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THERMOPLASTIC PALLET

FIELD OF THE INVENTION

5 The instant invention is directed to a pallet molded from particular thermoplastic resins and more particularly to a foamed thermoplastic resin molded pallet. The particular thermoplastics employed in the practice of this invention will be described hereinafter.

BACKGROUND OF THE INVENTION

10 Wooden 48"x 40"(1.22m x 1.02m) pallets currently in use in the grocery manufacturing industry have low durability, potential for damaging the goods, and in most cases are heavier than a desired weight of 50 pounds (22.68 kg) or less. Presently, in all cases, the pallet may not meet the structural load requirements.

15 Also, structural foam pallets in polyethylene are high density polyethylene (HDPE) and do not meet all the requirements of the grocery manufacturing industry. The issue with structural foam pallets made with commodity plastics such as HDPE is that the higher creep properties cause the pallets to deflect under load during racking in a warehouse. Further, because the modulus of commodity plastics is less than 265,000 p. s. i., (1.83×10^9 Pa) and in order to get the structural strength through design, the walls of the pallet need to be thickened and weights thereof have been significantly higher than
20 the desired less than 50 pounds (22.68 kg) for pallets. Some designs have incorporated profile extruded rods or metal rod reinforcement to overcome this. These various reinforcements affect the cost of recycling of the plastic pallet and may adversely affect the weight of the pallet.

25 There are generally two types of pallets and they are block pallets and stringer pallets. The stringer pallets are generally made of wood laid up with, generally, 2"x 4"x 48" (0.05m x 0.10m x 1.22m) long wooden studs in a horizontal mode with the 4" (0.10m) dimension being perpendicular to the top of the pallet. Wooden slats or stringers are nailed on top of the 2"x 4" (0.05m x 0.10m) in a direction opposite or transverse to the direction of the 2"x 4" (0.05m x 0.10m).

30 Block pallets are made up of blocks placed between the top and bottom planar plates which plates may be solid or which may contain opening or holes therein. These pallets may not have sufficient resistance to the bending particularly along the 48"

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(1.22m) direction. In other words, they lack stiffness and can deflect under temperature and load. Block pallets generally have four openings, 2 in each side, so as to provide four-way entry for the forks of a fork-lifter on any side of the pallet. Resistance to deflection is a critical requirement for pallets used in drive through situations, i. e. when the pallet with a load racked and the pallets are supported under the outer edge of the pallet such that a fork-lifter after picking up the pallet and load can drive in one continuous movement through and between the supports on the rack. This saves time and is more efficient than picking up the pallet, backing up, turning around etc. A rack is a tier of multi loaded pallets generally for five pallets and the distance between the supports of the rack are such that a pallet can be supported between the supports generally in the 48" (1.22m) direction.

The specifications for pallets as established by the Grocery Manufacturing Association requirements are that a pallet be exactly 48"x 40"(1.22m x 1.02m) ; have true 4-way entry; accommodate pallet jacks; have a smooth, non-skid, top load bearing surface having at least 85% coverage and should be flat; a bottom loading surface and have cut-outs for pallet jack wheels from four (4) sides; rackable from 48" and 40"(1.22m and 1.02m) dimension; must be recyclable; desired weight under 50 pounds (22.68 kg); have a load capacity of 2,800 pounds (1270.06 kg); capable of bearing 2,800 pound (1270.06 kg) loads safely in stacks of 5 loads high racking; and weather and moisture resistant. These are most of the major specifications which most, if not all, pallets made from commodity plastics are not capable of meeting.

U.S. 5,520,121 discloses a plastic pallet of the block type having a particular design as shown in the drawings. In addition, the pallets are made from recycled plastics i. e. recycled PE (polyethylene), col. 6, lines 14-22. Again, these units are formed from recycled and recyclable molded plastic material. Such recyclable plastics are generally polyethylene (low and high density polyethylene).

U.S. 4,364,499 is directed to a plastic pallet with oblong channels in which reinforcing rods are locked. The plastic disclosed is an expanded foam plastic of polyolefins, particularly of high density and medium density polyethylene and of polypropylene.

U.S. 3,664,271 discloses a formed plastic pallet including a first deck wall formed with a first deck and a plurality of integral female sockets and a second deck formed

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with a second deck wall and plurality of integral male plugs which are formed to be telescopically received in the respective female sockets to support the deck walls in spaced apart relationship. The plastic disclosed may be any type of formable material such as polyethylene, polypropylene or any of the ABS resins known in the trade (col, lines 69-71).

U.S. 3,610,173 discloses a plastic pallet formed of individual thermoplastic top and bottom deck members. Again the plastic disclosed is any suitable thermoplastic material such as high density polyethylene. Foamed polyurethane may be employed to fill the substantial hollows in the deck members. (col 2, lines 9-11 and lines 28-33).
Foamed urethane polyurethane is generally a cured or cross-linked plastic.

U.S. 3,405,666 discloses a pallet assembly made from cured plastic such as glass filled polyester (col 2, lines 71 and col 3, lines 1-15).

U.S. 3,331,336 discloses a pallet wherein the upper and lower decks may be blow molded as one piece.

WO-A-94 08 861 discloses a thermoplastic pallet comprised of a top load breaking deck, a bottom load bearing section and at least six posts interposed therebetween. The two pallet components, namely the base and the deck, are injection molded from recycled material, such as polypropylene or similar thermoplastic material.

In each of the prior art references, there is disclosed pallets of particular design and configurations and further disclosing as plastic polyolefins such as polyethylene and polypropylene as well as ABS plastics which are not capable of racking particularly under load and temperature because they are not resistant to deflection.

In addition and in today's warehouses, pallets are required to be open in the center, i. e., without a support under the center of the pallet to support the pallet against deflection so as to accommodate drive through type supports as discussed previously herein. That means that the supports on which the pallet rests or sits must be open in the center such that fork-lifters can drive between and through the supports. Therefore the pallets must resist sagging or deflection under load, temperature and time and be sufficiently light weight. Pallets made of commodity plastics are not capable of meeting such requirements.

SUMMARY OF THE INVENTION

In accordance with the present invention there is provided, a foamed thermoplastic resin pallet having a top load bearing deck and a bottom load bearing section which is non identical to the top loading bearing deck with at least six posts interdisposed therebetween, said top load bearing deck has a planar top and a bottom side with said bottom side having longitudinal and transverse reinforcing ribs protruding from the bottom side and are perpendicular to each other forming a crisscross pattern on said bottom side; said bottom load bearing section comprised of ramps circumferentially defining a perimeter around four openings and on which ramps the posts are joined; said ramps lie as a plane parallel to the top load bearing deck; said openings in the bottom load bearing section are capable of accommodating and receiving wheels of a pallet jack; said foamed thermoplastic resin is selected from the group consisting of aromatic polycarbonates, polyphenylene ethers, polyphenylene ether/high impact polystyrene blends, acrylonitrile-butadiene-styrene/aromatic polycarbonate blends, polyalkylene terephthalate resins, polyalkylene terephthalate blends with other polymers, and blends of the resins; said foamed thermoplastic resin pallet is capable of racking and is resistant to deflection under load of up to 2800 pounds (1270.06 kg) under temperature and time.

It is an object of this invention to provide a foamed engineering thermoplastic resin pallet.

It is another object of this invention to provide a block foamed engineering thermoplastic resin pallet.

Another object of this invention is to provide at least a two piece foamed engineering thermoplastic welded pallet.

According to preferred embodiments, the pallet of this invention meets the requirements of the Grocery Manufacturing Association, and with foamed thermoplastics, the pallets are lighter in weight.

BRIEF DESCRIPTION OF THE DRAWINGS

- Fig. 1 is an isometric view of the assembled foamed pallet;
- Fig. 2 is an isometric view of the bottom load bearing section;
- Fig. 3 is a partial isometric assembly view of the showing post and a receptacle;
- Fig. 4 is an isometric view of the post;
- Fig. 5 is an isometric view of the underside of top load bearing deck;

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and Fig. 6 is a partial isometric view of a receptacle.

DETAILED DESCRIPTION OF THE INVENTION

With reference to the drawings, Fig. 1 shows the assembled foamed pallet of this invention which comprises a top load bearing deck 2, support posts 4, openings 6 for the insertion of forks of a fork-lifter, strips 8, weight reduction holes 10 in the top deck, ramps 12, and chamfered edges 14. Fig. 2 shows the bottom load bearing section 16, chamfered edge 14, ribs 18, ramps 20 and support posts 4. In this drawing, support posts 4 are shown as attached to ramps 20 of the bottom load bearing section 16. Opening 22 are openings for accommodating the wheels of pallet jacks. Fig. 5 which is an

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isometric view of the underside of top load bearing deck 2 comprising reinforcing ribs 24, the underside of strips 8 and weight reduction holes 10.

In more detail, this invention is directed to a thermoplastic pallet molded out of structurally foamed engineering thermoplastic resin comprising a top load bearing deck 2 and a bottom load bearing section 16 which have interdisposed therebetween at least (6) blocks in the form of posts 4 and preferably nine (9) blocks. The bottom load bearing section has four (4) openings and foamed plastic strips hereinafter referred to as ramps 20 which define the perimeter of the 4 openings. The blocks 4 interdisposed between the top load bearing deck 2 and the bottom load bearing section 16 lie on and are joined circumferentially to the ramps and to the bottom side of the top load bearing deck 2. The bottom side of the top load bearing deck 2 comprises a series of reinforcing ribs in a crisscross pattern protruding from the bottom side of the top load bearing deck 2.

The post 4 which join the top load bearing deck 2 and bottom load bearing section may be formed during foam molding as part of either the top load bearing deck 2 or the bottom load bearing section 16. The post or the blocks 4 may also be formed separately and joined to the top and bottom. The foamed thermoplastic resin pallet is assembled and the constituent parts are joined to form the pallet by either sonic welding, chemically, solvent adhesion, adhesives, or the like. However, sonic welding is the preferred method of joining the parts to form the pallet of this invention.

In addition to further decrease the weight of the foamed pallet, the top load bearing deck 2 may have weight reduction holes through the deck. This also provides for drainage without significantly effecting its load bearing capacity. The bottom load bearing section 6 may also have weight reduction holes.

Also, the vertical sides of the pallet, i.e. the perpendicular sides between the top load bearing deck 2 and the bottom load bearing section 16,

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have at least two openings in each perpendicular side for the insertion of the forks of a fork lifter, namely, one fork is generally inserted into each opening. The openings are actually between the upright blocks 4 interdisposed between the top deck 2 and bottom section. This feature is shown in the
5 isometric view of Fig. 1.

In a further embodiment of this invention as shown in Fig. 1 and also in Fig. 5 , the top load bearing deck 2 has a foamed strip 8 of thermoplastic resin circumferentially on all sides of the top load bearing deck 2 in addition to having one foamed strip 8 in the center of the of the top deck 2 and,
10 preferably, at least two strips of foamed thermoplastic strips criss-crossing in the center of the top load bearing deck 2 and which extend to and integrally join the circumferential foamed thermoplastic strips. The foamed thermoplastic strips 8 and the ribs on the bottom side of the top load bearing deck 2 are all formed in the molding process. They are not separate units or
15 sections subsequently joined to form the top load bearing deck 2 . All features of this top deck 2 are integrally molded as one unit during injection molding.

The bottom load bearing section, as set forth previously, comprises ramps which circumferentially define four (4) openings to accommodate the
20 wheels of a pallet jack and are referred to as pallet jack openings. The blocks 4 sit on and may be molded as part of the ramps 20. In a further embodiment of this invention the edges of the ramps are chamfered to avoid chipping or breaking of the edges when the forks of a fork-lifter are inserted into the openings in the vertical sections of the pallet. Also, for reinforcement and
25 weight reduction, the surface of the ramps are ribbed but the top of the ribs are of a corrugated pattern instead of customary sharp or right angle edges. The edges of customary ribs would be damaged by the forks of a fork-lifter.

The structurally foamed engineering thermoplastics employed in the practice of this invention are the aromatic polycarbonates such as LEXAN®

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polycarbonate, polyphenylene ether such as PPO® resin; polyphenylene ether/high impact polystyrene resin blends such as NORYL® resin; acrylonitrile-butadiene-styrene resin blends with aromatic polycarbonate such as CYCOLOY® resins; polybutylene terephthalate (PBT) resins such as VALOX® resins; blends of PBT with other polymers such as XENOY® resins; all of which are manufactured by General Electric Company. Also included are blends of such polymers with other polymers. All of the above polymers and their preparation are well known in the art and are disclosed in numerous patents and technical articles.

10 The foaming of the above structural engineering thermoplastics is also well known in the art and is disclosed in numerous patents and technical articles. Specifically, a foaming or blowing agent is employed in admixture with the polymer composition which when injected into the mold is allowed to expand in the mold during molding by release of the molding pressure and
15 expanding of the foaming agent. As the pressure is released through venting, the thermoplastic resin foams as it fills the mold. The injection molding process is preferably employed in molding the constituent parts for the foamed pallet of this invention.

20 The inside temperatures of a warehouse can reach as high as 110° F and sometimes even higher. Pallets made out of higher commodity plastics such as polyethylene, polypropylene ABS plastics cannot withstand such conditions of temperature, time and load requirements necessary for meeting the Grocery Manufacturer's Association specifications, particularly the requirement of being resistant to deflection under load and temperature
25 when the pallets are racked and only supported at the outer edges of the pallet.

In the practice of this invention, the pallet is molded of structural foamed engineering thermoplastics. The pallet is preferably formed in at least two sections, a top load bearing deck 2 and a bottom load bearing section

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with at least six (6) support posts interdisposed therebetween and preferably nine (9) such support posts 4. While the parts may be joined by numerous methods as stated previously, sonic welding is one technique that may be utilized to join attached post as shown in Fig. 1 to the upper deck 2. It is fast and simple and the pallets are stronger where welded. Sonic welding is carried out at about 15,000 to 20,000 kilahertz.

The generally rectangular pallet deck includes the top deck 2 and mating bottom section 16. The bottom section 16 as illustrated in detail in Fig. 2 includes a plurality of ramps 20. A first set of ramps 20, preferably three, are parallel and spaced apart and another set of ramps 20, preferably three, are also in parallel alignment to each other but are perpendicular to the first set of ramps 20. The first and second set of ramps 20 intersect and are joined at the respective intersections. The intersections are positioned at the respective corners, and preferably when each set of ramps comprises three for a total of six ramps, four intersections are positioned at the four corners, four intersections are positioned midway between the corners, and one intersection is positioned at the center for a total of nine intersections. The pallet generally includes a respective first side, an opposed second side, a first end and an opposed second end. The bottom section 16 includes a plurality of receptacles 28 with each receptacle 28 positioned at an intersection. The top deck 2, as shown in Fig. 5, includes receptacles 28 which are matching and opposing to the receptacles 28 of the bottom section 16. A plurality of separate post 4, as shown in Fig. 4, are provided to interconnect opposing receptacles 28.

The detail of a separate post 4 is illustrated in Fig. 4. Opposing ends of each of the separate posts 4 includes connector means operably to provide for gripping engagement with a respective receptacle 28 to fixedly secure the top deck 2 and to bottom section 16. The connector means includes at least one upright partition 30 having a horizontally aligned edge 32. The other portion

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of the connector means is associated with the receptacle 28 and includes a pair of erect opposing members 34 for gripping the horizontally aligned edge 32. The erect opposing members 34 include opposing, facing, and adjacent protuberances 36 adapted to mate with a respective aligned edge 32. The

5 protuberances 36 which are positioned at respective free ends of each opposing member 34 are biased toward each other. The protuberances 36 include an upper or outermost portion having an inclined surface 38 for mating with the leading edge 40 of a respective the partition 30. As the separate posts 4 and separate receptacle 28 are moved into engagement as

10 illustrated in Fig. 2, the inclined surfaces 38 of a opposing protuberances 36 move apart as the inclined surfaces 38 engage the leading edge 40 of a partition 30. Due to the cantilever affect of the protuberances 36 being mounted on the end of opposing members 34, the opposing members 34 move away from each other to accommodate the leading edge 40. Continued

15 movement of the opposing members 34 toward the aligned edge 32 results in a rearward portion or trailing edge 42 of the protuberance 36 engaging the aligned edge 32 whereby the opposing members 34 spring back to or toward their original position so as to grip the upright partition 30.

As illustrated in Fig. 5, the aligned edge 32 may be the form of a slot 42

20 in the partition 30 or in the form of a horizontally aligned ridge 46 on the partition 30. When a slot 42 is utilized, the trailing edge 42 of the protuberance 36 engages the leading edge 40 of the slot 44 and the opposing members 34 spring back to there original position as the trailing edge 42 of the protuberance 36 moves over the aligned edge 32. When a ridge 46 is

25 utilized for engagement with the protuberance 36, the protuberances 36 move apart to accommodate the ridge 46 and then spring toward each other as the trailing edge 42 of the protuberances 46 extend over the aligned edge 32 of the ridge. As also illustrated in Fig. 5, a stop in the form of a wall 48 is provided for limiting relative movement of the upright partition 30 and the opposing

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members 34 so that the protuberances 36 engage the respective aligned edges 32 and further movement is limited.

As illustrate in Fig. 6, the receptacle 28 includes the opposing members 34 and the wall 48 which are both connected to the floor 50 of the receptacle 28. An outer wall 52 forms a socket for accommodating a post 4. The ends of the post 4 include the partitions 30 which extend laterally across the separate post 4. The exterior wall 54 of the separate post 4 is dimensioned so as to fit interior to the outer wall 52 of the receptacle 28.

As illustrated in Fig. 2, receptacles 28 are preferably provided at the intersections at the corners of the pallet so that the connection between the top deck 2 and the bottom section 16 is made through the separate posts 4. Preferably, the separate corner posts 4 are made of a non-foamed material. The separate posts 4 are preferably constructed of a non-foamed wear resistant material such as molded thermoplastic to resist the wear due to impact from fork lifts which are used to transport pallets. The connection provided by the separate corner post 4 may be the only connection provided between the top deck 2 and the bottom section 16 so that the previously mentioned welding techniques are not necessarily needed for attachment of the attached posts 4. The separate corner posts 4 are preferably made from a tough engineering thermoplastic resin since considerable force may have to be applied to make the snap fit connection. A quick blow with a sledge hammer is may be needed to effect the snap fit.

A preferred resin, for the separate post 4, which, based on the total weight of the composition, consist essentially of (a) from 10 to 60 weight percent of a polyester resin; (b) from 10 to 60 weight percent of an aromatic polycarbonate resin; and (c) about 5 to about 50 percent impact modifier additive. A preferred polyester blend is a poly(ethylene terephthalate), polycarbonate impact modified blend such as XENOY® resin which is manufactured by General Electric Company

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Typical polyester resins include poly(ethylene terephthalate) ("PET"), and poly(1,4-butylene terephthalate), ("PBT"), poly(ethylene naphthanoate) ("PEN"), poly(butylene naphthanoate), ("PBN") and (polypropylene terephthalate) ("PPT"), and mixtures thereof. The preferred polyester material
5 is PBT.

The preferred polycarbonate comprises an aromatic polycarbonate. Preferred polycarbonates are high molecular weight aromatic carbonate polymers having an intrinsic viscosity, as determined in chloroform at 25° C. of from about 0.3 to about 1.5 dl/gm, preferably from about 0.45 to about 1.0
10 dl/gm. These polycarbonates may be branched or unbranched and generally will have a weight average molecular weight of from about 10,000 to about 200,000, preferably from about 20,000 to about 100,000 as measured by gel permeation chromatography.

The impact modifier is preferably an acrylic or methacrylic grafted
15 polymer of a conjugated diene or an acrylate elastomer, alone or co-polymerized with a vinyl aromatic compound.

Although the invention has been described by reference to particular illustrative embodiments thereof, many variations and modifications of this invention may become apparent to those skilled in the art without departing
20 from the spirit and scope of this invention as set forth in the appended claims hereto.

CLAIMS :

1. A foamed thermoplastic resin pallet having a top load bearing deck and a bottom load bearing section which is non identical to the top load bearing deck with at least six posts interdisposed therebetween, said top load bearing deck has a planar top and bottom side with said bottom side having longitudinal and transverse reinforcing ribs protruding from the bottom side and are perpendicular to each other forming a crisscross pattern on said bottom side; said bottom load bearing section comprised of ramps circumferentially defining a perimeter around four openings and on which ramps the posts are joined; said ramps lie as a plane parallel to the top load bearing deck; said openings in the bottom load bearing section are capable of accommodating and receiving wheels of a pallet jack; said foamed thermoplastic resin is selected from the group consisting of aromatic polycarbonates, polyphenylene ethers, polyphenylene ether/high impact polystyrene blends, acrylonitrile-butadiene-styrene/aromatic polycarbonate blends, polyalkylene terephthalate resins, polyalkylene terephthalate blends with other polymers, and blends of the resins; said foamed thermoplastic resin pallet is capable of racking and is resistant to deflection under load of up to 2800 pounds (1270.06 kg) under temperature and time.

2. The foamed thermoplastic resin pallet of claim 1 comprised of at least nine posts interdisposed between the top load bearing deck and bottom load bearing section.

3. The foamed thermoplastic resin pallet of claim 1 in which the top load bearing deck has a series of weight reduction holes through the top deck.

4. The foamed thermoplastic resin pallet of claim 1 in which the top load bearing deck has longitudinal foamed thermoplastic resin strips and transverse foamed thermoplastic resin strips circumferentially in the top load bearing deck section and further has at least one foamed thermoplastic resin strip centrally crossing the top load bearing deck and extending to and integrally joining said circumferential foamed strips, all of said strips are an integral part of the upper deck.

5. The foamed thermoplastic resin pallet of claim 1 wherein the thermoplastic resin is a foamed phenylene polymer composition.

6. The foamed thermoplastic resin pallet of claim 1 wherein the thermoplastic resin is a polyalkyl terephthalate resin.

7. The foamed thermoplastic resin pallet of claim 1 wherein the polyalkyl terephthalate resin is a polybutylene terephthalate resin.

8. The foamed thermoplastic resin pallet of claim 5 wherein the phenylene ether polymer composition is an admixture of polyphenylene ether and high impact polystyrene.

9. The foamed thermoplastic pallet of claim 4 in which the top load bearing deck has 2 foamed strips, one strip is longitudinal and one strip is transverse to said longitudinal strip which strips cross each other in substantially the center of the top load bearing deck and each strip extends to and integrally joins the circumferential foamed thermoplastic resin strips.

10. The foamed thermoplastic resin pallet of claim 1 in which the pallet is 48" by 40" (1.22m x 1.02m) by at least 6" (0.15m) high.

11. The foamed thermoplastic resin pallet of claim 1 wherein the bottom load bearing section includes at least a first set of parallel and spaced apart ramps and a second set of parallel and spaced apart ramps, said second set being joined to and perpendicular to said first set of ramps.

12. The foamed thermoplastic resin pallet of claim 1 wherein said first and second set of ramps intersect and are joined at the respective intersections, bottom section including a plurality of receptacles, each receptacle being positioned at a respective intersection.

13. The foamed thermoplastic resin pallet of claim 12 wherein said top deck includes a plurality of receptacles which match and are opposing to the receptacles of the bottom section, a plurality of separate post interconnect opposing receptacles.

14. The foamed thermoplastic resin pallet of claim 13 wherein opposing ends of each post includes connector means for providing gripping engagement with a respective receptacle to fixedly secure the top deck to said bottom section.

15. The foamed thermoplastic resin pallet of claim 14 wherein said connector means includes at least one upright partition having a horizontally aligned edge and a pair of erect opposing members for gripping said aligned edge, one of said post or said receptacle comprising upright partition and said other of said post or said receptacle comprising said erect opposing members.

16. The foamed thermoplastic resin pallet of claim 15 wherein said opposing members include opposing, facing, and adjacent protuberances adapted to mate with a respective aligned edge.

17. The foamed thermoplastic resin pallet of claim 16 wherein said protuberances are positioned at respective free ends of each opposing member and resiliently biased toward each other for gripping said aligned edge.

18. The foamed thermoplastic resin pallet of claim 14 wherein said post comprises a non-foamed wear resistant thermoplastic material.

19. The foamed thermoplastic resin pallet of claim 18 wherein said thermoplastic comprises a composition comprising (a) from 10 to 60 weight percent of a polyester resin; (c) from 10 to 60 weight percent of an aromatic polycarbonate resin; and about 5 to about 50 percent impact modifier additive.