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Reifers et al.

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[54] **HIGH STRENGTH OPEN BOTTOM PACKAGING TRAY**

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[52] **U.S. Cl.**..... **229/2.5,** 99/174, 206/45.33, 217/26

[51] **Int. Cl.**..... **B65d 1/00,** B65d 65/00

[58] **Field of Search**..... 229/2.5, 29 M, 29 F; 217/26, 30; 206/45.33; 99/174

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[57] **ABSTRACT**

A tray of molded pulp or the like is provided for the packaging of meat, poultry or fish in conjunction with an overwrap transparent film. The tray bottom is formed of a plurality of inverted V or U-shaped ribs joining or intersecting in two directions and defining open windows therebetween, the height of each inverted V-shaped rib being on the order of several times the thickness of the remainder of the tray, the side and end walls having double sloped portions, and the total volume of the inverted V-shaped ribs being approximately equal to the volume of a bottom of an imperforate bottom tray of the same size.

7 Claims, 4 Drawing Figures

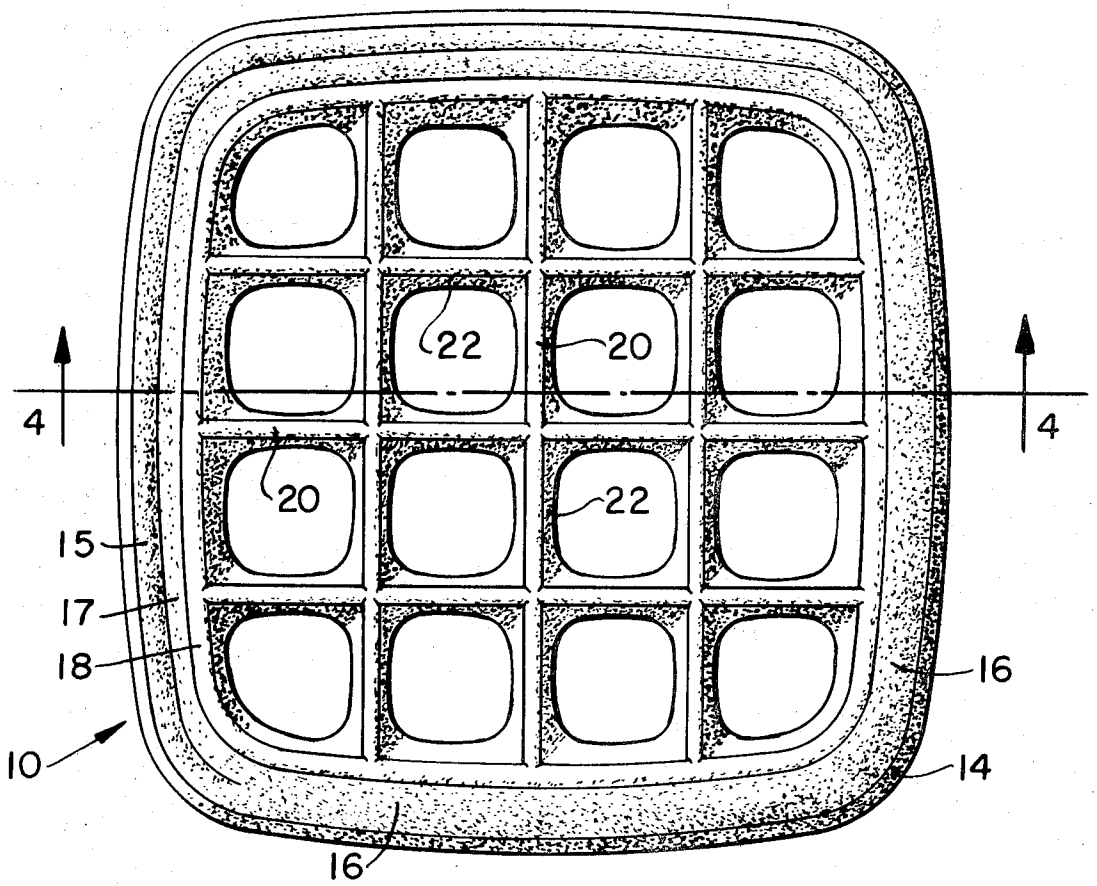


FIG. 1.

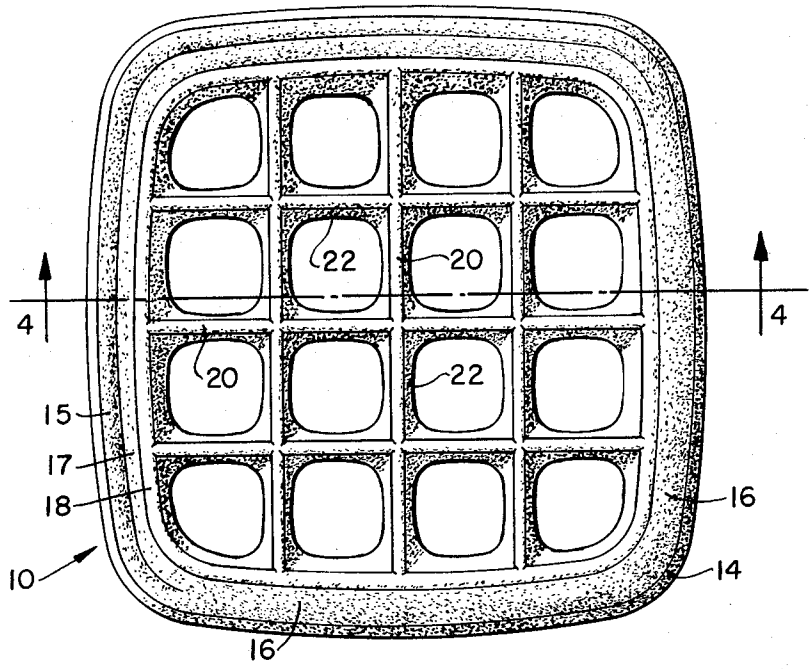


FIG. 2.

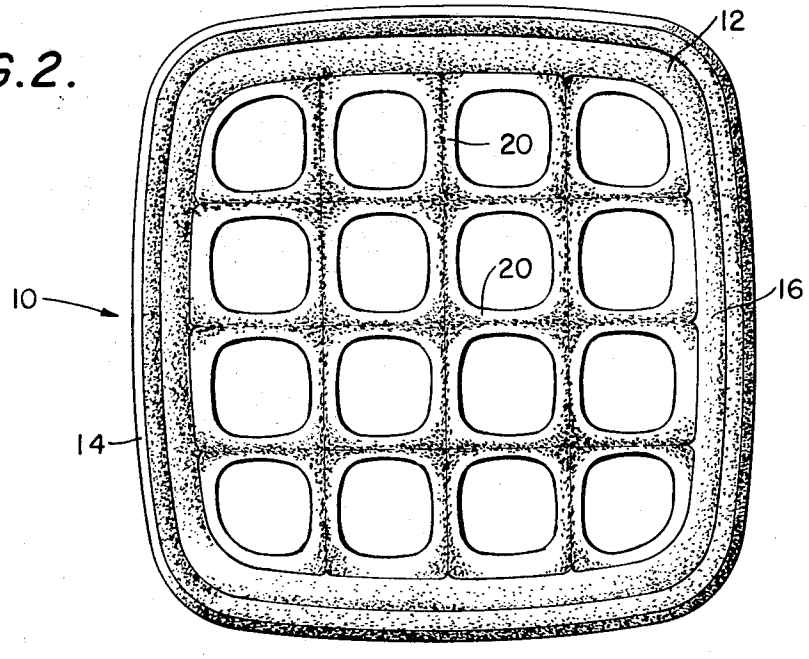


FIG. 3.

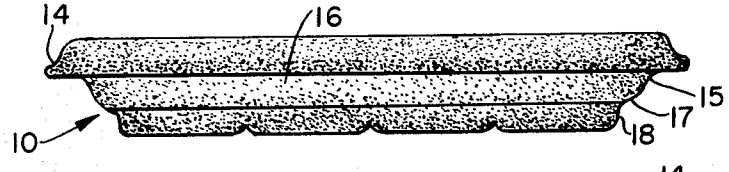
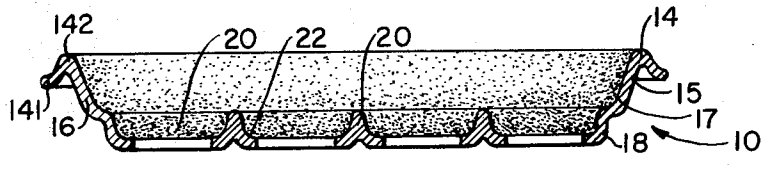


FIG. 4.



HIGH STRENGTH OPEN BOTTOM PACKAGING TRAY

FIELD OF THE INVENTION

The present invention relates to an open bottom food container and, more particularly, to a food container for use for the packaging of fresh meat, poultry and fish in conjunction with a transparent overwrap film, and where the bottom wall is replaced with a plurality of open windows defined by structural beams; and the resultant high strength package so produced.

BACKGROUND

Molded wood or paper pulp food trays have served the food packaging industry well for many years for the packaging of meat, fish and poultry. Such trays have the advantage, besides low price and low cost to the consumer, of being clean, sturdy and safe; of being biodegradable so as to minimize the solids pollution problem; of being capable of assimilating the free liquid juices which exude from meat, fish and poultry; of being air and vapor permeable so as to maintain color and freshness of meat and permit passage of liquid vapors. Nevertheless, in spite of the many advantages of such molded wood pulp trays, certain locals have effectively outlawed their usage by the requirement that a very high percentage of the food packaged therein be visible to the consumer and since wood pulp is normally opaque, such trays have not met this legal requirement.

Consequently, in such locals the only packaging trays utilizable in view of such laws are clear plastic trays. These clear plastic trays have many defects, some shared with foam plastic trays, including reduced strength, increased usage cost because of downgrading of meat, fabrication of non-biodegradable material; such trays have sharp edges which tend to cut the packaging film and/or hands, as well as the meat packaged therein. These trays collect liquid exudants in puddles from the meat, fish and poultry packaged therein, thereby not only causing discoloration of the packaged product, but also serving as a bacterial breeding ground and further serving to opacify the package itself and provide distortion in the remaining transparent areas thereby contributing to the very problem which such trays were designed to overcome; blood that goes under the tray acts to release the sealed film causing soiled hands, soiled check-out counters, leaking packages, etc. In addition, the conventional plastic trays, being formed of non-breathable material, inhibit oxygen migration to the meat at the bottom of the tray; this causes further discoloration of the meat and it is well known that meat in plastic trays deteriorates on the bottom first.

Another defect of the clear plastic trays involves their transmission of light along the plane of the tray walls, i.e. a light pipe or fiber optic effect; this causes further discoloration of the bottom of the meat. Light has a negative effect on meat quality causing discoloration more quickly than meat which is maintained more in the dark but under otherwise similar conditions. Because of the light pipe effect meat packaged in clear plastic has its bottom exposed to light constantly even when the tray rests on an opaque object such as the bottom of the meat cooler on an underlying package or between two packages.

SUMMARY

It is, accordingly, an object of the present invention to overcome the defects of the prior art.

It is another object of the present invention to provide a molded, nestable tray, preferably of molded wood pulp or the like, for the packaging of meat, fish and poultry which, in spite of being made of generally opaque or translucent material, provides a superior quality of visibility of the packaged product.

It is another object of the present invention to provide for the clean, safe and effective packaging of meats, fish and poultry.

It is another object of the present invention to provide a meat tray which, although being primarily open on the bottom, is sufficiently strong so as to facilitate the handling of meat which tends to be floppy.

It is another object of the present invention to provide a meat packaging tray which is not only effective but which is inexpensive.

It is another object of the present invention to provide a meat packaging tray which provides up to about 90% visibility of the meat packaged, by providing minimized effective support contact of the meat packaged in the bottom of the tray.

It is another object of the present invention to provide a meat packaging tray having improved fresh meat quality maintenance and superior visibility which are properties enhanced by the absence of visibility distorting and breathability inhibiting accumulations of free liquids, the tray tending to inhibit the exuding of juices by the meat but accepting any liquid which is exuded, in a controlled manner.

It is a major object of the present invention to provide a high visibility meat tray having an open multiple window bottom which has increased, rather than decreased, strength even when overwrapped with stretchable, transparent plastic film which acts to compress and sometimes collapse a conventional tray; and which also has high beam strength.

It is another object of the present invention to provide a meat packaging tray which provides visibility by providing a minimum surface contact of the meat.

It is another object of the present invention to provide for improved meat storage by providing a packaging tray in which the bottom side of the meat is subjected to increased oxygen transmission and in which the bottom of the meat is not subject to rapid deterioration as in imperforate plastic trays.

It is another object of the present invention to provide a packaging tray in which the bottom side of the meat is subjected to improved oxygen availability to best maintain freshness and color.

It is another object of the present invention to maintain the packaged meat in a moist but not wet condition.

It is another object of the present invention to eliminate meat contact with a non-breathing tray structure and provide an oxygen permeable, see-thru structure that keeps meat from touching the film windows on the bottom of the tray.

It is another object of the present invention to obviate the necessity of utilizing clear plastic food trays which often provide poor, distorted visibility, clear polystyrene plastic not being oxygen permeable and thus tending to discolor the meat, and which also transmit light to the bottom of the tray because of fiber optic

effect thereby adding to the discoloration problem, the clear plastic also collecting exuded liquid in pools thereby adding to visibility distortion and forming bacterial breeding grounds, and causing nutrient loss.

These and other objects and the nature and advantages of the instant invention will be more apparent from the following description:

Meat packaging trays have evolved substantially over the years. The earlier trays had essentially straight side walls and a flat peripheral lip, and these served the trade successfully for many years. However, as the nature of transparent plastic wrap film changed and non-elastic and non-shrink cellophane was replaced with more elastic thermoplastic or stretch overwrap films, the tray in accordance with Reifers U.S. Pat. No. 3,185,371 was developed improving the tray performance. In more recent years there has been a strong consumer desire for greater visibility of fresh meat packaged in trays.

One of the earlier attempts to provide visibility through the bottom wall of the tray involved simply providing one or more relatively large openings in the bottom of the tray. However, this was found to weaken the tray and was not a successful approach to the problem. The next attempt was to utilize a raised lip about the periphery of the opening(s) in the bottom wall of the tray, the function of the upwardly extending lip being to hold the meat upwardly, to trap juices, and to stiffen and reinforce the structure. However, this approach was not successful as the meat tended to sag through the large opening(s) and the structure was still too weak.

A recent approach, corresponding to the invention of the Bixler application Ser. No. 53,545 now U.S. Pat. No. 3,698,623 uses a plurality of meeting or intersecting, inverted V or U-cross-section shaped ribs extending across the bottom of the tray. This construction provides maximum visibility with minimum meat contact, and the inverted V-shaped ribs provide for a reinforced structure. The construction exemplified in the Bixler application is, in many respects, a successful approach to the problem, and the present invention constitutes an improvement on this basic construction.

In particular, the embodiments illustrated in the Bixler application still suffer, under certain conditions, from some weakness, these weaknesses being manifested when a tray containing meat, fish or poultry is tightly overwrapped with transparent stretch film which strongly squeezes the tray side walls inwardly distorting them and causing failure where ribs only are the single support to side walls. Thus, in certain environments it is found that the embodiments illustrated in the Bixler application need to be strengthened, particularly where the V-ribs are joined to the side walls of the tray. Thus, the smaller trays in accordance with the embodiments shown in the Bixler application may fail at this location because of the compressive force of the film alone whereas the larger size trays fail more easily here because of the compressive force of the film and because of greatly reduced beam strength in relation to the increased strength that is actually needed in the longer side walls.

Improved strength was provided in the larger size trays by the utilization of an improved force transfer distribution or transition zone shown in copending application Ser. No. 246,600. While this construction provides the preferred form in the larger size trays, in the smaller trays, to the contrary, the transition zone provided in the exemplified constructions of such copending application cover too great an area and thereby reduce the visibility to a greater degree than desirable. In addition, the great beam strength provided by such a transition zone is not necessary in the smaller trays because their smaller width and length provides a reduced beam length.

The present invention provides an improved structure in the smallest sized trays by the utilization of an improved transition zone at the location where the ribs of inverted V cross-section meet the side and end walls of the tray. This is accomplished by providing double sloped end and side walls which provide good side wall cave-in resistance, adequate beam strength, and maximized visibility.

As with the trays exemplified in the copending applications, there may be substantial variability in the size and shape of the ribs. In general, the height of the ribs is dependent on the size of the window openings therebetween, so that the smaller the opening and the greater the number of ribs for any given tray bottom area, the smaller the ribs need be in height, both for sufficient strength and for packaged product maintenance. In this latter regard, the packaged meat should be kept off the overwrap film on the bottom of the tray. In general, many small ribs tend to reduce visibility so that the preferred minimum rib height should be on the order of about ¼inches with openings therebetween of about 13/16 inch by 13/16 inch at the bottom of the inverted V-shaped ribs.

In general, it will be understood that the higher the ribs, the greater will be the strength. Greater rib strength is also provided, when the tray is molded of wood pulp, by the use of a narrow U or V-angle. In general, the total volume of the ribs forming the bottom of the tray and defining the open windows therebetween, is about 90–100 percent of the volume and weight of the same area of a bottom of a conventional tray of the same size, such as that shown in the Reifers U.S. Pat. No. 3,185,371.

Fresh meat packaged in conjunction with the tray of the present invention, when formed of molded wood pulp, stays fresh much longer than meat packaged in the so-called clear polystyrene trays. Over the normal holding time in the supermarket showcase, fresh meat packaged in accordance with the present invention has better bloom retention, flavor retention, and better blood control resulting in substantial savings due to reductions in rewraps, less downgrading, and less actual meat loss. Improvement also occurs in the appearance of meat packaged in accordance with the present invention compared with meat packaged in foam plastic trays. In general, the tray of the present invention provides improved oxygen transmission, moisture vapor and blood control under the meat, no fiber optic problem like clear polystyrene trays, all resulting in improved meat appearance with unequalled protection to meat freshness.

The improved characteristics of the package of the present invention are accomplished by the use of the high support beams of inverted V-cross-section, which are themselves strong and which meet the end and side walls along a transition zone which maintains high side wall compression resistance. This rib connection with the side and end walls is accomplished by the use of walls which have a double slope. The high rib strength,

when the tray is manufactured of wood pulp, is provided by rib filling which determines the precise configuration of the ribs; the filling, in turn, is determined by the rib V-angle, the type of material from which the tray is formed, and the weight, height and rib thickness. These factors are selected to optimize window visibility, strength and nesting of the tray. In general, the included V-angle will lie in the range of about 5° to 35°.

The fundamental aspects of the tray in accordance with the present invention may be said to be: spaced beam members, the spacing being open between such beam members to allow for viewing the tray contents between each beam of relatively solid material. The section modulus of the beams is such that in combination with the end and side walls, the total strength equals or exceeds the beam strength of a tray of the same material of equal or slightly more weight with a flat, solid bottom.

For a better understanding of the invention, a possible embodiment thereof will now be described with reference to the attached drawing, it being understood that such embodiment is intended as merely exemplary and in no way limitative.

BRIEF DESCRIPTION OF DRAWING

FIG. 1 is a top plan view of an embodiment of a tray in accordance with the present invention;

FIG. 2 is a bottom plan view of the tray of FIG. 1;

FIG. 3 is a front elevation of the tray of FIGS. 1 and 2; and

FIG. 4 is a section taken along line 4—4 of FIG. 1.

DETAILED DESCRIPTION OF EMBODIMENT

Noting the drawing, it will be seen that a tray **10** is provided for the packaging of meat, fish or poultry in association with an overwrap film of transparent plastic material such as shrink or stretch plastic film, or heat-sealable cellophane. The tray **10** has four upwardly and outwardly inclined walls **16** and these are preferably bowed as described in Reifers U.S. Pat. No. 3,185,371. The adjacent side walls merge at rounded corners **12**, and such side walls terminate at their upper end in a downwardly and outwardly extending peripheral lip **14**; while any conventional peripheral lip may be used, the preferred lip corresponds to the special lip disclosed in copending application Ser. No. 246,600.

Instead of a flat bottom as is conventional, the tray **10** is provided with a plurality of ribs **20** which extend between the bottoms of the side walls **16**. As is illustrated, the ribs **20** preferably extend in two different directions at right angles and are uniformly spaced to define therebetween windows of a more or less rectangular configuration. Of course, it will be understood that there may be provided variations in the configuration, spacing, height and arrangement of the ribs and of the windows, e.g. the ribs may intersect or meet at different angles so as to provide brick-work, diamond shaped, etc. window patterns.

As best seen in FIG. **4**, the ribs **20** form a cross-section and inverted V-shape with their apices forming the meat supporting surface, and it is clear from inspection that the V-apex of each rib is well rounded unlike the sharp ribs which might be present in hard plastic that might cut or otherwise damage the meat. In this illustrated embodiment the V ribs vary in cross-section along their length, i.e. they undulate, from a minimum included angle — midway between each intersection — of about 10° or less, to a maximum included angle — adjacent each intersection — on the order of about 30° included V-angle. Such ribs are about 5/16 inches high and the open windows therebetween are about 11/16 inches square. At the bottom of each rib **20** there is provided a slight horizontal flange portion **22** which is of a minimum width midway between each rib intersection, and of maximum width adjacent each rib intersection; for purposes of illustration the flanges **22** are shown in the drawing to be of larger size than in actual practice.

A major feature of the present invention constitutes the shape of the side walls **16** as best shown in FIGS. **3** and **4**. While in the past it has been conventional to provide a side wall of a single curvature, it has now been found in accordance with the present invention that in order to maximize strength and visibility in a small tray of the size shown, that it is necessary to provide a double sloped wall. Thus, the upper part of each wall **16** has an upper straight portion **15**, an intermediate curved portion **17** and a lower straight portion **18**. The curved portion **17**, in the preferred embodiment, has a radius of curvature of 0.187 inch. Also, in the preferred embodiment, the upper portion **15** of the walls **16** is inclined from the vertical at an angle of 17°. On the other hand, the lower vertical portion **18** is inclined at the same angle or substantially the same angle as the inverted V-shaped ribs **20** and, accordingly, has a steep angle of only about 5° from the vertical.

While the tray of the present invention is preferably molded of conventional wood or paper pulp stock which may be formed or preformed from a water slurry, it will be understood that other materials may be used; the ribs may be made of harder paper stock, or such ribs may be specially pressed or other wise treated. In a preferred embodiment, the wood pulp stock comprises about 3 percent ureaformaldehyde wet strength resin or about 1½ percent melamine-formaldehyde wet strength resin (both FDA approved) and, furthermore, has a large capacity to accept free liquids which have exuded from the "problem cuts" or "heavy bleeders," as they are known in the art; in this embodiment the bottom of the tray ribs may be specially treated with an inert, impervious water-resistant substance, e.g. wax or plastic such as polyethylene, while the upper portions of the ribs will accept this free liquid and expand to provide a softened cushion for the meat. If desired, the rib tops may also be coated with the impervious substance, leaving the side rib surfaces and its center free to accept excess free liquids.

As illustrated, the lip **14** is provided with a special shape which is particularly useful when used in combination with the special wood pulp stock having free liquid accepting capacity. The peripheral lip **14** has an outwardly extending horizontal terminal portion **141** and an upper domed portion **142**. When overwrapped with a heat-sealable film the film contacts the lip at both location **141** and location **142** and thereby forms a double seal or gasket. With the "problem cuts" of beef, namely the 10–15 percent of the meat packaged which bleeds profusely, the special accepting furnish in conjunction with the double sealing provided by the lip **14**, prevents the travel of free liquid by capillary action between the film and the lip from the inside to the outside of the tray where it would cause the plastic heat seal of the plastic film to open thereby effecting leak-

age and unwrapping of the package, besides providing an unsightly appearance.

The special lip **14** also has mechanical advantages even without the special accepting furnish. Thus the lip **14** is provided with greater material mass which provides additional cave-in resistance against the tension exerted by the stretched overwrapped film. In addition, the horizontal portion **141**, being at a height considerably lower than the top **142** of the lip **14**, absorbs inwardly directed forces in a manner that stresses the side wall **16** less because the resultant lever arm is lower, e.g. 30–35 percent lower. Additional vector analysis shows that the net effect in inward deflection resulting from inward force is reduced and there is 12 percent less bending moment.

If desired, the tray of the present invention may be formed of other, equivalent materials, the structural advantages of the tray deriving from its geometry. For example, the tray may be formed of plastic foam, such as structural cellular polystyrene foam comprising on the order of 70 percent void space, or porous polyolefin material or other open cell plastic, or a biodegradable plastic such as biodegradable foam polystyrene. If formed of materials having different strength characteristics, various changes in the configuration may be necessary and depending on the material, certain advantages may be absent.

It will be understood that visibility through the bottom of the tray to the bottom surface of the meat is very great, on the order of at least 80 percent, and that there is a minimum surface contact of the meat on the soft rounded apices of the inverted V's.

The tray of the present invention has many advantages, a number of which have been delineated above. In brief, however, it may be noted:

a. Visibility — Both sides of the meat, fish or poultry may be viewed, providing up to 90 percent view of contents with at least 80 percent of the bottom of the contents being visible. This actually results in improved visibility when compared to clear plastic trays some of which introduce an added layer of thick plastic sheet in each window area and do not control juices which distort, mislead, and impair vision where they exist.

b. Strength — Added beam of structural members across bottom adds stiffening. Tray easily resists all types of normal handling: (1) The tray has sufficient strength to resist handling during wrapping; compression of film on the inward side wall is the main force which tends to cause side wall deformation or collapse, but the present tray resists such deformation or collapse. (2) The tray resists damage from handling in the store and by consumer at home; insufficient beam strength of package for weight of contents may tend to deform or break some packages when lifted, but the tray of the present invention tends to resist such deformation or breakage.

c. Breathability — For meat freshness and bloom protection, the open meat suspending structure promotes oxygen transfer as does the absence of free liquid pools which in other packages clog the pores of the overwrap film. This maintains better meat color and provides for maintenance of meat bloom and quality over the extended period for store sale to home storage. In addition, no anaerobic bacteria, such as slime bacteria or botulism, are possible with the high oxygen transmission provided.

d. Juice Control — The ribbed tray suspends the entire bottom of the meat in a moisture saturated atmosphere, desirable for meat quality preservation. Only a small amount of liquid exudes from the meat and a portion of this water evaporates to provide this moisture laden atmosphere; the remaining portion of exuded liquid is controlled by the pulp. This controlled acceptance of free liquids enhances appearance, maintains near perfect visibility and prolongs the freshness and bloom of the meat. The actual contact of the meat with the tray is less than any tray structure ever known in commercial use. This minimal contact of the meat with the tray together with the maintenance of the moisture saturated atmosphere inhibits the exuding of liquids and insures that the meat retains its moist surface and juicy character but without forming puddles or pools of liquid.

e. Nestability — Trays nest closely for economical storage and shipping. The bottom itself determines the stacking interval and gives good denesting as well as prevention of jammed trays. The inverted V-shaped ribs are preferably indented in the bottom to match or complement the upper part of the rib shape thereby reducing the stacking interval with consequent reduced storage and shipping costs without a sacrifice in strength. The uniform rib support of the stacked tray bottoms allows ram stacking under pressure to reduce the stacking height of the trays. In addition to the obvious advantages of space saving provided, such ram stacking also aids denesting, since each tray tends to separate, due to the internal compressive spring back produced by pressure stacking of a natrually resilient material.

f. Refrigeration — Beam bottom construction holds meats suspended, providing improved circulation of moisture saturated air for oxygenation of the meat.

Contrary to the so-called clear polystyrene tray, the construction of the present invention with its open windows serves to effectively control the free flowing of bloody liquid.

Just one drop of blood in the polystyrene tray creates an immediate problem in the specific window area because of distortion of remaining visibility, and additionally exposes the meat surface to a pool of bloody liquid that provides a broth for bacterial action, often causing slime buildup and causing shorter shelf life in the store and in the home refrigerator. By way of contrast, the trays of the present invention with the multiple open window features maintain the advantages of control of exuding liquid, primarily by maintaining a saturated atmosphere about the meat but also by controlled acceptance while at the same time taking advantage of this control to maintain excellent visibility in the windows that are breathable, maintaining great effectiveness of the transparent film over the entire surface of the package, protecting it to the maximum freshness and minimum bacterial action.

The trays of the present invention also have no problem of cutting film like the clear plastic trays because the film is protected by the soft edges of the pulp tray. The meat contained in the clear polystyrene tray is exposed to bacteria and other contamination when the

film has been cut by the sharp edges of the polystyrene tray. After extended storage the meat in the clear polystyrene trays nearly always discolors on the bottom first because of the destructive effects of the non-breathing, light transmitting, clear styrene material. On the other hand, the trays of the present invention work to protect the meat freshness so perfectly that the bottom of the meat most always retains its meat freshness longer than the top of the meat under conditions of extended storage.

It will be understood that the invention is not limited to the embodiment disclosed which is offered illustratively and that modifications may be made without departing from the invention.

What is claimed is:

1. In a generally rectangular molded tray for the packaging of fresh meat, fish or poultry in conjunction with a transparent overwrap film heat-sealed thereabout, said tray comprising upwardly and outwardly inclined side walls defining the rectangular configuration; a generally rounded corner between each adjacent side wall; and a peripheral lip extending outwardly from said side walls and defining the periphery of said tray, the improvement comprising:

means for providing improved oxygen breathing through the bottom of the tray and for providing visibility through the bottom of the tray and for supporting the meat, fish or poultry at the bottom of said tray while maintaining a high humidity thereabout substantially without the formation of liquid pools, and also for protecting meat freshness and improving meat quality maintenance, said breathing and support means comprising a plurality of strong, substantially solid ribs having an inverted V-shaped cross-section with rounded apices, some of said ribs extending in one direction, and other of said ribs extending in a different direction, said ribs meeting and defining therebetween a plurality of open windows, said ribs having a section modulus in combination with said side walls such that the total strength is substantially equal to the beam strength of a tray of the same material of equal weight with a flat, imperforate bottom;

and means to resist sidewall deformation from the inward pressure of wrapping film and to increase rigidity and strength at the location where said inverted V-shaped ribs join said side walls, said means comprising a curved portion in each of said side walls thereby defining in such side walls a straight upper portion, a curved center portion and a straight bottom portion, said bottom portion having a height equal to the height of said inverted V-shaped ribs.

2. A tray in accordance with claim **1** molded of wood pulp.

3. A tray in accordance with claim **2** wherein said side walls are of bowed construction.

4. A tray in accordance with claim **2** wherein said ribs have a height about five times the thickness of said side walls.

5. A tray in accordance with claim **2** wherein said ribs have an included V-angle of about 10°.

6. A tray in accordance with claim **1** wherein said ribs extend parallel and perpendicular to said side walls and thereby meet at right angles to form rectangular open windows.

7. A tray in accordance with claim **1** wherein the bottom portion of said side walls are inclined at an angle of about 5° from the vertical.

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