BEVELED BLOCK PALLET

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ABSTRACT

A beveled block pallet is disclosed, the pallet being stringers supporting blocks, the blocks supporting stringers. The blocks are tapered to form a trapezoid shape to permit more strength with less weight.
BEVELED BLOCK PALLET

FIELD OF INVENTION

Background of the Invention

[0001] Pallets of various types are known in the art for use in shipping and warehousing of material. Typical pallets are constructed of wood and metal and are used for the transportation of goods. Typically, pallets are used in conjunction with forklifts or other similar vehicles. However, when pallets are used in a warehouse setting, it can be a great hindrance in efforts to disassemble pallets. Further, if the pallets are chipped or broken, the metallic fasteners can increase the cost of processing the chips as the fasteners (or parts of fasteners) have to be removed from the chips or sawdust. The presence of, for example, nails, prevents the use of standard saws or similar devices, which do not effectively cut through nails. Devices that are able to disassemble worn-out pallets that include nails face other disadvantages. First, they are often large, unwieldy and expensive. Second, oftentimes the nails remain in the stringers or deck boards after disassembly. In order to reuse the boards in optimal condition, the nails need to be removed, requiring additional time with attendant increased cost and expense.

[0005] More recently, companies who utilize pallets have turned to Radio Frequency Identification ("RFID") technology to monitor and track pallet location and other information. To use such technology, encoded RFID tags or devices are placed on a pallet. As the pallet moves through distribution channels, RFID readers scan the devices. By, for example, placing a RFID reader at a dock door of a warehouse, a supplier and customer know when a pallet arrives. However, there have been problems implementing RFID systems. One problem that faces RFID technology is that metal can prevent RFID readers from operating properly. A pallet without metallic fasteners would thus be desired. Further, the liquid inside of objects can absorb RF signals, making reading more difficult. It is thus desirable to have a wooden pallet that can be constructed with drier wood. However, nails and other metallic fasteners often cannot be used to construct a pallet with dry wood because they will cause checking and damage to the wood during construction.

[0006] Another problem that exists with the current metal fastener green wood pallets in the marketplace is that the blocks within a pallet are often found to split due to the use of solid sawn blocks that are green. These blocks cleave at the nail locations as the blocks dry out with use and/or shrink and expand due to moisture loss and uptake respectively.

[0007] In response to all of the problems discussed above, pallets free of metallic fasteners, such as nails, is disclosed. One such apparatus uses only adhesives to connect stringers to deck boards. However, there are numerous disadvantages to such a pallet. One is that the connection is often times not strong enough to resist typical tension perpendicular to grain/shearing forces or other forces. A second disadvantage to such a pallet is the required use of external clamps or similar devices to hold the pieces together in position while the glue sets. A third disadvantage of this technique is the excessive amount of time between initial alignment and ultimate formation of the pallet. This waste of time stems from the requirement of waiting for the glue to set before use of the pallet. There thus exists a need for a pallet that can be readily and economically assembled, which can withstand substantial impact and load forces, and can be easily disassembled and manufactured with dry wood, that will not interfere with RF signals or prevent RFID readers from operating properly.

[0008] One benefit of the present invention is that repairs for individual broken or damaged components can be made relatively easily in-situ. These repairs are a lot easier, quicker and more economical because the individual components are glued in place and thus held together with a complete component to component bond versus a pallet where metal fasteners have been utilized. In a metal fastener type pallet the components will fall off the pallet when the failure separates from one another metal fastener.

SUMMARY OF THE INVENTION

[0009] The use of beveled blocks in the manufacturing of stringer pallets allows for designing for maximum strength of
the blocks with regard to shear resistance while reducing the weight of the pallet due to the block size reductions. The beveled block also allows for narrow top stringers and wider bottom boards. The wider bottom face of the block provides improved shear capacity between the bottom stringers and the blocks and the bottom lead boards and the blocks. It also allows the placement of additional wood dowels while maintaining proper spacing of the dowels between each other, between edges both loaded and unloaded and vertically through the block.

[0010] The use of beveled blocks in the manufacturing of stringer pallets allows for wider bottom boards to decrease surface loading when the pallets are self-stacked. The block is beveled or tapered with a narrow top to support the width of the top stringer and a wide bottom to allow for maximum support of the bottom board to keep unsupported portions from splitting and breaking off in the cantilever created between the inside edge of the block and the inside edge of the bottom stringer. The individual beveling of these blocks allows maximum support and a minimum amount of weight in the blocks. This allows for overall reduced weight of the final pallet. There is weight saving in the ability to use a narrower top stringer as well as reduced material in the block. The total weight saving in these areas allow for a larger amount of product being shipped for the same number of pallets. The blocks may also be inverted such that the grain of the wood is vertical. In addition, the blocks can be manufactured from glued laminated wood where the laminations are vertical grain. Another way to achieve vertical grain for increased resistance to applied horizontal shear stresses is by using horizontal laminations and rotating the glue lines 90 degrees by turning the block stock, thereby the block laminations are orientated vertically in the pallet through the thickness of the pallet. The laminated blocks can have laminations that are not end jointed as the blocks generally resist horizontal shear loads only, not bending moment loads. Another method of making the blocks to reduce the weight is to space the laminations side to side and end to end.

[0011] The top deck of the pallet of the subject invention has a standard surface area of 87% coverage. The surface area allows the pallet to be used for any loading or material (FIG. 5). The bottom area of the pallet requires at least 55% surface area to allow self-stacking. Lower or higher surface areas on the bottom or top of the pallet can be arranged depending upon the end use of the pallet and the desired total weight of the pallet.

[0012] In carrying out one embodiment of the invention, a pallet made predominately of wood comprises a plurality of wooden stringers 10-12 and 23-25 (FIG. 3). Each wooden stringer comprises four elongated longitudinal surfaces and two end surfaces. A selected longitudinal surface is designated as a mounting surface and has a plurality of bores formed therein so that the longitudinal axes of the bores are generally normal to the mounting surface. The size and shape of the bores can range from a depth completely through the stringer to a smaller depth sufficient to receive a portion of a dowel.

[0013] The deck boards 3-7 can be connected to the stringers by a plurality of wooden dowels (FIG. 2). Each of the dowels 50 preferably has a first and second portion 52 and 54 (FIG. 1). The dowel comprises at least two contiguous dowel sections 58 and 60 having different cross-sectional size. The dowels are preferably constructed so that one portion fits into one of the bores in the stringer while the other portion fits into one of the openings in the deck board, thereby connecting the stringer to the deck board. Adhesive is used to augment that connection. The second end of the deck board can be similarly connected to a second stringer so that the deck board is transverse to the wooden stringers. A pallet can be formed by so connecting a plurality of deck boards to the stringers.

[0014] One benefit of the present invention is to provide a pallet that can be easily assembled through the use of wooden dowels that facilitate attachment of transverse deck boards to parallel stringers in a quick and efficient manner. This assembly is achieved through a clinching action of the dowel in the second board 30 that is joined to the first board 10 while not achieving a clinching of the dowel in the first piece of wood 1 to be joined to the second piece of wood 10. The dowel in such cases acts like a nail with a cap that pulls the first piece of wood to the second piece of wood with clinching in the second piece of wood and a staged cap on the dowel in the first piece of wood. The first stage of the stepped dowel, called the cap, fits in the first board 10 snug but does not clinch by having a diameter that is smaller than the pilot hole in the first piece of wood. The second and subsequent stages have a dowel diameter that is larger than the pilot hole such that the dowel clinches into the wood and provides withdrawal resistance immediately upon placement to provide a nail-like action.

[0015] Another benefit of the present invention is the placement of the dowel in such a way as to have it countersunk into the first board as shown in the drawings in FIG. 2. This countersinking allows the pressing of multiple pallets or pallet subcomponents without adjacent pallet or pallet subcomponents hanging up on the protruding or proud dowel head. In situations where significant pressures are applied to the pallets or subassembly of pallets glued together with mechanical type glues, i.e., phenolic glues such as resorcinnol, the applied pressure will result in the compression of the surface of the pallet or pallet subassembly leaving even dowels that have been inserted with their head or cap flush with the surface of the pallet or pallet subassembly stick up. The reason for this is that the dowel is placed with its grain perpendicular to the face of the pallet or pallet subassembly. Further, the dowels are seated up against fillets in the pilot hole when they are driven in place and are not able to move vertically into the wood without crushing the wood at the fillets in the pilot holes, which is undesirable. For this reason the dowel head doesn’t compress as much as the face of the pallet thereby leaving even a flush driven dowel to stick up in a clamping situation with high pressures such as 100 psi or greater.

[0016] Another benefit of the current invention is the opportunity to place partially cured adhesive on the dowel prior to inserting it into the pilot hole and during the clamping process for the whole pallet applying suitable processing parameters to cause the partially cured adhesive on the dowels to complete polymerization and glue the dowel into the pilot hole, e.g., with increased ambient temperature or radio frequency applications.

[0017] Another benefit of the present invention is that it allows for unique shook machining and assembly and pre-manufactured machining and assembly. In the shook assembly method the components of the pallet are assembled in parts or in whole and then machined in place. The components must maintain their placement and orientation to be properly assembled. The joints are face glued, stepped dowels are glued in place in their respective pilot holes and the wet assembly (wet meaning the assembly is handled when the glue is uncured) is pressed together and glues allowed to cure
under heat or with no heat applied or other methods of accelerating the curing process such as radio frequency or microwave. In the pre-manufactured approach the components are predrilled and machined and can be utilized in making any pallet and are not specific to any one unique pallet. This method requires a high level of precision machining and drilling of each part so that they all fit together and the dowels can be driven in place correctly. This precision is important since if a component with one part of the stepped dowel pilot hole is attached to another component with another part of the same stepped dowel pilot hole and the holes are not concentric the pilot hole for the same dowel will be staggered and the components will cleave when the dowels are placed in the staggered dowel pilot hole joining the adjacent wood components of the pallet together. This method involves configuring the pilot hole in each strata of the pallet vertical assembly in a centerline justification system. The wood elements are hygroscopic meaning that they absorb and desorb water and expand and shrink respectively. Thus, once the holes are drilled in a centerline justified system there is a limited time available to assemble and insert the dowels in order to limit the effects due to pilot hole movement in relation to the originally drilled pilot hole strata position.

Another benefit of the present invention is the filleting of the bottom stringers and bottom lead boards to allow wheeled pallet jacks to be utilized with the beveled block pallet with minimal wheel damage to the bottom stringers and bottom lead boards from any direction.

Another benefit of the present invention is the use of smaller length center blocks that allow higher load capacity of the pallet since the shorter length center blocks lead to lower hinge point stresses from the bending moment stresses around the bottom corners of the center block. This same benefit can be found by reducing the length of the end blocks in long length bending of the pallets based on being able to maintain the proper amount of surface contact area between the bottom face of the blocks and the bottom stringers and lead boards.

Another benefit of the present invention is that the gluing of all face joints between the various components in the pallet allows the pallet to stay intact as the lumber shrinks and expands from moisture content loss and uptake respectively.

Another benefit of the present invention is to provide a pallet of the afore described type that may in one embodiment employ an adhesive in conjunction with the dowels, the dowels being configured to eliminate the need for external clamps to hold the parts together while the adhesive sets or cures. Thus, there is no time wasted after initial alignment and connection because the dowels provide sufficient connectivity to allow for immediate handling and use of the formed pallets. The dowel action of serving to fasten together the two pieces of wood to be joined also serves to hold wet glued surfaces together while the wet uncured glue is placed in clamping devices and pressure applications where the adhesive and gluing strategy requires it.

Another benefit of the present invention is to provide a pallet that is lower in weight due to the spacing of the block laminations between adjacent blocks between the same two parallel glue lines either horizontal or vertical in the block.

Another benefit of the present invention is that repairs for individual broken or damaged components can be made relatively easily in-situ. These repairs are a lot easier, quicker and more economical because the individual components are glued in place and thus held together with a complete component to component bond versus a pallet where metal fasteners have been utilized. In a metal fastener type pallet the components will fall off the pallet when the failure separates the piece from any one metal fastener.

Another benefit of the present invention is to provide a pallet that can be more easily disassembled than metal fastener connected pallets. In the preferred embodiment the dowels are made of wood; therefore, the pallet can be more readily stripped or broken down using standard wood-cutting saws. This allows for an increased number of customers for used or worn pallets, because those customers have no need for specialty equipment to grind up nails.

Another benefit of the present invention is to provide a pallet which can be a carrier of RFID technology. Because the preferred embodiment does not have metal, the pallet will not prevent RFID readers from working properly. The pallet claimed herein can have a RFID device placed on it, and it will be able to be read by RFID readers without fear of a nail or other metal fastener preventing the RFID reader from working properly.

Another preferred benefit of the present invention is the rounding of the outside four corners to displace impact loads throughout the pallet more evenly thereby improving the distortion resistance of the pallet.

Another preferred benefit to the present invention is the rounding of the outer edges of the pallet to prevent forklift time and other forms of impact from tearing the elements along grain lines.

CONCISE DESCRIPTION OF THE DRAWINGS

FIG. 1 is a depiction of a dowel for use in the subject invention.
FIG. 2 is a depiction of a stringer secured to a deck board in the subject invention.
FIG. 3 is an exploded view of the pallet of the subject invention.
FIG. 4 is a side view of the pallet of the subject invention.

DETAILED DESCRIPTION OF THE INVENTION

Referring to FIG. 1, one embodiment of a wooden dowel 50 can be seen. The dowel 50 comprises a first portion 52 and a second portion 54. The dowel may have a plurality of dowel sections, a first section 56, middle sections 58, 60, and last section 62. While in a preferred embodiment, the dowel 50 has two middle sections 58, 60 other embodiments may have no middle section, one middle section, or three or more middle sections. The first and last sections 56, 62 may have side walls 64, 66 and end walls 68, 70, respectively. Each of the middle sections 58, 60 may have side walls 72, 74 and step walls 76, 78, respectively. In a preferred embodiment, each of the sections 56, 58, 60, 62 are contiguous to another section 56, 58, 60, 62. The side walls 64, 66, 72, 74 define a cross-sectional size for their respective sections 56, 58, 60, 62. In a preferred embodiment, the cross-sectional size of the side walls 64, 66, 72, 74 decreases as one progresses from the first section 56 to the last section 62 in a number of steps. In another embodiment, the cross-sectional size of the side walls is greatest in a middle section (not shown). The cross-sectional size of the side walls 64, 66, 72, 74 may be any suitable size. The length of each individual dowel section 56, 58, 60,
may vary considerably. In one embodiment, the dowel section 56, 58, 60, 62 with the smallest cross-sectional size is as long as or longer than the length of any of the other dowel sections. The dowel 50 may have some sections, e.g., 58, 60 or all sections 56, 58, 60, 62 that have grooves 80 or no grooves, e.g., 66, and the sections may have any length. The grooves may be either longitudinal or circumferential. The dowel 50 may have other configurations, such as, the dowel shown and described in U.S. Pat. No. 6,267,527, which is hereby incorporated by reference.

As shown in FIG. 1, an embodiment is depicted having dowel sections 56, 58, 60, 62 having a circular cross-sectional configuration. Other embodiments of the dowel 50 may be constructed so that each dowel section has a substantially square, triangular, or other cross-section. Further embodiments may mix and match square sections with triangular sections, or try other combinations. It is preferred that the dowel 50 be constructed from a single integral piece of wood. The dowel 50 may be constructed of different pieces of wood that are functionally attached to form the dowel 50. The dowel 50 is preferably made substantially of birch, but may also be made of red oak, cherry, ash, beech, or other suitable preferably hardwoods.

As shown in FIG. 2, the dowel 50 connects the stringer 10 and the deck board 1. Alternatively the dowel could similarly connect the top stringers to the block and bottom stringers and bottom lead boards to the block. The opening 13 of the deck board 10 is configured to receive either the first or second portion 52, 54 of the dowel 50. The opening 13 is preferably sized so that it is slightly larger than the dowel to eliminate the potential of cleavage of the top element that is being affixed. The dowel 50 may fit snugly into the opening 13. Preferably, the dowel 50 and the opening 13 form a friction fit in the second element caused by the dowel diameter or cross sectional area being larger than the diameter or cross sectional area of the pilot hole, opening 13, that the first element is to be fixed to. In a preferred embodiment, the dowel 50 can be partially inserted into the opening 13 by hand. Because of the stepped nature of the dowel 50, the dowel 50 can be partially inserted into the opening 13 with minimal force. Then the placement finished with a hammer or similar object to drive the dowel into the pilot hole properly seating and cinching the dowel in place so that it acts like a nail holding the first element to the second element. The partially inserted dowel 50 in the opening 13 of the deck board 10 is aligned with a selected bore of the stringer 30. The selected bore is configured to receive the portion of the dowel 50, that the opening 13 of the deck board 10 has not received. This receipt of the dowel Shank in a cinching fashion is achieved by machining the bore 38 to a smaller cross section area in the stringer or second wood piece. Thus, the bore 38 cinches or grabs the dowel portions 52, 54.

While the bore 38 is receiving the dowel in a cinching fashion the bore or opening in the first piece of wood or deck board is machined so that the opening 13 in deck board 10 is the same size or larger than dowel 50, cross sectional area. This means that the dowel 50 fits into the opening 38 in a cinching fashion while the opening 13 does not and is simply a snug fit to the dowel. The pallet components are held together by cross sectional differences in the component openings cross sections and bores with the dowel cross sections, whereby the openings are equal to or very slightly larger than the dowel head or top (first section 56) and less than the diameter of dowel 50 in the middle and last sections 58, 60, and 62. The second stage down from the top of dowel 50 can have a cross sectional area that is larger than the cross sectional area of the section stage of the pilot hole in the deck board 10 or first piece of wood such that the cap portion of dowel 50 has a cross sectional area equal to or less than the cross sectional area of the cap portion of dowel 50 and greater than the cross sectional area of the second section of dowel 50 in the first piece of wood 1. This provides for cinching of the dowel in the second piece of wood to be joined and cinching of the dowel in the lower portion of the first piece of wood to be joined while allowing a snug fit in the top cap portion of the dowel in hole 13 of board 1. The foregoing allows for the dowel to act like a nail in pulling the first piece of wood tightly to the second piece of wood. Again, because of the stepped nature of the dowel 50, the dowel can be partially inserted into the bore 38 with minimal effort. Through the ability to be partially inserted with minimal force, the dowel 50 provides proper alignment of the opening 13 with the bore 38. The dowel 50 can be substantially or fully inserted into the opening 13 and bore 38 through the use of a suitable pounding device (not shown), such as a hammer or mallet, or through manual strength. The dowel 50 may fit snugly into the selected opening 13 and bore 38. Preferably, adhesive (not shown) is disposed between the abutting parts of the dowel 50, stringer 30 and deck board 10.

As can be seen in FIG. 2, once the dowel 50 is inserted into the opening 13 and the bore 39, the deck board 1 and stringer 10 are connected. Preferably, the deck board 1 and stringer 10 will be aligned transverse each other. Alternatively other pallet components can be connected in the same way.

Referring now to FIG. 3, an embodiment of the pallet is depicted as having three stringers 23, 24 and 25 oriented in substantially the same plane in a parallel relationship. Many other pallet configurations may be used including, e.g., the stringer design, the block design, skids, stevedore type double wing, plywood panel deck stringer, nine block four-way entry pallet, single wing pallet with optional chamber on bottom boards, or the reversible stringer pallet. This list is given as an example of some types of pallets, and is not intended to be exhaustive. One of skill in the art would recognize that a wide variety of pallet formations can be contemplated and would fall within the scope of the invention.

As shown in FIG. 3, one embodiment may have stringers 23, 24 and 25 arranged parallel to each other in the same plane. Stringer 24 is spaced a substantially equal space from stringers 23 and 25, respectively. The distance between stringers 23 and 25 is substantially equal to the length of a pre-selected deck board. Each of the first pair of opposing longitudinal mounting surfaces has a plurality of bores. The embodiment may have a plurality of deck boards 1-9 arranged parallel to each other in the same plane and transverse to the stringers. Preferably, one of the first pair of opposing elongated longitudinal surfaces, of each deck board has a plurality of openings defined therein. The deck boards are arranged such that openings defined in the first end, second end and middle section of each deck board are aligned with the bores defined in the stringers 10-12. A plurality of dowels is inserted into the openings and aligned bores to connect the stringers to the deck boards. One set of deck boards are connected to opposing longitudinal mounting surfaces with adhesive on
facing surfaces while a second set of deck boards are connected to opposing longitudinal mounting surfaces, with adhesive on facing surfaces.

[0039] Each of the deck boards 1-9 has first and second opposing ends with each end having an opening 13 adapted for aligned relation with a selected bore 38 in one of the stringers 30. The openings 13 are configured to receive a remaining portion 52 or 54 of the dowel 50. The bores 38 and openings 13 can be configured with the use of a drill (not shown) with attendant drill bit (not shown). The drill bit may have many configurations, such as, e.g., the drill bit shown and described in U.S. Pat. No. 6,267,527, which is hereby incorporated by reference. Preferably, the stringers 30 and deck boards 10 provided are comprised of a dry wood. The method can further comprise providing an RFID device to be attached to the pallet.

[0040] An adhesive material (not shown) is applied to the stringers 30 and deck boards 10 such that some of the adhesive material is disposed in the bores 38 and openings 13. The adhesive material may be applied to the surfaces of the stringers 30, deck boards 10 or side walls 64, 66, 72, 74 of the dowels 50 to strengthen or augment the connection. The adhesive material is preferably PVA, but can be any material that would adequately connect the parts of the pallet together, such as, e.g., phenolics, elastomers, hot melts, urethane, epoxy, PF, or urethane/epoxy. Preferably, during the construction of a pallet, the adhesive is applied to the stringers 30 and deck boards 10 prior to the insertion of the dowels 50. In a preferred embodiment, the adhesive applied to the dowel 50 is thinned to allow for more ready insertion and connection. As the dowel is inserted into the bore or opening 13, the adhesive material may be at least partly scraped from the side walls 64, 66, 72, 74 to accumulate on the end wall 70 and step walls 76, 78. The amount of adhesive placed on the dowel can range from equivalent spread rates for the surface area of the dowel from 35 pounds per thousand square feet to 100 pounds per thousand square feet. The adhesive can be placed in such a way as to require heat to cure the glue after the dowel has been placed or pressure to cure the glue after the dowel has been placed. One example of applying heat to cure might be the use of A-Staged (partially polymerized) resorcinol glue on the dowel by tumbling it with under catalyzed resorcinol adhesive that coats the dowel and is dry to the touch. The dowels can be inserted into the pallet during manufacture without the use of wet glue allowing less waste, less time and better quality coating of the dowel. Then during the clamping process heat can be applied that allows curing (final polymerization and penetration of the adhesive to each shoulder of the glue line between the dowel surface and the pilot hole surface). Alternatively the adhesive might be A-Staged and tumbled onto the dowel so that the dowel has the adhesive applied to it and is easy to handle and insert into the pilot hole without applying wet adhesive. The glue in this case might be triggered to B-Stage (final polymerization) by the use of a water mist or pressure. Alternatively other forms of energy can be utilized to complete the polymerization of the glue preapplied to the dowel such as with radiofrequency or microwave.

[0041] In a preferred embodiment, the pallet described herein is only wood and adhesive and free of metal fasteners such as nails. The use of a wooden dowel 50 and wooden stringers 10-12 and deck boards 1-9, along with adhesive, can, through construction, create a pallet that exceeds industry requirements for static or dynamic strength, stiffness, and resistance to rough handling. These pallets have better cyclic vibrational damping characteristics than metal (nailed) fastener type pallets being that they their components are considered fixed at connection points versus pinned in a nailed pallet.

[0042] The joint of the pallet of the subject invention are cinched tightly by stepped dowels and maintain tight seams. Such tight joints are sealed and therefore microbe resistant. The dowels do not withdraw, which causes the joints to maintain a tight seal. The resulting joints do not provide gaps which can get moist and harbor microbes. As a result, it is much easier to clean/wash and dry pallets.

[0043] Further, the pallet described herein can be substantially lighter than standard pallets that employ nails or other metal fasteners. First, the use of wooden dowels inserted into bores or openings instead of nails creates less weight. The weight of the dowel being inserted is offset by the amount of wood drilled out of the deck boards and stringers. With the use of nails, there is no offset. With the use of a large number of nails in typical pallets (sometimes over one hundred for a pallet), this weight difference can become substantial. Second, the pallet described herein can be made with kiln dried wood, which is lighter than wet or green wood. Typical pallets are made of wet or green wood because hammering in nails in dry wood can cause damage to the wood, such as checking, and result in a damaged or weakened pallet. Through the use of the dowel 50, the pallet described herein can be constructed of wood that is kiln dried. Preferably, the wood is less than 15% moisture and more preferably in a range of about 12% to 15% with no element more than 5% different than any other element’s moisture content. The dowels should have the same moisture content range. The pallet described herein can be substantially lighter than typical patents, making them less likely to cause injury to workers during transport, and also yielding substantial savings in fuel economy during transport.

[0044] The pallet described herein can be constructed so that it meets industry requirements for a rated load of 2800 pounds while maintaining a pallet weight of less than sixty pounds. Preferably, such a pallet will be between fifty three and fifty eight pounds. More preferably, such a pallet will be less than fifty three pounds. In contrast, the typical nailed wooden pallet can weigh from seventy to eighty pounds.

[0045] The construction of a pallet of essentially all kiln dried wood and adhesive creates further advantages. A significant advantage is that the pallet is less likely to interfere with RFID. RFID readers can have difficulty reading RFID devices which are near liquid, which absorbs RF signals. The pallet described herein can be constructed of dried wood, lessening the amount of RF signal absorption and potentially allowing for higher read rate accuracy. Further, the pallet described herein is preferably constructed without metal. Metal can prevent RF readers from working properly. The pallet described therein is therefore likely to yield higher read rate accuracy.

[0046] The preferred lack of metal also allows for the pallet to be subjected to microwaving sterilization. This potentially results in a pallet that does not, for example, transport alien organisms or animals from one region to another.

[0047] The use of beveled or tapered blocks 13-21 FIGS. 3 and 4 in the shape of a trapezoid in the manufacturing of block pallets allows for maximum strength of the blocks with regard to shear resistance between the bottom boards and the bottom face of the block while reducing the weight of the pallet due
to the overall block volume. Thus deeper and narrower top stringer boards 10-12 have more strength for the same weight. The beveled block also allows for narrow top stringers and wider bottom stringers, i.e., boards 23-25. The narrow beveled block top supports the top stringer across its full width while also supporting the bottom stringer across its width. The beveled blocks are tapered on the inner lateral side only on side blocks 13, 15, 16, 18, 19 and 21, while the center blocks 14, 17 and 20 are tapered on opposing sides to form an isosceles trapezoid.

The use of beveled or tapered blocks in manufacturing stringer pallets allows for wider bottom boards to decrease surface loading when the pallets are self-stacked. The block is beveled with a narrower top and wider bottom and in the shape of a trapezoid. This allows maximum support of the bottom board to keep unsupported portions from splitting and breaking off in the cantilever created between the inside edge of the block and the inside edge of the bottom stringer. The individual beveling of these blocks allows maximum support for top and bottom stringers with a corresponding minimum amount of weight in the blocks. Additional beveling can be done if desired to achieve a larger weight saving. The beveling would be from the inside square end of the beveled blocks starting from the bottom inside edge to a predetermined point towards the outside end of the block. This allows the same bottom contact with a smaller contact area at the top of the beveled block, and also allows for overall reduced weight and material in the final pallet from reduced width in the top stringers and reduced volume in the blocks. The total weight saving in these areas allow a bigger payload for the pallet and much easier handling. The pallet of the subject invention weighs less than 55 pounds with a load capacity several times its heavier, conventional-nailed, block pallet which weighs 20 pounds more. The blocks may also be inverted such that the grain of the wood is vertical. In addition the blocks can be manufactured from glued laminated wood where the laminations are vertical grain or the horizontal laminations and glue lines are turned such that they are oriented vertically in the pallet through the thickness of the pallet creating vertical grain for higher shear resistance by the block. The deck stringers on a beveled block pallet can be manufactured to maximize strength and to save the most weight. The boards used in the manufacture of the pallet can be oriented so that the grain orientation has the crowns up, which means that the annual rings from a curve with the top of the curve toward the top of the pallet face.

The top deck of the pallet of the subject invention has a standard surface area of 87% coverage. The surface area allows the pallet to be used for any loading or material. The bottom area of the pallet requires at least 55% surface area to allow self stacking. Other percentage areas for the top and both can be utilized in different applications.

Beveled block pallets with their wider support areas with glued and doweled joints makes a pallet more resistant to flexing while in motion than for a standard stringer and nailed block pallet. This means longer pallet life and less product damage during shipping due to less motion being induced to items from the flexure of the pallet. Therefore there is less damage from rubbering and fatigue.

The use of beveled blocks transfers loads from the top stringers to the base boards more equally. They also give the top stringer support over a larger base so there is less rocking motion from side loading and creating a pallet with less flexure. Testing has shown these pallets to be stronger, lighter and longer lasting than the standard stringer and block pallets. The beveled block pallets of the subject invention resist corner loads that cause weakening of standard pallets from twisting or being knocked out of square.

The beveled block pallets of the subject invention may be manufactured in an applied pressure glue system using a clamp that controls clamping pressure between individual blocks within a pallet and within one stratum (e.g. blocks on corner). Pressure over 125 psi and below 400 psi, preferably 300 psi, should be achieved on each glue line. Special care needs to be taken that all the dowel caps are at least one sixteenth of an inch below the face of the pallet component; this prevents proud dowel heads from causing pressure translation problems in the strata at each clamp pressure point. The support of the base boards by the wide bottoms of the beveled blocks allows ruck-less or free stacking of pallets without damaging product or the bottom boards of the pallet.

Pallets in longwise bending transfer the tensile stresses in the bottom stringers into the end blocks via shear stresses. The shear stresses on the front toe of the inside beveled edge of the end blocks are greater than the shear stresses at the end of the bottom stringer to block connection. The dowels utilized to connect the bottom stringer to the blocks should be placed away from this lead edge toward the end of the stringer which is counterintuitive since in most cases involving timber connections the greatest loaded edge distance is desired. The optimum location for placement of the dowels is the middle (lengthwise) of the face connection between the bottom stringer and the block.

The present invention is not limited to the particular details of the apparatus depicted, and or other modifications and applications are contemplated. Certain other changes may be made in the above-described apparatus without departing from the true spirit and scope of the invention herein involved. For example, the present apparatus may be utilized with other styles of pallets, which have different formations of stringers, panel boards, or like members. It is intended, therefore, that the subject matter in the above depiction shall be interpreted as illustrative and not in a limiting sense.

1. A wooden pallet, free of metal fasteners, said pallet comprising a plurality of bottom stringers supporting a plurality of blocks, said blocks supporting a plurality of top stringers, whereby said blocks have a beveled side to form an upper surface that is smaller than a lower surface.
2. The wooden pallet of claim 1 wherein some of the blocks are beveled on opposing sides.
3. The wooden pallet of claim 1 wherein the blocks are located at least at the corners of the pallet, and said blocks are only beveled on one side.
4. The wooden pallet of claim 1 wherein the weight of the pallet is less than 55 lbs.
5. A wooden pallet free of metal fasteners for transporting and receiving loads, having a base and load-bearing surface, said base supporting a plurality of blocks on a lower surface of said block, each of said blocks being beveled on at least one side to form a block having an upper surface for support of said load bearing surface, said upper surface being smaller than said lower surface.
6. The wooden pallet of claim 4 wherein some of the blocks are beveled on two opposing sides.
7. The wooden pallet of claim 4 wherein the pallet is microbe resistant.
8. The wooden pallet of claim 5 wherein the weight of the wooden pallet is less than 55 lbs.
9. In a wooden pallet free of metal fasteners, comprising a lower plurality of stringers dispersed parallel to one another, an upper plurality of lead boards dispersed parallel to one another and perpendicular to said lower plurality of stringer, a plurality of blocks supported by said lower stringers, said blocks supporting said upper lead boards, wherein the improvement comprises:
   said blocks being tapered to form a trapezoid.
10. The wooden pallet of claim 9 wherein some of the blocks are an isosceles trapezoid.
11. The wooden pallet of claim 9 wherein the trapezoid is oriented to have the small side to be the load bearing surface.
12. The wooden pallet of claim 9 wherein a joint of the pallet is sufficiently tight to be microbe resistant.
13. The wooden pallet of claim 9 wherein the wooden pallet has a moisture content of less than 15%.

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