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BOTTOM STRUCTURE FOR LIQUID CONTAINING CARTON

Filed Sept. 28, 1966

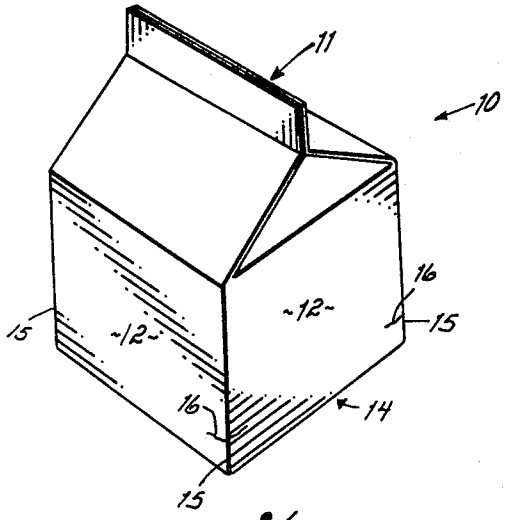


Fig. 1

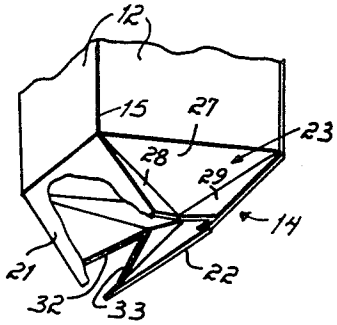


Fig. 3

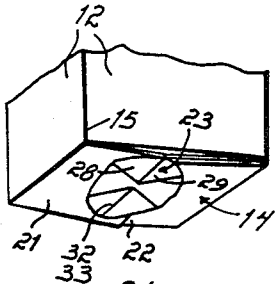


Fig. 4

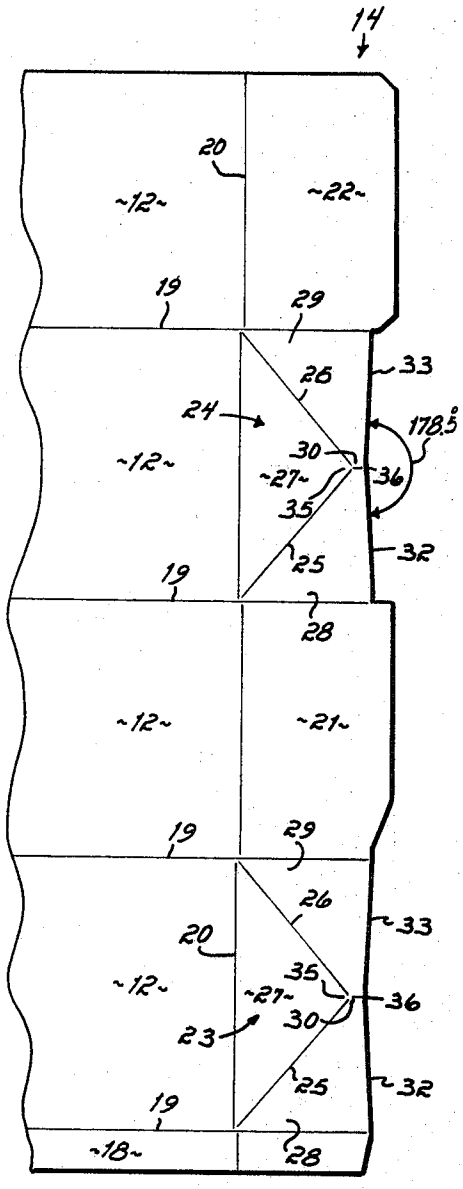


Fig. 2

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BOTTOM STRUCTURE FOR LIQUID CONTAINING CARTON

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ABSTRACT OF THE DISCLOSURE

A bottom structure for a liquid-containing carton including four panels hinged to each other and to the carton side walls, two of the opposed panels being formed by triangular sections which are foldable upon one another to provide a liquid-tight sealed bottom.

This invention relates to a bottom structure for liquid containing cartons. The invention is particularly directed to cartons of the type which are formed of paperboard which is coated on both sides with a thermoplastic film such as polyethylene and which are prefolded and thereafter sealed by heating the thermoplastic coating to its fusion point to form a bond between adjoining surfaces by which the bottom structure is formed.

The structure at the bottom of these cartons is constituted by four panels which are hinged to the carton side walls along a major horizontal score line and which are hinged to each other along vertical score lines. Of these, two opposing panels are formed of a central triangular section and two lateral triangular sections, the lateral sections being folded upon the central triangular section as the bottom structure is formed. These panels thus form gussets which interconnect the remaining two panels, the remaining panels overlying the gusset forming panels when the structure is completed.

It is obviously important that a completely liquid tight seal be formed following the application of heat and pressure to the bottom structure described. One possible trouble spot is created by the gusset panels, particularly at the location of the adjacent free edges of the lateral triangular sections. If these are spaced apart, a channel leak tends to form, the fluid flowing through the space between the adjoining free edges. A solution to this channel leak is proposed in Patent No. 3,120,335.

In accordance with that solution, the lateral triangles are made somewhat oversized so that when the gusset forming panel is folded to bring the free edges of the lateral triangles together, the edges crowd together under compression. The subsequent seal which is formed at the free edges of the lateral triangles has a satisfactory leak tight characteristic.

While the leak tight integrity of the bottom structure is maintained, a significant number of failures occur in other areas of the carton, these failures usually arising sometime during the period of handling the cartons between the dairy and the consumer. It must be understood that after a carton is filled with a liquid such as milk, the liquid applies a hydraulic pressure which is greatest at the bottom of the carton. The pressure is dynamically applied, for in transporting and otherwise handling the cartons, the liquid moves and applies pumping action to the carton walls. The pumping may cause a minor fracture of the thermoplastic film with which the paperboard is coated or the pumping may accentuate the effect of pinholes to cause wicking or lateral migration of the fluid through pinholes into the fibres of the paperboard. A manifestation of the stressed condition of the carton which

gives rise to leaking is the appearance of "smiles" at the corners of the carton adjacent to its bottom. These smiles are actually slight wrinkles in the carton structure. Patent No. 3,232,516 is directed to structure by which the stress is relieved in order to minimize the creation of smiles.

The present invention is also directed to carton structure by which the tendency of the cartons to produce leaks is minimized. The approach of the present invention has been to reduce certain static pressures in the carton structure and thereby eliminate the accentuating effect of the dynamic hydraulic forces on the points of static stress concentration.

It has been an objective of the present invention to form the free edge of the gusset forming panel as a very shallow V so that the free edges of the lateral triangular sections, when brought together, will just abut along their length without any compression stress. In structures formed in accordance with the present invention, it has been found that the elimination of compression stress between the two lateral triangular sections minimizes the stressed condition at the carton corners and immediately above the bottom structure.

Field tests of the present invention show a substantial reduction in the number of leakers and more particularly a reduction in the creation of smiles and leaks at the lower carton corners.

The present invention will be more readily understood from the following detailed description taken in conjunction with the accompanying drawings in which:

FIG. 1 is a milk carton to which the present invention is directed,

FIG. 2 is a fragmentary plan view of a blank illustrating the cuts and scores forming the bottom portion of the carton,

FIG. 3 is a fragmentary perspective view with certain panels broken away illustrating the formation of the bottom structure, and

FIG. 4 is a view similar to FIG. 3 showing the completely formed bottom structure.

The carton of the present invention is indicated at **10** in FIG. 1 and includes a top structure **11** with which the invention is not concerned, four side walls **12**, and a bottom structure **14**. The bottom structure of the present invention is to eliminate or minimize that concentration of stress which occurs at corners **15** and frequently results in smiles such as are illustrated at **16**, the smiles being slight creases at the corner which result from the combination of static and dynamic stresses on the carton.

The carton blank from which the container bottom structure is formed is illustrated in FIG. 2. It includes the side walls **12** and a side seam **18** which are hinged together along vertical scores **19**. The side walls terminate in a major horizontal score **20**. Two outside panels **21** and **22** are hinged to respective side walls by the horizontal score **20**. Two inside or gusset forming panels **23** and **24** are also hinged to respective side walls by the horizontal score **20**. The panels are hinged to each other by the vertical scores **19**.

Each gusset forming panel has two diagonal scores **25** and **26** which divide the panel into a central triangular section **27** and two lateral triangular portions **28** and **29**. The lateral triangular sections **28** and **29** are not quite triangular due to a slight offset **30** which will be discussed below.

The base of the central triangular section **27** is formed by the major horizontal score **20** and its sides are formed by the diagonal scores **25** and **26**. These lateral triangular sections are defined by sides formed by the vertical score **19**, a diagonal score **25** or **26**, and a free edge **32** or **33**. The free edges **32** and **33** form between them a shallow,

inwardly projecting V of approximately 178.5°. The function of the V configuration is to provide assurance that when the bottom structure is formed to bring the free edges **32** and **33** together, those edges will just abut along their length without applying to each other any compression stress.

The angular relationship of the diagonals **25** and **26** to the horizontal score **20** has been empirically determined and is designed to bring all of the bottom forming elements together with minimal stressing of any of the components of the carton and to provide as nearly as possible a right angular relationship at the four bottom corners of the carton. If the illustrated container is a half gallon container, for example, whose four walls are each approximately 3¾" wide, the diagonals should form an isosceles triangle whose base is 3.764" and whose height is 1.820". These dimensions will vary somewhat with the thickness of the blank stock. With this relationship having been determined for the central triangular section **27**, the offset at **30** is provided to assure the bringing together of the free edges **32** and **33** into proper abutting relation in the forming of the bottom structure. The amount of that offset is, in one embodiment of the invention, 0.058", that being the distance between the apex **35** of the triangular section and the apex **36** of the shallow V formed by the free edges **32** and **33**.

The free edges **32** and **33** are angulated outwardly from the apex **36** by less than 1° so that they intersect the vertical score **19** at a point displaced 0.020" from the intersection of the vertical score **19** with a straight horizontal line from the apex **36**.

Similarly, in the gallon container, whose four walls are each approximately 5½" wide, the diagonals **25** and **26** form an isosceles triangle whose base is 5.531" and whose height is 2.690". The offset at **30** is .044" and the free edges **32** and **33** are angulated outwardly from the apex **36** so that they intersect the vertical score line **19** at a point displaced .032" from the intersection of the vertical score **19** with a straight horizontal line from the apex **36**.

The manner in which the bottom structure is formed is illustrated in FIGS. 3 and 4. As shown in FIGS. 3 and 4, the gusset forming panels are pressed inwardly with the lateral triangular sections folding over upon the central triangular section. The outside panels are thus brought together with panel **21** having its free edge portion slightly overlapping the free edge portion of panel **22**. When the

panels are completely formed as illustrated in FIG. 4, the free edges **32** and **33** just abut each other without applying to each other any compression stress. When in this condition, the heated thermoplastic coating from the various contiguous surfaces flows and forms a complete seal under pressure throughout the bottom structure. The absence of any compression stress between the free edges of the lateral triangular portions minimizes the development, at the corners of the carton, of a stress giving rise to smiles and the formation of leaks at those corners.

What is claimed is:

1. A bottom structure for liquid containing cartons having four side walls of substantially equal width comprising,

four panels hinged to said side walls along horizontal scores and hinged to each other along vertical scores,

the two opposed panels each being formed by a central triangular section having a base formed by said horizontal score and two sides formed by intersecting diagonal scores, each panel also including two lateral triangular sections, each having a base formed by said vertical score and being hinged along one of said diagonal scores to said central section,

the remaining sides of said lateral triangular sections being free edges which together and before folding form a shallow, inwardly projecting V,

said first panels being folded inwardly with said lateral sections overlying their respective central section and with said free edges just abutting each other when lying substantially in the plane of the bottom of the carton, and

two opposed second panels being generally rectangular and hinged to opposite side walls, said second panels being adapted to overlie the first panels.

2. A bottom structure according to claim **1** in which said shallow V has an angle of approximately 178.5°.

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