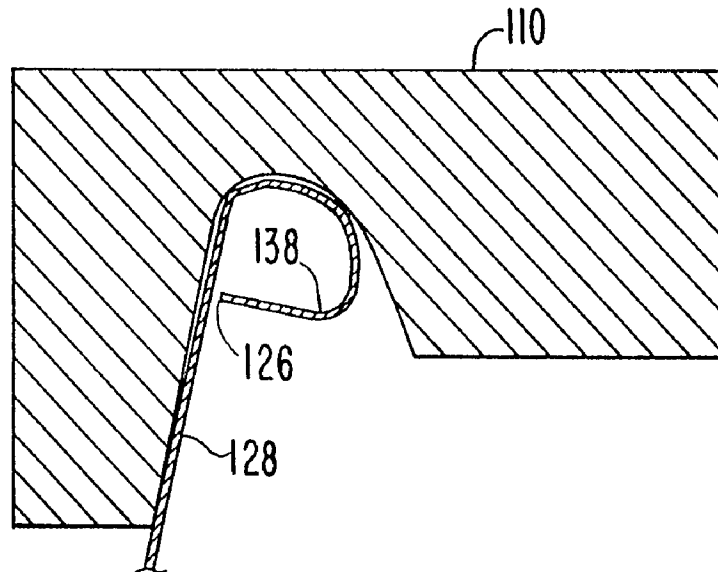




(72) SANDSTROM, Erland R., US  
(72) SHANTON, Kenneth John, US  
(72) HARTJES, Timothy Paul, US  
(71) JAMES RIVER CORPORATION OF VIRGINIA, US  
(51) Int.Cl.<sup>6</sup> B65D 3/28  
(30) 1995/07/28 (508,461) US  
(30) 1996/07/26 (686,773) US

(54) **RECIPIENT EN CARTON RIGIDIFIÉ PAR UN REBORD REPLIÉ  
EN CORDON, SON PROCÉDE DE RÉALISATION ET FLAN DE  
RÉALISATION DE CE RECIPIENT**  
(54) **CARTON HAVING BUCKLE-CONTROLLED BRIM CURL AND  
METHOD AND BLANK FOR FORMING THE SAME**



(57) Récipient réalisé en carton de papier d'une épaisseur minimale d'environ 0,007 pouces. Le rebord roulé présente une longueur d'arc inférieure à environ un quart de pouce. Le rayon de courbure externe du récipient, selon la section transversale à l'axe de la longueur de l'arc du rebord roulé, contiguë à ce rebord roulé, est inférieur à environ 1,5 pouces. Le carton utilisé renferme au moins 8 livres d'adhésif d'encollage environ par rame de 3000 pieds carrés. Le récipient est réalisé à partir d'une coque en carton (128) présentant un bord non fini (126). Le bord non fini (126) est comprimé contre la face d'un flan de formage (110). Le point initial de repliement

(57) A container is formed of paperboard having a caliper of at least approximately 0.007 inches, a rolled brim arc length of less than about 0.25 inches, an outer radius of curvature of the container cut through the plane normal to the axis of the rolled brim arc length adjacent the rolled brim being less than approximately 1.5 inches, and the paperboard material having at least approximately 8 lbs/3,000 square foot ream of size press adhesive. The container is formed by providing a paperboard shell (128) having an unfinished edge (126); urging the unfinished edge (126) into a forming surface of a forming die (110) and controlling an initial buckling



(21) (A1) **2,227,372**  
(86) 1996/07/26  
(87) 1997/02/13

(138) du rebord non fini (126) de la coque de carton (128) est déterminé de telle sorte que l'on obtient un rebord roulé en forme de tore en saillie exempt de défaut. Le récipient peut également être revêtu d'un apprêt styrène-acryle, qui améliore considérablement la cohésion entre le carton et un revêtement polymère externe.

point (138) of the unfinished edge (126) of the paperboard shell (128) such that a defect free prolate rolled toroidal brim is formed. The container may also include a styrene-acrylic primer coating to significantly improve bonding between the paperboard and a polymer outer coating.



PCT

WORLD INTELLECTUAL PROPERTY ORGANIZATION  
International Bureau

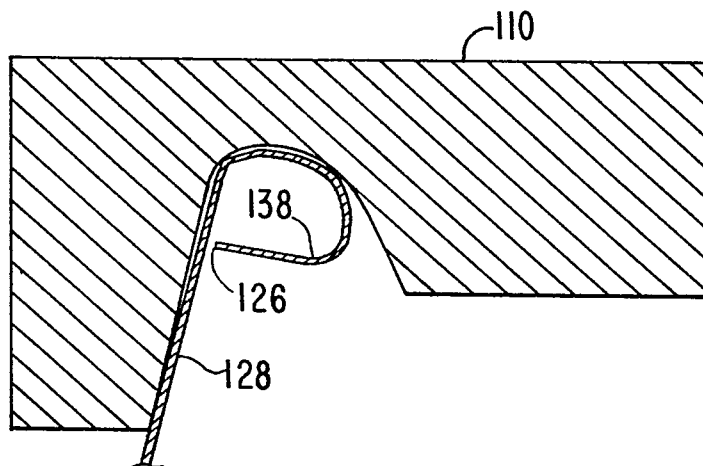
## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification <sup>6</sup> : <b>B65D 3/28</b>	<b>A1</b>	(11) International Publication Number: <b>WO 97/05024</b> (43) International Publication Date: 13 February 1997 (13.02.97)
(21) International Application Number: PCT/US96/12188 (22) International Filing Date: 26 July 1996 (26.07.96) (30) Priority Data: 508,461                      28 July 1995 (28.07.95)                      US 686,773                      26 July 1996 (26.07.96)                      US (71) Applicant: JAMES RIVER CORPORATION OF VIRGINIA [US/US]; 120 Tredegar Street, Richmond, VA 23217 (US). (72) Inventors: SANDSTROM, Erland, R.; 1317 Home Avenue, Menasha, WI 54952 (US). SHANTON, Kenneth, John; 320 Parkwood Drive, Neenah, WI 54956 (US). HARTJES, Timothy, Paul; 413 South Sidney Street, Kimberly, WI 54136 (US). (74) Agent: STUDEBAKER, Donald, R.; Sixbey, Friedman, Leedom & Ferguson, Suite 600, 2010 Corporate Ridge, McLean, VA 22102 (US).		(81) Designated States: CA, JP, European patent (AT, BE, CH, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE).  Published <i>With international search report.</i>

(54) Title: CARTON HAVING BUCKLE-CONTROLLED BRIM CURL AND METHOD AND BLANK FOR FORMING THE SAME

## (57) Abstract

A container is formed of paperboard having a caliper of at least approximately 0.007 inches, a rolled brim arc length of less than about 0.25 inches, an outer radius of curvature of the container cut through the plane normal to the axis of the rolled brim arc length adjacent the rolled brim being less than approximately 1.5 inches, and the paperboard material having at least approximately 8 lbs/3,000 square foot ream of size press adhesive. The container is formed by providing a paperboard shell (128) having an unfinished edge (126); urging the unfinished edge (126) into a forming surface of a forming die (110) and controlling an initial buckling point (138) of the unfinished edge (126) of the paperboard shell (128) such that a defect free prolate rolled toroidal brim is formed. The container may also include a styrene-acrylic primer coating to significantly improve bonding between the paperboard and a polymer outer coating.



- 1 -

**CARTON HAVING BUCKLE-CONTROLLED BRIM CURL  
AND METHOD AND BLANK FOR FORMING THE SAME**Technical Field of the Invention

5 The present invention relates to a canister type carton having a curled brim region. More particularly, the present invention relates to a canister type carton having a buckle-controlled brim curl, a method of forming such buckle-controlled brim curl as well as a paperboard blank used to form such a carton.

Background of the Invention

10 Various types of containers from drinking cups to elongated canisters have been manufactured over the years with rolled brims about an upper periphery thereof. Such rolled brims or brim curls as they are often referred to in the art serve both structural as well as aesthetic functions which are critical to the acceptance of such containers by the consumer.

15 Initially, it is imperative that a consumer oriented product be aesthetically pleasing to the consumer both visually as well as functionally. That is, a drinking cup or canister having a sharp, bare upper edge would not be readily accepted by the consumer. Such a rim is not visually pleasing to the consumer nor is such a rim comfortable for the consumer during use.  
20 Further, such a container is not structurally sound and could readily collapse when handled by the consumer. Additionally, with canister type containers having lids placed thereon, not only may the lid readily slip off over a sharp, bare upper edge, the seal between the lid and canister is not reliable.

25 The rigidity of a particular container is effected by the tensile and bending stiffness in both the vertical and circumferential directions of the container. As noted hereinabove, one expedient for increasing the rigidity of a paper container is to form a brim about the top of the container. As is disclosed in U.S. Patent No. 2,473,836 issued to Vixen et al., conventional

- 2 -

brim curling mechanisms utilize complimentary curved dies in which the lower die is first moved upwardly around the upper end of the cup to the top edge of the cup where it firmly holds the cup top. The upper die is then moved downwardly to engage the uppermost edge of the cup between the dies  
5 with both of the dies then moving downwardly together to curl the upper edge of the container thereby forming a brim. This brim adds significantly to the rigidity of the overall cup structure.

U.S. Patent No. 3,065,677 issued to Loeser discloses a similar brim curling mechanism for containers. A lower die having a curve forming upper  
10 surface is maintained stationary while an upper die having a curve forming lower surface descends downwardly toward the stationary lower die, deflecting the upper edge portion of the container secured by the lower die and again forming a brim about the upper periphery of the container. This brim, as stated previously, adds significantly to the overall rigidity of the  
15 container.

Containers of the above-mentioned type can be readily manufactured at relatively high speeds using conventional brim curl forming equipment by forcing an unfinished annular edge into a die which curls the brim outwardly forming a roughly elliptical toroidal rim. As is noted in U.S. Patent No.  
20 5,029,749, the orientation of the blank used in forming such containers may also aid in the manufacture of containers having brim curls formed thereon by reducing defects found in the brim curls. However, when manufacturing containers where either the paperboard stock material is relatively heavy and/or the radius of curvature of the annular edge to be rolled is relatively  
25 small, cracks often appear in the outer surface of the toroidal brim. Clearly, such cracks degrade the appearance of the rolled brim and can often degrade the functionality of the rolled brim particularly when the brim is to sealingly receive a lid thereon.

In an effort to overcome the above-noted shortcomings, pretreating at  
30 least the annular edge of the paperboard shells with steam has been introduced

- 3 -

as exemplified in U.S. Application Serial No. 08/208,883 to Aloisi et al. and assigned to the assignee of the subject invention. Therein, the shells are housed in a steaming unit prior to their final formation such that at least the annular edge region is moistened which permits the brim curl to be more readily and reliably formed. While such a unit aids in the formation of the container, the cost of such a unit as well as the expense of operating and maintaining such a unit are an added expense to the overall cost of each container.

In addition, containers of the type discussed above often include outer polymer coatings, such as polyethylene, applied to the paperboard material. Such polymer coatings may be extruded onto the surface of the paperboard. It is imperative that the polymer coating bond to the paperboard material. To this end, one of three methods are generally used, namely, corona treatment, flame treatment, or polyethylene imine treatment. These treatments are not always sufficient, however, if the polymer coating or the paperboard is treated with additional coating materials. In these cases, peeling of the polymer coating from the paperboard material can occur which is highly undesirable. Such peeling is particular a problem for brim curled containers in view of the stress imposed to the upper portion of the container during formation of the brim curl.

In view of the foregoing, there is clearly a need for a container that can be reliably manufactured at high speeds which exhibits an annular edge having relatively small radius of curvature and/or which is formed of a relatively heavy paperboard material having a brim curl which is substantially defect free.

#### Summary of the Invention

The primary object of the present invention is to overcome the aforementioned shortcomings associated with the prior art containers.

- 4 -

Another object of the present invention is to provide a container having a brim curl formed about a portion of the container having a relatively small radius without the formation of cracks in an outer surface of the brim curl.

5 Yet another object of the present invention is to provide a container formed from a blank having a relatively high thickness when compared to similar prior art paperboard containers.

A still further object of the present invention is to provide a canister type container wherein defects formed in the brim curl of the container are  
10 minimized.

Yet another object of the present invention is to form a canister type carton from paperboard material impregnated with sizing adhesive in an amount equivalent to from about at least 8 to about 20 lbs/3000 ft<sup>2</sup> ream of paperboard material, and preferably in an amount equivalent to approximately  
15 13 lbs. of sizing adhesive per 3,000 ft<sup>2</sup> ream of paperboard material.

A further object of the present invention is to provide a method of forming a paperboard container wherein an initial buckling point of the paperboard shell being subjected to a brim curl process is controlled so as to produce a substantially defect free brim curl.

20 A still further object of the present invention is to provide a paperboard shell for forming a container having paperboard characteristics which aid the paperboard shell in its travel into a forming die such that the initial buckling point of the paperboard shell occurs a substantial distance into the annular edge so as to form substantially defect free brim curls on  
25 containers having relatively small radius of curvature at the brim curl.

Yet another object of the present invention is to provide enhanced bonding of a polymer coating to coated paperboard used to form a paperboard container.

These as well as additional objects of the present invention are  
30 achieved by providing a paperboard container having a rolled brim with the

- 5 -

container being formed of a paperboard material, a rolled brim arc length of less than about 0.25 inches, an outer radius of curvature cut through the plane normal to the axis of the rolled brim arc length of the container adjacent the rolled brim being less than approximately 1.5 inches with the paperboard material forming the container having at least approximately 8 lbs/3,000 ft<sup>2</sup> ream of size press adhesive included therein and preferably approximately 13 lbs/3,000 ft<sup>2</sup> ream of paperboard material. One such container includes particular dimensions wherein the outer radius of curvature cut through the plane normal to the axis of the rolled brim arc length of the container adjacent the rolled brim is approximately 1.25 inches while an inner radius of curvature cut through the plane normal to the axis of the rolled brim arc length of the container adjacent the rolled brim is at least 1.09 inches. In this embodiment, the side wall of the container is substantially vertical and a major diameter of the rolled brim is approximately 0.14 inches while a minor diameter of the rolled brim is approximately 0.125 inches.

The aforementioned container is formed by providing a paperboard shell having an unfinished annular exposed edge; directing the unfinished annular edge into a forming surface of a forming die; urging the unfinished annular edge into the forming die and controlling an initial buckling point of the unfinished annular edge of the paperboard shell such that a substantially defect free prolate rolled toroidal brim is formed. In the embodiment illustrated in Figure 1A, the buckling point of the unfinished annular edge of the paperboard shell initiates a distance from about 4 to about 8 times the caliper of the paperboard shell from the unfinished annular edge. In all other containers manufactured in accordance with the present invention, the distance may be defined as from about 25% to about 50% of the arc length of the rolled brim to be formed from the unfinished annular edge.

In order to aid in the formation of the prolate rolled toroidal brim, a lubricant is provided on one of either the paperboard shell or forming surface of the forming die which allows the unfinished annular edge of the



- 6 -

paperboard shell to travel further along the forming surface before the buckling of the unfinished annular edge is initiated. This may be achieved by applying a lubricating agent to the paperboard blank prior to forming the paperboard shell, applying the lubricating agent to the paperboard shell, or  
5 applying the lubricating agent to the forming surface of the forming die. Preferably, the lubricating agent is added to a polyethylene coating which is applied to the paperboard material.

The paperboard blank may further include a styrene-acrylic coating applied prior to the formation of the polyethylene coating. The styrene-acrylic coating provides smoothness to the surface of the paperboard while  
10 enhancing, rather than diminishing, the resulting bond between the paperboard and the polyethylene coating.

These as well as additional advantages of the present invention will become apparent from the following detailed description when read in light  
15 of the several figures.

#### Brief Description of the Drawings

Figure 1A is a perspective view of one type of container which benefits from being formed in accordance with the present invention.

Figure 1B is a perspective view of another type of container which  
20 benefits from being formed in accordance with the present invention.

Figure 2A is a side elevational view of the container illustrated in Figure 1A.

Figure 2B, is a side elevational view of the container illustrated in Figure 1B.

25 Figure 3A is a top view of the container illustrated in Figure 1A.

Figure 3B is a top view of the container illustrated in Figure 1B.

Figure 4 is a cross-sectional view of an upper tool die for forming a brim curl on the container illustrated in Figure 1.

- 7 -

Figure 5 is a cross-sectional view of a lower tool die for forming the brim curl on the container illustrated in Figure 1.

Figure 6A is a schematic representation of a brim curl formed in accordance with the present invention which would be substantially defect free.

Figure 6B is a schematic representation of a brim curl not formed in accordance with the present invention which would exhibit defects in the exterior surface thereof.

Figure 7 is a schematic representation of a brim curl being formed illustrating the unfinished annular edge of the container entering the brim curl forming die at the point of engagement with the concave upper-toroidal surface of the die.

Figure 8 is a schematic representation of the brim curl being formed illustrating initial buckling of the unfinished edge as it is urged into engagement with the concave upper surface of the die.

Figure 9 is a schematic representation of the brim curl being formed illustrating initial curling of the rolled brim as it is further urged into engagement with the concave upper surface of the die.

Figure 10 is a schematic representation of the brim curl formed illustrating the completion of the rolled brim as it completes engagement with the concave upper-toroidal surface of the die.

Figure 11 is a composite photomicrograph of a section of a prolate rolled brim of a container formed in accordance with the present invention.

Figure 12 is a composite photomicrograph of a section of an oblate rolled brim of a container not in accordance with the present invention which when examined exhibits cracking on the exterior peripheral surface thereof.

Figure 13 is a partially cut-away, side elevational view of a second embodiment of the container illustrated in Figure 1A.

Figure 14 is a cross-sectional representation of a brim curl of the second embodiment of the present invention.

- 8 -

Detailed Description of the Invention

The present invention will now be described in detail with reference to the several figures.

Initially, reference is made to Figure 1A wherein a container 10 of the  
5 canister type having a substantially vertical side wall 12 is illustrated. This  
container being one type of container which benefits from being formed in  
accordance with the present invention. As can be seen from Figure 1A, the  
container 10 includes rounded corners 14, the particular dimensions of which  
will be described in greater detail hereinbelow. About an upper periphery  
10 thereof is a rolled brim or brim curl 16. In the type of container illustrated  
in Figure 10, the brim curl is provided in order to add stability to the  
container as well as allow the container to readily receive and form sealing  
engagement with a cooperating lid 18. The lid includes similar rounded  
15 corners and a substantially vertical side wall 20 which frictionally engages the  
brim curl 16 of the container 10. As mentioned hereinabove, the container  
10 is of the canister type and readily receives flowable products such as ice  
cream, frozen yogurt, sugar, flour, or similar type granular products. Once  
in place, due to the frictional engagement of the lid with the brim curl 16, the  
lid requires some jarring in order to remove the lid from the canister. In this  
20 regard, it is imperative that the brim curl 16 be substantially defect free in  
order to form a substantially continuous seal between the canister 10 and lid  
18.

Referring now to Figure 2A, the brim curl 16 formed about an upper  
periphery of the container 10 is readily illustrated. Further, the substantially  
25 vertical side walls 12 which extend upwardly from a substantially planar  
bottom 22 of the container 10 is readily illustrated. It should be noted that  
while the present invention is described with reference to the particular  
container 10 illustrated in Figures 1A, 2A and 3A, the underlying concepts  
set forth hereinbelow may be readily applied to any paperboard containers  
30 having a circular, elliptical, or other curvilinear type opening wherein it is

- 9 -

desired to for substantially defect free brim curls about an upper periphery of the container.

With the particular container illustrated in Figures 1A, 2A and 3A, the corners 14 have an inner radius  $R_1$  cut through the plane normal to the axis of the rolled brim arc length of approximately 1.094 inches where the brim curl begins and an outer radius at the outer periphery of the brim curl  $R_2$  cut through the plane normal to the axis of the rolled brim arc length of approximately 1.250 inches. In this regard, the diameter of the brim curl  $D_1$  at the curved corners 14 is approximately 0.125 inches while the diameter of the brim curl  $D_2$  along a length of the container is approximately 0.156 inches. It is the diameter of the brim curl along the curvilinear regions 14 which is critical and the essence of the present invention.

As is illustrated in Figure 3A, the bottom 22 of the container is of a smaller dimension than the top and includes a radius region  $R_3$  cut through the plane normal to the axis of the rolled brim arc length equal to approximately 1.034 inches. While the side walls 12 of the container are substantially vertical, it is necessary that such walls taper inwardly slightly thereby providing a bottom wall 22 having a smaller dimension than the top of the container such that the containers when stacked one upon the other will telescope into one another thereby reducing the overall height of the stack for storage and transportation purposes. Again, forming the brim curl along the elongated regions of the container occur substantially without fault. However, as can be appreciated by those skilled in the art, it is at the corners in the curved regions 14 where the paperboard material forming the brim curl is stressed which can often result in the cracking of the outer parameter of the brim curl.

As noted hereinabove, drinking cups having a relatively small radius of curvature at the opening benefit from forming the brim curls in accordance with the present invention. Cups of this type have a paperboard shell thickness of approximately .007 inches and when formed include a brim curl

- 10 -

17 and slightly angled side walls 23 as illustrated in Figures 1B, 2B and 3B. As discussed previously, when forming brim curls on containers where the portion of the container is of a small radius of curvature, the resultant stress on the paperboard shell is great, resulting in cracks and other noticeable defects in the outer surface of the brim curl. Accordingly, by forming such  
5 brim curls in accordance with the present invention reduces and substantially eliminates such defects.

Referring now to Figures 4 and 5, the brim curls formed in either of the containers illustrated in Figures 1-3 are formed by a die arrangement which is heretofore described in detail in U.S. Patent No. 5,029,749 issued to Aloisi et al. and discussed hereinabove and will only be described briefly in  
10 connection with the subject invention. The particular die arrangement for forming the brim curl 16 or 17 about an upper periphery of the container illustrated in Figures 1-3 includes an upper or male die 110 which may be manipulated by conventional brim forming devices such as those illustrated  
15 in U.S. Patent Nos. 2,473,836 and 3,065,677 discussed hereinabove. The upper die 110 includes a lower surface having a flange 112 extending axially therefrom thereby providing a slanted outer surface 114 and an undercut 116, the significance of which will be described in greater detail hereinbelow. The  
20 lower or female die 118 illustrated in Figure 5 includes an axial bore 120 which receives a container shell formed from paperboard material. The bore 120 being of the same configuration as that of the container itself with an unfinished annular edge of the container extending from the die 118. Also formed in the die 118 is a channel 122 which receives the paperboard  
25 material during a formation of the brim curl 16 or 17.

Referring now to Figures 7-10, a schematic illustration of the brim curl being formed in accordance with the present invention will be described in greater detail. Schematically illustrated in each of Figures 7-10 is the upper die 110 which includes the elongated surface 114 as well as the  
30 concaved forming surface 116. It has been determined in accordance with the

- 11 -

present invention that it is desirable that the unfinished annular edge 126 of the paperboard shell 128 which is to form the container as illustrated in Figure 1-3 extend into the forming region 130 of the die 110 as far as practical before initial buckling of the paperboard material takes place. It has  
5 been determined that many of the flaws and defects presently experienced in containers of this type can be alleviated by controlling the initial buckling point of the paperboard material and assuring that this initial buckling point is spaced from the unfinished annular edge by a distance of at least 25% of the arc length of an elliptical toroidal surface which forms the brim curl  
10 surface.

The elliptical toroidal surface being the surface formed by revolving an ellipse around a line spaced therefrom, this being the brim curl itself. In this regard, the elliptical toroid or brim curl can be classified into classes, an oblate toroidal surface or a prolate toroidal surface. With reference to Figure  
15 6B, an oblate toroidal surface is defined as the surface resulting when the flattened exterior portion of the ellipse 50 is closer to perpendicular to the line about which the elliptical toroidal surface is revolved. On the other hand, with reference to Figure 6A, a prolate toroidal surface is formed when the flattened exterior portion 50 of the ellipse is closer to parallel to the line  
20 about which the elliptical toroidal surface is revolved. The two classes are divided by a line at about  $45^\circ$  with respect to the line about which the elliptical toroidal surface, that is a surface where the flattened exterior surface 50 extends at an angle less than  $45^\circ$  with respect to the center line, is revolved. Those brim curls closely approximating a prolate toroidal surface,  
25 that is a surface where the flattened exterior surface 50 extends at an angle less than  $45^\circ$  with respect to the center line exhibit little, if any, failures while those brim curls more closely exhibiting an oblate elliptical toroidal surface or a surface extending at an angle greater than  $45^\circ$  with respect to the center line, generally include numerous failures.

- 12 -

Returning again to Figures 7-10, once the leading edge 126 of the paperboard carton shell contacts the concave forming surface of the die 110, the paperboard shell is urged into the die as far as possible before an initial buckling at 138 occurs in the paperboard material as illustrated in Figure 8.

5 Once the initial buckling of the paperboard material takes place, continued urging of the paperboard material into the forming die 110 will form a completed brim curl about an upper periphery of a container as illustrated with reference to Figures 8, 9 and 10. By controlling the initial buckling of the paperboard material, a more desirable prolate brim curl, as illustrated in

10 Figure 6A can be achieved. If the initial buckling point of the paperboard material is less than the predetermined position, an oblate type brim curl which results in cracks in an outer periphery of the brim curl as illustrated in Figure 6B is formed as discussed hereinabove. As has been discovered in accordance with the present invention, it is desired that the initial buckling

15 position of the unfinished annular edge of the paperboard shell for the container illustrated in Figure 1A be a distance of from about 4 to about 8 times the caliper of the paperboard shell from the unfinished edge. Otherwise stated, and particularly for containers similar to that illustrated in Figure 1B, the initial buckling position of the unfinished annular edge of the paperboard

20 shell should initiate a distance from about 25% to about 50% of an arc length of the rolled brim to be formed from the unfinished annular edge. In the particular embodiment illustrated with respect to Figure 1A, the arc length of the brim curl formed in accordance with the present invention is approximately 0.25 inches. Therefore, it is desired that the initial buckling

25 position be from 0.0625 inches to 0.125 inches from the unfinished annular edge or with a paperboard shell having a caliper of 0.0235 inches, the optimum initial buckling position would be 0.094 to 0.188 inches. Again, these values are set forth by way of example and the particular initial buckling position of the unfinished annular edge of the paperboard shell

- 13 -

would be dependent upon the desired brim curl to be formed as well as the caliper of the paperboard material being used.

In accordance with the preferred embodiment of the subject invention, the paperboard stock material which is used in forming the container illustrated in Figures 1-3 is preferably impregnated with sizing adhesives in an amount equivalent to from about at least 8 to about 20 lbs/3,000 ft<sup>2</sup> ream of paperboard material and preferably in the amount equivalent to approximately 13 lbs of sizing adhesive per 3,000 ft<sup>2</sup> ream of paperboard material. The sizing adhesives suitable for use in the present invention include those materials commonly applied to paperboard which serve to stiffen the board. Typical sizing adhesives include polyvinyl alcohol, carboxymethyl cellulose, naturally occurring gums, sodium silicate, polyvinyl acetate, styrene butadiene, starches and the like as well as various combinations of these materials. For economical reasons, starches are the preferred sizing adhesive for use in connection with the present invention. In addition to sizing adhesive, the paperboard material may be impregnated with pigments in the form of clay and the like. In this regard, it is preferred that the amount of pigmentation material not exceed more than 50% of the total sizing adhesive being applied to the paperboard material.

After further studies, it has been determined that various parameters affect the buckling resistance of the paperboard material. From this, it has been determined that the main factors affecting the buckling resistance of the container, which can be readily controlled during the manufacture of the paperboard material are the Z direction tensile strength of the paperboard material, the amount of wood pulp fiber and its character within the board, the caliper of the paperboard material, the moisture content of the paperboard material, the amount of sizing adhesive applied to the paperboard material as well as the addition of a lubricant to the paperboard material. In this regard, it is noted that increasing the Z direction tensile strength of the paperboard material increases the buckling resistance of the paperboard material.



- 14 -

However, when increasing the Z direction tensile strength to high levels which are required in order to significantly effect the buckling resistance, the productivity of the board machine forming the paperboard material is significantly reduced. Therefore, as is best illustrated in the following Table,

5 a compromise between the increase in size press weight and increase in Z direction tensile strength results in little or no failures in the brim curls while allowing for high productivity.

-15-

**TABLE 1**  
**KEY VARIABLES CONTROLLING TOP CURL FAILURES IN CONTAINERS**

Grade	Effect of Steam, Lubricant and Buckling Resistance	How Buckling Resistance Was Improved	Failures (1)	Steam (2)	Polyethylene Lubricant (3)	Buckling Resistance (4)	Cross Machine Stretch %	Z Direction Tensile PSIG	Size Coat Wght lb/R
A <sub>1</sub>			5.03	no	no	166	6.2	40	9
A <sub>2</sub>	Steam		1.42	yes	no	166	6.2	40	9
B <sub>1</sub>	Buckling Resistance	Increased Size Press Weight	1.71	no	no	199	5.6	38	13
B <sub>2</sub>	Steam + Buckling Resistance		0.48	yes	no	195	5.5	35	13
B <sub>3</sub>	Lubricant + Buckling Resistance		0.09	no	yes	188	5.9	44	13
B <sub>4</sub>	Buckling Resistance	Increased Size Press Weight	0.06	no	no	208	6.1	48	13
B <sub>5</sub>	Lubricant + Buckling Resistance	and Moderate ZDT Increase	0	no	yes	197	6.1	49	13
C <sub>1</sub>	Buckling Resistance	Large Increase in ZDT	0.14	no	no	198	6.9	55	7.5
C <sub>2</sub>	Lubricant + Buckling Resistance		0	yes	no	198	6.9	55	7.5

- 16 -

Referring to the above-noted table, three different grades of paperboard material were tested with the results of such tests set forth therein. The first sample being that having a size press coat weight of approximately 9 lbs/3,000 ft<sup>2</sup> ream and a Z direction tensile strength of approximately 40 lbs per square inch. As noted therein, without the use of steam, a significant number of failures were evidenced, however, with the use of steam, these failures are reduced significantly. As noted hereinabove, the use of steam adds to the production costs of manufacturing such containers. When the Z direction tensile strength of the paperboard material is increased significantly as exhibited in grade C, the failures are significantly reduced, however, again, as mentioned hereinabove, large increases in Z direction tensile strength result in a decrease in the productivity of the board machine forming the paperboard material.

As is evidenced by the grade B trials, an increase in sizing adhesives results in a decrease in failures observed in the trials. As further evidenced by trials B<sub>4</sub> and B<sub>5</sub>, with the combination of increased size press weight and a moderate increase in Z direction tensile strength the noted failures are substantially eliminated.

Referring now to Figures 11 and 12, photomicrographs of two brim curls formed utilizing conventional forming dies are illustrated wherein the caliper of the paperboard material used in each of the samples is identical. With the sample illustrated in Figure 11, the paperboard material included approximately 13 lbs/3,000 ft<sup>2</sup> ream of sizing adhesive wherein it can be noted that the initial buckling point of the paperboard material is on the order of 4 to 8 times that of the caliper of the material for containers such as that illustrated in Figure 1A or 25% to 50% of the arc length of the elliptical toroidal surface being formed. Unlike the sample illustrated in Figure 11, the brim curl formed on the sample illustrated in Figure 12 includes an initial buckling point which is less than 25% of the arc length of the elliptical toroidal surface and less than 4 times that of the

- 17 -

caliper of the paperboard material. Again, while the caliper of the paperboard material in each of the samples is identical, the sizing adhesive added to the sample set forth in Figure 11 is significantly greater than that of the sample set forth in Figure 12. In this regard, as set forth in accordance with the present invention, the unfinished annular edge of the paperboard shell of the sample set forth in Figure 11 passes further into the concave forming surface before buckling thus resulting in a substantially defect free brim curl. The unfinished annular edge of the paperboard shell of the example set forth in Figure 12 did not pass fully into the concave region of the forming die and thus buckled at a point less than an optimum distance into the paperboard material and consequently results in a brim curl exhibiting cracks and other failures in its outer surface.

The paperboard material is coated with a useful coating polymer prior to formation of the paperboard shells used in forming the containers in accordance with the present invention. Polymers suitable for this purpose are polymers comprising carbon and hydrogen moieties or carbon, hydrogen and oxygen moieties having a melting point below 270 °C and having a glass transition temperature ( $T_g$ ) in the range of -150° to +120°C. The preferred polymer is a low density polyethylene for containers similar to that illustrated in Figure 1A and a high density polyethylene for cups such as that illustrated in Figure 1B.

As noted hereinabove, an additional means in aiding in the passing of the paperboard material into the forming die is the addition of a lubricant to the polyethylene coating which is applied to the paperboard material. In the trials set forth hereinabove, the lubricant added to the polyethylene was glycerol monostearate, however, any known lubricant may be used to accomplish the same goals. By adding such lubricant, the leading edge of the paperboard material will not be prematurely caught in the forming die and thus permitted to pass

- 18 -

completely into the forming die before the initial buckling takes place. It should also be noted that a lubricant may also be applied to the forming die itself.

5 In conventional containers, polyethylene coating is applied to the paperboard material by way of an extruder and it is imperative that the polyethylene coating adhere to the paperboard material. To this end, as noted hereinabove, one of three methods are generally used. These being one of a corona treatment, flame treatment or polyethylene imine treatment better known in the art as a PEI treatment. However, it has been found, in accordance with the present invention, that with the addition of a lubricant as discussed  
10 hereinabove, one such process is not sufficient to adhere the polyethylene coating to the paperboard material. Therefore, the paperboard material is subjected both to a PEI treatment and a flame treatment in accordance with the present invention. This allows the lubricant containing polyethylene coating to adhere to the paperboard material resulting in a paperboard shell which passes further  
15 into the forming die when urged thus aiding in the control of the initial buckling point during formation of the brim curl in accordance with the present invention. This is achieved in that the use of the lubricant reduces the coefficient of friction of the surface of the paperboard material as well as reduces any static charge build up during handling of the paperboard material.

20 In addition to a lubricant, the paperboard material may also include a coating to impart smoothness to the paperboard. This is particular desirable for the outer wall of the resulting container to provide an aesthetically pleasing appearance and to enhance the ability to provide printing thereon. Ethylene vinyl acetate latex has been used as a coating to impart smoothness to paperboard.

25 Such coatings, however, have been found to diminish the bond between the paperboard and a polymer coating layer. Specifically, peeling of the polymer coating layer from the coated paperboard can occur. It has also been found that

- 19 -

the presence of the hereinabove noted lubricant further reduces the bonding strength between the polymer coating layer and a coated paperboard material.

5 A primer layer including a styrene-acrylic derivative latex on the surface of the paperboard material prior to extrusion of the polymer coating layer to the paperboard material provides very desirable results. Examples of such styrene-acrylic derivatives in the coating layer include, but are not limited to n-butyl-acrylate acrylonitrile, n-amyl-acrylate acrylonitrile, n-propyl-acrylate-acrylonitrile and n-ethyl-acrylate-acrylonitrile. Aliphatic acrylate styrene co-polymers are preferred and include, but not limited to, n-butyl-acrylate acrylonitrile-styrene, 10 n-amyl-acrylate acrylonitrile-styrene, n-propyl-acrylate-acrylonitrile-styrene and n-ethyl-acrylate-acrylonitrile styrene. Mean adhesion between the coated paperboard and the polymer coating of 170 and greater can be achieved using such a primer latex coating layer for the paperboard. Figure 13 is a partially cut-away side view of the container of Figure 2A illustrating paperboard material 26 and an extruded polymer coating layer 28. As noted above, polymer coating 15 layer 28 is preferably polyethylene.

Figure 13 also includes primer layer 30 which, in accordance with the present invention, is preferably a styrene-acrylic latex layer. Primer layer 30 provides the desired smoothness to the surface of the paperboard, while also 20 significantly increasing the bonding strength of polymer coating layer 28 to paperboard material 26. Such increased bonding strength is provided for both lubricated and non-lubricated polymer coatings.

Primer layer 30 of the present invention is extremely advantageous for a brim curled container in view of the extreme stress exerted on the top portion of the container during formation. Without sufficient bonding between the polymer 25 coating layer and the paperboard, the stresses created during formation of the brim can cause peeling and separation of the coating from the paperboard.

- 20 -

Figure 14 provides an expanded cross-section of the brim shown in Figure 6A illustrating paperboard material 26, polymer coating layer 28 and primer layer 30.

Specifically, the styrene-acrylic latex of primer layer 30 preferably includes n-butyl-acrylate-acrylonitrile-styrene co-polymer. The primer layer may also include one or more of an inorganic pigment, such as clay/carbonate, a thickener/water retention agent, a dispersant, a biocide, a defoamer and a dye. In the preferred embodiment, the composition of primer layer 30 includes approximately 20 parts of an acrylonitrile-styrene co-polymer, such as BASF Acronal S 504, and 100 parts inorganic pigment (clay/carbonate). Other styrene-acrylic polymers useful in the present invention include BASF's Acronal S 888 S and Acronal DSA 2285 X, as well as Dow Latex XU 30879.50, Dow Latex XU 30978.51, Dow Latex XU30955.50. Other styrene-acrylic polymers that can be used are BASF's Acronal S 304, Acronal S 760, Acronal 296 D, Acronal S 400, Acronal NS 567, Acronal S 702, Acronal S 728 and Acronal NX 4786; B.F. Goodrich's Carboset®GA-1086, Carboset®GA-2137, Carboset®GA-1161 and Carboset®XPD-2299; Morton International's Morton 4350, Morez®101LS, Morez®200, Morcryn®132, Morcryn®134, Morcryn®350, Lucidence®202, Lucidence®361 and Lucidence®371; and Reichhold International's Reichhold PA 7002.

Other latex primers, such as ethylene vinyl acetate, do not provide the advantageous bonding strength exhibited by the styrene-acrylic latex primer of the present invention. Specifically, the bonding strength of an extruded layer of polyethylene to paperboard was compared with an ethylene vinyl acetate primer. The ethylene vinyl acetate primer included 20 parts ethylene vinyl acetate, and the styrene-acrylic latex primer included 20 parts n-butyl-acrylate-acrylonitrile-styrene co-polymer. These primer layers were each applied to a paperboard material and a polymer layer was extruded on the primer layer. In one case, the

- 21 -

polymer did not include a lubricant and PEI was not performed and in the second case, the polymer included lubricant and PEI was performed.

The results of this comparison are provided hereinbelow in Table 2.

**TABLE 2**

	Spec	Lube %	PEI	Mean PE Adhesion (grams)
1	vinyl-acetate	0	no	71.3
2	styrene-acrylic	0	no	176.3
3	vinyl-acetate	6	yes	90.1
4	styrene-acrylic	6	yes	185.3

As shown in Table 2, the mean polyethylene (PE) adhesion for coated paperboard material, having in this example a gloss finish, more than doubled for the styrene-acrylic coating compared to the ethylene vinyl acetate coating.

Similar tests were run to determine the effect of conducting PEI treatment and not conducting PEI treatment when the polymer coating also included lubrication. The results of these tests are provided hereinbelow in Table 3.



- 22 -

TABLE 3

Test	Coating Formulation	Lube	PEI	Mean (PE Adhesion - Gloss)
1	None	0	no	350
2	acetate	0	no	71.9
3	acetate	0	yes	102
4	acetate	6	no	79.4
5	acetate	6	yes	117.16
6	acetate	0	no	71.29
7	acetate	2	yes	111.57
8	acetate	3	yes	58.15
9	acetate	6	yes	90.98
10	acrylic	0	no	176.3
11	acrylic	0	yes	195.2
12	acrylic	6	no	173.9
13	acrylic	6	yes	185.8

Test 1 was an uncoated paperboard material with no smoothness coating. Uncoated board is often used on the interior of paperboard containers and also generally includes a matt finish polyethylene coating thereon.

Tests 2-9 were coated paperboard material including an ethylene vinyl acetate primer layer. Specifically, Tests 2 and 3 did not include a lubricant. Further, Test 2 did not include PEI treatment, while Test 3 did. Tests 4 and 5 included a lubricant and, like Tests 2 and 3, Test 4 did not include PEI treatment and Test 5 did. As can be seen, the presence of a lubricant significantly reduced

- 23 -

the mean PE adhesion between the paperboard and the polymer coating layer. Although PEI treatment increased adhesion, the mean PE adhesion was still below 120.

5 Tests 6-9 included different levels of lubricant and PEI treatments with an ethylene vinyl acetate primer layer. The mean PE adhesion was still below 120 for all of these samples, and particularly, Tests 6, 8 and 9 were below 100.

10 Tests 10-13, however, utilized the styrene-acrylic primer layer of the present invention. As the results of Table 3 clearly provide, the mean PE adhesion was significantly improved using the styrene-acrylic primer layer to greater than 173, even when the polyethylene polymer coating included a lubricant. Consequently, it is readily apparent that significant improvements in bonding between extruded polyethylene and the paperboard coated with a smoothness coating can be achieved using a styrene-acrylic latex coating of the present invention.

15 By forming a paperboard container in accordance with the foregoing discussion, a container that can be reliably manufactured at high speeds and which exhibits an annular edge having relatively small radius of curvature and/or which is formed of a relatively heavy paperboard material having a brim curl which is substantially defect free is achieved.

20 While the invention has been described with reference to a preferred embodiment, it should be appreciated by those skilled in the art, that the invention may be practiced otherwise than as specifically described herein without departing from the spirit and scope of the invention. It is, therefore, to be understood that the spirit and scope of the invention be limited only by the  
25 appended claims.

- 24 -

We claim:

1. A paperboard container having a rolled brim, the container including;

a caliper of paperboard material forming the container of at least approximately 0.007 inches;

an arc length of the rolled brim of less than about 0.25 inches;

an outer radius of curvature of the container cut through a plane normal to the axis of the rolled brim arc length adjacent the rolled brim of less than approximately 1.5 inches; and

said paperboard material comprises at least approximately 8 lbs/3,000 ft<sup>2</sup> ream of size press adhesive.

2. The container as defined in claim 1, wherein said size press adhesive is at least one selected from a group including polyvinyl alcohol, carboxymethyl cellulose, naturally occurring gums, sodium silicate, polyvinyl acetate, styrene butadiene and starches.

3. The container as defined in claim 1 wherein said size press adhesive includes up to 50% pigmentation material.

4. The container as defined in claim 3, wherein said pigmentation material is clay.

5. The container as defined in claim 1, wherein said size press adhesive is in an amount in a range of 8 to 20 lbs/3,000 ft<sup>2</sup> ream of paperboard material.

6. The container as defined in claim 1, wherein said size press adhesive is in an amount in a range of 13 to 20 lbs/3000 ft<sup>2</sup> ream of paperboard material.

7. The container as defined in claim 1, wherein the amount of said size press adhesive is approximately 13 lbs/3000 ft<sup>2</sup> ream of paperboard material.

8. The container as defined in claim 1, wherein said paperboard material includes a polymer coating.

- 25 -

9. The container as defined in claim 8, wherein a melting point of said polymer coating is less than 270°C.

10. The container as defined in claim 8, wherein a glass transition temperature of said polymer coating is in a range of -150°C to +120°C.

11. The container as defined in claim 8, wherein said paperboard material further includes a styrene-acrylic derivative latex coating between said paperboard and said polymer coating.

12. The container as defined in claim 11, wherein said styrene-acrylic derivative is selected from the group consisting of n-butyl-acrylate acrylonitrile, n-amyl-acrylate acrylonitrile, n-propyl-acrylate-acrylonitrile and n-ethyl-acrylate-acrylonitrile.

13. The container as defined in claim 11, wherein said styrene-acrylic derivative latex coating includes an aliphatic acrylate styrene co-polymer.

14. The container as defined in claim 13, wherein said aliphatic acrylate styrene co-polymer comprises n-butyl-acrylate-acrylonitrile-styrene co-polymer.

15. The container as defined in claim 14, wherein said styrene-acrylic derivative latex coating further comprises an inorganic pigment, a water retention agent, a dispersant, a biocide, a defoamer and a dye.

16. The container as defined in claim 15, wherein said styrene-acrylic derivative latex coating comprises 20 parts n-butyl-acrylate-acrylonitrile-styrene co-polymer and 100 parts inorganic pigment.

17. The container as defined in claim 8, wherein a caliper of said paperboard material is approximately 0.0235 inches.

18. The container as defined in claim 1, wherein said outer radius of curvature of the container cut through a plane normal to the axis of the rolled brim adjacent the rolled brim is approximately 1.25 inches.

- 26 -

19. The container as defined in claim 1, wherein an inner radius of curvature of the container cut through a plane normal to the axis of the rolled brim arc length adjacent the rolled brim is at least 1.09 inches.

20. The container as defined in claim 1, wherein a side wall of the container is substantially vertical.

21. The container as defined in claim 1, wherein a major diameter of the rolled brim is approximately 0.14 inches.

22. The container as defined in claim 1, wherein a minor diameter of the rolled brim is approximately 0.125 inches.

23. A method of forming a container having a rolled brim comprising:  
providing a paperboard blank;  
forming a paperboard shell from said paperboard blank having an unfinished annular exposed edge, said paperboard shell having a caliper not less than 0.007 inches and comprising at least approximately 8 lbs/3000 ft<sup>2</sup> ream of size press adhesive;

directing said unfinished annular edge into a concave region of a forming die; and

forming a prolate toroidal brim by urging said unfinished annular edge a predetermined distance into the concave region of the forming die to form the rolled brim.

24. The method as defined in claim 23, further comprising the step of controlling an initial buckling point of said unfinished annular edge of said paperboard shell when said paperboard shell is urged into said concave region of the forming die.

25. The method as defined in claim 24, wherein said initial buckling point of said unfinished annular edge of said paperboard shell initiates a distance from about 4 to about 8 times the caliper of the paperboard shell from said unfinished annular edge.

- 27 -

26. The method as defined in claim 24, wherein said initial buckling point of said unfinished annular edge of said paperboard shell initiated a distance from about 25% to about 50% of an arc length of the rolled brim to be formed from said unfinished annular edge.

27. The method as defined in claim 23, wherein said size press adhesive is selected from a group including polyvinyl alcohol, carboxymethyl cellulose, naturally occurring gums, sodium silicate, polyvinyl acetate, styrene butadiene and starches.

28. The method as defined in claim 23, wherein said size press adhesive includes up to 50% pigmentation material.

29. The method as defined in claim 28, wherein said pigmentation material is clay.

30. The method as defined in claim 23, wherein said size press adhesive is in an amount in a range of 8 to 20 lbs/3,000 ft<sup>2</sup> ream of paperboard material.

31. The method as defined in claim 23, wherein said size press adhesive is in an amount in a range of 13 to 20 lbs/3,000 ft<sup>2</sup> ream of paperboard material.

32. The method as defined in claim 23, wherein the amount of said size press adhesive is approximately 13 lbs/3000 ft<sup>2</sup> ream of paperboard material.

33. The method as defined in claim 23, further comprising the step of lubricating the concave region of the forming die.

34. The method as defined in claim 33, wherein the step of lubricating the concave region includes applying a lubricating agent to paperboard material forming said paperboard shell.

35. The method as defined in claim 34, further comprising the step of extruding a polymer coating to said paperboard blank.

- 28 -

36. The method as defined in claim 35, wherein a melting point of said polymer coating is less than 270°C.

37. The method as defined in claim 36, wherein a glass transition temperature of said polymer coating is in a range of -150°C to +120°C.

38. The method as defined in claim 35, wherein said lubricating agent is added to said polymer coating.

39. The method as defined in claim 38 further comprising the step of treating said paperboard blank with at least one of a corona treatment, a flame treatment and a polyethylene imine treatment to adhere said polymer coating to said paperboard blank.

40. The method as defined in claim 39, where at least two of said treatments are used.

41. The method as defined in claim 38, wherein said lubricating agent is glycerol monostearate.

42. The method as defined in claim 35, further including the step of applying a styrene-acrylic derivative latex coating to said paperboard blank prior to extruding said polymer coating on said paperboard blank.

43. The method as defined in claim 42, wherein said styrene-acrylic derivative is selected from the group consisting of n-butyl-acrylate acrylonitrile, n-amyl-acrylate acrylonitrile, n-propyl-acrylate-acrylonitrile and n-ethyl-acrylate-acrylonitrile.

44. The method as defined in claim 42, wherein said styrene-acrylic derivative latex coating includes an aliphatic acrylate styrene co-polymer.

45. The method as defined in claim 44, wherein said aliphatic acrylate styrene co-polymer comprises n-butyl-acrylate-acrylonitrile-styrene co-polymer.

46. The method as defined in claim 45, wherein said styrene-acrylic derivative latex coating further comprises an inorganic pigment, a water retention agent, a dispersant, a biocide, a defoamer and a dye.

-29-

47. The method as defined in claim 46, wherein said styrene-acrylic derivative latex coating comprises 20 parts n-butyl-acrylate-acrylonitrile-styrene copolymer and 100 parts inorganic pigment.

48. A method of forming a paperboard container having a prolate rolled toroidal brim, comprising the steps of:

providing a paperboard shell having an unfinished annular edge;

directing said unfinished annular edge into a forming surface of a forming die;

urging said unfinished annular edge into the forming die; and

initially buckling said unfinished annular edge of said paperboard shell at a predetermined initial buckling point based on characteristics of said paperboard shell such that a substantially defect free prolate rolled toroidal brim is formed.

49. The method as defined in claim 48, wherein said initial buckling position of said unfinished annular edge of said paperboard shell initiates a distance from about 4 to about 8 times the caliper of the paperboard shell from said unfinished annular edge.

50. The method as defined in claim 48, wherein said initial buckling position of said unfinished annular edge of said paperboard shell initiated a distance from about 25% to about 50% of an arc length of the rolled brim to be formed from said unfinished annular edge.

51. The method as defined in claim 48, wherein said paperboard shell includes a size press adhesive in a range of 8 to 20 lbs/3000 ft<sup>2</sup> ream of paperboard material.

52. The method as defined in claim 48, wherein said size press adhesive is in an amount in a range of 8 to 20 lbs/3,000 ft<sup>2</sup> ream of paperboard material.

53. The method as defined in claim 48, wherein the amount of said size press adhesive is approximately 13 lbs/3,000 ft<sup>2</sup> ream of paperboard material.



- 30 -

54. The method as defined in claim 48, further comprising the step of lubricating said forming surface.

55. The method as defined in claim 48, wherein said paperboard shell includes a polymer coating extruded thereon.

56. The method as defined in claim 55 wherein a melting point of said polymer coating is less than 270°C.

57. The method as defined in claim 56, wherein a glass transition temperature of said polymer coating is in a range of -150°C to +120°C.

58. The method as defined in claim 55 wherein a lubricating agent is added to said polymer coating.

59. The method as defined in claim 58, further comprising the step of treating said paperboard blank with at least one of a corona treatment, a flame treatment and a polyethylene imine treatment to adhere said polymer coating to said paperboard shell.

60. The method as defined in claim 59, where at least two of said treatments are used.

61. The method as defined in claim 55, further including the step of applying a styrene-acrylic derivative latex coating to said paperboard shell prior to said polymer coating.

62. The method as defined in claim 61, wherein said styrene-acrylic derivative latex coating comprises n-butyl-acrylate-acrylonitrile-styrene co-polymer.

63. The method as defined in claim 62, wherein said styrene-acrylic derivative latex coating further comprises an inorganic pigment, a water retention agent, a dispersant, a biocide, a defoamer and a dye.

64. The method as defined in claim 63, wherein said styrene-acrylic derivative latex coating comprises 20 parts n-butyl-acrylate-acrylonitrile-styrene co-polymer and 100 parts inorganic pigment.

- 31 -

65. A paperboard blank for forming a container having a prolate rolled toroidal brim, said paperboard blank having;

a caliper of paperboard material of at least approximately 0.007 inches;

at least approximately 8 lbs/3,000 ft<sup>2</sup> ream of size press adhesive;

a polyethylene coating; and

a lubricating agent added to said polyethylene coating;

wherein said caliper of paperboard material, said size press adhesive, said polyethylene coating and said lubricating agent aid in controlling an initial buckling point of an unfinished edge of the paperboard blank when the blank is formed into a container.

66. The blank as defined in claim 65, wherein said size press adhesive is in an amount in a range of 8 to 20 lbs/3,000 ft<sup>2</sup> ream of paperboard material.

67. The blank as defined in claim 65, wherein said size press adhesive is in an amount in a range of 8 to 20 lbs/3,000 ft<sup>2</sup> ream of paperboard material.

68. The blank as defined in claim 65, wherein the amount of said size press adhesive is approximately 13 lbs/3000 ft<sup>2</sup> ream of paperboard material.

69. The blank as defined in claim 65, wherein said size press adhesive is selected from a group including polyvinyl alcohol, carboxymethyl cellulose, naturally occurring gums, sodium silicate, polyvinyl acetate, styrene butadiene and starches.

70. The blank as defined in claim 65, wherein said size press adhesive includes up to 50% pigmentation material.

71. The blank as defined in claim 70, wherein said pigmentation material is clay.

72. The blank as defined in claim 65, wherein a caliper of said paperboard material is approximately 0.0235 inches.

-32-

73. The blank as defined in claim 65, wherein said lubricating agent is glycerol monostearate.

74. The blank as defined in claim 73, wherein the paperboard blank is treated with at least one of a corona treatment, a flame treatment and a polyethylene imine treatment to adhere said polymer coating to said paperboard material.

75. The blank as defined in claim 74, where at least two of said treatments are used.

76. The blank as defined in claim 65, wherein said paperboard blank further includes a styrene-acrylic derivative latex coating between said paperboard material and said polyethylene coating.

77. The blank as defined in claim 76, wherein said styrene-acrylic derivative latex coating comprises n-butyl-acrylate-acrylonitrile-styrene co-polymer.

78. The blank as defined in claim 77, wherein said styrene-acrylic derivative latex coating further comprises an inorganic pigment, a water retention agent, a dispersant, a biocide, a defoamer and a dye.

79. The blank as defined in claim 78, wherein said styrene-acrylic derivative latex coating comprises 20 parts n-butyl-acrylate-acrylonitrile-styrene co-polymer and 100 parts inorganic pigment.

80. A paperboard containers comprising:  
a paperboard material forming the container;  
a styrene-acrylic derivative latex coating included on at least one side of said paperboard material; and  
an extruded polymer coating included on said styrene-acrylic derivative latex coating;  
wherein said polymer coating is polyethylene and a mean PE adhesion of said polymer coating to said paperboard material is not less than 170.

81. The paperboard container as defined in claim 80, wherein said polymer coating is polyethylene and the mean PE adhesion of said polymer coating to said paperboard material is not less than 170.

*amended sheet*

82. The paperboard container as defined in claim 80, wherein said styrene-acrylic derivative is selected from the group consisting of n-butyl-acrylate acrylonitrile, n-amyl-acrylate acrylonitrile, n-propyl-acrylate-acrylonitrile and n-ethyl-acrylate-acrylonitrile.

83. The paperboard container as defined in claim 80, wherein said styrene-acrylic derivative latex coating includes an aliphatic acrylate styrene co-polymer.

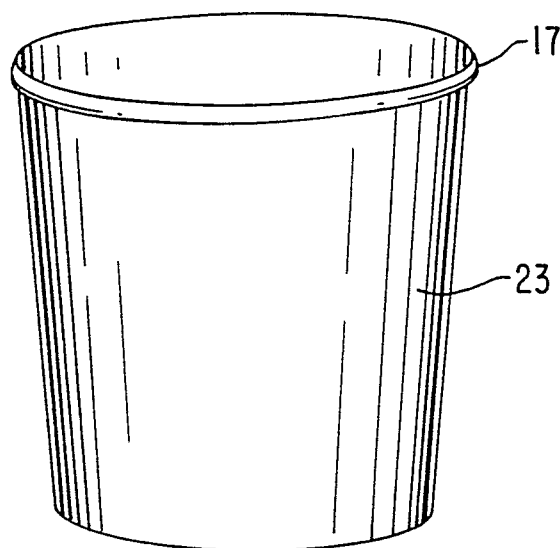
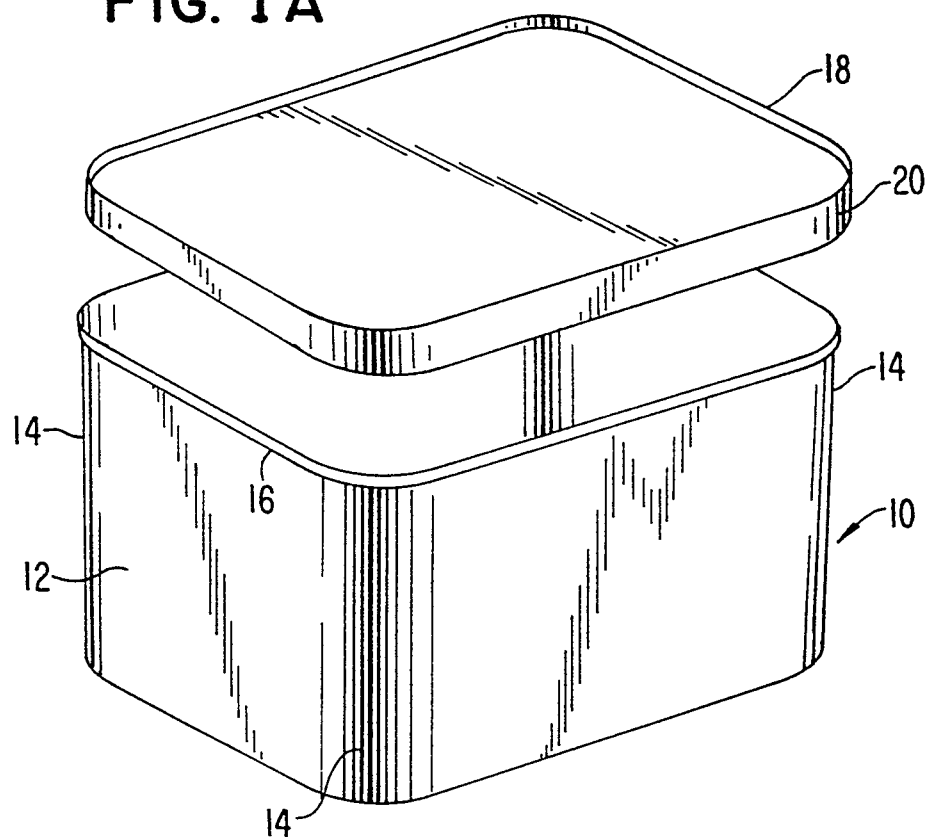
84. The paperboard container as defined in claim 83, wherein said aliphatic acrylate styrene co-polymer comprises n-butyl-acrylate-acrylonitrile-styrene co-polymer.

85. The paperboard container as defined in claim 84, wherein said styrene-acrylic derivative latex coating further comprises an inorganic pigment, a water retention agent, a dispersant, a biocide, a defoamer and a dye.

86. The paperboard container as defined in claim 85, wherein said styrene-acrylic derivative latex coating comprises 20 parts n-butyl-acrylate-acrylonitrile-styrene co-polymer and 100 parts inorganic pigment.

*amended sheet*

1/9

**FIG. 1A****FIG. 1B**

2 / 9

FIG. 2A

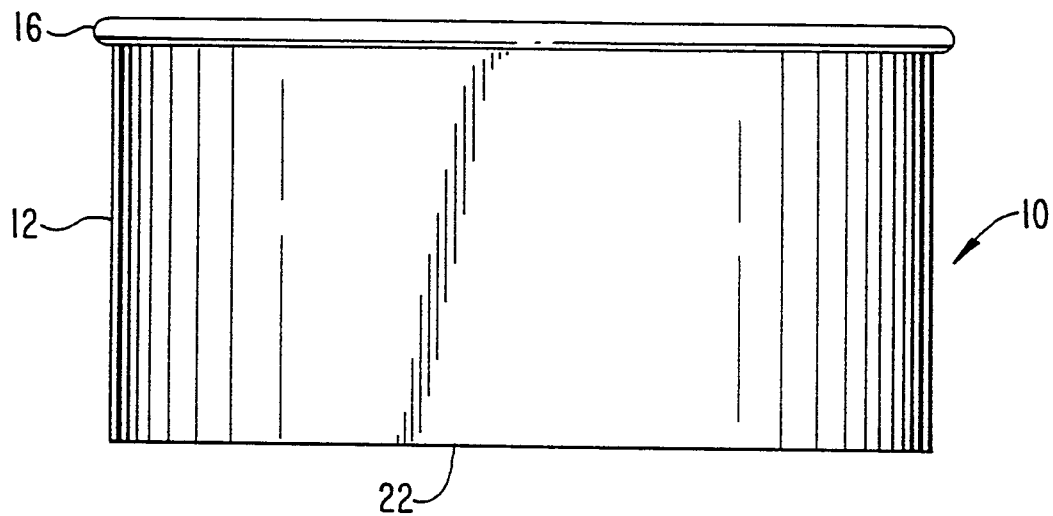
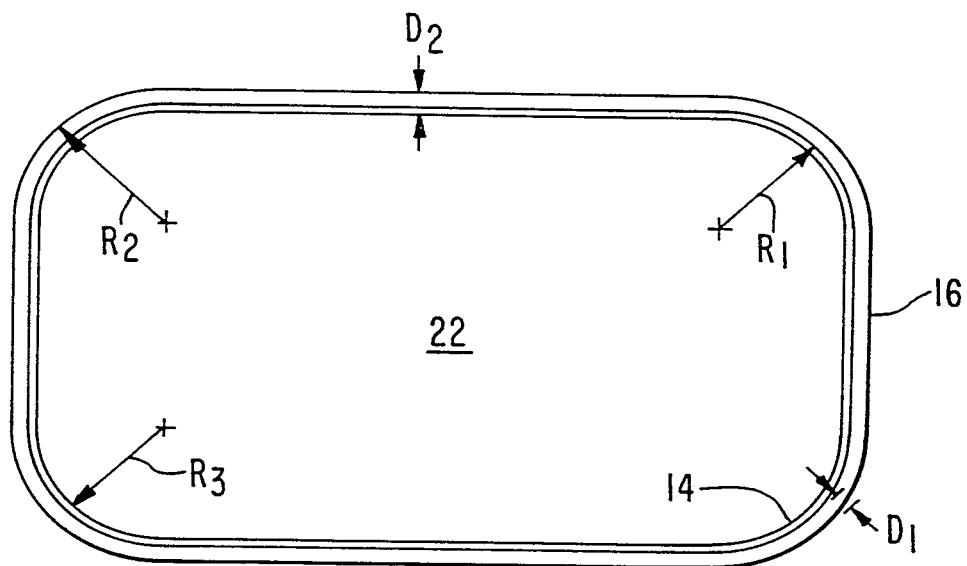


FIG. 3A



3 / 9

FIG. 2B

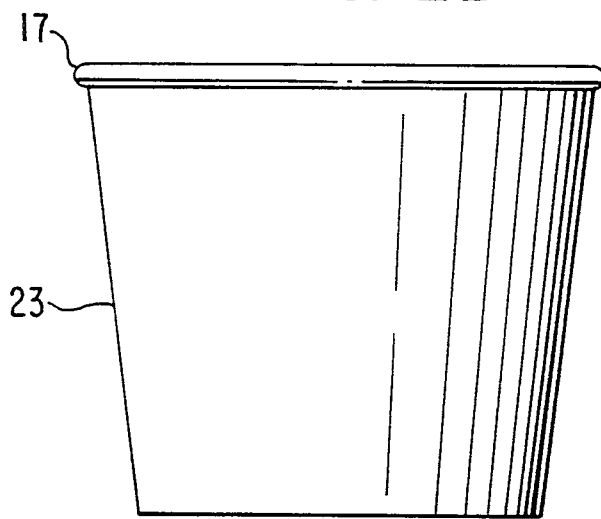
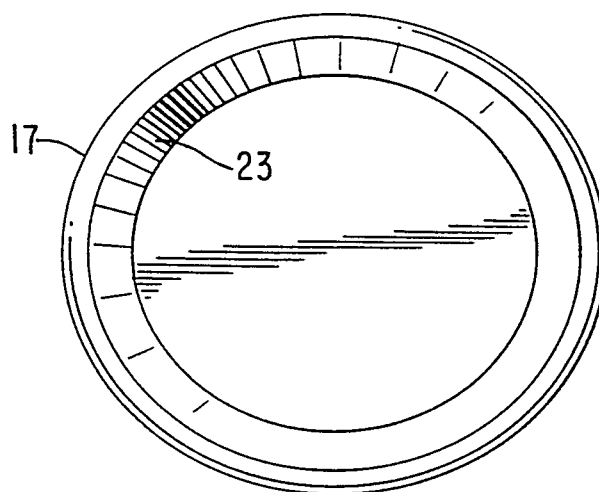


FIG. 3B



4 / 9

FIG. 4

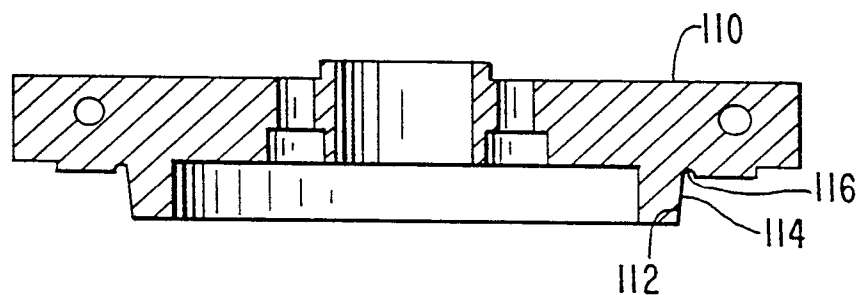


FIG. 5

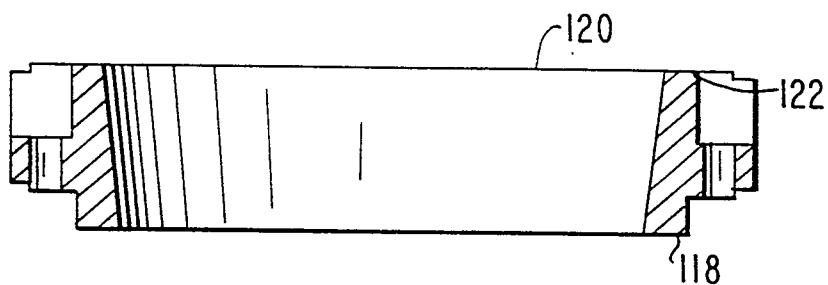




FIG. 6B

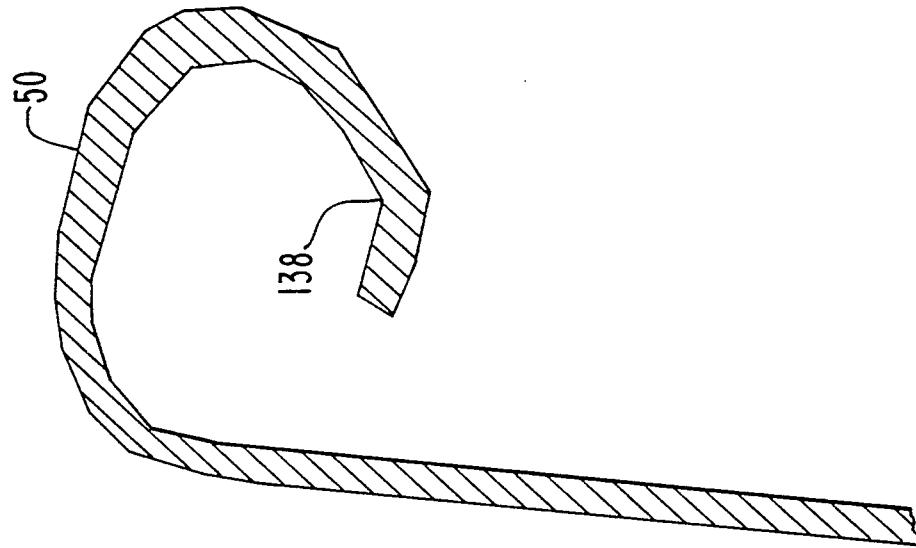


FIG. 6A

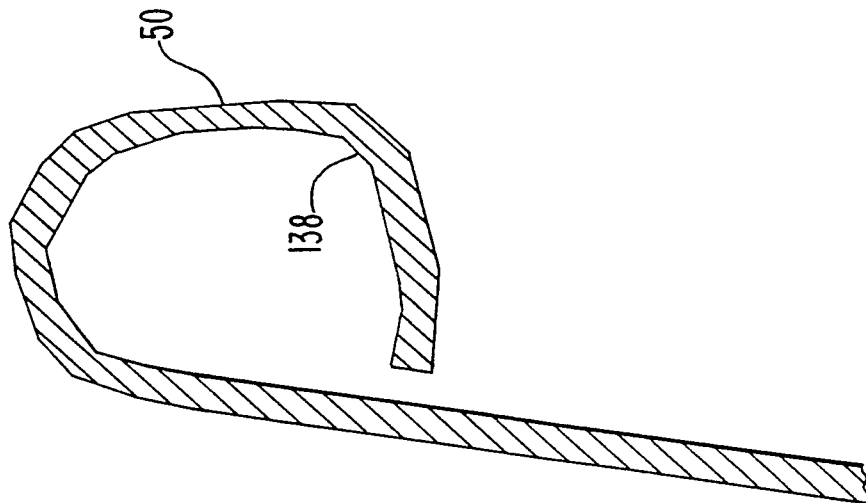


FIG. 8

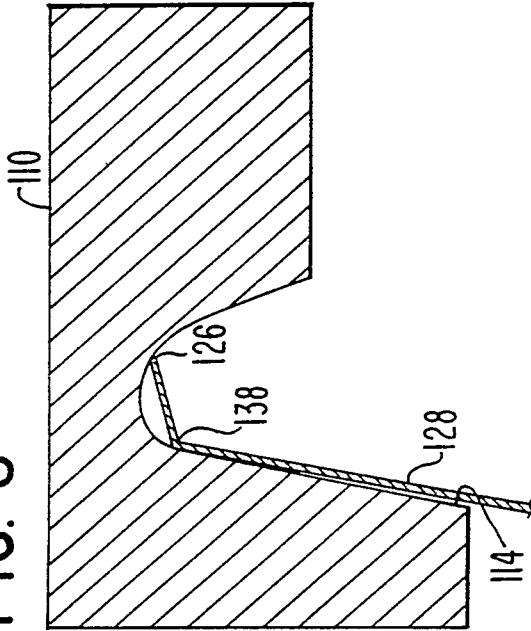


FIG. 10

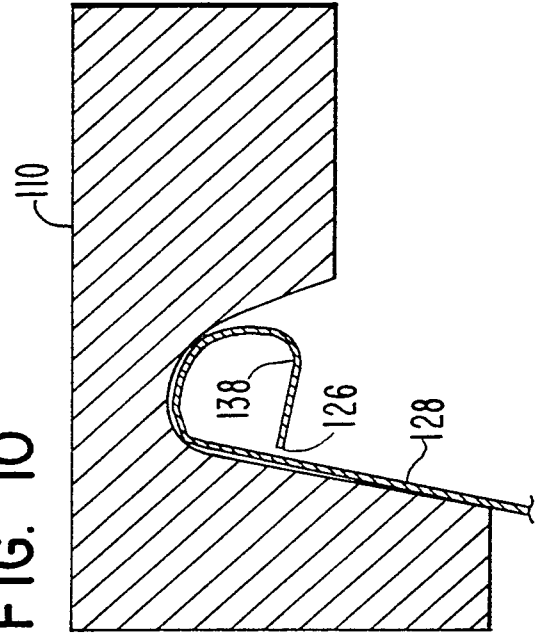


FIG. 7

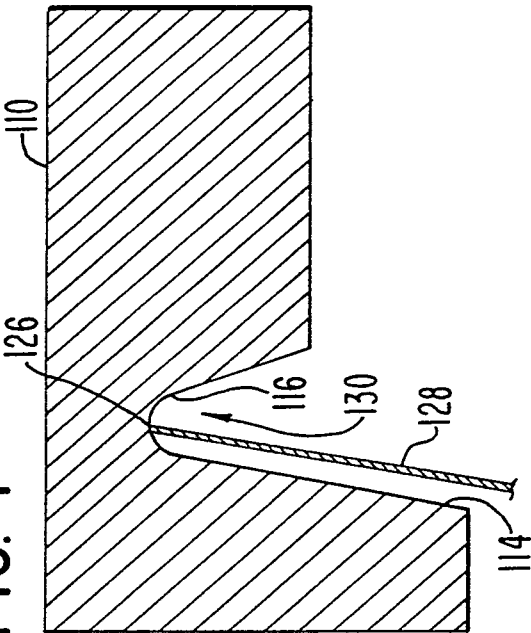
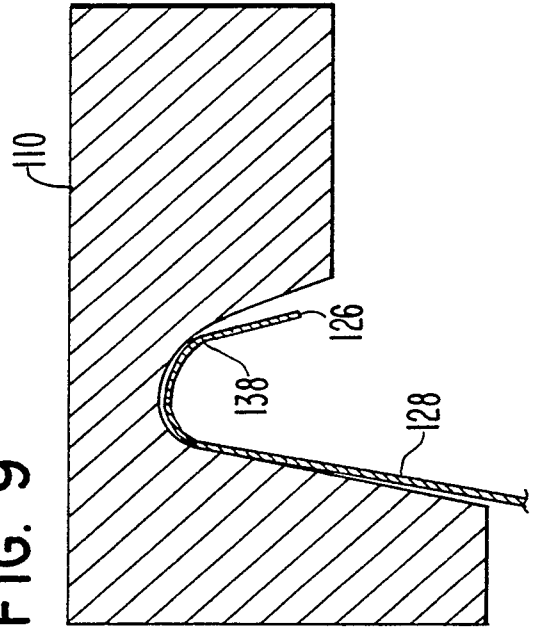
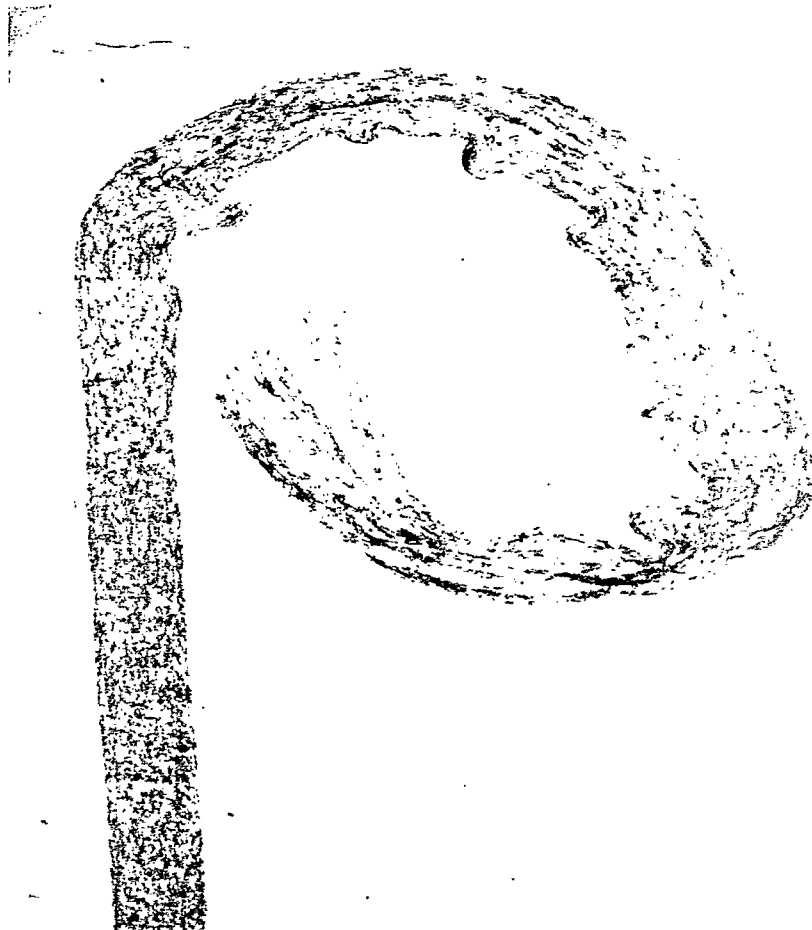


FIG. 9



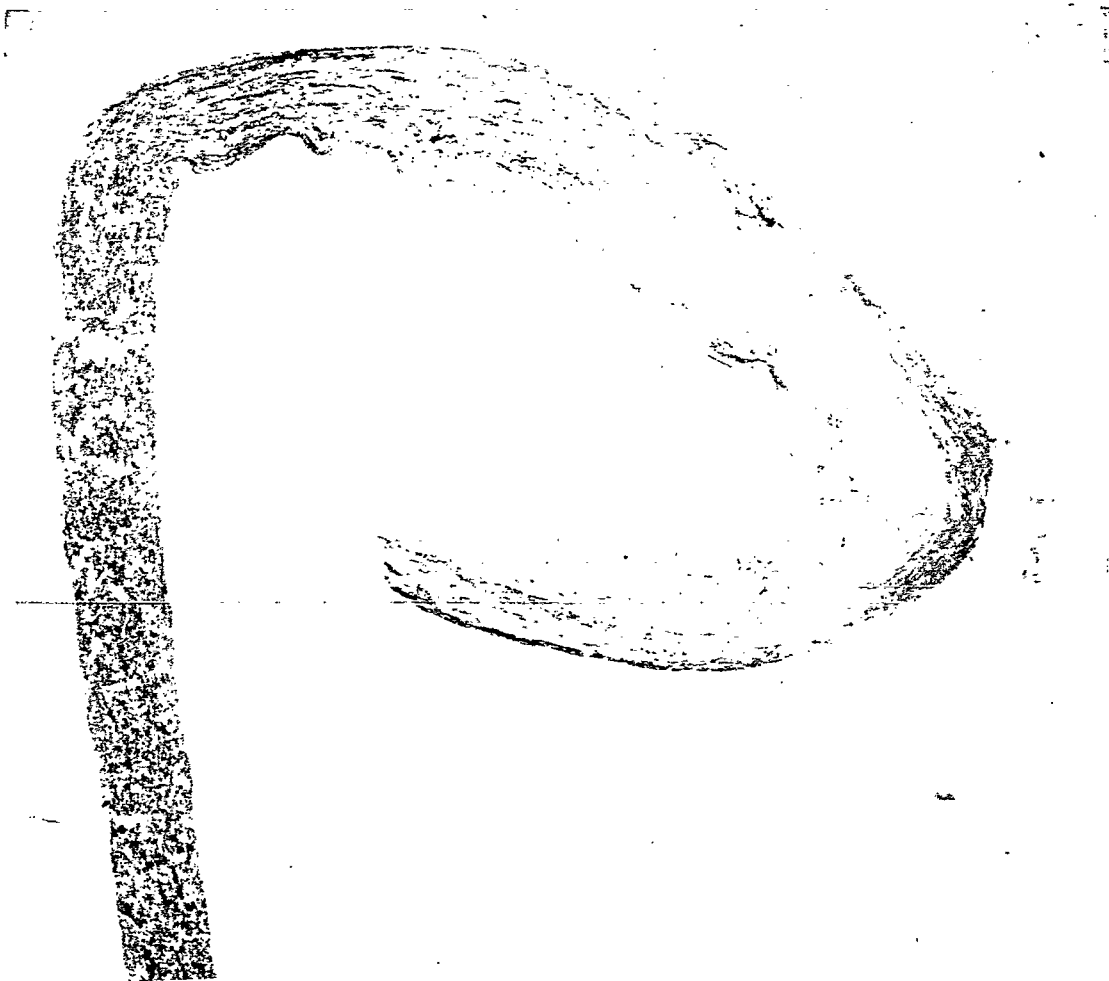
7 / 9

**FIG. II**



8 / 9

**FIG. 12**



9 / 9

FIG. 13

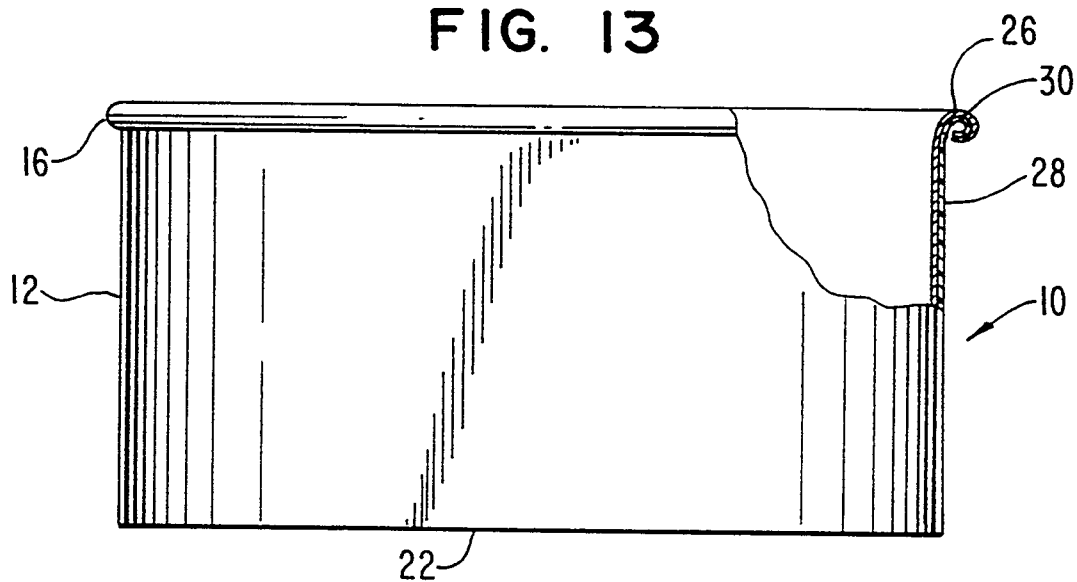


FIG. 14

