LOCKING APERTURE FOR MOLED PULP CONTAINER

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This is a continuation-in-part of copending application Serial No. 312,713 filed September 30, 1965, now abandoned. This invention relates to molded pulp structures, and more particularly to smooth or non-feathered edge apertures in the side walls of dish-shaped molded pulp articles, and specifically to improved locking arrangements for molded pulp containers which are provided by use of the step arrangement associated with such smooth or non-feathered edge apertures.

One of the troublesome problems in the molded pulp industry involves the molding of side wall apertures which are necessary for various purposes such as ventilation holes, locking openings, drainage outlets and the like. Dish-shaped containers or other such structures are generally molded by suction deposition of pulp on an open face wire-covered die which includes a ported base portion and a ported surrounding outwardly flared wall portion defining the configuration of the article. With a male die, the wire-covered portion determines the inside configuration of the dish-shaped article; and, with a female die, the wire-covered portion determines the outside configuration of the dish-shaped article. It will be clear that an aperture may readily be formed in the bottom of the molded pulp structure by simply blocking formation of pulp at the desired location on the base portion of the die with an appropriately shaped solid member at least as thick as the intended thickness of pulp, since the base portion is essentially transverse and usually perpendicular to the direction in which the die and the article are separated, and the aperture formed by the solid member has an axis conveniently aligned with the direction of article-die separation.

The provision of apertures in the side walls has heretofore been accomplished by the use of a solid blocking member whose pulp exposed wall, in the case of a female die, must initiate at a point flush with the wire screen forming the side wall at the base of the intended aperture, and necessarily flares outwardly from the base of the intended aperture relative to a line parallel with the direction of article-die separation. The purpose of such an arrangement is to permit the molded article to be separated from the dish-shaped die without unduly distributing or distorting the pulp fibers adjacent the base of the intended aperture. However, during suction deposition, the pulp fibers tend to accumulate and override the flush blocking member adjacent the base of the intended aperture with a consequential formation of a feathered edge which is generally unsatisfactory for usual aperture purposes. In the case of a male die, the feathered edge formation occurs at the top of the aperture for identical reasons.

Accordingly, it is an object of the present invention to provide a molded pulp structure including a side wall aperture which overcomes the foregoing problems. Another object of the present invention is to provide a mold pulp article including a base wall having a portion transverse to the direction of article-die separation and a side wall angled to the base wall with a smooth, non-feathered edge aperture extending exclusively through the side wall.

Another object of the present invention is to provide a dish-shaped container of molded pulp including an integral step to facilitate the formation of a smooth edge aperture in the wall of the container.

Another object of the present invention is to provide a step associated with a smooth-edged locking aperture for a container such as an egg carton wherein the step arrangement structurally cooperates with other structural features of the carton to provide an improved locking arrangement.

Other features and advantages of the present invention will become apparent to one skilled in the art from a reading of the following description in conjunction with the accompanying drawings, wherein similar reference characters refer to similar parts, and in which:

FIG. 1 is a fragmentary perspective view of an apertured molded pulp article according to this invention;

FIG. 2 is a front elevational view of the structure of FIG. 1;

FIG. 3 is a sectional view on line 3—3 of FIG. 2;

FIG. 4 is a sectional view through a novel molding die showing the method of and apparatus for forming a side wall aperture according to this invention;

FIG. 5 is an end view of a stylized egg carton in a partly opened position utilizing the side wall aperture of this invention;

FIG. 6 is a fragmentary end view of the egg carton of FIG. 5 in the fully closed position;

FIG. 7 is a sectional view of a feathered edge side wall aperture as heretofore known in the prior art;

FIG. 8 is a plan view of a specific egg carton in the closed position having features which cooperate with the step arrangement of the locking aperture to produce an improved locking arrangement, with parts of the carton top broken away;

FIG. 9 is a front elevational view of the carton of FIG. 8, also with parts of the carton top broken away;

FIG. 10 is an end elevational view of the carton of FIG. 8;

FIG. 11 is a plan view of the carton of FIG. 8 in the opened position;

FIG. 12 is an elevational view of the opened carton of FIG. 11 partially in longitudinal section on line 12—12 of FIG. 11;

FIG. 13 is a transverse sectional elevational view on line 13—13 of FIG. 11;

FIG. 14 is a transverse fragmental sectional elevational view on lines 14—14 of FIG. 11;

FIG. 15 is a transverse fragmental sectional elevational view on line 15—15 of FIG. 9;

FIG. 16 is a transverse fragmental sectional elevational view on line 16—16 of FIG. 8;

FIG. 17 is a view similar to FIG. 16 with the parts of the container in different positional relationship; and

FIG. 18 is also a view similar to FIG. 16 with the parts of the container in different positional relationships.

Referring to the drawings, an exemplary or illustrative molded pulp structure shown in FIGS. 1—3 may comprise a portion of an article 10 such as a container including a generally flat central bottom base portion 12 and a generally flat lateral flange base portion 14, and a side wall portion 16 integrally joined to the base portions. The base portions lie in generally parallel planes which are substantially normal or perpendicular to the direction in which the article 10 and its forming die are separated, and the wall portion 16 is flared outwardly from each base portion at a substantial obtuse angle as is customary in the molded pulp industry so that the dish-shaped article 10 may be readily removed from the forming mold. It will be appreciated, of course, that transverse base walls while inherently having at least a single point or portion perpendicular to the direction of article-die separation, as with a semi-spherical bottomed dish-shaped article, may frequently be mostly out of a plane.
which is strictly perpendicular to the direction of article-die separation. Thus, the term transverse is used to indicate that the base wall generally extends across the line of article-die separation, and by no means is necessarily perpendicular thereto throughout. Similarly, the outwardly flaring side walls may often occupy diverse planes in different articles, but all include a portion which is acutely angled to the direction of article-die separation. Viewing the illustrated exemplary article 10 from one side, the wall portion 16 and base portion 12 are joined in a manner forming a major corner 18 of generally convex configuration; and, the wall portion 16 and base portion 14 are joined in a manner forming a major corner 20 of generally concave configuration.

The wall portion 16 includes a step 22 formed by a riser portion 24 joined along one edge at a minor convex corner 26 to the base portion 12 and a tread portion 28 joined along one edge by another minor convex corner 30 to the wall portion 16. The opposite edges of the riser and tread portions are joined together at a minor concave corner 32. The riser portion 24 is out of the plane of but generally parallel with the main plane of the wall portion 16, and the tread portion 28 is out of the plane of but generally parallel with the main plane of the base portion 12. The pulps may connect the ends of the riser and tread portions with the base and the wall portions, as shown at 34.

An aperture 36 extends exclusively through the side wall portion 16. In the drawings, the aperture 36 is generally of rectangular configuration comprising four edges 38, 40, 42 and 44. The aperture 36 is formed partly in the main portion 16 of the wall and partly in the tread portion 28 of the stepped concave portion 22, including the minor convex corner 30 which joins the tread portion 29 to the main part of the wall portion 16. The four edges of the aperture 36 are formed in such a way that they are essentially smooth, being characterized even in the as-formed condition by an absence of substantial accumulation of pulps forming feathered edges of a ragged nature. Thus, the molded pulp article in the region of the aperture 36 is of substantially uniform thickness, right up to the edge of the aperture.

It will be noted in the illustrated embodiment that the aperture 36 extends substantially across the lateral dimension of the tread portion 28, and that the length of the step 22 extends along the major convex corner 18 only a slight distance beyond the edges 40 and 44 of the aperture 36, this distance being less than the dimension of the aperture. It will be appreciated, on the other hand, that an aperture of any desired configuration may be provided according to this invention, which need not extend across the full lateral dimension of the tread portion 28. Additionally, the concave step 22 may extend for any desired distance on either side of the aperture along the major convex corner 18, and the riser and tread portions may be of any desired width.

Referring to FIG. 4, the aperture article is formed on a die 46 by vacuum or suction deposition of an aqueous pulp slurry, the water thereof being drawn through porous surfaces formed by a screen mesh covering 48 through suitable ports (not shown) in the die and into a chamber (not shown) in back of the die in a conventional manner. This leaves a layer of pulp fibers matted on the screen 48 of the die 46 as shown in FIG. 4. The article is thereafter separated from the die and dried according to known processes.

The conventional manner of providing apertures molded directly in the pulp article makes use of a screen blocking member secured to the die. This prevents formation of pulp in the area blocked by the member and forms an aperture in an easily understood manner. For this reason, the apertures may readily be provided in the base portion of walled or dished articles by providing a blocking member on the corresponding bottom portion of the die. With such an arrangement, it will be clear that the article may readily be separated from the die because the bottom wall generally transverse to the direction in which the article and die are separated, and the axis of the aperture through the base wall of the article is aligned with the direction of article-die separation. In FIGS. 4 and 7, the direction of article-die separation is indicated.

The provision of apertures on the side wall of such dish-shaped articles, on the other hand, has heretofore been attained in a singularly unsatisfactory manner. For instance, looking at FIG. 7, a solid plug 52 illustrated in dash-dot lines blocking the screen 48 on the side wall portion must be flared outwardly, as is shown in FIG. 2. The intended base 56 of the aperture 58 so that the molded article 60 may be separated from the die. This results in an aperture the base edge of which includes a substantial accumulation of pulp which builds up on the tapered pulp-exposed surface 54 of the blocking member 52. The pulp accumulation tapers to a feathered edge 62 which results in a ragged aperture edge unsatisfactory for many purposes.

As seen in FIG. 4, the side wall aperture according to this invention is formed by a solid plug or forming die 64 screened as at 66 to the die 46 outside the screen 48. The die area 46 includes channels of the internal surfaces to define a protruding or convex step 68 to form the concave inward step 22 of the article described in full detail in connection with FIGS. 1-3. The solid plug 64 forms a non-porous area which obstructs suction on what corresponds to the tread portion 28 of the step as well as on the portion of the wall 16 where the aperture 36 is to be formed. The inner or pulp-exposed surface 70 of the plug 64 is tapered outwardly from a line perpendicular with the bases to insure easy separation of the dished article from the mold, as can be understood. Solely for the purpose of illustrating this invention, the die 46 includes both a male portion forming the step 20 and a female portion forming the corner 18. It will be appreciated that simple dished articles having only a base and an outwardly flaring side wall may be formed on either a male or a female die. When formed on a male die, the step will extend outwardly of the general confines of the article; and, when formed on a female die, the step will extend inwardly of the general confines of the dished article. The showing of both conditions in a single die-formed article is thus not to be construed as the only possibility.

In FIGS. 5 and 6, a specific illustrative embodiment may include a standard 2 x 6 egg carton 72 including a pocketed bottom member 74 with a locking flap 76 hinged along the upper front margin, and a lid or top member 78 hinged along the upper rear margin of the bottom member. The top includes a base portion 80 and a depending wall portion 82 at an obtuse angle thereto which lies closely adjacent and outside the locking flap 76 when the top and bottom come together in the closed position. Along the upper corner where the base 80 of the top joins the front wall 82 of the top, a step 84 similar to the step 22 of FIGS. 1-3 is provided; however, the step 84 is of a relatively smaller size, the depth of the riser portion being not much greater than the thickness of the pulp forming the base 80 of the top. A locking aperture 86 is formed in the front wall 82 and extends upwardly into the tread part of the step 84. A locking protrusion or lug 88 on the locking flap 82 is positioned to cooperatively engage with the aperture 86 when the carton is closed to secure the lid 78 in the closed position. Aside from providing a smooth edge aperture, the stepped construction additionally provides a corner 90 parallel with the corner where the base 80 and wall 82 join as well as a depending wall portion 92 parallel with the main plane of the side wall 82 to increase the strength of the carton top compared with conventional carton tops where the locking aperture includes part of the base portion of the top itself and thus destroys the strength imparting corner where the base and wall portions of the top join.
It has recently been discovered that the increased strength imparted to the carton cover by the step, as noted immediately above, is only one of several advantages afforded by the step of this invention. Accordingly, to illustrate certain other advantages of the foregoing disclosure, the following detailed description discloses in full detail a modified carton generally similar to the stylized one previously described above in connection with FIGS. 5 and 6, but the following description goes far greater detail in order to point out the advantages obtained when the locking aperture of a molded pulp carton is associated with the step edge and the smooth edge described above. Regarding FIGS. 8-18, an egg carton 100 embodying the features of this invention comprises a bottom member 102 and a top member 104. The bottom member 102 includes side walls such as end walls and a front wall 106 and a rear wall 108, each having a plurality of inwardly co-located half-posts 110 integrally formed at spaced intervals to help define a plurality of egg pockets 112. Rib means 114 intersecting with the half-posts and with a series of full posts 116 located interiorly of the carton complete with definition of the plurality of downwardly disposed article-receiving pockets 112 in the bottom member 102. As can be seen, especially in connection with FIG. 11, the pockets 112 are adapted to hold one dozen eggs and, in the illustrated embodiment, they are arranged in two rows of six eggs each. The rows extend parallel with the front and rear walls 106, 108 of the bottom member.

The ribs 114 which connect between the posts and/or half-posts are defined by a pair of convergingly sloping rib walls 118 and 120. As best seen in connection with FIGS. 15 and 17, the rib wall 120 includes an upwardly directed and generally co-planarly arranged extension 122 which rises upwardly beyond the point of juncture of the pair of rib walls to provide a single thickness layer of pulp material between the articles, such as the eggs E, positioned in the pockets. Additionally, the other rib wall 118 includes an aperture 124 which underlies the upwardly extending tab 122. The margins or boundaries of the aperture 124 are defined by pulp fibers distributed as a rough, feathered edge 126. Additionally, the margins of the upstanding anti-check tabs 122 are also defined by rough, feathery formations of pulp 128 which remain as a result of the molding operation by which the anti-check tabs 122 and apertures 124 are formed. The ribs and posts and half-posts of the bottom member 102 not only define the plurality of article-receiving pockets 112, but also impart a great deal of strength to this portion of the container, and thus hold the front and rear walls 106, 108 of the bottom member in relatively fixed relationship to each other even under the stresses and strains encountered under normal handling of the carton. Thickened gusset formations 129 provided at the juncture of the rib walls 118 and 120 on either side of the tabs 122 and tab nesting apertures 124 further serve to strengthen the bottom portion 102 of the container. Furthermore, since the upper surface of the gussets 129, viewed in cross section transversely of a rib 114, are shaped like inverted U's or V's (see FIG. 15) and the lower surface of the gussets, viewed in cross section longitudinally of a rib, are shaped like upright U's or V's (see FIG. 17), the gussets 129 are extremely useful as anti-jamming means to prevent frictional sticking when inserting the containers 100 at a jammed together in a nested stack.

The top member 104 includes a substantially planar base portion 130 suitable for carrying indicia such as printed advertising material, flat labels glued or otherwise adhered thereto which in turn carry pre-printed advertising material, or the like. The top member further includes an outwardly flaring depending front wall 132 and rear wall 134. The front wall 132 and rear wall 134 are integrally connected with the planar base portion 130 to form corners 136 and 138, respectively, in the plane of the base portion 130. An elongated molded pulp hinge 140 connects the lower edge of the top member rear wall 134 with the upper edge of the bottom member rear wall 108 to enable the top member 104 to be folded down over the bottom member 102 from an opened position illustrated in FIGS. 11-14 to a closed position illustrated in FIGS. 8-10.

A locking flap 142 having a width substantially smaller than the height of the top member front wall 132 is provided. The locking flap 142 is connected at its inner edge by means of an elongated pulp hinge 144 to the upper edge of the bottom member rigid front wall 106. This hinge enables the locking flap 142 to fold up inside the front wall 132 of the top member in the mid-line position, as is well-known with this type of carton.

A pair of male locking protrusions 146 are formed on the locking flap in a position to register with a pair of female locking apertures 148 formed in the front wall 132 of the top member. When the locking protrusions 146 are properly received in the locking aperture 148, the top and bottom members are retained together in the closed position, as is well-known with this type of carton.

The substantially planar base portion 130 of the top member 104 includes a slight upwardly bowed configuration, either initially molded or formed during an afterpressing operation. As can best be seen in FIGS. 9 and 10, the upward bow at the lateral mid-point of the carton amounts to an upward height increase for the carton of from one to several times the thickness of the molded pulp when the carton is formed. Looking particularly at FIG. 9, however, it can be seen that the upwardly bowed configuration is more pronounced at the longitudinal ends of the carton, that is in the general zones of the locking apertures 148 associated with the top member 104. Although in FIG. 9 there is a slight upwardly bowed configuration at the longitudinal mid-point of the carton top member 104, it is understood that the substantially planar base portion 130 may be essentially flat at this mid-zone, or may even be reversely downwardly bowed to a slight extent. In any event, the advantages of the upwardly bowed configuration of the substantially planar base portion are offsetting so long as the bowed configuration is present near the longitudinal ends of the carton, as explained below.

The corner 136, formed where the top member front wall 152 joins the base portion 130 of the top, is interrupted by a pair of step formations 159. Each step is formed by a riser portion 152 which is not only defined by the plurality of article-receiving pockets 112, but also is a part of the upwardly extending tab 122. The step portion defines the plurality of article-receiving pockets 112, but also is a part of the upwardly extending tab 122. The step portion 152 is joined at its upper edge to the base portion 130. The riser portion has a width or height not significantly greater than the thickness of molded pulp forming the base portion 130. The step 159 is further formed by a narrow tread portion 154, the inner edge of which joins with the lower edge of the riser portion 152 and the outer edge of which joins with the top member front wall 132. The width of the narrow tread portion is only several times, preferably between one and ten times, the thickness of a pulp wall. The juncture of the upper edge of the riser portion 152 with the base portion 130 forms a continuation of the corner 136 between the base portion and front wall of the top. As can be seen from the drawings, the continuation of the corner 136 is in the plane of the substantially planar base portion and thus helps maintain the slight upwardly bowed configuration.

The female locking aperture 148 extends, as can be seen, through the front wall 132 of the top member for a major portion of its open area, and through at least part of the narrow tread portion 154 of the step 159 for a minor part of its open area. Actually, in the preferred embodiment, the locking aperture has at least eighty percent of its open area in the front wall and no more than twenty percent of its open area in the narrow tread portion. Additionally, because of the step the locking aperture according to this invention is defined by smooth, forming die established edges characterized by an absence
of significant accumulation of pulp distributed as a feathered edge, and the thickness of the molded pulp walls is substantially uniform even closely adjacent the edges of the aperture. Additionally, the step 150 permits the locking aperture 148 to be located lower on the top member front wall, thus enabling the use of a narrower locking flap with a resultant saving in pulp material.

A series of generally vertically disposed buttress ribs 156 are integrally formed as inwardly extending indentations in the front and rear walls 132, 134 of the top member 104. The buttress ribs 156 serve to resist vertically directed forces and thus strengthen the carton top in the half-post 110 portion, forcing the bottom portion of the carton against vertically directed forces. Additionally, the integrally formed buttress ribs 156 in the top member side walls merge with the planar base portion 130 of the top in a manner which forms continuations of the corners 136 and 138 between the front and rear walls and the base portion.

The corners 136 and 138, as best seen in FIGS. 8 and 11, thus follow a zig-zag or convoluted path which lies substantially in the plane of the base portion 130. The zig-zags or convolutions are formed by the corner extending inwardly at the locations of the buttress ribs 156 and extending inwardly at the locations of the steps 150. The buttress ribs 156 and especially the steps 150 thus serve to impart structural rigidity to the corners 136 and 138, and maintain the desired upwardly bowed configuration to the base portion 130. The steps 150, as best seen in FIG. 15, which rigidify the corner 136 have the effect of causing the top member front wall 132 and the base portion 130 to move somewhat in unison as an integrated, angular unit. For instance, as explained more fully below, downward motion of the central area or the base portion 130 reducing the amount of upward bow results, because of the rigid corner provided by the steps 150, in slight outward motion of at least the mid-portions of the lower edge of the front wall 132.

The top 104 further includes a pair of detent protrusions 158 which depend from the lower edge of the top member front wall 132. The detent protrusions 158 are offset rearwardly from the outer margin or edge of the front wall 132. The bottom member 102 includes a pair of cooperating detent apertures 160 through the locking flap 142 adjacent the lower edge of the flap near its hinge 144. The detent apertures are adjacent half-posts 110 formed in the bottom member front wall 106, the half-posts 110 at these two locations being shortened somewhat as at 162 so that the detent protrusions 158 may be received through the apertures 160 above the shortened half-posts and behind the locking flap hinge 144 when the carton is in the closed position. The detent protrusions 158, in the preferred embodiment, are formed as extensions of two of the inwardly contoured buttress ribs 156 in the top member front wall 132.

It will be noted, additionally, that the locking flap 142 includes a series of inwardly contoured portions 164 which register with the buttress ribs 156 of the cover front wall. The detent apertures 160 are formed in two of these inwardly contoured portions. The locking flap between the inwardly contoured portions 164 is designed to make room for articles such as the eggs E positioned in the pockets adjacent the bottom member front wall. The ends of the locking flap 142 adjacent the corner or end pockets in the front row, however, are not outwardly contoured to the main frame of the locking flap. These end portions, on the contrary, retain their inwardly contoured character as at 166 adjacent the two end article receiving pockets.

In the preferred embodiment illustrated in the drawings, the two male locking protrusions 146 and the two cooperating female locking apertures 148 are provided one each above the half-post 110 which separates the first and second egg pockets of the front row, and one each above the half-post 110 which separates the fifth and sixth egg pockets of the front row. The two detent protrusions 158 and the two cooperating detent apertures 160 are located one each above the half-post which is lowered as at 162 and which separates the second and third egg pockets of the front row, and one each above the other half-post which is shortened as at 162 and which separates the fourth and fifth pockets of the front row.

In operation, the container locking arrangement illustrated in FIGS. 8-18 results in an improved egg carton. For instance, after the open container has been filled with eggs, usually by means of an automatic filling machine, the filled carton is conveyed through an automatic lid closing and carton latching machine. Such machines are of several varieties, and they generally manipulate the various functional attributes of the carton in the same manner as such portions would be manipulated by hand, but at much higher speeds. First, the machine simultaneously rotates the carton top 104 upwardly and inwardly about its hinge 140 and the locking flap 142 upwardly and inwardly about its hinge 144. The locking flap is rotated inwardly to the position illustrated in FIGS. 15-18 where at least the inwardly contoured, upper end portions 166 of the locking flap contact at least the end eggs E in the row adjacent the front wall 106 of the carton bottom. With eggs of the size for which the carton is designed, this contact by the locking flap tends to disturb or shift the contacted eggs slightly in their pockets 112.

Thereafter, the top member 104 is rotated downwardly over the locking flap 142. The portions of the top member front wall 132 which are located directly vertically beneath the locking aperture 148 thus ride over the outer edges of the locking protrusions 146. When the top member 104 is moved downwardly to the closed position, the lower edge of the front wall 132 contacts or bears upon the locking flap hinge 144, the locking protrusions 146 register with the locking apertures 158 to permit the top member front wall 132 to be sprung inwardly, and the detent protrusions 158 project downwardly through the detent aperture 160 of the locking flap. The step 150 which exerts a rigidifying effect on the corner 136 materially assists the above mentioned springing of the top member front wall 132 to its proper inward position. For instance, most automatic closing machines engage the outer base portion 130 of the top to move the top to the closed position. This facilitates outward flexing of the front wall 132 as it rides over the locking protrusion 146 during its final motion to the closed position. Thereafter, when the downward force of the closing device is removed to permit the upwardly bowed portion of the base 130 to snap back up to its normal closed configuration, the step 150 assists in snapping the front wall 132 to its desired inward position.

Additionally, the detent protrusions 158, which are rearwardly offset as mentioned above, readily engage through the detent aperture 160 even while the top member front wall 132 is sprung outwardly to clear the locking protrusions 146. Especially, when oversize eggs in the pockets of the front row resist folding of the flap 142 to the proper inward position, the rearward offset of the detent protrusions 158 insures that these protrusions engage properly behind locking flap hinge 144. Thus, even with oversize eggs in the pockets of the front row, when the top member 104 is closed to the point where the lower edge of its front wall bears on the locking flap hinge, the upward snap of the bowed portion of the base 130, as assisted by the steps 150, serves to shift the detent protrusions rearwardly into their cooperating detent apertures 160. When they are shifted rearwardly and the carton is in the closed position, as illustrated in FIG. 16. In this position, as can be seen, the detent protrusions 158 will be out of engagement with the locking flap hinge 144.

Thereafter, the closed carton is characterized by superior egg protecting features. The width of the locking flap 142, which as mentioned above is significantly smaller than the height of the top member front wall 132, is not
utilized to support the top member. On the contrary, the lower edge of the top member front wall 132 bears on the locking flap hinge 144, and the buttress ribs 156 in the front and rear walls of the top member 104 as well as the half-posts 110 in the front and rear wall of the bottom member 102 adequately resist vertical forces. Additionally bowed configuration of the planar base 130 provides an additional cushioning feature. When the filled and closed egg cartons are stacked in shipping cases, the cartons of one layer are oriented 90° from the cartons of the adjacent layer. Thus, the upward bow at one longitudinal end of a carton need support only one end of the angularly positioned carton in the layer next above. Although the upwardly bowed configuration of the carton top has insufficient strength to completely support the weight of a full carton positioned thereon, the combined effect of the upward bow of all of the cartons packed in a shipping case provides a resilient cushioning effect on all the cartons throughout the shipping case whereby harmful shifting or rattling of the cartons within the case is minimized.

Additionally, the upwardly bowed configuration serves to protect the contents of the carton even when the carton is considered as an individual unit outside the shipping case. For instance, on display shelves in retail establishments or in ultimate use in a consumer's refrigerator, when heavy objects are placed on top of the egg carton the vertically downward forces, as illustrated in FIG. 18, tend to flatten out the upwardly bowed configuration. Such forces may even push the top member to a downwardly bowed configuration. However, the strengthening integrated into the carton 136 by the step 150 helps rotate or shift the top member front wall 132 outwardly in response to downward motion of the base 130. As seen in FIG. 18, when the downward forces are applied, the top member front wall 130 shifts outwardly until the rearwardly offset detent protrusions 158 positively engage behind the locking flap hinge 144. This limits outward motion of at least the mid-portions of the corner edge of the top member front wall 132 beyond a predetermined point. Such point insures that the lower edge of the top member front wall still bears upon the rigid locking flap hinge, and thus the vertical forces are still resisted by the buttress ribs 156 of the top and the half-posts 110 of the bottom. This outward shifting of the top member front wall to absorb severe vertical forces provides an additional advantage. As noted above, in the normally closed position, at least the end of contact the locking flap at 166 to insure that the locking protrusions 146 are always properly engaged with the locking apertures 148. Since the lower edge of the top member front wall 132 bears on the locking flap 142 near its hinge, it will be appreciated that downward pressure on the carton top results in an inward rotative pressure on the locking flap. However, with the rearwardly offset detent protrusion 158 of this invention, such pressures do not result in egg breakage for the following reason. The detent protrusions permit outward shifting of the top member front wall 132 in response to vertical downward forces, as noted above. This relieves some of the pressure from the locking flap 142, so that the sturdy locking flap hinge absorbs the majority of the downward pressure and only a minority of such forces contribute to the inward folding of the locking flap.

Finally, the rearwardly offset detent protrusions 158 facilitate manual unlocking and opening of the carton. As best seen in FIG. 17, when fingertip pressure is applied between the lower edge of the top member front wall 132 and the locking flap adjacent its hinge 144, usually at the mid-point of the carton between the third and fourth egg pockets of the front wall, the detent protrusions 158 permit outward flexing of the top member front wall to facilitate clearance of the locking apertures 148 from the locking protrusions 146. Thus, upward and outward motion of the lower edge of the top member front wall is permitted by the rearwardly offset detent protrusions 158 for easy manual opening (FIG. 17) of the carton without sacrificing the ability of the detent protrusion 158 to resist severe vertical forces (FIG. 18) on the closed carton. In addition, it will be noted that the features are accomplished by the above detailed structural changes which effectively maintain the overall eye appeal of the egg carton.

Thus, a molded pulp structure has been disclosed which provides a clean, smooth-edged aperture in the side wall of a dish-shaped article. The aperture in the side wall includes a step arrangement which materially strengthens the corner formed by the side wall and the base wall of the dish-shaped article. When such step and aperture are utilized in conjunction with the locking mechanism of a container. They cooperate with certain other features of the locking arrangement to provide a superior container lock. Especially, in connection with the specific embodiment of egg carton disclosed above, the steps through which locking apertures are formed cooperate with the upward bow in the container top and with the rearwardly offset detent protrusions at the lower edge of the side wall through which the apertures are formed to provide a strong yet easily manipulated carton latch requiring less material than heretofore while retaining the attractive appearance now accepted by consumers of eggs.

While the above described embodiments constitute preferred modes of practicing this invention, other embodiments and equivalents may be resorted to within the scope of the actual invention, which is claimed as follows.

What is claimed is:

1. A molded pulp container comprising a bottom member and a top member adapted to come together in a closed position, a locking flap hinged to one member, a male locking protrusion formed on the locking flap, the other member including a substantially planar base portion and an integral wall portion at an obtuse angle to the substantially planar base portion forming therewith a corner structure in the plane of the base portion, the wall portion and the locking flap adapted to lie closely adjacent each other when the members are in the closed position with the locking flap inside the wall portion, a female locking aperture formed in the wall portion to receive the male locking protrusion when the members are in the closed position, a step in the other member formed by a riser portion out of the plane of the wall portion and joined at one edge to the base portion and a narrow tread portion joining the opposite edge of the riser portion with the wall portion, the juncture of the one edge of the riser portion with the base portion forming a continuation of the corner structure between the wall portion and the base portion, the continuation of the corner structure being in the plane of the substantially planar base portion, the width of the narrow tread portion between the opposite edge of the riser portion and the wall portion being between one and ten times the thickness of the wall portion, the female locking aperture extending through the wall portion for at least eighty percent of its open area and through at least part of the narrow tread portion for no more than twenty percent of its open area, and the aperture being defined by edges substantially parallel to the base portion with protrusions at the ends of the aperture formed by an absence of significant accumulation of pulp distributed as a feathered edge whereby the thickness of the molded pulp container is substantially uniform closely adjacent the edges of the aperture.

2. The molded pulp container as set forth in claim 1 wherein the riser portion has a width between its joined edges not significantly greater than the thickness of molded pulp forming the base portion whereby the aperture extends practically to the base portion.

3. The molded pulp container as set forth in claim 1 wherein the riser portion of the step lies in a plane essen-
tially parallel with the plane in which the wall portion lies.

4. The molded pulp container as set forth in claim 1 wherein the bottom member includes a plurality of downwardly dished article-receiving pockets, the locking flap being hinged to one side of the pocketed bottom member, and the other member is hinged to the other side of the pocketed bottom member.

5. A molded pulp container comprising a bottom member including a front wall and a rear wall, a plurality of inwardly contoured half-posts integrally formed at spaced intervals in the rear wall, each half-post intersecting the half-posts to define therewith a plurality of downwardly dished article-receiving pockets in the bottom member, a top member including a substantially planar base portion suitable for carrying indicia and having outwardly flaring depending front and rear walls integrally connected therewith to form corners in the plane of the base portion of the top member, an elongated pulp hinge connecting the lower edge of the top member rear wall with the upper edge of the bottom member rear wall to enable the top member to fold down over the bottom member in a closed position, a locking flap having a width substantially smaller than the height of the top member front wall, an elongated pulp hinge connecting the locking flap to the upper edge of the bottom member front wall to enable the locking flap to fold up inside the top member front wall in the closed position, a male locking protrusion formed on the locking flap, a female locking aperture formed in the top member front wall to receive the male locking protrusion and retain the top and bottom members together when they are in the closed position, the substantially planar base portion of the top member including a slightly upwardly bowed inner edge, whereby downwardly directed forces on the closed container to protect articles therein, the bowed configuration of the base portion being maintained at least in part by the corners formed with the top member front and rear walls, a step in the top member formed by a riser portion out of the plane of the top member front wall and joined at its upper edge to the base portion and a narrow t阅读下章 joining the lower edge of the riser portion with the top member front wall, the juncture of the upper edge of the riser portion with the base portion forming a continuation of the corner between the base portion and the front wall of the container, the continuation of the corner being in the plane of the base portion to help maintain the bowed configuration of the base portion so that downward flexure of the base portion between the front and rear thereof tends to cause slight outward flexing of at least the mid-portion of the lower edge of the top member front wall away from the locking flap, the female locking aperture extending through the top member front wall for a major part of its open area and through at least part of the narrow t阅读下章 for a minor part of its open area, a detent protrusion depending from the lower edge of the top member front wall, a second aperture formed on the locking flap adjacent a half-post of the bottom member front wall to permit the detent protrusion to be received behind the locking flap hinge in the closed posi-