MODULAR TOP FRAME

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ABSTRACT

The modular top frame has a plurality of rails that are interconnected with corner members and has a top and a bottom surface between the inner and outer perimeter of the top frame. The corner members are assembled with two corner parts which have an outer side, a central rib and reinforcing ribs. The corner members have retainer pins in pin receiving apertures positioned along and adjacent to the outer side and the central rib so that when the corner parts are positioned one over the other, the retainer pins and the pin receiving apertures join the corner parts. The corner members have improved resistance to torsional and bending stresses. The top frame has an outside and an inside perimeter and the provides an area between the outside and inside perimeter equal to or greater than 48% of area of the outside perimeter.
MODULAR TOP FRAME
CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] Not Applicable

STATEMENT REGARDING FEDERALLY SPONSORED RESEARCH OR DEVELOPMENT

[0002] Not Applicable.

REFERENCE TO A MICROFICHE APPENDIX


BACKGROUND OF THE INVENTION

[0004] 1. Field of the Invention
[0005] The present invention relates to the field of palletized units for transporting containers. In particular, the present invention relates specifically to a top frame used with palletized units for transporting containers.

[0006] 2. Description of the Known Art
[0007] Typically in the beverage industry, empty containers, such as cans and plastic and glass bottles, are manufactured at one location and must be transported to another location where they can be filled and capped. To package these empty containers for shipment, a first layer of the containers are placed on a pallet. Typically, the pallet may be made from a heavy duty plastic material or wood. Since these containers have no top on them, their tops are open to foreign contamination from material entering the open top of the container. A tier sheet is placed on the top of the first layer of the open containers to avoid contamination and then a second layer of open containers is placed on the tier sheet. Another tier sheet is placed on the top of the second layer of open containers and so on until the pallet has the desired number of layers of open containers. When the last layer of the open containers is reached, a final tier sheet is placed on the top of the last layer of the containers and then a top frame is positioned on the top of the final tier sheet. Banding strips are positioned around the pallet, and the top frame with the containers therebetween and tightened so that a container palletized unit is provided. The strips keep the container’s tightly compressed so that the palletized unit can be easily moved and transported.

[0008] As containers are constantly developed, there is a continuous effort to reduce the cost of the containers by decreasing the amount of material used to form the containers. For example, to reduce plastic bottle costs, less material is used by making the walls thinner. These lighter bottles have lower crush strength properties and are not able to support the weight that the prior containers with heavier walls can support.

[0009] Storage cost are another important factor when storing and transporting palleted container packaged units. The palleted units are stacked one on top of the other to minimize the “footprint” or storage area taken up by the palleted units. The more palleted units that can be stacked on each other requires less storage space area and consequently decreases the storage costs. It is desirable to provide a top frame that allows for higher stacking of the palleted units without crushing the containers and particularly the containers on the bottom palleted unit.

[0010] After the palleted unit is transported from the container manufacturing facility to the container filling facility, the palleted unit is disassembled, the containers removed from the pallet and are filled with the desired liquid and then capped. In some cases, the disassembly process is performed by automated equipment and certain types of equipment are not able to automatically disassemble top frames that have cross members. The top frames are then washed and returned to the container manufacturing facility.

[0011] The weight in design of the top frames are also an important factor. Workers are required to physically place the top frame on top of the containers mounted on the pallet as described above, remove the top frame when the palleted unit arrives at the container filling facility, wash the top frame and package it for return to the container manufacturing facility. These physical movements by the workers make it desirable for the top frames to have a very efficient strength to weight ratio. By providing a top frame design that is low in weight allows for easier movement of the top frames by workers. In addition, heavier top frames put additional weight on the palletized containers and exert additional crushing forces on them. It is also desirable that the strength be sufficient so that the top frames can be reused a number of different times.

[0012] In the past, wooden top frames have been used but have left contaminants in the containers, have been heavy to move and expensive to replace.

[0013] Other top frames of various designs and configurations are known. One such known top frame design has extruded sides interconnected at their ends with corner connectors. The sides allow the top frame to be used with either it’s top or bottom in contact with the top tier sheet. The corner connectors have fingers extending into the ends of the sides and are secured thereto. The corner connectors are assembled from an upper and lower corner connector member each of which have two pins on one side and two pin receiving openings on the other side. This design allows the corner connector members to be manufactured in the same mold. When one corner connector member is placed on top of the other corner connector member, they are assembled by assembling the two pins with the complementary pin receiving openings and secure the connector members together to form the corner connectors.

[0014] This known top frame design, when used in connection with lighter containers having lower crush strength properties, do not allow higher stacking of the palleted units. These known top frames do not have sufficient contact area with the containers to distribute the load over a sufficient area so as to allow higher stacking. When the widths of the rails are increased to increased the contact area, the known design of the corner connectors allow for twisting of the rails when the straps are tightened. This twisting of the rails provides even less area in contact with the containers on the palleted unit.

[0015] This known top frame design also has buttons which are received in openings in the adjacent top frames to avoid relative movement between the top frames when they are stacked for shipment back to the container manufacturer. When this known top frame is in use and placed on the top tier sheet, movement between the top tier sheet and a top frame to adjust their relative positions is restrained. The buttons engage the top tier sheet and their edges resist adjustment thereof. In fact in some cases, the edges of the buttons may tear the top tier sheet if such movement is attempted. The worker is then required to lift the top frame and adjust the position of the top tier sheet. Accordingly it is desirable to provide a device which not only avoids relative movement
between the top frames when stacked but also allows for adjustment between the top tier sheet and the top frame when used with a palletized unit.

[0016] Another known design provides an injection molded plastic top frame, generally made with polypropylene, with steel reinforcement. Such a design provides an upper half and a lower half of the top frame which are assembled placing a reinforcing steel members between the upper and lower halves and then joining them together. By using steel reinforcement, the weight of this design is increased.

[0017] Yet another known top frame design is provided with a one-piece structural foam injection molded construction polyethylene or polypropylene. Such a top frame has a bottom with inside and outside sides extending upwardly and a series of cored out sections between the inside and outside sides. This design provides that the bottom is in contact with the containers and the cored out sections are positioned on the top of the container pallet. These cored out sections do not allow a pallet of this design to be used with either the top or bottom sides of the pallet in contact with the top tier sheet. This design requires the workers to orient the top frame in one specific direction thus increasing the labor by the workers. Furthermore, these cored out sections trap contaminants that may enter the empty containers before they are filled and are difficult to clean when returning them to the container manufacturer. In addition, the manufacturer of these frames and the frames in the prior example, require a very large molding machine with extensive clamping pressures and expensive large mold cost. Also, in such a unitary construction only one material may be used and in critically stressful areas, other materials may not be used.

[0018] In the last two known designs described above, crossmembers are optionally provided which extend between opposing sides. Frames with no cross members allows for “chimney stacking”, that is, positioning a stack of smaller frames inside a stack of larger frames which decreases the cost of shipping. Furthermore, the use of cross members is not compatible with some automatic de-palletizing equipment. The automatic depalletizers are provided in an automatic filling line and depalletizes the containers and automatically provides them to filling equipment. Some automatic depalletizing equipment cannot operate with crossmembers on the top frame. Accordingly, it is desirable to provide a top frame with no cross members extending between the opposing sides.

[0019] It is desirable to provide a top frame where both sides of the top frame may be positioned on the top tier sheet to minimize labor by workers. It is also desirable to provide a top frame that is lightweight and may be readily manipulated by workers and positioned on a palletized unit and removed therefrom and subsequently moved and transported to another location.

[0020] Another desirable feature is to provide a top frame having a modular design that provides an improved corner member to increase resistance to torsion and bending forces exerted on the top frame and also allow the use of different materials in critically stressful areas. It is also desirable that the strength be sufficient so that the top frames can be reused a number of different times.

[0021] Yet another desirable feature is to provide a top frame that allows for higher stacking of the palletized units without crushing the containers and particularly the containers on the bottom pallet. It is desirable to provide a top frame that resists twisting when the banding straps are tightened.

[0022] Other desirable features and advantages of the present invention will become apparent from a study of the following description and the accompanying drawings which are illustrative of the invention.

SUMMARY OF THE INVENTION

[0023] The present invention provides the above described desirable features with an improved modular top frame for restraining containers on a pallet. The modular top frame of the present invention is constructed from a number of components which provide these desirable features.

[0024] The top frame of the present invention has side members which are extruded one piece side rails. The side rails have opposing ends, an inner and outer side and a top and a bottom side. To strengthen the side rails, reinforcing portions or ribs extend between the top and bottom of the rails. The reinforcing ribs and top and bottom sides and the inner and outer sides of the side rails define longitudinal apertures extending between the opposing ends of the side rails. By providing such a modular construction, the number and size of the reinforcing ribs may be readily modified to meet the requirements for any specific application. Furthermore, the material from which the side rails are made may be modified to meet specific requirements. In the preferred embodiment of the present invention, the rails are manufactured from a glass filled polycarbonate material which gives them the desired strength to weight ratio. In addition, the side rails have flat top and bottom sides which allows them to be used with either side in contact with the top tier sheet.

[0025] The top frame of the present invention has a sufficient contact area with the containers in the palletized units to distribute the load over a sufficient area of the containers so as to allow higher stacking. The top frame of the present invention also provides a design that allows three typical palletized units to be vertically stacked. The top frame has an outside perimeter and inside perimeter. It has been found that the area between the outside and inside perimeter must be equal to or greater than at least 48% of area of the outside perimeter. The corner connectors of the present invention provides for restraining twisting of the rails as their width increase and maintain them in contact with the empty containers so that this area parameter can be achieved.

[0026] The corner members of the present invention interconnect the ends of the side rails to restrain torsional and bending forces on the side rails. The corner members are advantageously made from identical corner parts. When one corner part is positioned on top of another corner part, they may be assembled together to form the corner member.

[0027] Each corner member has a corner body with an outer side and a top and a bottom side, which when assembled with their respective rails are substantially coplanar with the top and bottom sides of the rail. Each corner member also has a first and second connector including a first and second set of interconnecting fingers respectively, extending from the corner body at an angle of 90° with respect to each other. The corner members have a junction portion between the first and a second set of interconnecting fingers. The first set of interconnecting fingers are adjacent one side of the junction portion and the second set of interconnecting fingers are adjacent the other side of the junction portion.

[0028] To assemble the corner members with the side rails, the first set of interconnecting fingers are received in the
longitudinal apertures in one side rail and the second set of interconnecting fingers are received in the longitudinal apertures in another side rail. Other corner members are similarly assembled with the side rails to form a generally rectangular modular top frame of the present invention. The corner members are secured to their respective rails with connector pins of the first and second connectors extending through the rails and the interconnecting fingers.

The corner members are constructed of two identical corner parts. This modular design allows the corner parts to be manufactured in the same mold and are designed to be assembled with each other with one corner part on the top and another corner part on the bottom. Such a design allows for lower molding cost, and the use of different materials for the corner members and the rails. Preferably, the corner members are made from glass filled nylon or other materials that are stronger than the material from which the rails are made and provide additional resistance to force is exerted on the rails. By allowing the use of different materials, the corner members can be made from a stronger material than the rails to resist the forces on the rails created when the bunding is tightened so that the surface of the rails in contact with the containers remains in contact with them.

The corner parts have a base, a junction portion and a first and second set of interconnecting finger portions between the junction portion as described above in connection with the corner members. The corner parts have an outer side extending upwardly away from the base to a top surface and the outer side is positioned opposite and spaced from the junction portion. The outer side extends from the outside of one set of interconnecting finger portions in generally the same direction to a central portion of the outer side. The outer side also extends from the outside of the other set of interconnecting finger portions in generally the same direction to the central portion.

To reinforce the corner parts, a central rib is provided extending between the junction portion to the central portion of the corner part. The outer side portion of the corner part on one side of the central portion is a mirror image of the outer side portion of the corner part on the other side of the central rib except for the retainer pin receiving apertures and retainer pins as will be hereinafter described. The corner parts also have additional ribbing as will be hereinafter described to further strengthen the corner member and resist torsional and bending forces thereon.

The corner parts are designed to be assembled by placing one corner part on top of another and pressing them together. The corner parts of the present invention are designed with a series of retainer pin receiving apertures and retainer pins advantageously positioned to resist the torsion exerted on them when the banding straps are tightened around a palletized unit.

It has been found that by positioning the retainer pin receiving apertures and retainer pins as herein described that the corner members of the present invention have improved strength characteristics to provide an improved top frame of the present invention. A series of retaining pin apertures and retainer pins are alternately positioned adjacent and on each side the central rib. On one side of the central rib a retaining pin aperture is provided and on the other side of the central rib a complementary retaining pin is provided and vice versa. Each of the retaining pin apertures and retaining pins are positioned so that when the corner parts are assembled the retainer pin is received in its complementary retaining pin aperture. On one side of the central rib the retaining pin apertures and retaining pins alternate along the central rib and vice versa.

To further strengthen the corner member and hold the corner parts together so that foreign matter does not enter therebetween, the corner parts have a series of retaining pin apertures and retainer pins positioned along and adjacent the outer side portions of the corner part. On one outer side portion, a retaining pin aperture is provided and on the other outer side portion, a retaining pin is provided and vice versa. Each of the retaining pin apertures and retaining pins are alternately positioned so that when the corner parts are assembled the retainer pin is received in its complementary retaining pin aperture. In the preferred embodiment, the retaining pin apertures and retaining pins alternate along the one outer side portion and vice versa with respect to the other outer side portion.

In order to further strengthen the corner parts and consequently the corner members, a series of strengthening ribs are provided in each of the corner parts and also in the finger portions thereof the strengthening ribs increase the resistance of the corner members to bending and torsional forces.

On occasion the top tier sheet shifts with respect to the top frame so that the top tier sheet is not properly positioned. When a number of the top frames are stacked to be shipped back to the container manufacturer, the top frames may not stay properly stacked and shift with respect to each other. The present invention provides a nesting and tier sheet retaining device which maintains a stacked relationship between the top frames and also allows for adjustment of the tier sheet when the top frame is positioned on the top tier sheet. The nesting and retaining device includes a ramp on each side of the corner members adjacent to a complementary pocket. The ramp is received in the pocket of an adjacent top frame when the top frames are stacked to provide nesting therebetween. The ramp terminates at a rounded or flattened tip positioned away from the top and bottom surfaces of the corner members. The ramp and its tip on the corner members contact the top tier sheet and allow the worker to adjust the relative positions of the top tier sheet and the top frame without lifting the top frame. This adjustment is provided by the top tier sheet moving along the ramp and tip without tearing the top tier sheet.

Other desirable features and advantages of the present invention will become apparent from a study of the following description and the accompanying drawings which are illustrative of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of a container palletized unit showing the top frame of the present invention.

FIG. 2 is a side elevational view of the container palletized unit shown in FIG. 1.

FIG. 3 is a top view of the top frame of the present invention having side rails and corner members.

FIG. 4 is a side elevational view of the top frame of the present invention shown in FIG. 3.

FIG. 5 is a perspective view of one of the side rails shown in FIG. 3.

FIG. 6 is an end view of the side rail shown in FIG. 5.

FIG. 7 is a top view of a corner member shown in FIG. 3.
FIG. 8 is a top view of the portion of the top frame shown in FIG. 3 with portions shown in section and indicated by the circled portion 8.

FIG. 9 is a sectional view of the top frame shown in FIG. 3 and taken along line 9-9 thereof.

FIG. 10 is a top view of a corner member portion of the corner member shown in FIG. 3.

FIG. 11 is a sectional view of the corner member shown in FIG. 7 and taken along lines 11-11 thereof.

FIG. 12 is a partial sectional view of the corner member shown in FIG. 7 and taken along lines 12-12 thereof.

FIG. 13 is a sectional view of the corner member shown in FIG. 7 and taken along lines 13-13 thereof.

FIG. 14 is a partial sectional view of the corner member shown in FIG. 7 and taken along lines 14-14 thereof and nested with another corner member.

FIG. 15 is a breakaway perspective exploded view of the top and bottom corner portions when forming the corner members of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

The present invention provides a modular top frame 10 with the above described desirable features that may be implemented in a variety of designs for restraining containers 12 on a pallet 14. For ease of description, the invention will be described in connection with the top frame 10 shown in FIGS. 1-15 and it should be understood that the advantageous features of the present invention may be used in connection with a variety of top frames.

The top frame 10 of the present invention is provided for use with a container palletized unit 16 as shown in FIGS. 1 and 2. Typically, in the beverage industry, empty containers 12, such as cans and plastic and glass bottles, are manufactured at one location and must be transported to another location where they can be filled and capped. To package these containers 12 for shipment, a first layer of the containers 18 are placed on a pallet 14. Typically, the pallet 14 may be made from a heavy duty plastic material or wood. Since these containers 12 have no top on them, their tops are open to foreign contamination from material entering the open top of the container. A tier sheet 20 is placed on the top of the first layer of the open containers 18 to avoid contamination and then a second layer of open containers 22 is placed on the tier sheet 20.

Another tier sheet 24 is placed on the top of the second layer of open containers 22 and so on until the pallet 14 has the desired number of layers of open containers 12. When the top layer of the open containers 26 is reached, a top tier sheet 28 is placed on the top of the top layer of open containers and a top frame 10 is positioned on the top of the top tier sheet 28. A series of straps 30 are provided around the pallet 14, top frame 10 with the containers 12 therebetween and tightened and firmly secured so that a container palletized unit 16 is provided. As the straps 30 are tightened, the top frame 10 is forced against the containers 12 and consequently the pallet 14. The straps 30 keeps the containers 12 tightly compressed so that the container palletized unit 16 can be easily moved and transported.

As containers 12 are constantly developed, there is a continuous effort to reduce the cost of the containers 12 by decreasing the amount of material used to form the containers 12. For example, to reduce plastic bottle costs, less material is used by making the walls thinner. These lighter bottles have lower crush strength properties and are not able to support the weight that the prior containers with heavier walls can support. The present invention provides a top frame 10 that can be used with such containers and accommodate the compressive force of the straps 30 and also the compressive forces of higher stacking of the packaged units 16.

The top frame 10 of the present invention has side rails or members 32, 34, 36 and 38 which are extruded one piece side plastic members as shown in FIGS. 3-6. It should be understood that the side rail 32 is complementary to the side rail 36, that is that they have the same length (L), width (W) and height (H), see FIGS. 5 and 6. Likewise, the side rail 34 is complementary to the side rail 38 and has the same length (L'), width (W) and height (H). This provides for a top frame 10 that has a generally rectangular configuration.

For ease of description, the side rail 32 will be described in detail and it should be understood that the side rails 34, 36 and 38 are similarly formed so that a generally rectangular top frame 10 is provided. The side rails 32, 36 have a predetermined length, L, being for example the distance between its opposing ends 32a and 32b, a predetermined width, W, and a predetermined height, H. The side rails 34, 38 have a predetermined length, L', being for example the distance between its opposing ends 34a and 34b, a predetermined width, W, and a predetermined height, H. The lengths L and L' are determined by the size of the pallet 14 with which the top frame 10 is used. The width W is the distance between the inner and outer sides 40, 42 of the rail. As will be herein-after more fully described, the width W is an important dimension so that a sufficient number of containers 12 are contacted by the top frame 10. The height H of the side rail 32 is the distance between the top and bottom sides 44, 46.

Each of the side rails 32, 34, 36 and 38 have respective top and bottom sides 44, 46 and 44a, 46a, 44b, 46b and 44c, 46c. The area of the side rails in contact with the top tier sheet when the top frame is in an operative position is the length times the width of either the top sides 44, 44a, 44b, and 44c or the bottom sides 46, 46a, 46b, 46c.

While preferably the side rail 36 has the same length L as the side rail 32, the side rails 34, 38 may have a different length, L', that is the difference between their respective ends 34a, 34b and 38a, 38b, so as to match the size of the pallet 14 with which they are used. The other side rails 34, 36 and 38 also have also have a width W which is the distance between their respective inner and outer sides 40a, 42a and 40b, 42b and 40c, 42c. Preferably, the width W of the rails 32, 34, 36 and 38 are the same but it should be understood that it is within the contemplation of this invention that they may have differing widths.

The other side rails 34, 36 and 38 have respective top and bottom sides 44a, 46a and 44b, 46b and 44c, 46c which defines the height H of the side rails 34, 36 and 38. The height H of all of the side rails are the same so that either the top or the bottom of the side rails may be placed in contact with the top tier sheet. The top sides 44, 44a, 44b and 44c and the bottom sides 46, 46a, 46b and 46c provide smooth continuous top surfaces 48, 48a, 48b and 48c and smooth continuous bottom surfaces 50, 50a, 50b and, 50c to maximize the surface in contact with the top tier sheet 28 and consequently the top layer the open containers 26. This allows the top frame 10 to be used so that either the top sides 44, 44a, 44b and 44c or the bottom sides 46, 46a, 46b and 46c of the rails may contact the top tier sheet 28.
To strengthen the side rails, reinforcing portions or ribs 52 are provided which extend between the top and bottom sides of the rails. The ribs 52 are typically shown in FIGS. 5 and 6 in connection with the rail 32. The reinforcing ribs 52 and top and bottom sides 44, 46 an inner and outer sides 40, 42 of the side rail 32 extend between the opposing ends 32A, 32B of the side rail 32 and define longitudinal apertures 54 extending between the opposing ends of the side rail. On the outside of the rail 32, the outer channel aperture 54 is formed by the top and bottom sides 44, 46, the reinforcing rib 52 and the outer side 46. On the inside of the rail 32, the inner channel aperture 54 is formed by the top and bottom sides 44, 46, the reinforcing ribs 52 and the inner side 44. The balance of the longitudinal apertures 54 are formed by a pair of reinforcing ribs 52 and the top and bottom sides 44, 46. The number of the longitudinal apertures 54 are dependent on the width W of the rail 32. It should be understood that the balance of the side rails 34, 36, and 38 are similarly constructed.

By providing such a modular construction, the number and size of the reinforcing ribs 52 and consequently the number and size of the longitudinal apertures 54 may be readily modified to meet the requirements for any specific application. Furthermore, the material from which the side rails 32, 34, 36, and 38 are made may also be modified to meet those specific requirements. In the preferred embodiment of the present invention the rails are manufactured from a glass filled polycarbonate material which gives them the desired strength to weight ratio. In addition, the side rails have flat top surfaces 48, 48A, 48B and 48C and flat bottom surfaces 50, 50A, 50B and 50C which allows them to be used with either side in contact with the top tier sheet and consequently the top layer of containers.

The top frame 10 of the present invention also has corner members 56 to interconnect the ends of the side rails, as shown in FIGS. 7-9. The corner members 56 are identical in construction and are advantageously made from identical corner parts 58. This construction allows corner parts 58 to be manufactured in the same mold and when one corner part is positioned on top of another corner part they may be assembled together to form the corner member 56 as will hereinafter be more fully described.

Each corner member 56 has a corner body 59 with an outer side 60 and a top and a bottom base side. 62, 64 having top and bottom surfaces 66, 68. When the corner members 56 are assembled with their respective adjacent rails, the top and bottom surfaces 66, 68 of the corner members 56 are substantially coplanar with the smooth continuous top surfaces 48, 48A, 48B and 48C and smooth continuous bottom surfaces 50, 50A, 50B and 50C respectively of the rails.

Each corner member 56 has a first and second connector 69, 73 for connecting the corner member to two rails. The first and second connectors 69, 73 have a first and second set of interconnecting fingers 70, 72 respectively, extending from the corner body 59 at an angle of 90° with respect to each other. The corner members 56 have a junction portion 74 between the first and a second set of interconnecting fingers 70, 72 with the first set of interconnecting fingers 70 adjacent one side 76 of the junction portion 74 and the second set of interconnecting fingers 72 adjacent the other side 78 of the junction portion 74.

The assembly of a corner member 56 with the side rails 32 and 34 will hereinafter be described as shown in FIGS. 8 and 9. It should be understood that other corner members 56 are provided to assemble side rails 34, 36 and 38 and 38, 32, 34 in the same manner as described herein with respect to rails 32, 34. To assemble the corner member 56 with the side rails 32, 34, the first set of interconnecting fingers 70 are received in the longitudinal apertures 54 in the side rail 32 until the end 32C contacts the corner body 59. An aperture 71 is provided between each of the interconnecting fingers 70 and 72 so that the reinforcing ribs 52 are received therebetween. The second set of interconnecting fingers 72 are likewise received in the longitudinal apertures 54 in the side rail 34 until the end 34A contacts the corner body 59. An aperture 80 is provided through the inner and outer sides 40, 42 of the side rail 32 and through the interconnecting fingers 70. The aperture 80 is positioned so that when the end 32C is in contact with the corner member 56, the connector pins 82 of the connectors 69, 73 are inserted into the aperture 80 and interlock with each other to hold the rail 32 to the corner member 56.

The interconnecting fingers 70 are sized so that their upper and lower surfaces 84, 86 and side surfaces 88, 90 contact each of the sides defining the aperture 80. Since the fingers 70 extend into the apertures 80, the torsional and bending forces exerted on the side rail 32 are resisted to keep the rail in contact with the top tier sheet 28 and consequently the top layer of containers 26. As shown in the drawings, there are six interconnecting fingers 70. Depending on the width of the side rail, the number of interconnecting fingers may be increased or decreased.

The interconnecting fingers 72 are likewise secured to the end 34A of the rail 34 as described above in connection with the interconnecting fingers 70 and the rail 32.

Other corner members 56 are similarly assembled with the side rails to form a generally rectangular modular top frame 10 of the present invention. The corner members are secured to their respective rails with connector pins of the connectors 69, 73 extending through apertures 80 the rails and their respective interconnecting fingers.

The corner members 56 are constructed of two identical corner parts 58. This modular design allows the corner parts 58 to be manufactured in the same mold and are designed to be assembled with each other with one corner part on the top and another corner part on the bottom. Such a design allows for lower molding cost, and the use of different materials for the corner members and the rails.

The corner parts 58 have a base 92 having an outer surface 93, a junction portion 94 and a first and second set of interconnecting finger portions 96, 98 on opposite sides of the junction portion, as shown in FIGS. 10, 11 and 15. The corner parts 58 have an outer side 100 extending upwardly away from the base 92 to a top surface 102 and the outer side 100 is positioned opposite and spaced from the junction portion 94. The outer side 100 has one outer side portion 104 which extends from the outside 106 of the base in generally the same direction as the interconnecting finger portions 96. The outer side portion 104 extends to a central portion 108 of the outer side 100. The central portion 108 is generally curved and may be of any desired configuration. Another side portion 110 of the outer side 100 extends from the central portion 108 to the outside 112 of the base 92 from which one set of interconnecting finger portions 98 extend. The outside 106, 112 intersect at the junction portion 94.

The outer surface 93 of the base 92 is bounded by the outer side 100, including the outer side portions 104, 110 and the central portion 108, and the outside 106, 112 to define a
predetermined area, indicated at “Ac” in FIG. 7. When two corner parts 58 are assembled to form a corner member 56, the area “Ac” is the area of each of the top and bottom surfaces 66, 68 of the a top and a bottom base side, 62, 64 of the corner member respectively. Accordingly, when the top frame is positioned on the top tier sheet the area “Ac” of each of the corner members is in contact with the top tier sheet.

[0074] To reinforce the corner parts 58, a central rib 114 is provided extending upwardly from the base 92 to an upper surface 115. The central rib 114 extends between the junction portion 94 and the central portion 108 of the corner part 58. A series of finger ribs 116 are provided and extend upwardly from the base 92 to an upper surface 118. The finger ribs 116 extending between the center 120 of the finger portions 96 in generally the same direction as the finger portions 96 to the side portion 110 of the outer side 100. Another series of finger ribs 122 are provided and extend upwardly from the base 92 to the upper surface 124. The finger ribs 122 extend between the center 126 of the finger portions 98 in generally the same directions as the finger portions 98 to the base portion 104 of the outer side 100. The finger ribs 116, 122 and the central rib 114 intersect each other and at those intersections 128 of the outer surfaces are integrally formed to further reinforce the corner part 58. The upper surfaces 102 of the outer side 100, upper surface 115 of the central rib 114 and the upper surfaces 118, 124 of the finger ribs 116 and 122 respectively are coplanar so that two corner parts 58 may be assembled to form a corner member 56 as will be hereinafter further described.

[0075] In order to connect to corner parts 58 to form the corner member 56, retainer pins 130 and pin receiving apertures 132 are provided and positioned to strengthen the corner member formed thereby and resist torsional and bending forces exerted on the top frame 10. A first retaining set 134 of retainer pins and pin receiving apertures are positioned adjacent to and along one side 135 of the central rib 114. The first retaining set 134 has alternating retainer pins and pin receiving apertures. The first retaining set 134 has a retainer pin 130a adjacent a pin receiving aperture 132a and a retainer pin 130a adjacent the pin receiving aperture 132a. A second retaining set 136 has alternating retainer pins and pin receiving apertures. The second retaining set 134 is a pin receiving aperture 132b adjacent a retainer pin 130b and a pin receiving aperture 132b adjacent the retainer pin 130b. The second retaining set 136 is generally positioned adjacent to along the central rib 114 on the other side 138 of the central rib 114.

[0076] The first and second retaining sets 134, 136 are positioned to engage each other when two corner parts 58 are assembled to form the corner member 56. Since the first retaining set 134 alternate the retainer pins and pin receiving apertures, the second retaining set 136 oppositely alternate their retainer pins and pin receiving apertures, the first retaining set 134 engages the second retaining set 136. Such a design allows for manufacturing the corner parts 58 from one mold.

[0077] A partial sectional view of the upper and lower corner parts 58 in an assembled position and taken through the first and second retaining sets thereof is shown in FIG. 12. The retainer pin 130a has an outer peripheral surface 140 and extends upwardly from the base 92 of the corner part 58 and past the coplanar upper surfaces 102, 115, 118 and 124 of the outer side 100, central rib 114 and the finger ribs 116, 122 respectively and terminates at the end 142. For ease of manufacture, the retainer pin 132a has an aperture 144 therethrough.

[0078] When an upper corner part 58u is positioned over the lower corner part 58l in an assembly position, the pin receiving aperture 132b of the upper corner part 58u is positioned above and in alignment with the retainer pin 130u of the lower corner part 58l. The pin receiving aperture 132b is defined by a pin receiving body 146 which extends upwardly from the base 92 of the upper corner part 58u and past the coplanar upper surfaces 102, 115, 118 and 124 of the outer side 100, central rib 114 and the finger ribs 116, 122 respectively and terminates at the end 148. The pin receiving aperture 132b is defined by an internal surface 150 which receives the retainer pin 130u therein.

[0079] As the upper and lower corner parts are assembled, the outer peripheral surface 140 of the retainer pin 130u is in frictional contact with the internal surface 150 of the pin receiving aperture 132b. As the upper and lower corner parts are moved together, eventually the coplanar upper surfaces 102, 115, 118 and 124 of the outer side 100, central rib 114 and the finger ribs 116, 122 respectively of both of the upper and lower corner parts contact each other. In this position, the edge 142 of retainer pin 130u and the end 148 with the pin receiving aperture 132b are spaced from the base 92 of the opposing upper and lower corner parts. During this assembly process it is preferable that the upper and lower parts 58u and 58l be heated to allow greater frictional contact between the retainer pin 130u and the pin receiving aperture 132b when the heat dissipates. It should be understood that the retainer aperture 132b of the lower corner parts 58 and the retainer pin 130u of the upper corner part 58u are similarly constructed and assembled.

[0080] While the preferred embodiment describes the first and second retaining sets 134, 136 is being adjacent the central rib, it should be understood that the first and second retaining sets are centrally positioned, they need not be positioned adjacent the central rib.

[0081] A third retaining set 152 of retainer pins and pin receiving apertures are positioned adjacent to and along the outer side portion 104, shown in FIG. 10. The third retaining set 152 has alternating retainer pins and pin receiving apertures. The third retaining set 152 has a retainer pin 130c adjacent a pin receiving aperture 132c and a retainer pin 130c adjacent the pin receiving aperture 132c. A fourth retaining set 154 is generally positioned adjacent to and along the outer side portion 110 and has alternating retainer pins and pin receiving apertures. The fourth retaining set 154 is a pin receiving aperture 132d adjacent a retainer pin 130d and a pin receiving aperture 132d adjacent the retainer pin 130d and another retainer pin 130d adjacent thereto.

[0082] The third and fourth retaining sets 152, 154 are positioned to engage each other when two corner parts 58u and 58l are assembled to form the corner member 56, as shown in FIGS. 11 and 15. FIG. 11 is a cross-section through the third retaining set 152 on the lower corner part 58u adjacent the outer side portion 104 with the fourth retaining set 154 on the upper corner parts 58l positioned above the third retaining set. It should be understood that the fourth retaining set 154 on the lower corner parts 58l is similarly constructed and assembled with the third retaining set 152 of the upper corner part 58u.

[0083] Since the third retaining set 152 alternate the retainer pins and pin receiving apertures while the fourth retaining set 154 oppositely alternate their retainer pins and pin receiving apertures, the third retaining set 152 engages the
fourth retaining set 154 during assembly of the upper and lower corner parts 58u, 58l. Such a design allows for manufacturing the corner parts 58 from one mold.

[0084] A partial sectional view of an upper and lower corner parts 58u and 58l in an assembled position are shown in FIG. 11 while FIG. 15 shows the upper and lower corner parts in an exploded view prior to assembly. It should be understood that all of the retainer pins 130, 130u, 130l, 130c and 130d are identical in construction as are all of the pin receiving apertures 132, 132u, 132l, 132c and 132d. It is within the contemplation of this invention that the retainer pins and pin receiving apertures may be of a wide variety of constructions and designs.

[0085] The retainer pin 130c has an outer peripheral surface 156 and extends upwardly from the base 92 of the corner part 58 and past the coplanar upper surfaces 102, 115, 118 and 124 of the outer side 100, central rib 114 and the finger ribs 116, 122 respectively and terminates at the end 158. For ease of manufacture, the retainer pin 130c has an aperture 160 therein.

[0086] When an upper corner part 58u is positioned over the lower corner part 58l in an assembled position shown in FIG. 15, the pin receiving aperture 132d of the upper corner part 58u is positioned above and in alignment with the retainer pin 130c of the lower corner part 58l as shown in FIG. 15. The pin receiving aperture 132d is defined by a pin receiving body 146 which extends upwardly from the base 92 of the upper corner part 58u and past the coplanar upper surfaces 102, 115, 118 and 124 of the outer side 100, central rib 114 and the finger ribs 116, 122 respectively and terminates at the end 142. The pin receiving aperture 132d is defined by an internal surface 150 which receives the retainer pin 130c therein.

[0087] As the upper and lower corner parts are assembled, the outer peripheral surface 140 of the retainer pin 130c is in frictional contact with the internal surface 150 of the pin receiving aperture 132d. As the upper and lower corner parts are moved together, eventually the coplanar upper surfaces 102, 115, 118 and 124 of the outer side 100, central rib 114 and the finger ribs 116, 122 respectively of both of the upper and lower corner parts contact each other. In this position, the end 142 of retainer pin 130c and the end 148 of the pin receiving aperture 132d are spaced from the base 92 of the opposing upper and lower corner parts. The retainer pins 130c and pin receiving apertures 132c are similarly assembled with their complementary pin receiving apertures 132d and retainer pins 130d. During this assembly process it is preferable that the upper and lower parts 58u and 58l be heated to allow greater frictional contact between the retainer pin 130c and the pin receiving aperture 132d when the heat dissipates.

[0088] Corner parts 58 also have retainer pins 160 and alternating pin receiving apertures 162 on the ends 164, 166 of the first and second set of interconnecting finger portions 96, 98 as seen in FIGS. 10 and 13. Due to space considerations, the retainer pins 160 and alternating pin receiving apertures 162 are of a different design than described above with respect to the pin receiving apertures 132 and retainer pins 130. FIG. 13 is a cross-sectional view through the first set of interconnecting fingers 70 and show the complementary first set of finger portions 96 on the lower corner part 58l assembled with the second set of finger portions 98 on the upper corner part 58u.

[0089] The pin receiving apertures 162 and the retainer pin 160 are formed integrally with the finger ribs 116 extending through the finger portions 96 while the pin receiving apertures and retainer pins of the finger portions 98 are formed integrally with the finger ribs 122 of the finger portions 98. The pin receiving apertures 132 included enlarged portions 168 in the finger ribs 116, 122 while the retainer pins 160 include enlarged portions 170 in the finger ribs 116, 122. The pin receiving apertures 162 are defined by the inner surface 172. The top 174 of the pin receiving apertures 132 is coplanar with the top surface 118, 124 of the respective finger ribs 120, 122. The retainer pins 160 have a pin portion 176 extending upwardly of the top surfaces 118, 124 of the respective finger ribs 116, 122.

[0090] During assembly of the upper and lower corner parts 58u, 58l, the pin portions 178 are positioned adjacent the apertures 172 on their respective corner parts and as the corner parts are moved together the retainer pins 130 are secured to the pin receiving apertures 132.

[0091] The corner parts are designed to be assembled by placing one corner part on top of another and pressing them together. The corner parts of the present invention are designed with a series of retainer pin receiving apertures and retainer pins advantageously positioned to resist the torsion exerted on them when the bundling straps are tightened around a pallet assembly.

[0092] It has been found that by positioning the retainer pin receiving apertures and retainer pins as herein described that the corner members of the present invention have improved strength characteristics to provide an improved top frame of the present invention. A series of retaining pin apertures and retainer pins are alternately positioned adjacent and on each side the central rib. On one side of the central rib a retaining pin aperture is provided and on the other side of the central rib a complementary retaining pin is provided and vice versa. Each of the retaining pin apertures and retaining pins are positioned so that when the corner parts are assembled the retainer pin is received in its complementary retaining pin aperture. On one side of the central rib the retaining pin apertures and retaining pins alternate along the central rib and vice versa.

[0093] To further strengthen the corner member and hold the corner parts together so that foreign matter does not enter therebetweeen, the corner parts have a series of retaining pin apertures and retainer pins are alternately positioned along and adjacent the side portion of the corner part. On one side portion extending to the central portion, a retaining pin aperture is provided and on the other side portion extending from the central portion, a retaining pin is provided and vice versa. Each of the retaining pin apertures and retaining pins are alternately positioned so that when the corner parts are assembled the retainer pin is received in its complementary retaining pin aperture. By providing a modular design different materials may be used through the rails and the corner members. Preferably, the corner members are made from glass filled nylon which well they are of a stronger materials than the rails provide additional resistance to force is exerted thereon.

[0094] As shown in FIG. 5, the top frame 10 of the present invention has a sufficient contact area 185 with the containers in the palletized units 16 to distribute the load over a sufficient area of the containers so as to allow higher stacking. The top frame 10 has an outside perimeter 180 and an inside perimeter 182. The outside perimeter 180 is defined by the outer sides 42, 42a, 42b, 42c of the rails 32, 34, 36, 38 and the outside sides 60 of each corner member 56 as seen in FIG. 3. The inside
perimeter 182 is defined by the inner sides 40, 40a, 40b, 40c of the rails 32, 34, 36, 38 respectively and the junction portions 74 of the corner members 56. The bottom surfaces 50, 50a, 50b, 50c of the rails 32, 34, 36, 38 and the bottom surface 68 of the corner members 56 are generally coplanar and define the bottom surface 184 of the top frame 11. The top surfaces 48, 48a, 48b, 48c of the rails 32, 34, 36, 38 and a top surface 66 of the corner members are generally coplanar and define the top surface 186 of the top frame 110. Such a construction allows, either the top or bottom surfaces 86, 84 of the top frame to be in contact with the top tier sheet.

[0095] It has been found that the top frame contact area 185, that is the area between the outside and inside perimeter 180, 182 must be equal to or greater than at least 48% of total load area. The total load area 187 is defined by the area bounded by the outside perimeter 180 or, alternatively, the outer sides 42, 42a, 42b and 42c of the rails and the outer sides 60 of each of the corner members. The corner connectors of the present invention provides for restraining twisting of the rails as their width is increased and maintain them in contact with the empty containers so that this area parameter can be achieved. By increasing the size of the top frame to meet these requirements, the straps 30, when tightened, exert both a torsional and bending forces on the side rails 32, 34, 36, and 38 of the top frame 10. Since the side rails have a greater width in order to contact a greater area, the top frame 10 is designed to resist the torsional and bending forces on the rails and maintain the top frame in contact with the top tier of containers and therefore allow higher stacking of the packaged units.

[0096] It should be understood that the area of the top frame in contact with the top tier sheet is the total contact area 185 of the either the top or bottom of the side rails and corner members. The area of the side rails in contact with the top tier sheet when the top frame is in an operative position is the sum of the length (L) times the width (W) of either all of the top sides 44, 44a, 44b, and 44c or all of the bottom sides 46, 46a, 46b, 46c of the rails. The area of each corner member in contact with the top tier sheet is “Ac” as described above. The area “Ac” is the area of each of the top and bottom surfaces 66, 68 of the a top and a bottom base side, 62, 64 of the corner member respectively.

[0097] When the top frame 10 is positioned on the top tier sheet 28, on occasion the top tier sheet shifts with respect to the top frame and is not properly positioned over the top layer of the open containers 26. When a number of top frames are stacked to be shipped back to the container manufacturer, the top frames may not stay properly stacked and may shift with respect to each other. The top frame 10 of the present invention provides a nesting and tier sheet retaining device 188. The nesting and tier sheet retaining device 188 is provided on the top and the bottom 62, 64 of each of the corner members 56, as shown in FIGS. 3, 7, 8, 9, 11, 13 and 14.

[0098] As shown in FIG. 14, the corner member 56 has an upper corner part 58a and a lower corner part 58b. The nesting and tier sheet retaining device 188 includes a ramp 190 having a ramp surface 192 that extends at an angle upwardly from the top surface 84 of the upper corner part 58a and consequently upwardly from the top surface 66 of the corner member 56. The ramp surface 192 of the ramp 190 and terminates at a rounded or flattened tip 194. A return surface 196 is provided which extends from the tip to the top surface 66 of the corner member 56. A pocket 198 is provided in the top surface 66 of the corner member 56 adjacent the ramp 190 and has a bottom and side walls 200, 202 respectively.

[0099] The lower corner part 58b also has another portion of the nesting and tier sheet retaining device 188 which includes a ramp 190 having a ramp surface 192 that extends at an angle away from the lower surface 86 of the lower corner part 58b. The ramp surface 192 of the ramp 190 terminates at a rounded or flattened tip 194. A return surface 196 is provided which extends from the tip to the lower surface 86 of the corner member 56. The nesting and retaining device 188 also includes a pocket 198 in the lower surface 86 of the corner member 56 adjacent the ramp 190 and has a bottom and inside walls 200, 202, respectively.

[0100] The pockets and ramps 198, 190 are positioned so that when a number of top frames are stacked, the pockets 198 on the lower corner member 56 receive the ramps 190 on the bottom of the upper corner member 56a. The ramps 190 allow the top frame to be slid into position with respect to adjacent top frames and when the ramps 190, tip 194 and return surface 196 are received by the pockets 198, relative movement of the adjacent top frames is resisted. When a number of stop frames are so stacked, sliding movement between the stacked top frames is resisted and a top frame so stacked remain in the stacked relationship.

[0101] The nesting and retainer 188 also allows adjusting movement of the top tier sheet when the top frame is positioned thereon. In some cases, the relative position between the top tier sheet and the top frame needs to be adjusted so that they are properly positioned on the top layer of the open containers 26. The ramps 190 contact the top tier sheet and the tip 194 yieldingly engages the top tier sheet to hold it in position while the bands or ramps 30 secure the top frame to the top tier sheet and consequently the top layer of the open containers 26. If the top tier sheet inadvertently shifts with respect to the top frame, the ramps and tips allow it to be repositioned without damaging the top tier sheet. This avoids the necessity of a worker lifting the frame to adjust the position of the top tier sheet. The ramp and its tip on the corner members contact the top tier sheet. Since the tip is flattened or rounded, it does not dig into the top tier sheet if it is moved but does provide some resistance to adjusting movement. This allows the worker to adjust the relative positions of the top tier sheet and the top frame without lifting the top frame. This adjustment is provided by the top tier sheet moving along the ramp and tip without tearing the top tier sheet.

[0102] The invention has been described with reference to the preferred embodiment. Obviously, modifications and alterations will occur to others upon reading in understanding this specification. It is our intention to include all modifications and all the rations in so far as they come within the scope of the appended claims or equivalents thereof.

Having described our invention, we claim:

1. A modular top frame for restraining containers on a pallet, said modular top frame having a plurality of extruded one piece side rails having opposing ends and an inner and outer side and a top and a bottom side, a plurality of corner members having a corner body having an outer side and a top and a bottom side, first connectors connecting said corner members to one of said side rails and second connectors connecting said corner members to another of said side rails, said first connectors including a first set of interconnecting fingers and said second connectors including a second set of interconnecting fingers,
said corner members having upper and lower corner parts, each of said upper and lower corner parts having base, a junction portion and a first and second set of interconnecting finger portions on opposite sides of said junction portion, each of said upper and lower corner parts having an outer side extending away from said base and opposite and spaced from said junction portion and extending between said first and second set of interconnecting finger portions, said outer side of said upper and lower corner parts having a central portion, and a first and second outer side portions extending from said central portion, each of said upper and lower corner parts having a central rib extending between said junction portion and said central portion of said upper and lower corner parts, each of said upper and lower corner parts having a plurality of retainer pin receiving apertures and retainer pins positioned along and adjacent to both sides of said central rib, and along and adjacent to said first and second outer side portions, said retainer pin receiving apertures and said retainer pins on said upper and lower corner parts engage each other to form said corner member.

2. A modular top frame for restraining containers on a pallet as described in claim 1 wherein said retainer pin receiving apertures and said retainer pins are alternately adjacent each other and positioned along and adjacent to each of said first and second outer side portions.

3. A modular top frame for restraining containers on a pallet as described in claim 1 wherein one of said first and second interconnecting finger portions have reinforcing ribs extending from said interconnecting finger portions to one of said first and second outer side portions of said corner part.

4. A modular top frame for restraining containers on a pallet as described in claim 1 wherein said first and second interconnecting finger portions have reinforcing ribs, said ribs of said first interconnecting finger portions extending to one of said first and second outer side portions and said ribs of said second interconnecting finger portions extending to the other of said first and second outer side portions.

5. A modular top frame for restraining containers on a pallet as described in claim 4 wherein said ribs of said first interconnecting finger portions intersect and are formed integrally with said ribs of said second interconnecting finger portions.

6. A modular top frame for restraining containers on a pallet as described in claim 1 having a nesting and tier sheet retaining device having a ramp having a ramp surface that extends at an angle away from one of said top and bottom sides of said corner member, said ramp surface terminates at a tip spaced from said one of said top and bottom sides, a return surface which extends from said tip to said one of said top and bottom sides, and a pocket adjacent said one ramp, another ramp having another ramp surface that extends at an angle away from another of said top and bottom sides of said corner member, said other ramp surface terminates at another tip spaced from said other of said top and bottom sides, another return surface which extends from said other tip to said other of said top and bottom sides, and another pocket adjacent said other ramp.

7. A modular top frame for restraining containers on a pallet as described in claim 6 in which each corner member has a nesting and tier sheet retaining device.

8. A modular top frame for restraining containers on a pallet as described in claim 1, said top frame having an inside and outside perimeter wherein the area between said inside and outside perimeter defines the top frame contact area and the area of said outside perimeter defines the total load area, and said top frame contact area being greater than 48% of said total load area.

9. A modular top frame for restraining containers on a pallet as described in claim 1, wherein each of said top and bottom surfaces of said side rails and said corner members defining an upper and a lower top frame contact area, each of said upper and lower top frame contact areas being greater than 48% of said total load area.

10. A corner member for a modular top frame for restraining containers on a pallet, wherein the modular top frame has side rails with a top and bottom surface and an inner and outer surface, said corner member having top and bottom sides, upper and lower corner parts, each of said upper and lower corner parts having a base, a junction portion and a first and second set of interconnecting finger portions on opposite sides of said junction portion, each of said upper and lower corner parts having an outer side extending away from said base and opposite and spaced from said junction portion and extending between said first and second set of interconnecting finger portions, said outer side of said upper and lower corner parts having a central portion, and a first and second outer side portions extending from said central portion, each of said upper and lower corner parts having a central rib extending between said junction portion and said central portion of said upper and lower corner parts, each of said upper and lower corner parts having a plurality of retainer pin receiving apertures and retainer pins positioned along and adjacent to both sides of said central rib, and along and adjacent to said first and second outer side portions, said retainer pin receiving apertures and said retainer pins on said upper and lower corner parts engage each other to form said corner member.

11. A corner member for a modular top frame for restraining containers on a pallet, wherein the modular top frame has side rails with a top and bottom surface and an inner and outer surface, as described in claim 10 wherein said retainer pin receiving apertures and said retaining pins are alternately adjacent each other and positioned along and adjacent to each of said first and second outer side portions.

12. A corner member for a modular top frame for restraining containers on a pallet, wherein the modular top frame has side rails with a top and bottom surface and an inner and outer surface, as described in claim 10 wherein one of said first and second interconnecting finger portions have reinforcing ribs extending from said interconnecting finger portions to one of said first and second outer side portions of said corner part.

13. A corner member for a modular top frame for restraining containers on a pallet, wherein the modular top frame
has side rails with a top and bottom surface and an inner and outer surface, as described in claim 10 wherein said first and second interconnecting finger portions have reinforcing ribs, said ribs of said first interconnecting finger portions extending to one of said first and second outer side portions and said ribs of said second interconnecting finger portions extending to the other of said first and second outer side portions.

14. A corner member for a modular top frame for restraining containers on a pallet, and wherein the modular top frame has side rails with a top and bottom surface and an inner and outer surface, as described in claim 10 wherein said ribs of said first interconnecting finger portions intersect and are formed integrally with said ribs of said second interconnecting finger portions.

15. A corner member for a modular top frame for restraining containers on a pallet, wherein the modular top frame has side rails with a top and bottom surface and an inner and outer surface, as described in claim 10 having a nesting and tier sheet retaining device having a ramp having a ramp surface that extends at an angle away from one of said top and bottom sides of said corner member, said ramp surface terminates at a tip spaced from said one of said top and bottom sides, a return surface which extends from said tip to said one of said top and bottom sides, and a pocket adjacent said one ramp, another ramp having a another ramp surface that extends at an angle away from another of said top and bottom sides of said corner member, said other ramp surface terminates at another tip spaced from said other of said top and bottom sides, another return surface which extends from said other tip to said other of said top and bottom sides, and another pocket adjacent said other ramp.

16. A modular top frame for restraining containers on a pallet, said modular top frame having a plurality of side rails having opposing ends and an inner and outer side and a top and a bottom surface, a plurality of corner members having an outer side and a top and a bottom surface, said corner members connecting said ends of said side rails to form a rectangular top frame having an top and a bottom surface, an inside and outside perimeter wherein the area between said inside and outside perimeter defines the top frame contact area and the area of said outside perimeter defines the total load area, and said top frame contact area being greater than 48% of said total load area.

17. A modular top frame for restraining containers on a pallet as described in claim 16 wherein each of said top and bottom surfaces of said side rails and said corner members defining an upper and a lower top frame contact area, each of said upper and lower top frame contact area being greater than 48% of said total load area.

18. A modular top frame for restraining containers on a pallet as described in claim 16 including first connectors connecting said corner members to one of said side rails and second connectors connecting said corner members to another of said side rails, said first connectors including a first set of interconnecting fingers and said second connectors including a second set of interconnecting fingers, said corner members having upper and lower corner parts, each of said upper and lower corner parts having base, a junction portion and a first and second set of interconnecting finger portions on opposite sides of said junction portion, each of said upper and lower corner parts having an outer side extending away from said base and opposite and spaced from said junction portion and extending between said first and second set of interconnecting finger portions, said outer side of said upper and lower corner parts having a central portion, and a first and second outer side portions extending from said central portion, each of said upper and lower corner parts having a plurality of retainer pin receiving apertures and retainer pins positioned along and adjacent to both sides of said central rib, and along and adjacent to said first and second outer side portions, said retainer pin receiving apertures and said retainer pins on said upper and lower corner parts engage each other to form said corner member.

19. A modular top frame for restraining containers on a pallet as described in claim 16 wherein said corner member having upper and lower corner parts, each of said upper and lower corner parts having base, a junction portion and a first and second set of interconnecting finger portions on opposite sides of said junction portion, each of said upper and lower corner parts having an outer side extending away from said base and opposite and spaced from said junction portion and extending between said first and second set of interconnecting finger portions, said outer side of said upper and lower corner parts having a central portion, and a first and second outer side portions extending from said central portion, each of said upper and lower corner parts having a central rib extending between said junction portion and said central portion of said upper and lower corner parts, each of said upper and lower corner parts having a plurality of retainer pin receiving apertures and retainer pins positioned along and adjacent to both sides of said central rib, and along and adjacent to said first and second outer side portions, said retainer pin receiving apertures and said retainer pins on said upper and lower corner parts engage each other to form said corner member.

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