Nov. 2, 1965 K. L. CRABTREE 3,215,327

LOCKING APERTURE FOR MOLDED PULP CONTAINER

Filed March 19, 1965 3 Sheets-Sheet 1

Fig. 1.

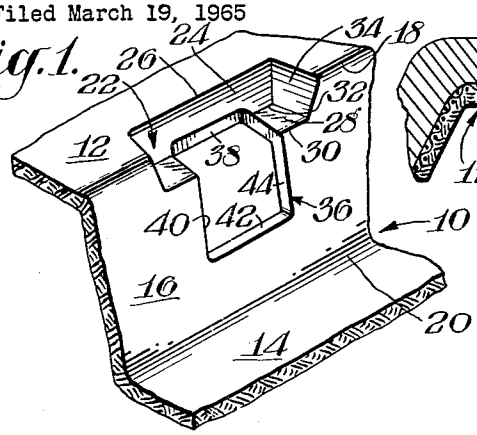


Fig. 4.

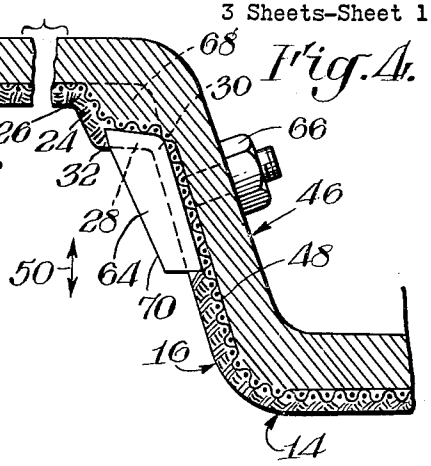


Fig. 2.

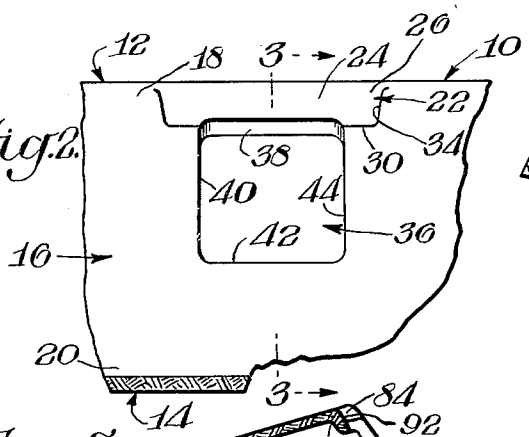


Fig. 3.

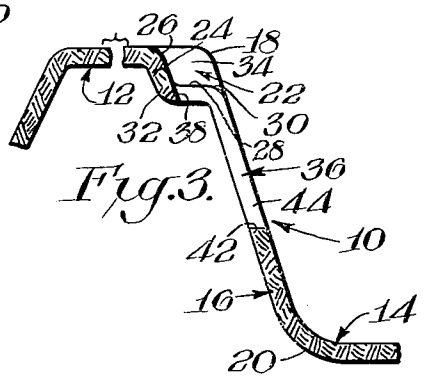


Fig. 5.

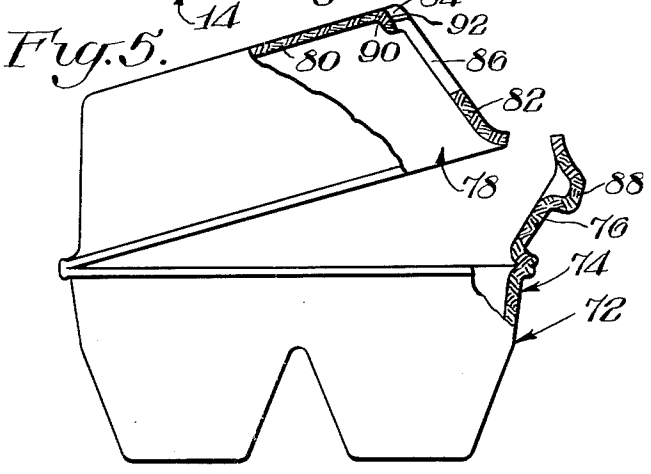


Fig. 6.

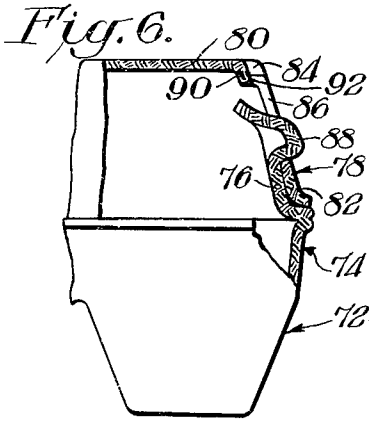
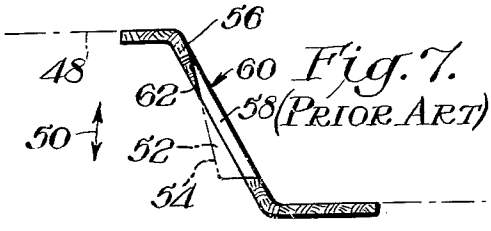


Fig. 7.



(PRIOR ART)

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Nov. 2, 1965 K. L. CRABTREE 3,215,327

LOCKING APERTURE FOR MOLDED PULP CONTAINER

Filed March 19, 1965 3 Sheets-Sheet 2

Fig. 8.

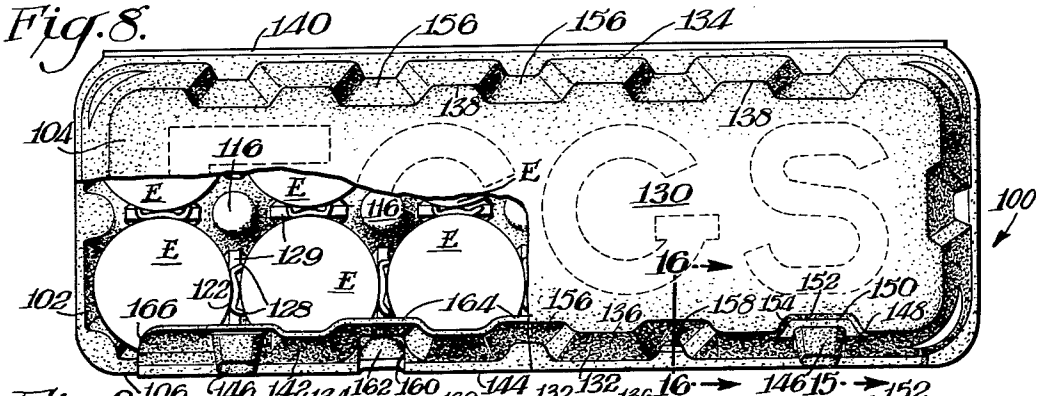


Fig. 9.

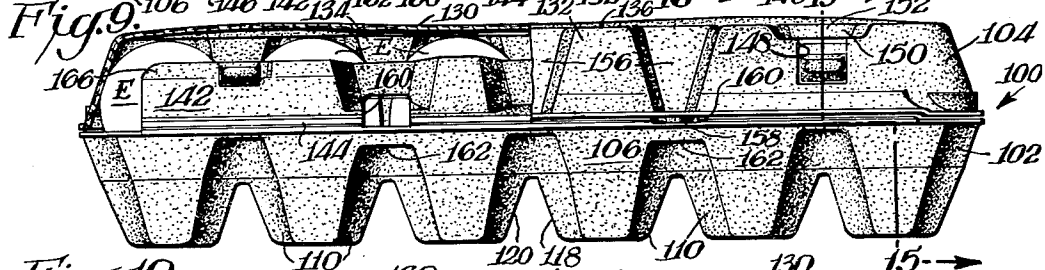


Fig. 10.

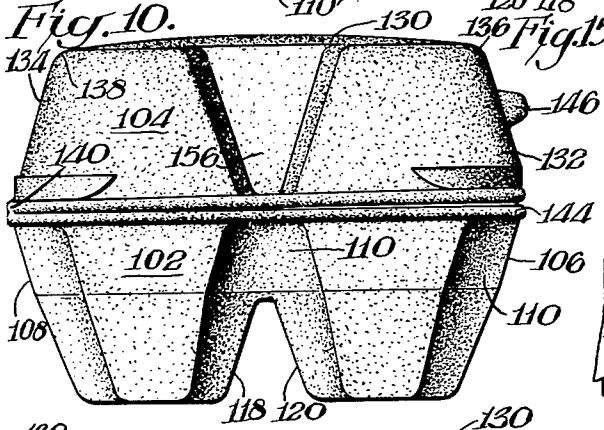
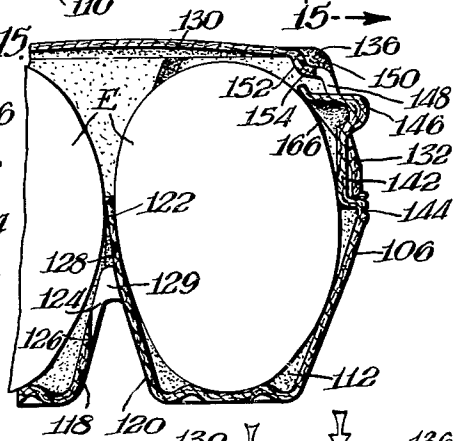


Fig. 15.



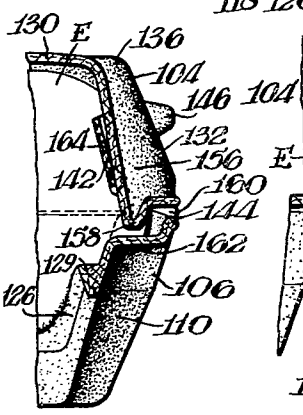


Fig. 16.

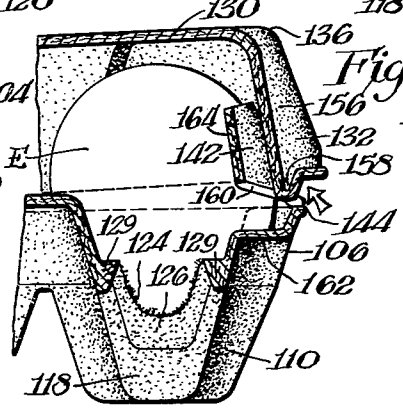
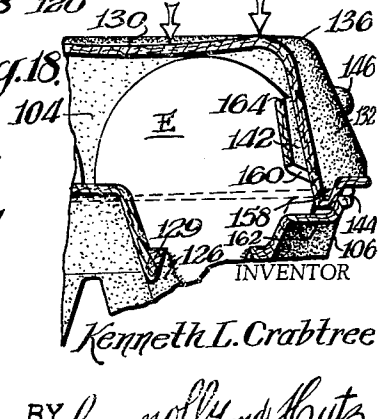


Fig. 17.

Fig. 18.



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Nov. 2, 1965 K. L. CRABTREE 3,215,327

LOCKING APERTURE FOR MOLDED PULP CONTAINER

Filed March 19, 1965 3 Sheets-Sheet 3

Fig. 11.

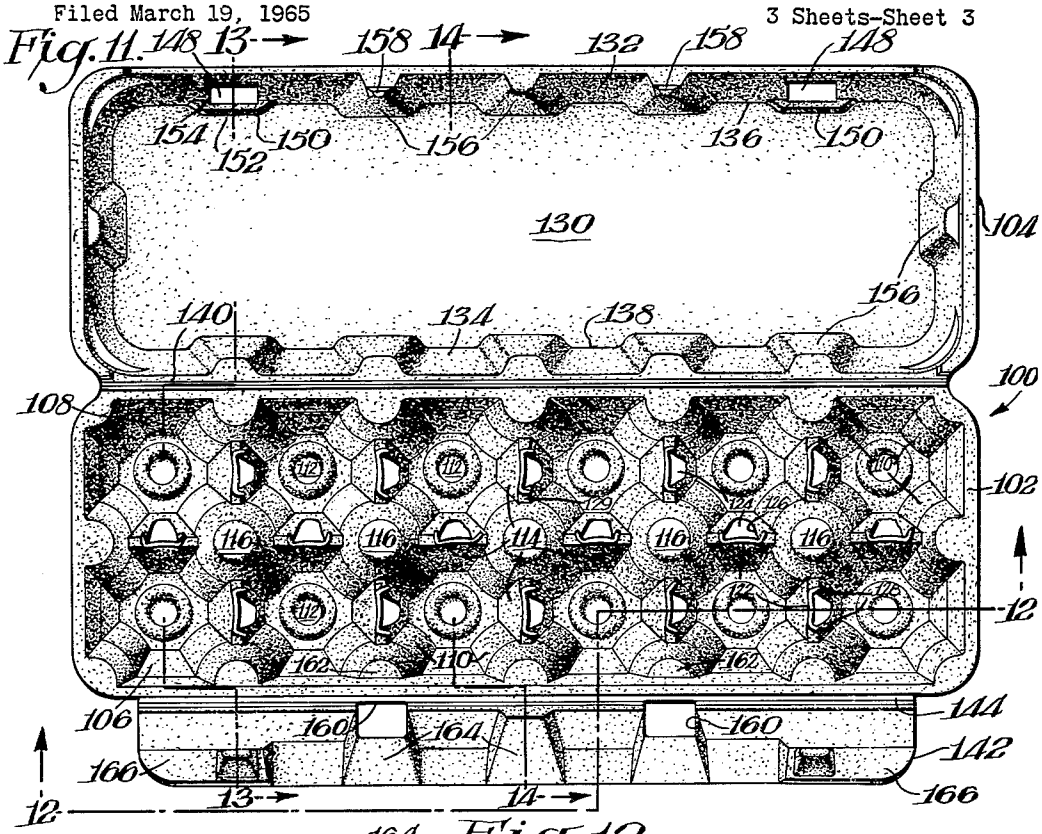


Fig. 12.

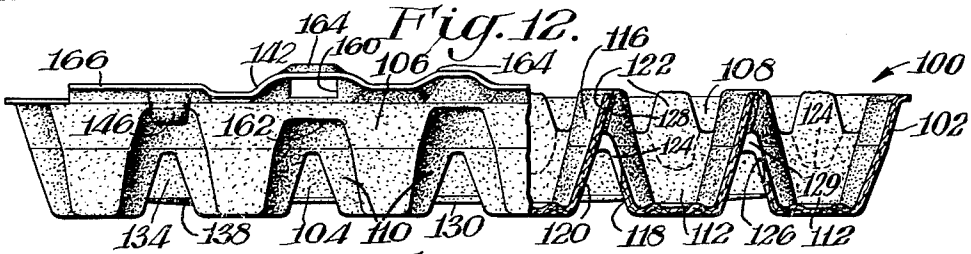


Fig. 13.

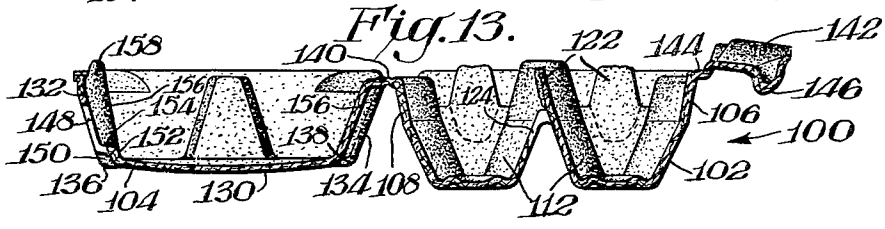
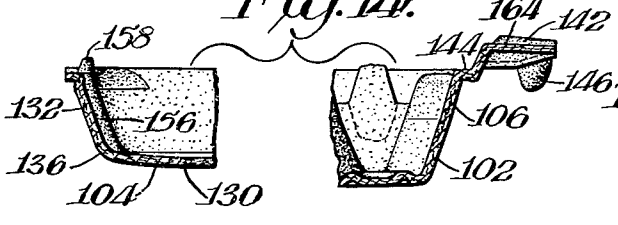


Fig. 14.



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United States Patent Office

3,215,327

Patented Nov. 2, 1965

3,215,327

LOCKING APERTURE FOR MOLDED PULP CONTAINER

Kenneth L. Crabtree, Fairfield, Maine, assignor to Keyes Fibre Company, Waterville, Maine, a corporation of Maine

Filed Mar. 19, 1965, Ser. No. 444,916
8 Claims. (Cl. 229—2.5)

This is a continuation-in-part of copending application Serial No. 312,713 filed September 30, 1963, 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 heretofore troublesome problem 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 overlie 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 egde 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 positioned 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 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 still 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 portions **12** and **14**. Pulp 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 **28** to the main part of the wall portion **16**. The four edges of the aperture **36** are forming die established and are essentially smooth, being characterized even in the as-formed condition by an absence of substantial accumulation of pulp 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 every 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 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 apertured 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 instance, 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 is 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 by an arrow **50**.

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 at **54**, from 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 and screen are formed with plural porous 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 purposes of illustrating this invention, the die **46** includes both a male portion forming the corner **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 specific commercial egg carton generally similar to the stylized one previously described above in connection with FIGS. 5 and 6, but the following description goes into 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 structure and smooth-edged aperture 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 contoured 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 dished 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 a number of the containers **100** are 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 close 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 after-pressing 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 from which 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 effected as 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 **132** joins the base portion **130** of the top, is interrupted by a pair of step formations **150**. Each step is formed by a riser portion **152** which is out of but essentially parallel with the plane of the top member front wall **132**. The riser 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 **150** 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 **150** 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 same manner that the half-posts **110** strengthen 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-portion 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 plane 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 portions 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 flat **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 ends 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 **148** 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 planar 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, bowed 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 inner 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 planar 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, 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, the slight upwardly 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 imparted to the corner **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-portion 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 eggs contact the locking flap **142** 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 row, 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 these 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 smooth, forming die established edges characterized 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 is 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 front and rear walls, rib means 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 slight upwardly bowed configuration which tends to resist 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 tread portion 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 cover, 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 tread portion for a minor part of its open area, a detent protrusion depending from the lower edge of the top member front wall, a detent aperture through 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 position, the detent protrusion being offset rearwardly sufficiently to permit easy machine locking and manual unlocking of the container even when unusually large articles in the pockets adjacent the bottom member front wall resist inward folding of the locking flap but the detent protrusions being positioned to limit outward motion of at least the mid-portion of the lower edge of the top member front wall beyond a predetermined point to resist downwardly directed forces on the closed container.

6. The molded pulp container as set forth in claim 5 wherein the lower edge of the top member front wall bears on the locking flap adjacent the locking flap hinge in the closed position, and wherein the detent protrusion is offset rearwardly sufficiently to permit outward motion of at least the mid-portion of the lower edge of the top member front wall to the point where the locking flap hinge resists the majority of downwardly directed forces with only a minority of such forces contributing to inward folding of the locking flap.

7. The molded pulp container as set forth in claim 5 wherein the downwardly dished article-receiving pockets are adapted to hold one dozen eggs, and wherein the locking flap is designed to contact at least some of the eggs in the pockets adjacent the bottom member front wall to insure retention of the male locking protrusion in the female locking aperture.

8. The molded pulp containers as set forth in claim 7 wherein the pockets for holding one dozen eggs are arranged in two rows of six eggs each, the rows extending parallel with the bottom member front and rear walls, and wherein two male locking protrusions and two cooperating female locking apertures are provided, one each above the half-post which separates the first and second pockets of the front row and one each above the half-post which separates the fifth and sixth pockets of the front row, and wherein two detent protrusions and two cooperating detent apertures are provided, one each above the half-post which separates the second and third pockets of the front row and one each above the half-post which separates the fourth and fifth pockets of the front row whereby the most significant outward flexing of the lower edge of the top member front wall in response to downwardly directed forces occurs above the half-post which separates the third and fourth pockets of the front row to facilitate fingertip access between the top member fron wall and the locking flap during manual carton opening.

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