary skill in the art will readily understand that wood grain can be oriented such that it is said to be parallel or perpendicular, i.e., run with or against, a particular dimension or direction.

[0031] By arranging the glue lines and the grain in this manner such that it runs with the height and against the width, the laminate spacer block can be used to produce a pallet of increased strength. For example, because the grain is perpendicular, i.e., runs against, the width dimension of the block, the grain is also perpendicular to the times of a fork lift approaching the pallet in any direction. Thus, if the fork lift strikes the spacer block, the time contacts the spacer block in a direction where the wood has the greatest strength to resist the blow without significant damage. This means that the pallet may be able to withstand repeated strikes from a fork lift time before failure, increasing the life of the pallet, and consequently decreasing costs.

[0032] As the grain orientation runs with the height dimension of the spacer block, nails or other fasteners used to construct the pallet can more easily be driven into the wood, reducing “shiners.” Nails have a tendency to follow the grain of wood and to bend or be re-directed at an angle such that the nail may be exposed, creating a hazard. A timber block and a laminate block with glue lines oriented parallel to the pallet decks both present the wood grain perpendicular to the direction of a nail driven into the block to attach the decks, creating the possibility that rather than being driven directly downward through the block, the nail will follow the path of the grain and be redirected at an angle.

[0033] As seen, for example, in FIG. 4, a laminate block with a grain that all runs the same direction and with the height dimension, results in the ability to be incorporated into a pallet such that nails have a better hold and a deeper drive, and the nails’ end destination in the wood can be better controlled. Any tendency of the nail to bend can further be controlled by orienting the end wood components 51, 52 such that the wood grain expands inward toward the center of the laminate block. Thus, any slight curvatures found in the grain that might cause a slight redirection of the nail are oriented such that the nail is redirected inward, not outward, further reducing the likelihood of shiners.

[0034] Although nails may typically be used to construct the pallet itself, by using glue to adhere the wood components of the laminate spacer block, the laminate spacer block has greater strength. If nails or similar types of fasteners were first used to create the spacer block, the additional driving of nails into the spacer block to then attach the stringer boards and the pallet decks would result in a substantially weaker block, and hence a weaker pallet.

[0035] Referring again to FIG. 4, the laminate spacer block 50 has an arrangement in which wood components of two different nominal width dimensions are used. However, components may be of a single nominal dimension, as shown in the arrangement of the laminate spacer block 500 shown in FIG. 5. If desired, three or more different nominally dimensioned pieces of wood may also be used.

[0036] In exemplary embodiments where the wood components are of two different nominal dimensions, the number of pieces having the smaller width dimension is preferably greater than the number of pieces having the larger width dimension. Preferably, the wood components are 1x4’s and 2x4’s, although any combination of boards and/or dimension may be used depending on the desired dimensions of the pallet. Typically, where 1x4’s and 2x4’s are both used, a total of five wood components, three 1x4’s and two 2x4’s, are used to construct a spacer block for use in a standard size pallet. However, it should be appreciated that any number of wood components may be used to create a spacer block depending on both the dimensions of the wood components used and the pallet desired.

[0037] FIG. 4 illustrates a preferred embodiment in which the wood components 51-55 of the spacer block 50 are arranged such that two pieces of dimension bookend three boards. FIG. 6 shows an exemplary embodiment of a spacer block 600 having wood components of two different nominal dimensions in which the components are arranged in an alternating fashion.

[0038] The spacer blocks may be cut from laminate beams made by any method of gluing wood together to create a laminate. Spacer blocks for use in pallets in accordance with exemplary embodiments of the present invention are made from nominally dimensioned boards and dimension that are glued together to create laminate beams. The laminate beams are cured using a radio frequency, while external pressure is applied. Following curing, the spacer blocks are cut to size from the laminate beams.

[0039] The beams may advantageously be made from nominally dimensioned scrap of any length. Typically scrap may be in lengths between two and sixteen feet. Where shorter lengths are used, such as two to four foot lengths, individual pieces may be added together, such as by finger joining them in an end-to-end fashion to a desired length for manufacturing a laminate beam from which the laminate blocks for the pallet may be cut.

[0040] Any adhesive may be used to create the glued laminate beams. However the end use of the pallet that includes laminate spacer blocks may play an important role in determining a proper adhesive. For example, for pallets that will be used in the food industry, and thus may be exposed to extreme cold conditions such as an industrial freezer, the adhesive may be selected to maintain excellent adhesion in cold weather conditions. The adhesive is also typically waterproof.

[0041] One example of such an adhesive includes the use of ISOSET A322 resin available from Ashland Chemical of Columbus, Ohio. This resin may be mixed with a cross-linking agent in an amount of about 15-17 parts by weight cross-linking agent to 100 parts resin to create an adhesive. When this resulting glue is applied at an amount of about 70-80 lbs per 1000 square feet of coverage area, this may result in a laminate beam with excellent adhesion.

[0042] The glue may be cured by a radio frequency for a certain period of time, which is typically proportional to the adhesive used and the thickness of the wood components to be bonded. In a preferred embodiment of the invention, the laminate blocks are cured at a radio frequency of 5 MHz for about 150 seconds. An external pressure is applied during the cure that pushes the wood components against one another. Side pressure is typically applied at about 150 psi,
while a top pressure of about 5 psi is applied. The top pressure primarily keeps the wood components from sliding when the side pressure is applied, thus helping to produce a beam that has top and bottom surfaces that are substantially flat.

[0043] After curing, the laminate beams are cut into shorter blocks of a desired length for use in making pallets in accordance with exemplary embodiments of the invention.

[0044] The invention is further described with respect to the following examples which compare exemplary embodiments of the invention to pallets constructed with other types of blocks.

EXAMPLES

[0045] Various spacer block samples were constructed and tested according to ASTM D-1185 Fork Tine Test Methods for Pallets and Block Compression Test Methods for Pallets.

[0046] Example 1 is a laminate spacer block created from a series of 2x4 s and 1x4 s arranged in bookend fashion as shown in FIG. 4.

[0047] Example 2 is a laminate spacer block created from a series of 1x4 s arranged as shown in FIG. 5.

[0048] Example 3 is a laminate spacer block created from a series of 1x4 s and 2x4 s arranged in alternating fashion as shown in FIG. 6.

[0049] Comparative Example 1 is a solid timber block.

[0050] Comparative Example 2 is a laminated spacer block created from 7 1x1 s sandwiched between two 2x6 s, such that the glue lines and the grain orientation of the 2x6 s were parallel with the pallet deck.

[0051] Comparative Example 3 is a laminated spacer block created from a single 1x5 s sandwiched between two 2x5 s, arranged such that the glue lines of the laminate and the grain orientation were all parallel to the pallet deck.

[0052] Spacer blocks and pallets constructed using the spacer blocks were constructed according to each of the six foregoing block arrangements and were then tested using the Fork Tine Test and Block Compression Test for Pallets.

[0053] In the Fork Tine Test, a pallet is loaded on a track inclined at 10 degrees and is loaded with 1400 lbs., uniformly distributed on the pallet. A six inch fork lift tine is mounted at the end of the track, tipped down at 4 degrees from the plane of the track. The loaded pallet is placed on the incline track at a distance of 36 inches from the fork tine end and released. This procedure is repeated for three trips. If the pallet and block stay intact for three or more trips the pallet/block passes.

[0054] The results of the Fork Tine Test are shown in Table 1.

<table>
<thead>
<tr>
<th>Example</th>
<th>Pass?</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Y</td>
</tr>
<tr>
<td>2</td>
<td>Y</td>
</tr>
</tbody>
</table>

[0055] In the Block Compression Test a loose block is stood on end on a fixed steel plate. A fork lift tine is mounted vertically above the block and is lowered until it makes contact with the block. The fork tine is then loaded until the block fails. The test was conducted three times to determine an average failure load.

[0056] The results of the Block Compression Test are shown in Table 2.

<table>
<thead>
<tr>
<th>Example</th>
<th>Trial 1</th>
<th>Trial 2</th>
<th>Trial 3</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>3590</td>
<td>3614</td>
<td>3000</td>
<td>3401</td>
</tr>
<tr>
<td>2</td>
<td>2912</td>
<td>3063</td>
<td>2900</td>
<td>2958</td>
</tr>
<tr>
<td>3</td>
<td>3120</td>
<td>2675</td>
<td>3400</td>
<td>3065</td>
</tr>
<tr>
<td>Comp. 1</td>
<td>2912</td>
<td>2580</td>
<td>2608</td>
<td>2700</td>
</tr>
<tr>
<td>Comp. 2</td>
<td>2343</td>
<td>2638</td>
<td>1536</td>
<td>2172</td>
</tr>
<tr>
<td>Comp. 3</td>
<td>2448</td>
<td>2580</td>
<td>2608</td>
<td>2545</td>
</tr>
</tbody>
</table>

[0057] As shown, pallets according to exemplary embodiments of the present invention constructed using laminate spacer blocks with glue lines and wood grain perpendicular to the pallet decks provide superior impact resistance and compression strength.

[0058] The present invention is not to be limited in scope by the specific embodiments described herein. Indeed, various modifications of the present invention, in addition to those described herein, will be apparent to those of ordinary skill in the art from the foregoing description and accompanying drawings. Thus, such modifications are intended to fall within the scope of the following appended claims. Further, although the present invention has been described herein in the context of a particular implementation in a particular environment for a particular purpose, those of ordinary skill in the art will recognize that its usefulness is not limited thereto and that the present invention can be beneficially implemented in any number of environments for any number of purposes.

1. A wood pallet comprising:
   a top deck for receiving a load;
   a bottom deck;
   at least two spaced-apart stringers extending longitudinally between the ends of the pallet;
   and a plurality of spacer blocks attached to the stringers, the stringers and the spacer blocks situated between the top deck and the bottom deck to maintain the decks in a spaced relationship,
wherein the plurality of spacer blocks comprise laminate blocks of glued wood components, the wood components having a height, a length, and a width, wherein the glue lines of the laminate spacer blocks are substantially perpendicular to the stringers and wherein the grain of each of the wood components runs in the same direction as one another and against the width dimension of the spacer block.

2. The wood pallet of claim 1 wherein the pallet comprises end spacer blocks and intermediate spacer blocks, wherein the end spacer blocks are attached at opposite ends of the stringers and wherein the intermediate spacer blocks are attached along the length of the stringers other than at the ends of the stringers.

3. The wood pallet of claim 2, wherein the end spacer blocks are substantially the same height and width of the intermediate spacer blocks, but are of greater length.

4. The wood pallet of claim 1, wherein the wood components of the spacer block are nominally dimensioned.

5. The wood pallet of claim 4, wherein the wood components of the spacer block are of at least two different nominal dimensions.

6. The wood pallet of claim 5, wherein the wood components of the spacer block of different nominal dimensions comprise boards and dimension.

7. The wood pallet of claim 6, wherein the wood components of the spacer block alternate between dimension and boards.

8. The wood pallet of claim 7, wherein the spacer block comprises five wood components.

9. The wood pallet of claim 8, wherein the number of boards in the spacer block is greater than the number of pieces of dimension.

10. The wood pallet of claim 6, wherein the wood components of the spacer block comprises boards book-ended by dimension.

11. The wood pallet of claim 10, wherein the spacer block comprises five wood components.

12. The wood pallet of claim 11, wherein the number of boards in the spacer block is greater than the number of pieces of dimension.

13. The wood pallet of claim 1, comprising three stringer boards and a plurality of spacer blocks attached thereto, the stringer boards and spacer blocks spaced apart from one another to receive tines of a standard forklift from any direction.

* * * * *