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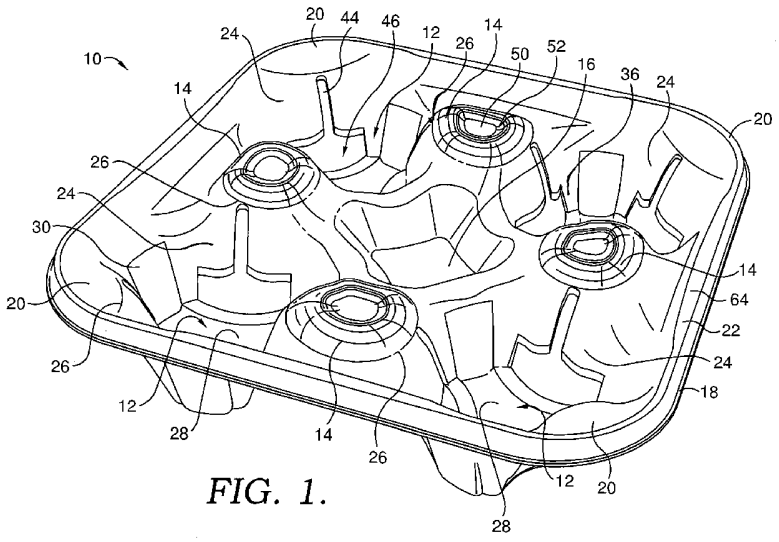



FIG. 1.

(57) **Abstract**: A molded cup carrier of resilient material for holding cups of different shapes and sizes, the cup carrier comprising at least one cup-holding socket, at least two stabilizing posts positioned around each socket and a center cavity defined between the sockets. Each socket includes a floor within each socket having a cup-contacting surface upon which a cup can rest when inserted into the socket. One embodiment includes the stabilizing post having a thumb hold disposed on the top surface of the stabilizing post to aid in preventing a user's thumb from slipping off the top surface of the post. Each stabilizing post may also include at least one curved stabilizing wall extending inwardly and downwardly into a respective socket. The molded cup carrier may also include a peripheral rim wherein a portion of the peripheral rim is inwardly arced.

WO 2011/146416 A2

# CUP CARRIER WITH THUMB HOLDS AND CURVED STABILIZING WALLS

## BACKGROUND ART

Carrying trays for holding and carrying beverage cups are well-known and in widespread use throughout fast-food restaurants, stadiums, convenience stores, coffee shops and the like.

Typically, the trays are comprised of a main body portion provided with a number of cup-holding sockets. The number of cup-holding sockets can vary, depending on the style of the carrying tray. Multiple designs exist, each having different shapes and sizes of cup-holding sockets with varying degrees of accommodation for beverage cups of different shapes and sizes.

Over time the demands on these carrying trays have evolved. The fast-food restaurant industry has continued to increase maximum portion sizes, including the use of very large beverage cups for soft drinks. One type of beverage cup that has become very popular has a "step-walled" structure where the bottom portion of the cup is smaller in diameter than the top portion of the cup. These "step-walled" cups are designed to hold large amounts of beverage while maintaining a base small enough to fit into reasonably-sized cup holders, such as those present in automobiles or the arm rests of stadium seats. These cups often have the capacity to hold 32 or even 44 ounces of liquid. However, the design of these cups only provides a carrying tray with a smaller gripping area towards the bottom, while raising the height of the liquid load, thus making the cups top-heavy.

More recently, many restaurants have introduced and heavily marketed high-end coffee and tea beverages, which are typically served in smaller, narrower cups than traditional soda cups. These cups may only hold 10 or even less ounces of liquid.

These combined trends have created broader requirements on the range of cup sizes that must be accommodated by a cup carrier.

Manufacturers have attempted to accommodate the variety of large and small cup sizes in several ways. The most common method is to provide flexible members on the sides of the cup-holding sockets that deflect as the cup is inserted, in an attempt to accommodate a range of cup base sizes. Examples of this approach are shown in U.S. Pat. Nos. 4,208,006 to Bixler, 4,218,008 to Vellieux, and 6,398,056 to Letourneau. The problem with this approach has been that, due to the downward sloping walls, the contact point with the cup is related to the cup base size. Therefore, cups with smaller base sizes are gripped at very low points, thereby decreasing stability.

Another method to address this problem has been to increase the depth of the cup-holding sockets. A deeper socket can provide some tipping resistance to a small cup, even if it

is not gripped securely. Some examples of this approach are illustrated in U.S. Pat. Nos. D438,100 to Cekota, and 7,225,927 to Sweeney. A drawback of this approach is that it necessitates a taller structure, preventing the design from being run on certain molding machines. Another disadvantage of this approach is that it increases the developed area of a carrier. If the product is made to the same weight as a shorter carrier, the weight per unit area must be lower, thereby weakening the structure. If the weight is increased to compensate, this results in higher material, energy, and transportation costs and increases the amount of natural resources used. Another disadvantage of this approach results because bundles of these carriers create taller stacks, thereby requiring an increase in storage space and shipping costs.

A third method has been to replace the angled sidewall members with short, flexible tabs. Some examples of this approach are illustrated in U.S. Pat. Nos. 6,679,380 to Brown and 6,651,836 to Hofheins. The longer the tabs, the wider a range of cup sizes can be contacted by them. However, the longer the tabs, the weaker their gripping force becomes. Also, the rigidity of the socket structure is weakened due to the lack of material near the base of the socket. Cup tipping tendency may be greater if the bottoms of the cups are not captured by the socket.

A fourth method has been to provide sockets of different sizes on the same cup carrier, as shown for example in U.S. Pat. Nos. D319579 to Vigue, 5,096,065 to Vigue, and 6,679,380 to Brown. The problem with this approach is that the practicality of the cup carrier is significantly decreased. Such a cup carrier is restricted to a limited number of combinations of large and small cups. The cup carriers disclosed in these references have four cup carrying sockets - two of which can only carry large cups and two of which can only carry small cups.

U.S. Pat. No. 7,762,396 to Yang et al. describes a modification on the above approaches, including a stabilizing wall divided into two distinct slopes, an upper portion and a lower portion. The upper portion has a downward slope that is shallower than the downward slope of the lower portion. This configuration is an improvement over the above configurations, but it still limits the range of cup sizes that this carrier can accommodate securely. Cups having bases that do not fit into one of the two specified slopes, either the upper portion or the lower portion, may not receive the full advantages of this stabilizing wall configuration.

In addition to problems with cup fit discussed above, cup carriers also have been called upon to support heavier weights, due to the use of larger sized cups. The heavier weights often make it more difficult for persons carrying two or more cups in the cup carrier to achieve a grip on the carrier such that they can comfortably and securely carry the additional load, particularly with one hand. Often, the user attempts to grip the carrier on one side of the carrier between the cups. The user places their thumb between the cups on the top of the carrier and wraps their

hand or other fingers around the rim underneath the carrier. The carriers of the prior art include flat or convex areas for the thumb to bear against. In these embodiments, the user's thumb has a propensity to slip, particularly when only using one hand and when the cantilevered weight is too much over time or the weight of the load shifts suddenly. Further, cup carriers that have been overloaded tend to buckle in a predictable manner, collapsing along a line between adjacent cup sockets, through or near the center of the tray. The area between the cup sockets is a weak point in a typical cup carrier.

Accordingly, a need exists for a cup carrier capable of carrying beverage cups within a wide range of sizes, including large cups, "step-walled" cups, and small cups, in a secure and stable manner. A need also exists for a cup carrier capable of being comfortably and securely held and carried by a user. A need also exists for a cup carrier capable of carrying several filled cups at a time without having the carrier collapse or buckle from the weight of the filled cups. A further need exists for a cup carrier that can be produced using pre-existing molding machines and is composed of less material.

## DISCLOSURE OF INVENTION

The present invention involves the provision of a cup carrier formed of a resilient material having cup-holding sockets capable of holding and securing a variety of cups having different shapes and sizes. Each socket has stabilizing posts positioned in a spaced apart arrangement around the socket and a floor at the bottom of the socket on which a cup can rest. Extending inwardly and downwardly from each stabilizing shoulder are stabilizing walls. The stabilizing walls are composed of a curved portion. The curved portion has a tangent slope that is shallower proximate an upper end of the curved portion and gradually increases along the curve toward a lower end such that the slope may be substantially vertical at one or more points along the lower end of the curve.

This socket configuration extends the stabilizing wall further into an upper region of the socket, thereby enabling the stabilizing wall to contact smaller diameter cups at a higher point. The higher contact point increases cup stability. In one embodiment, the socket configuration allows the stabilizing wall to be substantially in contact with the cups from the upper most contact point down to the stabilizing wall's lower most edge, thereby providing a larger area of contact increasing the pull out friction area. In another embodiment, the curvature of the stabilizing wall of the socket allows the stabilizing wall to flex so that the cup wall will run tangent to the curve of the stabilizing wall for each of a wide range of cup sizes, automatically adjusting to the appropriate angle to be in optimal contact with the cups. Both of these

embodiments include elements that increase the gripping effect and the ultimate stability of the cup within the socket.

The socket configuration also allows the carrier to hold larger cups, such as "step-walled" cups. In one embodiment, the entire curved portion of each stabilizing wall is in contact with the larger cups. The fact that the upper part of the curved portion is in contact with the larger cups is beneficial. Because the upper portion initially has a relatively shallow angle, it in turn exerts more gripping force against the cup when it is deflected outwardly by the cup's sidewall. This is especially advantageous in the case of "step-walled" cups because, as mentioned above, these types of cups only provide a small gripping area, while raising the height of the liquid load, thus making the filled cups top-heavy and more susceptible to tipping.

The cup carrier also includes a feature to increase the user's ability to comfortably and securely hold and carry the cup carrier. The cup carrier includes stabilizing posts between or surrounding a socket. This is the area where a user typically grips the carrier to carry it. The cup carrier includes recessed "thumb holds" in the top surface of at least one stabilizing post to provide a depressed surface to ergonomically mimic the natural shape of the exterior of a thumb and create an increased area of friction and/or a vertical surface to prevent the thumb from sliding off the top of the post when a loaded carrier is held in a single hand. The cup carrier may alternatively include projections protruding upwardly from the top surface of the stabilizing posts and/or the corners.

The carrier also includes structural features to increase strength and rigidity. For example, the carrier may have a stepped center cavity or well. The center cavity may include a stepped sidewall which resists buckling and provides increased rigidity. Further, a portion of the outer rim may be recessed and/or may be angled inward to create a stiffer rim member. In addition, a portion of the outer rim may have a wider horizontal top face to further increase the torsion and bending stiffness of the cup carrier. Another element that may provide extra strength and stiffness to the cup carrier is the smoothly contoured or curved gutter members between the outer rim and the stabilizing posts. This configuration provides the same or greater stiffness with less material, or a greater stiffness with the same amount of material.

Other aspects and advantages of the present invention will be apparent from the following detailed description of the preferred embodiments and the accompanying drawing figures.

## BRIEF DESCRIPTION OF DRAWINGS

The accompanying drawings form a part of the specification and are to be read in conjunction therewith, in which like reference numerals are employed to indicate like or similar parts in the various views, and wherein:

Fig. 1 is perspective view of one embodiment of a cup carrier in accordance with the teachings of the present invention;

Fig. 2 is a top side view of a cup carrier in accordance with one embodiment of the present invention;

Fig. 3 is a fragmentary cross-sectional view of a socket portion of the cup carrier of Fig. 2 taken generally along line 3-3 in the direction of the arrows;

Fig. 4 is a fragmentary cross-sectional view of a socket receiving a smaller beverage cup in accordance with one embodiment of the present invention;

Fig. 5 is a fragmentary cross-sectional view of a socket receiving a larger beverage cup in accordance with one embodiment of the present invention;

Fig. 6 is a fragmentary cross-sectional view of a post of the cup carrier shown in Fig. 2 taken generally along line 6-6 in the direction of the arrows;

Fig. 7 is a perspective view of one embodiment of a cup carrier in accordance with the teachings of the present invention; and

Fig. 8 is a top view of one embodiment of a cup carrier in accordance with the teachings of the present invention.

## BEST MODE FOR CARRYING OUT THE INVENTION

The following detailed description of the invention references the accompanying drawing figures that illustrate specific embodiments in which the invention can be practiced. The embodiments are intended to describe aspects of the invention in sufficient detail to enable those skilled in the art to practice the invention. Other embodiments can be utilized and changes can be made without departing from the scope of the present invention. The present invention is defined by the appended claims and the description is, therefore, not to be taken in a limiting sense and shall not limit the scope of equivalents to which such claims are entitled.

As such, those skilled in the art will appreciate that the conception upon which this disclosure is based may readily be utilized as a basis for the designing of other structures, methods and systems for carrying out the several purposes of the present invention.

The entire disclosure, including the specification and drawings, of U.S. Patent No. 7,762,396 issued July 27, 2010 to Keegan Y. Yang, et al., entitled Cup Carrier (the "'396 patent") and U.S. Patent App. No. 61/345,134 filed on May 16, 2010 to Keegan Y. Yang, et al., entitled "Cup Carrier with Thumb Holds and Curved Stabilizing Walls" are incorporated herein by reference.

The invention will now be described with reference to the drawing figures, in which like reference numerals refer to like parts throughout. For purposes of clarity in illustrating the characteristics of the present invention, proportional relationships of the elements have not necessarily been maintained in the drawing figures.

Reference numeral 10 designates generally a cup carrier formed of a resilient material, such as molded fibrous pulp. Cup carrier 10 may be manufactured by molding fibrous pulp against molds or dies in a process and manner well-known in the art. In an alternative embodiment, cup carrier 10 may be made from other materials, such as plastics, foams, or other materials having desirable strength and resiliency.

Cup carrier 10 has at least one cup-holding socket 12 molded therein to securely hold beverage cups of a variety of shapes and sizes. Such cups may be of a conventional style having a frustoconical sidewall with a circular cross-section and a bottom wall secured thereto. The cups may also include "step-walled" cups wherein the bottom portion of the cup is smaller in diameter than the top portion of the cup. The cups may have a flat bottom surface or a rimmed bottom surface and can be made from materials such as plastic, paperboard, foam, or the like. The cups may have a variety of capacities, for example, ranging from compact cups capable of holding only four ounces (4 oz.) of liquid to very large "step-walled" cups capable of holding forty-four ounces (44 oz.) of liquid.

Fig. 1 shows a cup carrier 10 being substantially rectangular in shape that includes four cup-holding sockets 12 of substantially the same size, one being provided in each corner 20 of the carrier 10, with a center cavity 16 positioned therebetween. However, the carrier 10 can take on different configurations and numbers of sockets 12. Even though the illustrated carrier 10 includes four sockets 12, it will be understood that the number of sockets 12 may be varied to be less than or greater than four sockets 12. For example, in one embodiment, the carrier 10 includes one or two sockets 12 with the remainder of the carrier 10 comprising a substantially flat food carrying surface. The carrier 10 can also include a downturned continuous peripheral rim or flange 18 having a top surface 22.

Each cup-holding socket 12 comprises at least two stabilizing posts 14 positioned in a spaced apart arrangement around socket 12. Stabilizing posts 14 may be positioned at a level

substantially equal to the top surface 22 of the rim 18, as depicted in Fig. 1, or may be positioned at a level above or below the top surface 22 of the rim 18. Each post 14 includes two generally opposing stabilizing walls 24. In addition, each corner 20 also includes a stabilizing wall 24 extending inwardly and downwardly therefrom as shown. The three stabilizing walls 24 are spaced substantially equidistantly around each cup-holding socket 12. As discussed in further detail below, the upper edges 26 of the three stabilizing walls 24 (which are shown in the Figures as curved structures) define the size of the socket 12 opening, and thus the diameter of the widest cup that may be received within socket 12. As shown in Fig. 1, the outer edges 26 of the stabilizing posts 14 and corners 20 are also the upper edges 26 of the stabilizing walls 24.

As best seen in Figs. 2-3, each socket 12 is provided with a floor 28. The socket floor 28 is integrally molded with sidewall portions 30 that are located around socket 12 between stabilizing posts 14 and corners 20. The socket floor 28 optionally has reinforcing ribs 32 associated therewith. The reinforcing ribs 32 are slightly raised above the socket floor 28, normally to a distance between $^1/_{16}$-$^1/_4$ of an inch. In the embodiment illustrated in Fig. 2, there are three reinforcing ribs 32 associated with each socket floor 28.

In one embodiment, the reinforcing ribs 32 comprise horizontal portions 34 associated with the socket floor 28 and generally vertical portions 36 connected therewith that extend at least partially up the sidewalls 30, as best shown in Fig. 3. This configuration provides socket 12 with additional rigidity and strength.

The bottom of a cup inserted into the cup-holding socket 12 normally, though not always, will rest on a cup-contacting surface as shown in Fig. 4. The cup-contacting surface can either be the top surface of the floor 28, or if reinforcing ribs 32 are present, then the top surface 40 of the reinforcing ribs 32. If the cup-contacting surface is the top surface of the socket floor 28, then the bottom of the cup will rest directly on the socket floor 28. When the top surface 40 of the reinforcing ribs 32 is the cup-contacting surface, then the bottom of the cup is slightly elevated above the socket floor 28. In the embodiment shown in Figs. 4, the cup-contacting surfaces are the top surfaces 40 of the reinforcing ribs 32.

Now turning back to Figs. 1 and 3, extending downwardly and inwardly from each stabilizing post 14 and each corner 20 is a stabilizing wall 24 that continues to a distance above the socket floor 28. Each stabilizing wall 24 has a curved profile as will be discussed in further detail below. As seen in Fig. 3, the curve may resemble a parabolic curve starting with a very flat tangent slope angle wherein the tangent slope angle gradually increases to a substantially vertical slope. Each stabilizing wall 24 may optionally include a slot 44 which vertically bisects the wall 24. The slot 44 may extend upward from an opening 46, which is defined between the

lower edge 48 of the stabilizing wall 24 and the socket floor 28. The slot 44 may terminate at a point at, below, or above the outer edge 26 of stabilizing post 14 or corner 20. The configuration formed by the opening 46 and slot 44 is commercially known as a T-Slot®. However, while a T-Slot® configuration is illustrated in the figures, it will be understood that in other embodiments, different types of openings and slots may be defined through the stabilizing walls. For example, in other embodiments, the configuration defined through the stabilizing wall may take the form of a triangle, a rectangle, an inverted Y-shape, or any other suitable configuration now known or hereafter developed.

The stabilizing walls 24 are deflected outwardly when a cup is inserted into the cup-holding socket 12. The deflection, elasticity and stiffness of the stabilizing walls 24 can be controlled by adjusting the thickness, density, nature of material, and/or degree of curvature of the curved portion 42 of stabilizing walls 24. The material, such as molded pulp, should have a resiliency and texture such that the deflected walls 24 exert a gripping force on the inserted cup, regardless of the cup size. The curved shape of stabilizing walls 24 act like a spring to resist displacement by the extents of the cup and thereby exert a resistance force against the walls of the cup. The combination of the three curved walls 24 surrounding the cup and the resulting spring action of the walls 24 exert a substantially horizontal "clamping" force against the cup providing an increased frictional force resisting the removal of the cup within the socket. This configuration provides a more solid seating of the cup within socket 12 of cup carrier 10.

As described above, an important aspect of the invention is the configuration of socket 12. In order to securely hold the cups placed within sockets 12, the curved portion 42 of stabilizing walls 24 is designed to contact the cups (of varying sizes) at a point desirably high up on the side of the cups. Curved portion 42 provides stabilizing walls 24 with increased strength and allows them to better support and hold the cups. Curved portion 42 also affords the cup carrier the ability to more effectively hold a larger range of cup diameters. This is also why a parabolic-like shape works well. Additionally, as shown in Fig. 4 curved portion 42 may also be comprised of an upper curved transition portion 42a with a substantially linear face 42b extending downward and inward toward the center of socket 12. Another embodiment includes curved portion 42 being configured such that curved portion 42 extends downward and outward at the lower edge 48 (directed away from the center of socket 12) forming more of a "C" shape profile.

Curved portion 42 allows stabilizing wall 24 to protrude laterally into socket 12 higher on socket 12 than a dual-sloped or single-sloped linear wall of existing cup carriers. This configuration of stabilizing walls 24 affords socket 12 the ability to contact both small and large

cups at a higher point on the slant or vertical height of the sides of the cups. This is demonstrated in Figs. 4-5. Fig. 4 shows a socket 12 holding a smaller cup 56, similar to one used to contain coffee. Fig. 5 shows a socket 12 holding a "step-walled" cup 60, as described above. Fig. 4 illustrates that the stabilizing wall 24 is not totally deflected and still contains a curved section while contacting the smaller cup 56 at a desirable height. Fig. 5 illustrates cup carrier 10 carrying the larger cup 60 wherein there is little curved portion 42 visible and the substantial length of the stabilizing wall 24 is in contact with the cup's side wall.

The stabilizing wall's 24 curved profile also enables the socket to accommodate relatively large cups, as the upper end of curved portion 42 of the stabilizing wall 24 is configured to facilitate a relatively large amount of inward deflection. In fact, as seen in Figs. 4-5, the fact that stabilizing wall 24 includes curved portion 42 necessarily results in stabilizing wall 24 having an upper transition zone (i.e., the area where the tangent of the curved portion 42 begins to change in slope) that is further from the center of the socket as compared to the upper transition zones of existing cup carriers having single or dual sloped linear stabilizing walls, thereby allowing the stabilizing wall to undergo inward deflection further from the center of the socket and, thus, enabling the socket to accommodate larger cups.

The embodiment of cup carrier 10 of the present invention shown in Fig. 4 has a stabilizing wall 24 that extends downwardly and inwardly in a parabolic curve-linear profile with a relatively shallow tangent angle toward the top, then having the tangent angle gradually getting steeper. This design extends the stabilizing wall 24 further into the top portion of socket 12, thereby enabling the stabilizing wall 22 to contact smaller diameter cups 56 at a relatively higher point on the side of cup 56. This configuration provides increased stability of cup 56 within socket 12. As can been seen in Fig. 4, the contact point 58 for the cup 56 will depend on the diameter and slope of the cup's walls and where the wall engages curved portion 42 of stabilizing wall 24. Thus, the higher up on the cup's wall, the better. Additionally, the configuration allows the stabilizing wall 24 to be in contact with cup 56 from the contact point 58 down to the lower edge 48 to further increase stability. All the while, as illustrated in Fig. 5, socket 12 has the ability to receive and secure larger cups, such as "step-walled" cups 60.

Fig. 5 illustrates socket 12 of an embodiment of the present invention receiving a larger cup 60. When larger cup 60, such as a 32-ounce "step-walled" cup, is inserted into socket 12, it is contacted by the entire curved portion 42 of the stabilizing wall 24 substantially along its length from the point of contact down to lower edge 48. Because the curved portion 42 initially has a relatively shallow angle, it exerts more gripping force on the cup 60 when it is deflected outwardly by the cup's sidewall. This is especially advantageous in the case of "step-walled"

cups because, as mentioned above, these types of cups 60 only provide a small gripping area, while raising the height of the liquid load, thus making the cups 60 top-heavy and more susceptible to tipping when full of fluid.

In another embodiment not shown, the construction and curvature of the stabilizing wall 24 of the socket 12 allows the stabilizing wall 24 to flex so that the cup wall will run tangent to the curve of the stabilizing wall for each of a wide range of cup sizes, automatically adjusting to the appropriate angle to be in optimal contact with the cups depending on the diameter of the cup 56 or 60.

Additionally, in yet another embodiment, stabilizing walls 24 of the present invention may be similar to those disclosed in the issued '396 patent except for that they may include three, four, five or more portions having different angles, as opposed to just two angles as shown and described in the '396 patent to simulate and replicate the behavior of curved portion 42.

In addition, as can be seen in Figs. 1-3, one embodiment of cup carrier 10 includes "thumb holds" or "thumb positioners" 50 recessed or indented into the upper surface 52 of at least a portion (i.e., one or more) of each stabilizing post 14. Thumb holds 50 provide a user with a secure location to grip cup carrier 10 with his/her thumb(s). The recessed thumb holds 50 assist in preventing the user's thumb from sliding off of the stabilizing post 14, as can happen when the stabilizing post 14 has a flat upper surface 52. The thumb holds 50 also present the user with a more comfortable and ergonomic way to grip and hold cup carrier 10. For example, as illustrated in Fig. 6, a user may grab cup carrier 10 such that the palm of the user's hand surrounds a portion of the carrier's peripheral rim 18 and the user's thumb 54 is located within the recessed thumb hold 50. Additionally, the user may also find it comfortable and stable to place the user's index (i.e., pointer) finger underneath and proximate the thumb hold 50.

Further, as shown in Fig. 6, an embodiment of the cup carrier 10 of the present invention includes a smoothly contoured or curved gutter 82. Gutter 82 is generally between peripheral rim 18 and stabilizing post 14 and spans between sockets 12. As seen in Fig. 7, there are four gutters 82 corresponding to the four stabilizing posts in this embodiment of the present invention. Alternatively, gutter 82 may have a similar configuration, but with angular walls having more pronounced corners transitions.

As shown in Figs. 7-8, in an alternative embodiment of cup carrier 10 of the present invention, the thumb holds 50 may be comprised of one or more protrusions 68 extending from the upper surface 52 of stabilizing post 14 instead of, or in addition to, the thumb holds 50 being recesses. For example, one or more stabilizing posts 14 may include a protrusion 68 extending from the outer portion of its upper surface 52 closest to the cup carrier's peripheral ring 18. This

provides a structure for the thumb 54 to rest against providing a vertical barrier to prevent the thumb 54 from slipping off post 14 when a user is carrying full cups in cup carrier 10. In addition, an embodiment of the cup carrier of the present invention includes raised corner portions 70. The raised corner portions 70 provide a thumb hold in each corner, as well as increase the stiffness of the corner section. The raised corner portions may be included with either embodiment of the thumb holds 50 (the recess or protrusions 68).

The indented thumb holds 50 or protuberances 68 may be of any desired ornamental size, shape and contour. The specific size, shape and contour of the thumb holds 50 as shown in Figs. 1-3, or protuberances 68 shown in Figs. 7-8 may improve the aesthetic appearance of the tray, and also provides for the functional advantages as discussed above.

As illustrated in the figures, one embodiment of cup carrier 10 of the present invention is comprised exclusively of softly curved contours at all wall transitions. Unlike the prior art cup carriers, an embodiment of cup carrier 10 includes only a relatively small number of corners or sharp edges. In fact, the only area in which this embodiment of cup carrier 10 includes any substantially non-rounded corners is at the bottom of socket 12 where the socket floor 28 meets the socket's sidewall 30, as is necessary to accommodate most cups, which have a flat bottom wall.

Among the other advantages described below, cup carrier 10 made of molded fiber or the like having curved contour at plane transitions can more effectively be pressed (as compared to a cup carrier having sharper corners and edges), which results in shorter drying times. This, in turn, allows the equipment forming the cup carriers to operate at faster speeds and leads to a larger output of cup carriers produced over a given duration of time.

Additionally, the curved contours of cup carrier 10 facilitate de-nesting. As is known in the art, once they are formed, a plurality of cup carriers 10 are placed one on top of the other in a stack and then compressed to reduce the height of the stack for shipping. This procedure can sometimes cause two or more cup carriers 10 to become inadvertently stuck together when a user, such as a fast food restaurant employee, attempts to separate a single cup carrier 10 from the stack. By having fewer corners or sharp intersection lines, the curved contours of cup carrier 10 reduces the chances that two cup carriers will become stuck together and thereby facilitates the de-nesting from a stack.

Moreover, the curved contours of cup carrier 10 have numerous other advantages over the prior art including increased strength and better cup stability, improved shape retention, and the elimination of corners and edges that can create weak spots or stress concentrations in the walls of cup carrier 10 that make it susceptible to buckling.

In addition to the description above, the socket configurations can alternatively be defined, in part, by two independent diameters - the diameter $D_1$ at the upper edges 26 of the stabilizing walls 24, and the diameter $D_2$ at the lower edges 48 of the stabilizing walls 24 (see Fig. 2).

As mentioned above, the upper edges 26 of the three stabilizing walls 24 define the size of the socket 12 opening, and thus the diameter of the widest cup that socket 12 can accommodate. As illustrated in Fig. 2, the diameter $D_1$ of a circle drawn tangent to the edges 26 defines the size of the socket 12 opening. Diameter $D_1$ may be between about two inches (2") and about four inches (4"), or alternatively between about two-and-one-half inches (2.5") and about three-and-one-half inches (3.5"). In one embodiment, diameter $D_1$ may be about three inches (3").

Another diameter $D_2$ is formed by a circle drawn tangent to the lower edges 48 of the stabilizing walls 24. Diameter $D_2$ is equal to or smaller than diameter $D_1$ and may be between about one inch (1") and about three inches (3"), or alternatively between about one-and-one-half inches (1.5") and about two-and-one-half inches (2.5"). In one embodiment, diameter $D_2$ may be about two inches (2"). The socket configuration can be further defined by the ratio of the diameters $D_2$ and $D_1$. For example, the ratio of diameter $D_2$ to diameter $D_1$ can be between about 0.5 and 0.8, and in one embodiment is about 0.67.

As illustrated in Fig. 3, the socket configurations can be further defined by the distances and ratios between the cup-contacting surface 28 or 40 and the lower edges 48 of the stabilizing walls 24, and the upper edges 26 of the stabilizing walls 24. The distance $D_3$ between the cup-contacting surface and the lower edges 34 can be between about zero inches (0") and about one inch (1"), and in one embodiment is about one-half inch (0.5"). The distance $D_4$ between the cup-contacting surface and the upper edges 26 can be between about one inch (1") and about three inches (3"), and in one embodiment is about one-and-eight-tenths inches (1.8"). The ratio of distance $D_3$ to distance $D_4$ can be between about zero (0) and 0.6, and in one embodiment is about 0.3. The depth of socket 12 remains such that the carrier 10 can be produced using pre-existing molding machines. The overall height $D_5$ of the carrier 10 can be, for example, about two inches (2"). However, it will be understood that the height $D_5$ can certainly be more or less than that.

In addition, as best shown in Figs. 2 and 6, the outer peripheral rim or flange may be inwardly arced or curved. An arced portion 62 may have a relatively large radius or may be comprised of a plurality of large radiuses. Inwardly arced portion 62 creates a stiffer outer rim that provides cup carrier 10 with additional strength and stiffness. Further, as shown in Fig. 6,

an outer flange 80 of rim 18 may be angled inward toward cup carrier along a portion of the rim that may or may coincide with the inwardly arched portion. Additionally, as illustrated in Fig. 8, a portion of or the entire peripheral rim 18 may include a wider portion 64 as another element that improves the bending or torsional stiffness of cup carrier 10.

As depicted in Fig. 7, cup carrier 10 may also include extended buttresses 66 extending from the sockets' sidewalls 30 to improve shape retention of the socket.

Further, in order to provide increased strength and rigidity, the carrier 10 may include a uniquely designed center cavity 16. As best shown in Fig. 4, the carrier's center cavity 16 may have a stepped sidewall configuration. As illustrated, the cavity 16 includes a generally vertical upper sidewall 72, a generally horizontal intermediate wall 74, a generally vertical lower sidewall 76, and a bottom wall 78. This configuration provides a structure that increases the torsion, shear and bending stiffness of cup carrier 10 thereby increasing the resistance to buckling and failure. Fig. 5 shows another embodiment that does not include a stepped sidewall that is also within the scope of the present invention. Notwithstanding this difference, Figs. 4 and 5 primarily illustrate cup carrier 10 receiving cups of two different sizes.

All of the features of cup carrier 10, including but not limited to, the sockets, posts, recessed thumb holds, curved stabilizing walls, soft curved contours, outer peripheral rim, extended buttresses, and center cavity may be of any desired ornamental size, shape and contour. The specific size, shape and contour of these features as shown in the figures improves the aesthetic appearance of the tray, and also provides for the functional advantages as discussed above.

To demonstrate the unexpected benefits of the improvements of the cup carrier of the present invention over those cup carriers known in the art, testing of a variety of physical characteristics and key performance qualities were performed. Cup carriers V and W are products of Huhtamaki America, cup carrier X is a product of Pactiv Corp., cup carrier Y is a product of Cascade, and cup carrier Z is a product of PrimeLink. Testing was performed to compare the weight of embodiments of cup carrier 10 against the weights of existing carriers. Lighter weight carriers require less material and energy to manufacture, dry, ship, and dispose of. The carriers were weighed after conditioning for at least 24 hours in a standard atmosphere control laboratory. The average weights of the various styles of cup carriers described above are listed below in Table A.

**Table A – Tray Weight**

| | Conditioned Weight (g) |
|---|---|
| Embodiment 1 - (Present Cup Carrier) | 32.1 |
| Embodiment 2 - (Present Cup Carrier) | 36.6 |
| Cup carrier V | 34.1 |
| Cup carrier W | 33.7 |
| Cup carrier X | 35.1 |
| Cup carrier Y | 37.1 |
| Cup carrier Z | 36.7 |

As mentioned above, in some instances, cup carrier 10 is used to carry four large cups 60 having capacities of thirty-two ounces (32 oz.) or more. In such instances, carriers can be prone to buckling about their center sections. For example, the carriers undergo significant torsion and bending stresses when loaded with full cups, especially when a user is attempting to hold the carrier with one hand. In such instances, material failures or buckling can occur about the carrier's center well or cavity.

To compare the rigidity of the embodiments of the new cup carrier 10 against existing cup carriers in the market place, a rigidity test was performed. The rigidity test measures the force required to bend a cantilevered rim of the cup carriers down by one-half inch (1/2") while the cup carrier is supported at the bottom of the center and at the top of the opposite rim. The load was applied to the rim of the carrier and the higher the number, the more rigid the carrier. The results of the rigidity test are presented in Table B below.

**Table B – Rigidity**

| | Deflection Force (gf) |
|---|---|
| Embodiment 1 - (Present Cup Carrier) | 638 |
| Embodiment 2 - (Present Cup Carrier) | 803 |
| Cup carrier V | 548 |
| Cup carrier W | 498 |
| Cup carrier X | 277 |
| Cup carrier Y | 405 |
| Cup carrier Z | 274 |

Thus, the two embodiments of cup carrier 10 of the present invention demonstrated higher rigidity over the existing cup carriers. In particular, embodiment 1 has the lowest weight, but the second highest rigidity, thus, obtaining better performance than existing cup carriers with lower material and shipping costs.

Another test to compare the strength and rigidity of cup carrier 10 against that of existing cup carriers, a deflection test was performed whereby the carriers were tested for their ability to support 32-ounce cups filled with liquid. During the test, one side of the carrier was clamped to a device in order to simulate being held by a hand. The two unsupported cup-holding sockets (i.e., those sockets furthest from the clamping device) were loaded with 32-ounce "step-walled" cups filled with liquid. The 32-ounce "step-walled" cups are considered to be highly demanding large cups, for the reasons already noted above. Once the load was applied, the deflection of each carrier was measured at thirty (30) seconds and at one-hundred-eighty (180) seconds wherein the cup carriers effectively act as cantilevered beams. If, during the thirty (30) second or one-hundred-eighty (180) second time period, the carrier failed, the result was noted as "Failed" and no measurement was taken. However, if the load was supported the full thirty (30) or one-hundred-eight seconds, the tester measured the distance that the unsupported edge of the carrier had deflected down under the sustained load. Carriers with lower deflections were judged to be stronger. In cases where one type of carrier passed some, but not all, of the tests, the tester only measured the deflection when it passed. The results of these tests are recorded below in Table C.

**Table C – Rigidity Test**

| | % Fail (30s) | Deflection (mm)(30s) | % Fail (180s) | Deflection (mm) (180s) |
|---|---|---|---|---|
| Embodiment 1 - (Present Cup Carrier) | 0 | 12 | 0 | 14 |
| Embodiment 2 - (Present Cup Carrier) | 0 | 11 | 0 | 13 |
| Cup carrier V | 100% | N/A | 100% | N/A |
| Cup carrier W | 67% | N/A | 100% | N/A |
| Cup carrier X | 80% | N/A | 100% | N/A |
| Cup carrier Y | 0 | 8 | 0 | 11 |
| Cup carrier Z | 90% | N/A | 100% | N/A |

The data illustrates that embodiment 2 of new carrier 10 had the second lowest failure rate (it never failed), and the second lowest deflection (13 mm) of all the cup carriers tested. Only carrier Y had lower deflection; however, is also the heaviest cup carrier and, therefore costs more to manufacture and transport. Further, embodiment 1 of the new carrier is the lightest weight, yet has comparable deflection properties as the two substantially heavier carriers. From the test data in Tables A-C it can be seen that the cup carrier of the present invention is not only stronger per unit weight overall, but can also can be made lighter weight than every existing carrier tested, yet still obtain better performance characteristics.

To compare the cup-holding ability of cup carrier 10 against that of its proprietary existing cup carriers (cup carriers V and W) and cup carrier Y, the only other brand to withstand the deflection test, a tipping angle test was performed. All of the other cup carriers have sidewalls with a unitary angle or slope. Cups filled with a liquid were placed in the cup-holding sockets of the carriers. Each carrier was loaded with two thirty-two ounce (32 oz.) step walled cups and two twelve ounce (12 oz.) coffee cups. Each of the loaded carriers was then tilted until at least one of the cups became dislodged. The angle at which the cup became dislodged was measured and recorded up to forty-five degrees (45°). If no cups were dislodged by the time the carrier was tipped to 45°, then the test was stopped, and the result of 45° was recorded. The results of these tipping tests are recorded below in Table D.

**Table D – Maximum Secure Tipping Angle**

| | Tipping Angle |
|---|---|
| Embodiment 1 - (Present Cup Carrier) | 40° |
| Embodiment 2 - (Present Cup Carrier) | 40° |
| Cup carrier V | 30° |
| Cup carrier W | 33° |
| Cup carrier Y | 35° |

The results of the tipping test illustrates that the cup carrier of the present invention provides increased resistance to a cup tipping over when compared to all of the other tested existing cup carriers. In general, the performance of the cup carrier of the present invention exceeded that of every other carrier. From these tests, it is seen that cup carrier 10 offers a significant improvement in the strength of the cup carrier and an advantage in the range of cup sizes that can be securely held without tipping when manufactured at a weight comparable to the competition. Moreover, the features of cup carrier 10 provides substantial improvement over the existing cup carriers as the cup carrier of the present invention can be realized the added efficiency of reducing the weight of each carrier by over 10% and still have equivalent or, in most cases, superior performance characteristics.

From the foregoing, it may be seen that the cup carrier of the present invention is particularly well suited for the proposed usages thereof. Furthermore, since certain changes may be made in the above invention without departing from the scope hereof, it is intended that all matter contained in the above description or shown in the accompanying drawing be interpreted as illustrative and not in a limiting sense. It is also to be understood that the following claims are to cover certain generic and specific features described herein.

CLAIMS

1. A cup carrier of resilient material comprising:

at least one cup-holding socket to hold cups of different shapes and sizes;

at least two stabilizing posts positioned around the socket;

a cup-contacting surface upon which a cup can rest when inserted into the socket; and

at least one stabilizing wall extending inwardly and downwardly from each of said stabilizing posts into the socket, each said stabilizing wall includes a curved portion wherein said curved portion includes an upper end, a lower end, and a tangent line of the curve, the tangent line having a slope wherein the slope increases along the curve from the upper end to the lower end.

2. The cup carrier of claim 1 wherein the slope is substantially horizontal at the upper end of the curved portion and substantially vertical at the lower end of the curved portion.

3. The cup carrier of claim 1 wherein the curved portion has a substantially parabolic shape to provide a cup-contacting point located in an upper region of said socket.

4. The cup carrier of claim 1 wherein the curved portion of the stabilizing wall is configured to exert a desirable amount of gripping force against a beverage cup when the beverage cup is received in the socket.

5. The cup carrier of claim 1 further comprising at least two cup-holding sockets with a downwardly extending center cavity defined therebetween.

6. The cup carrier of claim 1 wherein at least one stabilizing post has a top surface and includes a thumb hold disposed on the top surface.

7. The cup carrier of claim 6 wherein said thumb hold is a recessed portion of the top surface.

8. The cup carrier of claim 6 wherein said thumb hold is a projection extending upwardly from the top surface.

9. The cup carrier of claim 1 further comprising a peripheral rim wherein said rim has at least one portion being inwardly arced.

10. The cup carrier of claim 1 wherein each stabilizing wall defines a slot therethrough extending up from a respective opening and terminating at a point proximate the upper edge of the stabilizing wall.

11. The cup carrier of claim 1 wherein the cup carrier is formed at least partially of molded pulp.

12. A cup carrier of resilient material comprising:

at least one cup-holding socket to hold cups of different shapes and sizes;

at least two stabilizing posts positioned around the socket wherein at least one post includes a top surface and a thumb hold disposed on the top surface;

a cup-contacting surface upon which a cup can rest when inserted into the socket; and

at least one stabilizing wall extending inwardly and downwardly from each of said stabilizing posts into the socket.

13. The cup carrier of claim 12 wherein the thumb hold is a recessed portion of the top surface of at least one stabilizing post.

14. The cup carrier of claim 12 wherein said thumb hold is contoured to receive a thumb.

15. The cup carrier of claim 12 wherein said thumb hold is adapted for preventing a user's thumb from sliding off of the stabilizing post.

16. The cup carrier of claim 12 wherein the thumb hold is a projection extending upwardly from the top surface on at least one stabilizing post.

17. The cup carrier of claim 12 wherein each said stabilizing wall includes a curved portion that includes an upper end, a lower end, and a tangent line of the curve, the tangent line having a slope wherein the slope increases along the curve from the upper end to the lower end.

18. The cup carrier of claim 17 wherein the slope of the tangent line is substantially horizontal proximate the upper end of the curved portion and substantially vertical at the lower end of the.

19. The cup carrier of claim 17 wherein the curved portion has a parabolic shape.

20. The cup carrier of claim 12 wherein the cup carrier is formed at least partially of molded pulp.

21. A molded cup carrier of resilient material for holding cups of different shapes and sizes, said cup carrier comprising:

at least two cup-holding sockets;

at least two stabilizing posts positioned around each said socket wherein at least one post includes a top surface and a thumb hold disposed on the top surface to resist a user's thumb from slipping off the top surface of said post;

a floor within each said socket having a cup-contacting surface upon which a cup can rest when inserted into the socket;

at least one curved stabilizing wall extending inwardly and downwardly from each stabilizing post into a respective socket; and

a downwardly extending center cavity defined between the sockets.

22. The cup carrier of claim 21 further comprising a plurality of corners wherein at least two sockets are disposed proximate one of the corners, each corner having a top surface and a portion of the top surface outwardly extending, and wherein a stabilizing wall extends inwardly and downwardly from each corner into a respective socket.

23. The cup carrier of claim 22 further comprising a peripheral rim spanning between the plurality of corners around a perimeter of the carrier wherein a portion of the peripheral rim is inwardly arced.

24. The cup carrier of claim 21 wherein the cup carrier is formed at least partially of molded pulp.

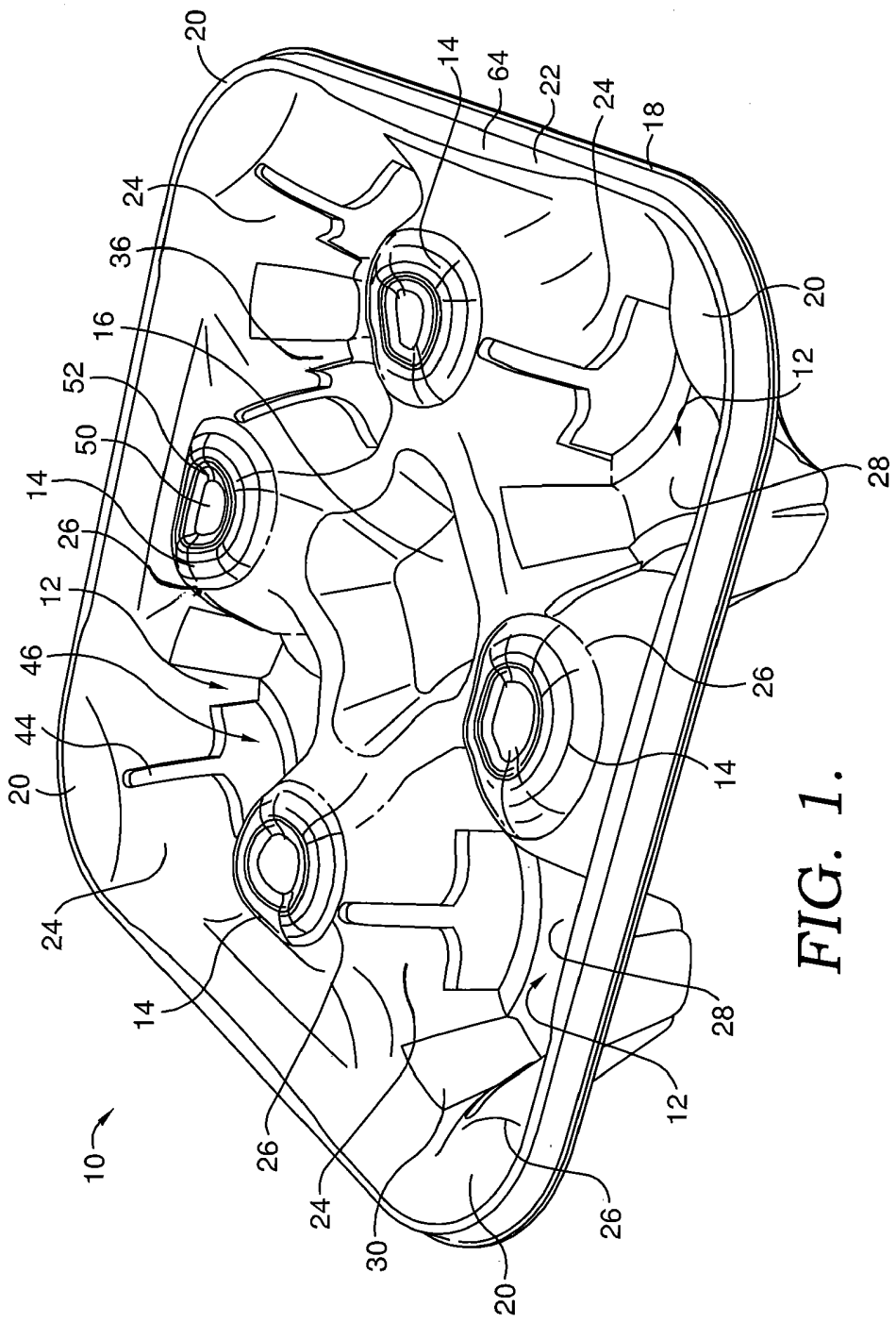

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FIG. 1.

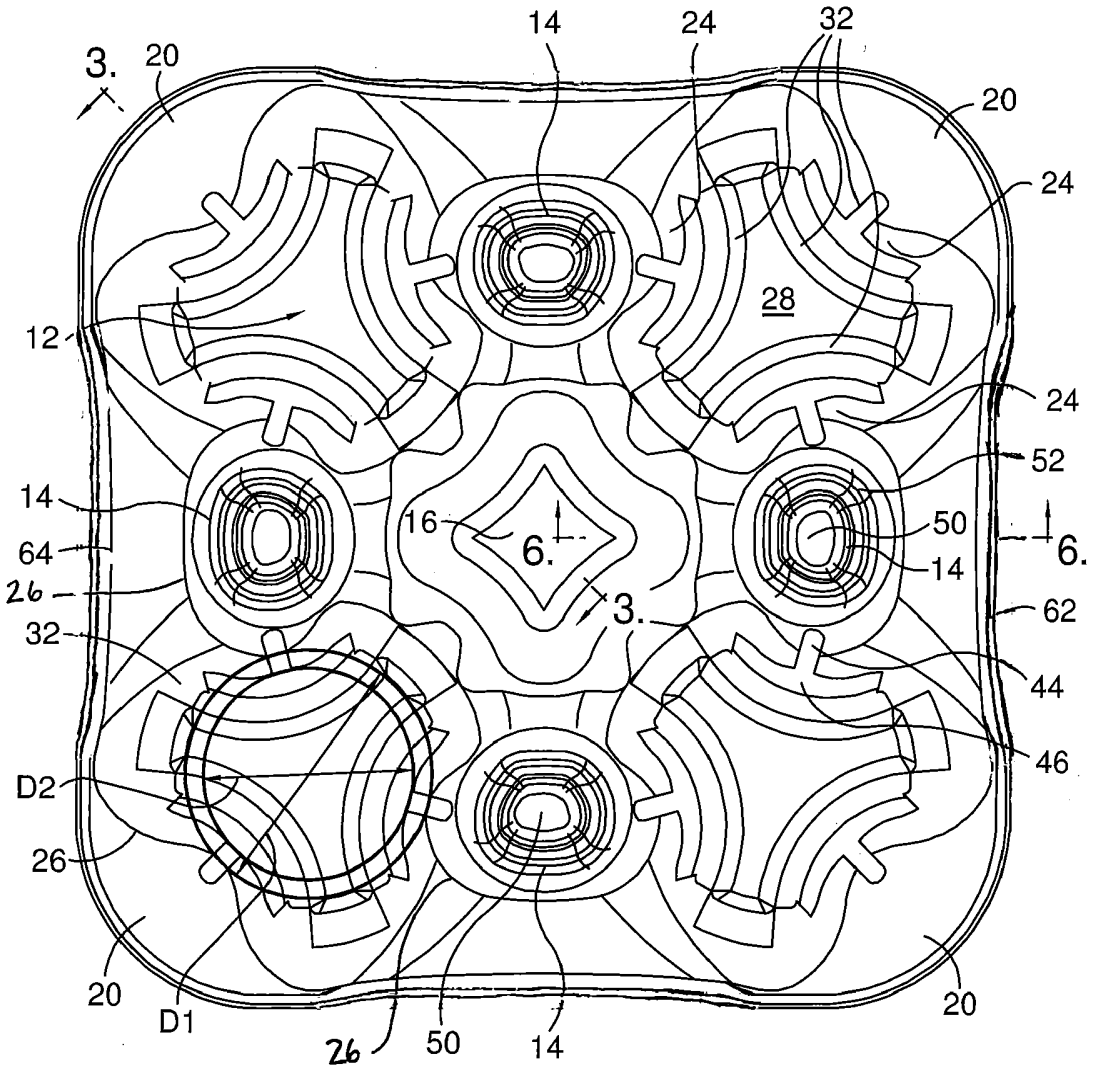

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*FIG. 2.*

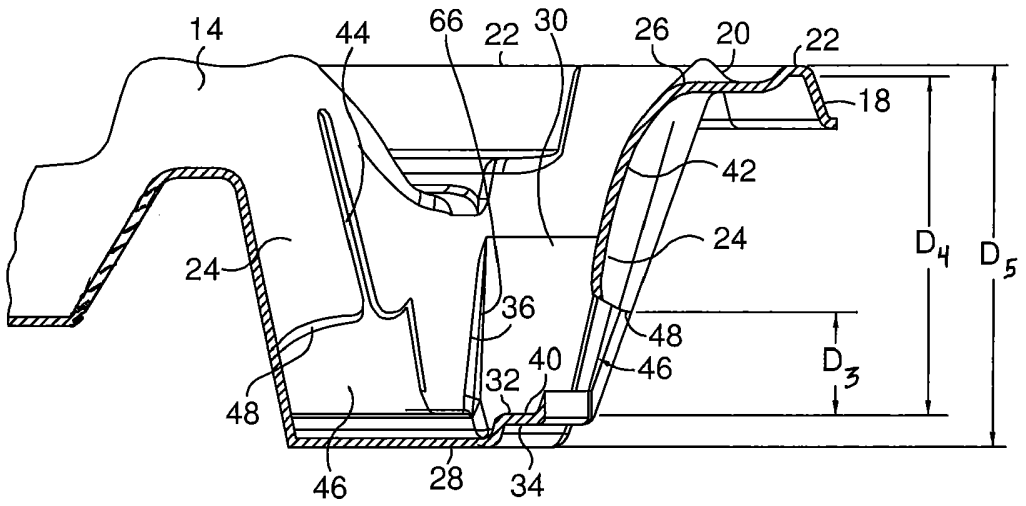



FIG. 3.

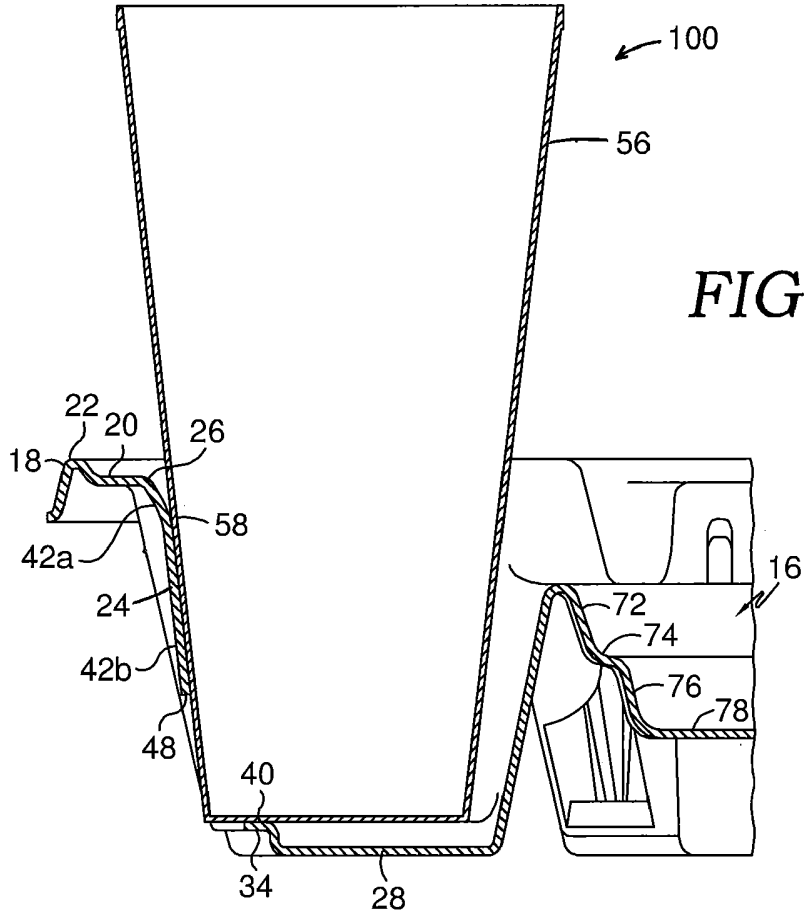



FIG. 4.

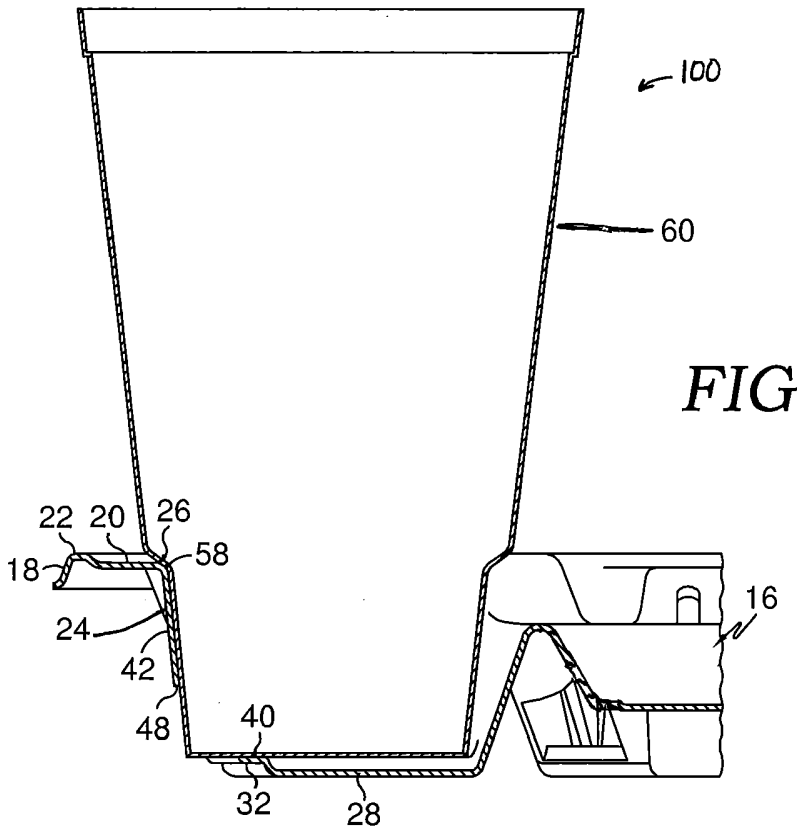



FIG. 5.

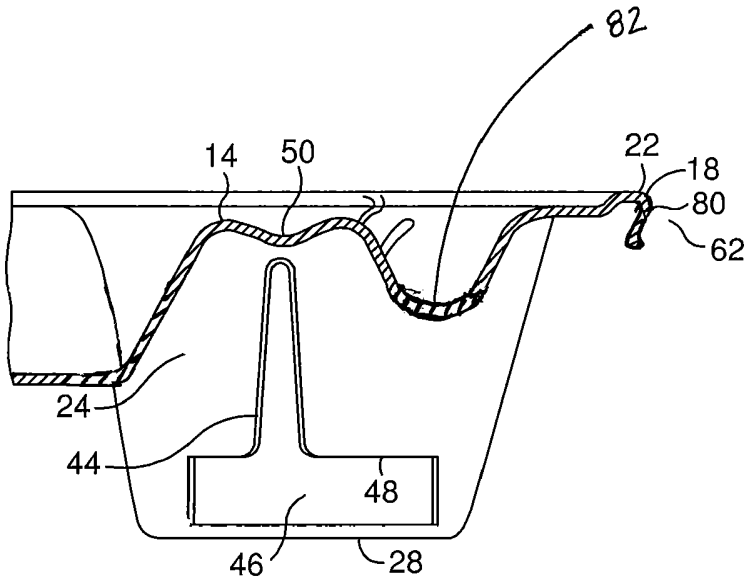



*FIG. 6.*

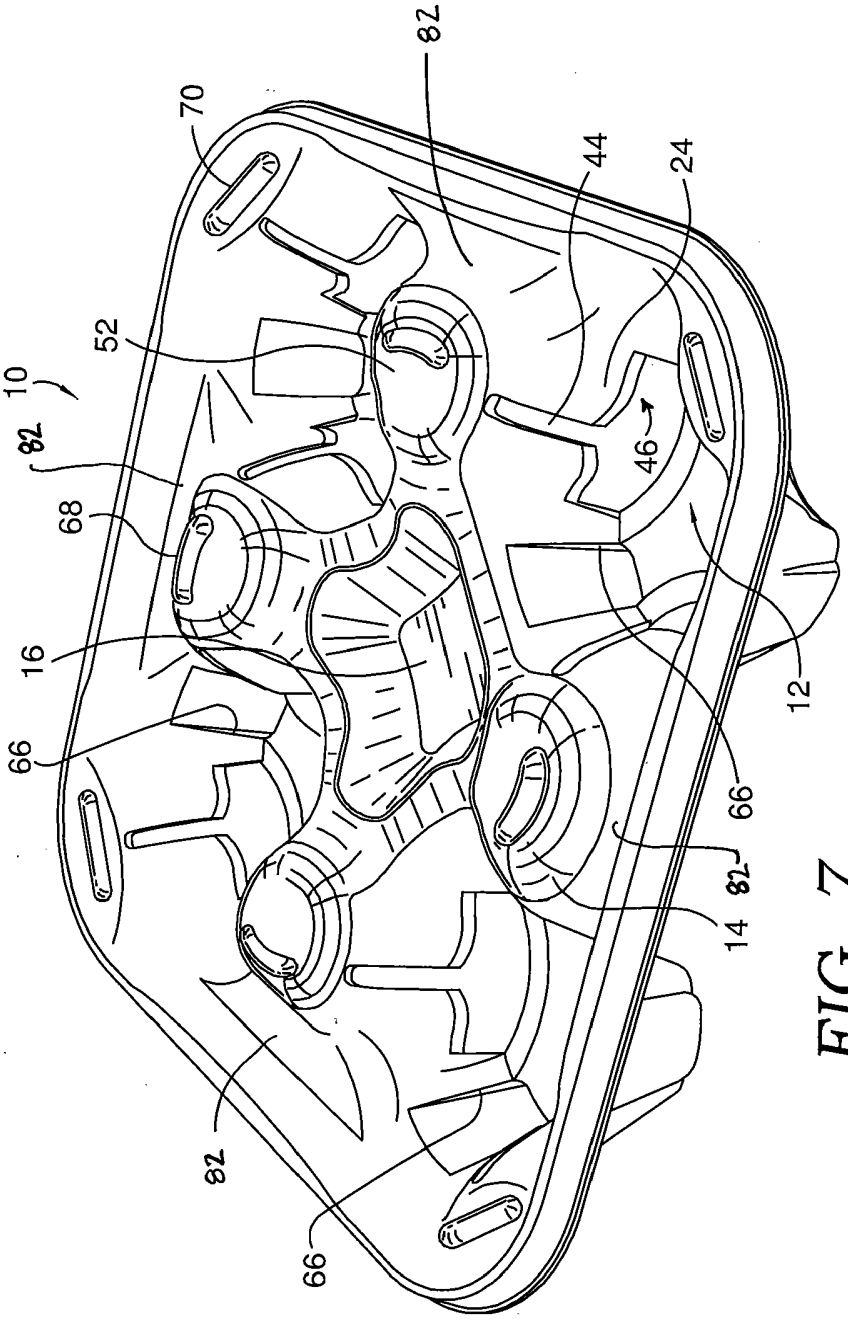



FIG. 7.

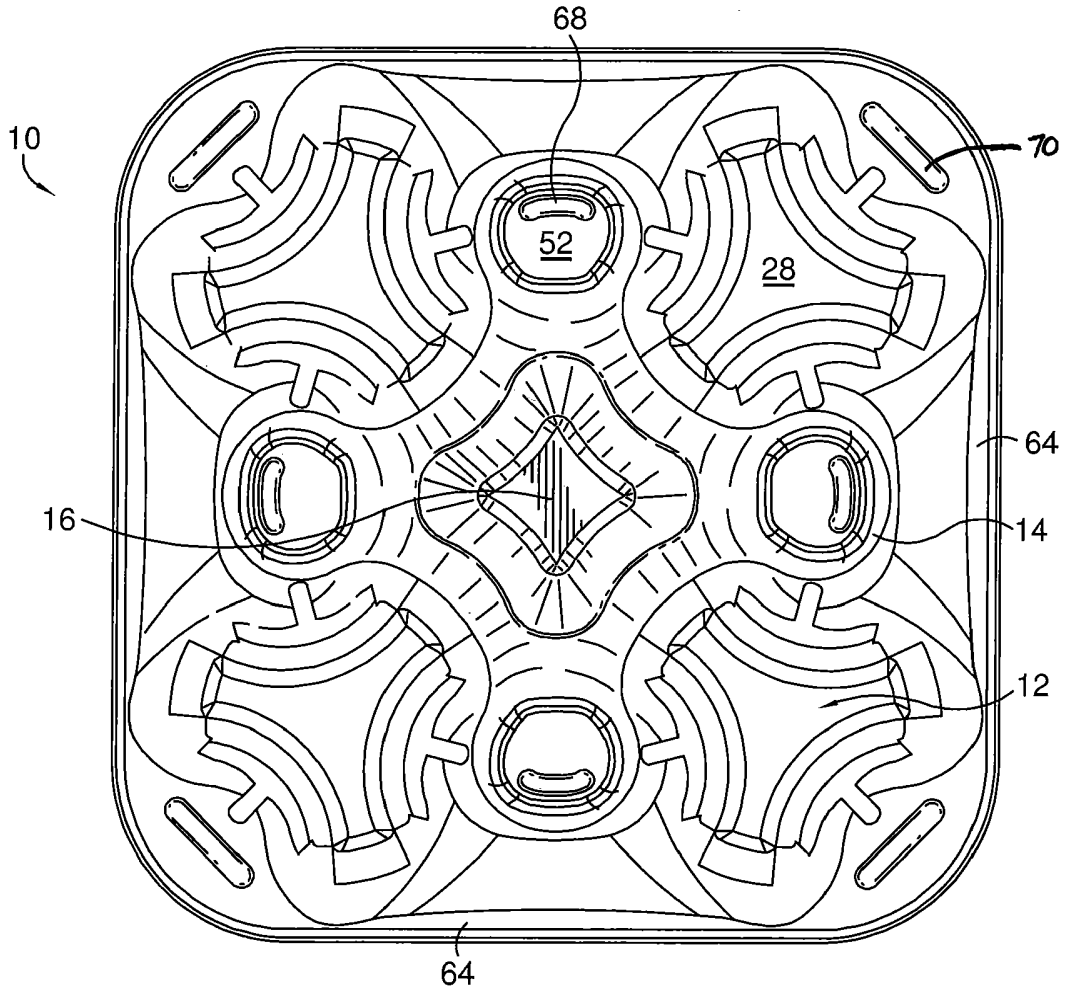



*FIG. 8.*