



EUROPEAN PATENT APPLICATION

Application number: **90314282.6**

Int. Cl.⁵: **B65D 51/14, B65D 5/06**

Date of filing: **24.12.90**

Priority: **26.01.90 US 471283**

Date of publication of application:
07.08.91 Bulletin 91/32

Designated Contracting States:
DE DK ES FR GB IT NL SE

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Method and apparatus for constructing gable-top container closure system.

A method and apparatus for constructing a gable-top container (1) having a stiffening fillet (56) applied to the inner or outer surface of one or more panels of the pouring spout. A pair of sealing jaws (100,102) are compressed against first portions of the first and the second gable rib panels (50,52) with a force sufficient for reciprocal sealing of the first and second roof rib panels and the first and the second gable rib panels of the container, while compressing the portions of the first and second gable rib panels generally overlying the stiffening fillets with a force sufficient for reciprocal sealing of the first and the second roof rib panels and the first and the second gable rib panels overlaying the stiffening fillet without substantially displacing the stiffening fillet from the desired location.

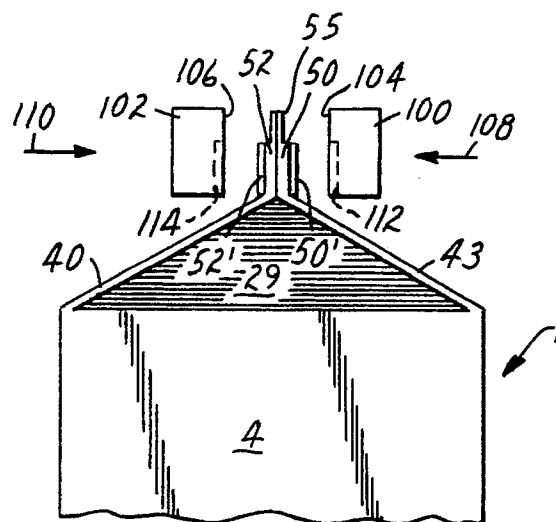


FIG. 13

METHOD AND APPARATUS FOR CONSTRUCTING GABLE-TOP CONTAINER CLOSURE SYSTEM

Background of the Invention

1. Field of the Invention

This invention relates to packaging, and particularly to a method and apparatus for constructing a gable-top container having improved opening characteristics.

2. Description of the Prior Art

Containers for beverages such as milk, fruit juices, and drinks are conventionally constructed from blanks of thermoplastic coated paperboard. The most widely used of such containers have a rectangular cross-sectional body surmounted by a gable-top closure incorporating an extensible pouring spout. Blanks from which the containers are constructed are divided into a plurality of panels which are adapted to form the walls and closure members. The panels are formed and separated by score lines at which the blank is folded. Particular panels are intended to be joined together in a lapped arrangement in the completed container. Typically, those panels are pressed together and heated or exposed to high frequency radiation to fuse the adjoining thermoplastic surfaces and form a generally strong seal. To finally seal the filled container, two or more panels are finally joined and sealed to form a rib along the top edge of the roof panels. Exemplary of such container blanks are those shown in Alden U.S. Patent No. 2,750,095 and Wilcox U.S. Patent No. 3,245,603.

Containers of this type are opened for access to the contents by a two-step toggle action process. First, the gable edges of the roof panels at the front of the container are pushed outward and upward toward the rear of the container by thumb pressure, breaking the seal between the outside surfaces of the two lip panels, and breaking the seal in the rib panels surmounting the roof above the pouring spout. The gable edges are forced backward past the point at which the lip panels are joined, to nearly touch the roof panels.

Second, the gable edges are pushed forward and towards each other. The forces are communicated through spout panels to the tip of the pouring spout, breaking the seal between the lip panels and the underside of the roof panels and snapping the spout outward to a pouring position.

In early models of gable-top containers, the panels comprising the lips of the pouring spout were bonded to the underside of the roof panels. The resulting sealed spout was difficult to open, generally requiring insertion of a tool behind the

lips to separate them from the roof underside. The cardstock panels often tore or delaminated, producing an unsightly and unsanitary container. In those cases where an adhesive was applied to only those panels which were to be joined, it was simple to eliminate adhesive from the spout panels to reduce the forces required to open the spout. The resulting container, of course, was not effectively sealed and was subject to leakage.

An improvement in gable-top containers to provide a hermetic seal for an extended shelf life package consisted of coating the inner surface of the container blank with a foil and an overcovering layer of thermoplastic such as polyethylene. The panels to be sealed are bonded by heating the thermoplastic surface coatings to a softening or melting temperature, compressing the panels together and cooling. The use of thermoplastic coatings or foil adds some stiffness to the panels, and the container is made resistant to wicking by liquids. However, the strong bonding of the lip panels results in buckling, tearing and delamination of the cardstock upon opening the seal. Thus, the spout is difficult to open, and the opened panels are unappealing in appearance.

As used in the food packaging industry, the term hermetic refers to a container designed and intended to be secure against the entry of oxygen which degrades flavor. The term is also used to designate containers used for aseptic filling and storage, i.e. containers secure against the entry of microorganisms. The hermetic barrier of such cartons typically comprises an aluminum or other barrier film coating the inner surface, overcovered with a thermoplastic such as polyethylene. The carton wall thickness is thus increased, resulting in larger channels where the edges of overlying panels have a stepped relationship in the gable rib area, increasing the chance for leakage.

Attempts to provide an easily opened spout seal have included (a) perforations in the spout panels which tear open to expose pouring lips, (b) improved control of the sealing temperature, (c) the use of added scoreline patterns to concentrate the opening forces, and (d) the use of anti-adhesion agents, i.e. adhesives, to reduce the required opening forces.

U.S. Patent Nos. 4,712,727; 4,813,547; and 4,869,373, all entitled "Gable-Top Container", all generally describe an improvement in the formation of a gable-top container of paneled flexible material to stiffen the package material adjacent the sealed area to be opened. This results in a more reliable, consistently openable hermetically sealed opening for gaining access to the contents.

Referring now to the drawings, a gable-top container is depicted such as may be utilized in conjunction with the above '727; '547; and '373 patents. Figure 1 shows a typical container 1 in a closed, sealed condition as for storage of beverages and the like. The container is self-sustaining in shape and is hermetically sealed. Container 1 is comprised of a series of panels, including a container body having four body panels 2-5. Front body panel 4 and second side body panel 5 are shown in Figure 1, while rear body panel 2 and first side body panel 3, not shown, oppose panels 4 and 5, respectively, forming a container of rectangular cross-section. Usually, the cross-section is square. The bottom of the container 1 is closed. First roof panel 28 is connected to the upper edge of first side panel 3. Second roof panel 30 is connected to the upper edge of second side panel 5. When the container is in the closed condition, the roof panels 28 and 30 converge upwardly to form a gable roof construction. Roof rib panel 54 is attached to roof panel 30 and extends upwardly therefrom. Likewise, upper rib panel 55 is attached to roof rib panel 54 and extends upwardly therefrom.

First triangular end panel 29 is connected to the upper edge of the front body panel 4. When the container is closed, end panel 29 is folded under the gable roof formed by the two roof panels. Also shown are first roof wing panel 40 and second roof wing panel 43. The roof wing panels 40 and 43 are subpanels of roof panels 28 and 30, respectively. A second triangular end panel, not shown in this Figure, is usually adapted to remain folded under the opposite gable roof, unless it is desired to open both gable ends of the container.

Figure 2 shows the container of Figure 1 in which the spout has been partially opened. The first and second foldback panels 41 and 42 and overlapping roof wing panels 40 and 43 are typically pushed outward and backward with thumb pressure to break the seal between the inner surfaces of the first and second upper rib panels 49 and 55, and between the outer surfaces of the first and second gable rib panels 50 and 52, the latter not visible in this drawing. The gable rib panels are connected to the upper edge of foldback panels 41 and 42, and extend upwardly therefrom.

Figure 3 shows the container at the point where foldback panels 41 and 42 have been pushed backward about 90 degrees from their sealed position. These panels are roughly triangular in shape, each having one edge defined by scoreline 35 or 36, where they are attached to a lateral edge of first triangular end panel 29. First and second gable rib panels 50 and 52 act as lips of the pouring spout, and meet at a common gable rib score line 51. The upper terminus 51A of the

common rib score line at the free edge 53 of the pouring lip comprises the tip of the pouring spout. First and second upper rib panels 49 and 55 extend upwardly from the first and second roof rib panels 48 and 54 to a level higher than the free upper edge 53 of gable rib panels 50 and 52.

To complete the unsealing and opening of container 1, foldback panels 41 and 42 are pushed backward beyond the position shown in Figure 3. The roof rib panels and upper rib panels will fold along foldline 57. The blank may or may not be scored at that location.

The gable rib panels are slightly longer than the roof rib panels. Thus, after the panels are folded backward, a subsequent forward and inward movement of wing panels 40 and 43 transmits opening forces in a toggle-like action along the wing panels and gable rib panels 50 and 52 toward the common line 51 between the gable rib panels. A component of these forces extends outward and upward from line 51 and from gable score lines 35 and 36 to pull the gable rib panels 50 and 52 away from roof rib panels 54 and 48, the latter not visible in Figure 3, and to pull foldback panels 41 and 42 away from roof wing panels 40 and 43. Likewise, triangular end panel 29 is forced outward, and the distended panels create a pouring spout. The various score lines delineating the panels act as hinges for the panels as they are unfolded.

Certain features of the gable-top container construction of the '727; '547; and '373 patents will produce a liquid-proof spout seal which is easily opened without tearing, delamination, or buckling of the spout panel members. These features underlie the spout panel members in Figure 3, and are not visible in that Figure. These features include one or more fillets 56, shown in Figure 4.

Figure 4 illustrates an exemplary flat sheet material blank for constructing a gable-top container as described in the '727; '547; and '373 patents. The inner surface or face is shown, and it is coated with a thermoplastic such as polyethylene. The outer surface may also be similarly coated. The sheet material may include a gas impermeable layer such as aluminum foil. An appropriate pattern of score lines divides blank 1A into a plurality of panels and sub-panels which are used as walls of the container and its closure parts when the container is erected.

The central portion of blank 1A comprises four body panels 2, 3, 4, and 5, having their lower edges along bottom score line 13, and their upper edges along top score line 31. These transverse score lines are shown as extending from blank edge 6 to opposite blank edge 12 in substantially parallel relationship across the face of the blank. Vertical score lines 7, 8 and 9 transect the blank to define the lateral edges of the body panel 2, 3, 4

and 5, and other panels above the body panels. These and other score lines are not necessarily straight, but may be slightly offset in certain sectors of the blank to improve the fit of the various panels in the erected container.

In the example shown in Figure 4, side seam flap 11 is connected to one lateral edge 10 of a body member for sealing to the edge of another body member 2 by the container sealing process. Bottom closure means 26 is shown as a group of bottom closure panels 14 through 21 attached to the body members along bottom score line 13, and extending downward therefrom. Bottom closure score lines 22 through 25 enable bottom closure panels 14, 16, and 18-21 to be folded under closure panels 15 and 17 and sealed to provide a leakproof container bottom. Such a closure means is well-known in the art. A separately formed structure may alternatively be used to close the bottom of the container. In fact, any closure means which results in a satisfactorily tight seal may be used.

The gable-top of the container is formed from a series of panels above top score line 31. First and second roof panels 28 and 30 are connected to the upper edges of the first and second side panels 3 and 5, respectively. The roof panels are oppositely disposed and when erected, converge upwardly to meet along score line 44 to form a gable roof. Connected to the upper edge of the front panel 4 is a first substantially triangular end panel 29 whose two lateral edges 35 and 36 formed by score lines extend upwardly to score line 44. Similarly, second triangular end panel 27 is connected to the upper edge of back panel 2, and has lateral edges 32 and 33 which extend upwardly to score line 44.

On each side of triangular end panel 29 is a foldback panel. First foldback panel 41 is connected to triangular end panel 29 along edge 35, and to first roof wing panel 40 along score line 8. Panel 41 has a score line 44 as its upper edge. Similarly, second foldback panel 42 is connected to triangular end panel 29 along edge 36, and to second roof wing panel 43 along score line 9. It has score line 44 as its upper edge.

Similarly, third and fourth foldback panels 39 and 38 are connected to triangular end panel 27 along lateral edges 33 and 32, respectively. The third foldback panel 39 is attached to the first roof panel 28 along score line 7, and the fourth foldback panel 38 is connected to the second roof panel 30 by side seam flap 11 when the container is erected.

Attached to the upper edge of each foldback panel 38, 39, 41 and 42 along score line 44 is a gable rib panel 45, 46, 50 and 52, respectively. Similarly, attached to the upper edge of first and second roof panels 28 and 30 are first and second roof rib panels 48 and 54, respectively. First and

second gable rib panels 50 and 52 are connected to each other at a common score line 51, and third and fourth gable rib panels 46 and 45 are connected to each other at common score line 47. The uppermost end 51A of line 51 is the tip of the pouring spout of the erected container.

First gable rib panel 50 is connected to first roof rib panel 48 at score line 8, and second gable rib panel 52 is connected to second roof rib panel 54 at score line 9.

First roof wing panel 40 comprises a triangular portion of first roof panel 28 defined by score lines 34, 44 and 8, and is adjacent first foldback panel 41. Second roof wing panel 43 comprises a triangular portion of second roof panel 30 defined by score lines 37, 44 and 9 and is adjacent second foldback panel 42. These roof wing panels are more or less coextensive with the adjacent foldback panel when the erected container is closed.

A first upper rib panel 49 is connected to the upper edge of the first roof rib panel 48. Likewise, a second upper rib panel 55 is connected to the upper edge of the second roof rib panel 54. The score lines 60 and 61 separate the upper rib panels from the adjacent roof rib panels, and are substantially continuous with the free upper edge 53 of the first and second gable rib panels 50 and 52. The latter panels serve as lips of the pouring spout of the erected container.

The score lines may be applied to blank 1A before or after the thermoplastic coating is applied to the blank. The score lines may be applied to either surface or both surfaces of the blank. For purposes of clearer delineation of the various panels, score lines are shown in the drawings on either or both of the inner and outer surfaces of the blank and container.

In the embodiment shown in Figure 4, two stiffening fillets 56 overlie portions of the first and second gable rib panels 50 and 52, and extend downwardly to overcover portion of the first and second foldback panels 41 and 42 and small upper portions of first end panel 29.

Each fillet 56 comprises a strip 66 of material resistant to the container sealing process, and a layer 72 of adhesive. This adhesive layer 72 is attached to any of the panels forming the pouring spout of the gable-top container.

The material of the strip may be constructed from any suitable material, but is preferably constructed from unoriented polypropylene, such as that utilized as a film backing in a pressure sensitive adhesive tape marketed under the trademark "Y-8450" by Minnesota Mining and Manufacturing Company of St. Paul, Minnesota. A fillet constructed of unoriented polypropylene exhibits several advantages over strips constructed of other materials and specifically polyester. Specifically, unorien-

ted polypropylene has a lower modulus of elasticity than polyester (i.e. as low as 0.2×10^6 p.s.i.). Therefore, a more compliant strip may be constructed which is better able to conform to the scorelines between the pouring spout panels. The optimum temperature range per bonding the un-oriented polypropylene strip is $260^\circ - 320^\circ$ F. Un-oriented polypropylene is the preferred material for the strip in that it is dimensionally stable, even when subjected to the elevated temperatures and pressures experienced when a container is sealed. Oriented polypropylene, although having increased tensile strength, has a tendency to return to its unoriented state when exposed to temperatures (i.e., $180^\circ - 200^\circ$ F) below the sealing temperatures. This distortion of oriented polypropylene results in buckling and separation of the polypropylene from a mounting surface.

The strip 66 and adhesive layer 72 may be preformed as a tape which is applied by machine to the blank 1A.

For hermetic sealing containers, the modulus of elasticity of strip 66 may be as low as 0.2×10^6 p.s.i. (1.4×10^8 kg/m²), but preferably for materials other than polypropylene is at least 0.4×10^6 p.s.i. (2.8×10^8 kg/m²).

The layer 72 is of such an adhesive type and thickness that when the fillet 56 is compressed between gable rib panel 50 and 52 and roof rib panels 48 and 54 during the first sealing process, a portion of the adhesive of layer 72 extrudes from between the panel or panels and strip 66 of resistant material. The extruded adhesive fills channels otherwise open to leakage and effectively seals the container. The adhesive used may be sealable by pressure, heat, or other process.

Figure 5 is an enlarged cross-sectional view through the rib portion of a container formed from this invention, showing the panel members and fillet exaggerated in thickness for the sake of clarity. It is understood that all of the panel members shown include a thermoplastic coating on at least the inner surfaces, and preferably on both the inner and outer surfaces. Additionally, the panel members may include a film or foil of gas-impermeable material such as aluminum, overcovered by the thermoplastic coating.

First and second roof rib panels 48 and 54 overlie first and second gable rib panels 50 and 52. The gable rib panels are separated from foldback panels 41 and 42 by scorelines 44, and the roof rib panels are likewise separated from roof wing panels 40 and 43 by scorelines 44. Upper rib panels 49 and 55 are separated by score lines 60 and 61 from the roof rib panels 48 and 54, and extend upwardly therefrom. Each of the panels shown in the Figure includes a coating of thermoplastic on at least the inner surface. Stiffening fillet 56 is shown

attached to the inner face of gable rib panels 50 and 52, and to an upper portion of foldback panels 41 and 42. The fillet includes resistant strip 66 and adhesive layer 72.

Fillet 56 may comprises a tape having a relatively thick backing or strip 66 of a stiff material whose bond to the thermoplastic surface of the panels is weaker than its bond to adhesive layer 72. The adhesive layer 72 may be thermoplastic in nature, but preferably is a pressure-sensitive adhesive. The latter affords easier positioning during application to the blank 1A, and does not require the application of heat for positioning. However, the thermal carton sealing process has been found to significantly enhance the sealing strength of the pressure-sensitive adhesives (PSA's) which were tested. Typical pressure sensitive adhesives can be formed into stable thick layers at room temperature, and will readily extrude at the temperatures and pressures used to thermally seal polyethylene. Thus, when an extruded bead of adhesive is desired, PSA's appear to work well.

In Figure 5, the container contents occupy the space between panel 40 and panel 41, and the space between panel 42 and panel 43.

When the first sealing process is thermal in nature, the upper rib panels, the gable rib panels, and the roof rib panels are heated to the softening or melting point of the thermoplastic coating, and compressed together as shown in Figure 5. The upper rib panels are bonded on their inner surfaces at interface 69, and gable rib panels 50 and 52 are preferably mutually bonded on their outer surfaces at interface 70.

A further sealing feature may be produced if desired. A thick layer 72 of an extrudable adhesive may be used in the fillet. Compression at an elevated temperature during the carton sealing process extrudes the adhesive from between the gable rib panels and strip 66, and the extruded bead 79 of adhesive bonds overlying panels 50 and 52 just above the upper edge 75 of strip 66. A similar extrusion of adhesive is produced along the lateral edges of strip 66 as well, both where the gable rib panels and roof rib panels are joined, and along the exposed portion of the common gable rib score line. A hermetic seal is achieved where the adhesive extrudes, even when the bead of extruded adhesive is minimal. The quantity of extruded adhesive may be varied by controlling the type of adhesive, the thickness of the adhesive layer, and the temperature and pressure of the carton sealing process. The quantity of extruded adhesive may be controlled to fill the small channels 73 or channel 74 which typically develop along the free upper edge 53 of the gable rib panels.

Furthermore, the space at the tip of the pouring spout, that is, the space between common line 51

and the corresponding line 47 of the third and fourth gable rib panels, usually not securely sealed in the prior art by the first sealing process, may also be controllably filled with a bead of extruded adhesive during the carton sealing process to provide an aseptic or essentially hermetic seal. This seal is especially enhanced by features to be later described.

Because the bead bonding the gable rib panels to, the roof rib panels is relatively narrow, the seal may be broken with minimal force to open the spout. The adhesion of strip 66 to the container panel should preferably produce a peel strength greater than 50 oz. per inch of width (612 grams per cm. width) at room temperature, so that the fillet will remain an integral part of the panel to which it is attached, both before and after the spout panels are unsealed and unfolded. The fillet may be adhesively attached to at least one of the pouring spout panels listed above, depending upon what is desired for the particular application.

Preferably, the thickness of adhesive layer 72 is considerably greater than would be required for merely bonding strip 66 to a panel. For example, while the latter may be attained with a monomolecular layer of adhesive, this invention generally requires an adhesive layer exceeding 0.001 inch (0.0025 cm) in thickness for achieving desired additional stiffness and leakproof hermetic sealing. An adhesive layer of about 0.002 inch (0.005 cm) has proven optimal for certain pressure sensitive adhesives used to seal polyethylene coated containers. With other adhesives, a thickness of up to 0.004 inch (0.0102 cm) may be used. However, in conjunction with a strip constructed of unoriented polypropylene, an adhesive layer of approximately 0.003 inches (0.008 cm) has been found to be preferred.

Figure 6 shows a gable-top container 1 formed from the blank of Figure 4 and sealed according to conventional container sealing process, and subsequently opened from the closed and sealed condition. Second roof panel 30 and first roof panel 28 converge upwardly so that their upper edges 44 meet or almost meet. Roof rib panels 48 and 54 are sealed along approximately one-half of the length of the rib structure, and enclose third and fourth gable rib panels 45 and 46. When the container is closed, common scoreline 47 between the third and fourth gable rib panels is somewhat spaced from common scoreline 51. The void between those scorelines is a vertical channel which when filled with adhesive will prevent leakage. First and second upper rib panels 49 and 55 are joined by the container sealing process. The spout panels of the rib structure are shown to have been opened by first breaking the seal between the upper rib panels 49 and 55, and then breaking the seal

between gable rib panels 50, 52 and roof rib panels 48, 54. First triangular end panel 29, and first and second foldback panels 41 and 42 are folded outward to extend the pouring spout.

Stiffening fillet 56 is shown at the inside of the pouring spout, overlying and attached to a portion of the inside surface of the first gable rib panel 50 and the second gable rib panel 52, not visible in this view. Conforming to a preferred embodiment, the fillet 56 also extends downward over scoreline 44 to overcover a portion of foldback panels 41 and 42. The advantages of such extension will be later described.

Fillet 56 is shown as spaced from roof wing panel 40 and roof rib panel 48 to form side spacing 59, and also spaced from the free upper edge 53 of gable rib panel 50 to form lip spacing 58. During the first sealing process, a portion of the adhesive is extruded from the adhesive layer of the fillet 56 into channels 73, previously described, resulting from spacings 58 and 59, to effectively seal these areas from leakage. The surface 68 of the fillet 56 which has no adhesive layer is, of course, in contact with roof rib panels 48 and 54 when the carton is sealed. Fillet 56, being resistant to the container sealing process, does not strongly adhere to the thermoplastic surfaced roof rib panels, although the pressures and temperatures typical of the first sealing process minimally result in a close conformity of their surfaces which is subsequently maintained by the tight seal of the rib panel members. The seal between surface 68 and the overlying panel, though not as tenacious as that of the opposite adhesive coated side of the strip, nevertheless prevents fluid leakage. A hermetic seal results from (a) the thermoplastic heat seal between exposed portions of the gable rib panels and opposing roof rib panels, or (b) a bead of adhesive extruded from beneath the strip, to be described later, or the seal between surface 68 and the overlying panel, or (d) a combination of the two.

The sealing temperature is difficult to accurately control, and if the fillet adhesive softens excessively, the fillet strip may slide downward, not retaining its proper alignment on the gable rib panel or panels. The portion of the fillet below the gable rib panels will be much less affected because of the lower temperature, and will maintain the original position of the fillet. The high adhesion of adhesive layer 72 is regained upon cooling.

The Figure also shows the fillet as overlying score line apex 64 at the top of triangular end panel 29.

It was discovered in the '727; '547; and '373 patents that enhanced sealing results from cutting, notching or slotting the strip 66 where it overcovers the common gable rib scoreline 51, especially the portion of the common line just below its upper

terminus 51A. Thus, strip 66 may include a cut extending downwardly from the upper edge of the strip, along at least a portion of the common line 51. This enables adhesive from layer 72 and/or melted thermoplastic polyethylene to extrude through the cut, notch or slot to contact the opposite gable rib panels 45 and 46 at common scoreline 47, and bond thereto. This difficult-to-seal site is thus effectively sealed.

U.S. Patent Nos. 4,726,234; 4,813,548; and 4,872,562, all entitled "Gable-Top Container", the contents of which are all hereby incorporated herein by reference, also disclose a gable-top container construction in which a stiffening fillet is utilized in the same manner as herein described with respect to the '727; '547; and '373 patents. However, in the case of the '234; 548; and 562 patents, the stiffening fillet is applied to the outer surface of one or more corresponding panels of the container, as shown in Figures 7 and 8.

U.S. Patent Nos. 4,756,426; 4,792,048; and 4,869,372, all entitled "Gable-Top Container Closure System", the contents of which are all hereby incorporated herein by reference, also disclose a gable-top container construction 1 in which a stiffening fillet 56 is utilized in the same manner as herein described with respect to the '727; '547; and '373 patents in that the fillet 56 is applied to the inner surface of one or more panels forming the pouring spout. However, in the case of the '426; '048; and '372 patents, the stiffening fillet 56 includes two layers laminated to each other, as shown in Figures 9-11.

More specifically, the fillet comprises (a) a strip 56a of reinforcing material constructed of material resistant to deleterious effects of the conventional container sealing process, i.e. it will not melt, or otherwise degrade at the temperature and pressure of the container sealing process, (b) first layer of high strength adhesive 56b attached to one side of the strip, and (c) an adhesive web 56c including a controlled release adhesive delaminably attached to the opposite side of the strip of resistant material and adapted to seal to the panels opposite the panels overlain by the fillet, when the container is erected, closed and sealed.

Collectively, the '234; '548; and '562; '426; '048; '372; '727; '547; and '373 patents shall hereinafter be jointly referred to as the "Fillet" patents. In the '727; '547; and '373 Fillet patents, it has been observed that unoriented polypropylene is the preferred material for the reinforcing strip in that it is dimensionally stable, even when subjected to the elevated temperatures and pressures experienced when a container is sealed. Oriented polypropylene, although having increased tensile strength, has a tendency to return to its unoriented state when exposed to temperatures (i.e. 180° -

200°) below the sealing temperature. This distortion of oriented polypropylene results in buckling and separation of the polypropylene from a mounting surface.

It is to be understood that the Fillet patents all disclose a specific gable-top container construction, it is to be understood, for the purposes of this invention, that the use of a stiffening fillet may be utilized in any gable-top container construction, regardless of the particular agreement, size or shape of panels, provided that a pouring spout is included having at least the first triangular end panel, the first and second fold back panels, the first and second wing panels, the first and second gable rib panels, along with the first and second roof rib panels.

However, although an improvement over existing gable-top containers, the use of the stiffening fillets described above in the Fillet patents provides gable-top containers that are more difficult to seal properly when the stiffening fillets overly any one or more of the first and second roof rib panels or the first and second gable rib panels. That is, the overall thickness of the ridge or rib of the gable-top container is increased over a portion of its length.

Typically, the first and second roof rib panels and first and second gable rib panels are sealed together to form the ridge or rib of the gable-top container by the compressive application of a pair of parallel sealing jaws or bars after heating with hot air to a temperature which melts or fuses the thermoplastic surface coatings, to seal together the panels to be joined. When the thickness of the gable-top ridge structure varies along the length of the gable ridge, as with the reinforcing fillets, effective sealing of the container is diminished in at least two respects. First, the non-reinforced portion of the gable ridge structure do not receive an even application of compressive force from the sealing jaws. Second, and as a consequence of the first disadvantage, increased pressure is applied to the portions of the first and second roof rib panels or the first and second gable rib panels that overly the stiffening fillets so that the stiffening fillets have a tendency to be squeezed out of position (i.e. displaced), with apparent adverse consequences. Such displacement includes deformation or damage to the reinforcing strip of the fillet, as well. Reduction of the overall compressive force applied by the sealing jaws to prevent the stiffening fillets from being displaced may prevent effective reciprocal sealing of the first and second roof rib panels and the first and the second gable rib panels and therefore, of the container.

Summary of the Invention

The present invention includes a method for

producing a gable-top container, comprising the steps of: (a) providing a container body having sides, a bottom and a top, and an extensible pouring spout including a generally triangular end panel connected to the container body top and extending upwardly therefrom, first and second foldback panels, the first foldback panel connected to the container body top and to one lateral edge of the first triangular end panel, and the second foldback panel connected to the container body top and to the other lateral edge of the first triangular end panel, first roof wing panel adjoining the first foldback panel and connected thereto, a second roof wing panel adjoining the second foldback panel and connected thereto, a first roof rib panel connected to the first roof panel and the first roof wing panel, a second roof rib panel connected to the second roof panel and the second roof wing panel, a first gable rib panel connected to an upper edge of the first foldback panel, a second gable rib panel connected to an upper edge of the second foldback panel, the uppermost end of the first triangular end panel and the first and the second foldback panels forming a tip of the pouring spout; (b) providing at least one stiffening fillet overlying at least a portion of and bonded to one or more of the first and the second roof rib panels and the first and second gable rib panel for simultaneously stiffening one or more of the first and the second roof rib panels and the first and second gable rib panels to transfer applied opening forces therealong and for limiting the force required to open the container from the sealed condition, the fillet comprising a strip of material resistant to the temperature and pressure of the container sealing process and a layer of adhesive attached to one side of the strip and to one or more of the first and the second roof rib panels and the first and the second gable rib panels for bonding the strip thereto; (c) erecting a gable-top container; (d) heating the first and the second roof rib panels and the first and the second gable rib panels to a temperature sufficient for reciprocal sealing of the first and the second roof rib panels and the first and the second gable rib panels; (e) applying a first sealing pressure to first portions of the first and said second roof rib panels sufficient for reciprocal sealing of the first and second roof rib panels and the first and the second gable rib panels of the container to seal the container; and (f) applying a second sealing pressure on portions of the first and the second roof rib panels overlying said stiffening fillet during sealing of the container sufficient for reciprocal sealing of facing portions of the stiffening fillet and the first and the second roof rib panels and the first and the second gable rib panels without substantially displacing the stiffening fillet from the desired location on one or more of the first and the second roof rib

panels and the first and the second gable rib panels.

In one embodiment, the method further includes the steps of: providing a pair of sealing jaws including opposed sealing surfaces for compressive contact with exterior surfaces of the heated first and second roof rib panels; (b) forming opposed recesses in the sealing surfaces of the pair of sealing jaws, the recesses being aligned with portions of the first and the second roof rib panels overlying said stiffening fillet; (c) compressing the sealing jaws against the exterior of the first and the second roof rib panels after heating so that during sealing of the first and the second roof rib panels the first sealing pressure is applied to the first portions of the first and the second roof rib panels and the second sealing pressure is applied to the second portions of the first and the second roof rib panels for reciprocal sealing of facing portions of the first and the second roof rib panels, the first and the second gable rib panels and the stiffening fillet without substantially displacing the stiffening fillet from the desired location. The present invention further provides for apparatus for use in carrying out the above method with a gable-top container including a container body having sides, a bottom and a top, an extensible pouring spout including a generally triangular end panel connected to the container body top and extending upwardly therefrom, first and second foldback panels, the first foldback panel connected to the container body top and to one lateral edge of the first triangular end panel, and the second foldback panel connected to the container body top and to the other lateral edge of the first triangular end panel, first roof wing panel adjoining the first foldback panel and connected thereto, a second roof wing panel adjoining the second foldback panel and connected thereto, a first roof rib panel connected to the first roof panel and the first roof wing panel, a second roof rib panel connected to the second roof panel and the second roof wing panel, a first gable rib panel connected to an upper edge of the first foldback panel, a second gable rib panel connected to an upper edge of the second foldback panel, the uppermost end of the first triangular end panel and the first and second foldback panels forming a tip of the pouring spout, a stiffening fillet overlying at least a portion of and bonded to one or more of the first and the second roof rib panels and the first and the second gable rib panels for simultaneously stiffening one or more of the first and the second roof rib panels and the first and second gable rib panels and to transfer applied opening forces therealong and for limiting the force required to open the container from the sealed condition, the fillet comprising a strip of material resistant to the temperature and pressure of the container seal-

ing process and a layer of adhesive attached to one side of the strip and to one or more of the surface of the first and the second roof rib panels and the first and second gable rib panels for bonding the strip thereto, comprising: (a) a pair of sealing jaws including opposed sealing surfaces for compressive contact with exterior surfaces of the first and second roof rib panels; (b) means for heating the to a desired temperature sufficient for reciprocal sealing of the pouring spout of the container; (c) means for cooperative movement of the pair of sealing jaws between positions spaced from the container and sealing positions in contact with the exterior of the first and the second roof rib panels; and (d) means for compressing said pair of sealing jaws against first portions of the first and the second roof rib panels with a first sealing force sufficient for reciprocal sealing of facing surfaces of the first and the second roof rib panels and the first and the second gable rib panels of the container, while compressing second portions of the first and second roof rib panels generally overlying the stiffening fillet with a second sealing force sufficient for reciprocal sealing of the first and the second roof rib panels and the first and second gable rib panels overlying the stiffening fillet without substantially displacing the stiffening fillet from the desired location.

In one embodiment of the apparatus of this invention, the compressing means includes a recess formed in said sealing surface of each of said sealing jaws, said recesses being generally co-extensive with the stiffening fillet when said sealing jaws are in said contact position, whereby said first sealing pressure is applied to said first portions of the first and the second roof rib panels and said second sealing pressure is applied to said second portions of the first and the second roof panels.

The present invention also includes a gable-top container constructed according to the above described method.

Brief Description of the Drawings

The present invention will be further described with reference to the accompanying drawing wherein like reference numerals refer to like parts in the several views, and wherein:

Figure 1 is a perspective view of the upper end of a closed container formed from the container blank of Figure 1.

Figure 2 is a perspective view of the container end of Figure 1 with a partially opened rib.

Figure 3 is a perspective view of the container end of Figure 1 with its sealed rib fully open and the spout panels in the closed position.

Figure 4 is a plan view of an embodiment of a conventional container blank with a stiffening fillet

applied to an inner surface of one or more panels of the pouring spout.

Figure 5 is an enlarged cross-sectional view through the closed upper closure along line 6-6 of Figure 1.

Figure 6 is a partial perspective view of the container end of Figure 1 with the pouring spout completely opened. A portion of the container is cut away to view panel members below the roof and roof rib panels.

Figure 7 is a perspective view of an alternate container end with its sealed rib fully open and the spout panels in the closed position showing a stiffening fillet applied to the outer surface of one or more panels of the pouring spout with the pouring spout in a closed position.

Figure 8 is an enlarged cross-sectional view through the closed upper closure of a gable-top container with a stiffening fillet applied to an outer surface of one or more of the panels of the pouring spout.

Figure 9 is a perspective view of another alternate container end with its pouring spout in an open position showing a stiffening fillet applied to the inner surface of one or more panels of the pouring spout with the stiffening fillet including two delaminable layers.

Figure 10 is a partial enlarged cross-sectional view through the closed upper closure of a gable-top container with a stiffening fillet applied to an inner surface of one or more of the panels of the pouring spout of Figure 9.

Figure 11 is a partial plan view of a container blank with a stiffening fillet applied to inner surface of one or more panels of the pouring spout.

Figure 12 is a top view of erected but unsealed gable-top container according to this invention with a pair of sealing jaws adjacent the exterior of the first and second roof rib panels.

Figure 13 is a front view of the gable-top container and sealing jaws of Figure 12 after the gable-top container has been sealed.

Figure 14 is a side view of the sealing surface of one of the sealing jaws of Figures 12 and 13 with a recess portion.

Figure 15 is a top view of the gable-top container of Figure 13.

Figure 16 is a side view of the gable-top container of Figures 13 and 15.

Detailed Description

Referring now to Figure 12, the method of this invention will now be discussed along with apparatus for carrying out that method. gable-top container 1 is as shown and discussed previously with respect to Figures 1-11. Specifically, although not shown, a stiffening fillet is applied to the inner or

outer surfaces of one or more surfaces of the panels of the pouring spout, as described in the Fillet patents, but more specifically, the stiffening fillets overly one or more of the first and the second roof rib panels 50, 52 or the first and second gable rib panels 48, 54.

A pair of opposed sealing jaws, 100 and 102, respectively, are positioned adjacent the exterior of the first and second roof rib panels, 50 and 52, respectively. Each sealing jaw includes a sealing surface, 104 and 106, respectively, for application to the exposed surfaces of the first and the second roof rib panels. Means are provided for heating the container panels to a desired temperature sufficient for sealing of facing surfaces of the pouring spout panels of the gable-top container. Usually, such means takes the form of streams of heated air directed against the panels of the container to be sealed, in a manner known in the art, and thus will not be discussed herein further.

Means are also provided for movement of the sealing jaws 100 and 102, such as in opposed directions 108 and 110, from a spaced apart position as shown in Figures 12 and 13, to opposed positions in compressive contact with the first and second roof rib panels 50 and 52, during the sealing of the gable-top container. The application of heat and the pressure of the sealing jaws will seal the gable-top container, as previously described. Such sealing jaws are known in the art and the mechanism for moving the sealing jaws against the gable-top container panels and compressing the panels are also known in the art and will not be discussed in greater detail hereinafter. The following companies are sources of commercially available machines for sealing gable-top containers that may utilized in the method and apparatus of the present invention: Cherry-Bureve of Louisville, KY and Pure-Pak of Wald Lake, Michigan.

Means are provided for applying a first sealing pressure to first portions 50', 52' of the first and said second roof rib panels sufficient for reciprocal sealing of the first and second roof rib panels 50, 52 and the first and second gable rib panels 48, 54 of the container and applying a second sealing pressure on portions of the first and the second roof rib panels overlying the stiffening fillet during sealing of the container sufficient for reciprocal sealing of facing portions of the stiffening fillet without substantially displacing the stiffening fillet from the desired location on the first and the second roof rib panels. For the purposes of this invention, the term "displacement" also includes any deformation or damage to the reinforcing strip caused by compression during sealing of the gable-top container.

In the illustrated embodiment, the means for applying a differential sealing pressure to the por-

tions of the first and second roof panels overlying the stiffening fillet include a pair of recesses or indents 112 and 114, shown in greater detail in Figure 14, each formed in aligned, opposing locations on the sealing surfaces 104 and 106 of the sealing jaws 100 and 102. The recesses 112, 114 are constructed so as to generally overly the second portions 50', 52' of the first and second roof rib panels that overly the stiffening fillet 56, as is also shown in cross section in Figures 5 and 8. It will be appreciated that the pair of indents or recesses reduce and limit the level of compressive sealing force applied to the stiffening fillet (not shown), compared to the compressive sealing force applied to remainder of the first and the second roof rib panels. By constructing the recesses in an appropriate manner, the level of compressive force applied to each portion of the first and second roof rib panels can be carefully controlled. The relief or recess should be at least nominally the thickness of the stiffening fillet but is preferably 0.0005 cm to 0.013 cm deeper in each jaw. It is one of the advantages of this invention that the method may be practiced and the apparatus constructed by relatively minor and inexpensive modifications of conventional container sealing systems.

Although the illustrated embodiment of the invention include a pair of one piece sealing jaws, each having a recess formed in a sealing surface, it is within the spirit and scope of the present invention to provide sealing jaws having independent portions aligned with the location of the stiffening fillet and the remainder of the roof rib panels. In this arrangements, the independent portions of the sealing jaws could be applied to the aligned portions of the first and the second roof rib panels with independent levels of compressive sealing forces by a mechanism (not shown) adapted for this purpose.

Figures 13, 15 and 16 each show a gable-top container 1 sealed according to the method and apparatus of this invention. Portions 50', 52' of the first and second roof rib panels 50, 52 overlying the stiffening fillet (not shown) have a thickness that is perceptively larger relative to the remainder of the first and the second roof rib panels. Although not directly affecting the functional aspects of the gable-top container and stiffening fillet as disclosed in the Fillet patents, the method and apparatus of the present invention prevents damage to the stiffening fillet and ensures the proper location and functioning of the stiffening fillet during opening of the gable-top container, and in all other respects the gable-top container constructed according to the method and by the apparatus of this invention operates as described in the Fillet patents.

The following are examples of gable-top containers constructed according to the method and

using the apparatus of the present invention:

Example 1

A two (2) liter foil lined gable-top carton from Tetra Pak AB of Lund, Sweden was formed on a Liquipak Model 1800 Form/Fill/Seal machine. The machine is available from Liquipak, Inc. The carton thickness was 0.066 cm (0.026 inches) so the two portions forming the roof rib panels together are 0.132 cm (0.52 inches) thick and the panels forming the two wing panels together are 0.264 cm (0.104 inches) thick. A YR8921 tape, available from Minnesota Mining & Manufacturing Co. of St. Paul, Minnesota, measuring 0.017 cm x 2.54 cm x 7.0 cm was applied to the inside surface of the tip of the pouring spout as the stiffening fillet. The gap setting of the jaws when closed was 0.18 cm and jaws are closed to a gap of 0.23 cm. over the two wing panels. Each jaw had a relief of 0.025 cm in the area contacting and surrounding the fillet. The sealing width (from the top of the tape to the bottom of the tape) was approximately 1.0 cm. The top portion of the carton was heated with hot air to a temperature of between 250° F and 400° F and sealed with unheated jaws. The carton sealed satisfactorily and showed no displacement of the fillet or damage to the foil.

Example 2

A carton was prepared as described in Example 1 except that the jaws used for sealing were flat and had no recess.

The resulting carton showed the fillet squeezed through the top of the spout producing an unsightly ragged edge. Part of the fillet was also squeezed downward into the spout causing severe wrinkling of the fillet and channels to form between the fillet and the inside wall of the carton. The foil also fractured which could cause seepage of liquid into the wall of the carton.

Example 3

A one-half gallon foil lined gable-top container was obtained from International Paper Company and prepared sealed with sealing jaws having a recess as described in Example 1. The resulting carton showed satisfactory sealing with no displacement of the fillet or damage to the foil.

Example 4

A one-half gallon foil lined gable-top container from International Paper Company was sealed as described in 1 except that jaws used for sealing were flat and had no recess. The resulting carton

showed displacement of fillet through the top of the spout and wrinkling of the fillet inside of the spout. The foil was also fractured it was sealed.

The present invention has now been described with reference to several embodiments thereof. It will be apparent to those skilled in the art that many changes can be made in the embodiments described without departing from the scope of the present invention. Thus, the scope of the present invention should not be limited to the structures described in this application, but only by structures described by the language of the claims and the equivalents of those structures. For instance, the stiffening fillet described herein, and as disclosed in the Fillet patents, may include a single strip, or more include two or more independent strips, each applied to one or more of the first and the second roof rib panels and the first and the second gable rib panels, all of which is included in the term "fillet" for the purposes of this invention. Further, although the gable-top container described herein has been referred to as hermetically sealed, the method and apparatus of this invention are also applicable to non-hermetic sealing of a gable-top container, if desired.

Claims

1. A method for producing a gable-top container (1), comprising the steps of:
 - (a) providing a container body having sides (2,3,4,5), a bottom and a top, and an extensible pouring spout including a generally triangular end panel (29) connected to the container body top and extending upwardly therefrom, first and second foldback panels (41,42), the first foldback panel connected to the container body top and to one lateral edge of the first triangular end panel, and the second foldback panel connected to the container body top and to the other lateral edge of the first triangular end panel, a first roof wing panel (40) adjoining the first foldback panel and connected thereto, a second roof wing panel (43) adjoining the second foldback panel and connected thereto, a first roof rib panel (48) connected to the first roof panel and the first roof wing panel, a second roof rib panel (54) connected to the second roof panel and the second roof wing panel, a first gable rib panel (50) connected to an upper edge of the first foldback panel, a second gable rib panel (52) connected to an upper edge of the second foldback panel, the uppermost end of the first triangular end panel and the first and the second foldback panels forming a tip (51) of the pouring spout;

- (b) providing at least one stiffening fillet (56) overlying at least a portion of and bonded to one or more of the first and the second roof rib panels and the first and second gable rib panel for simultaneously stiffening one or more of the first and the second roof rib panels and the first and second gable rib panels to transfer applied opening forces therealong and for limiting the force required to open the container from the sealed condition, the fillet comprising a strip of material (66) resistant to the temperature and pressure of the container sealing process and a layer of adhesive (72) attached to one side of the strip and to one or more of the first and the second roof rib panels and the first and the second gable rib panels for bonding the strip thereto; 5
- (c) erecting a gable-top container; 10
- (d) heating the first and the second roof rib panels and the first and the second gable rib panels to a temperature sufficient for reciprocal sealing of the first and the second roof rib panels and the first and the second gable rib panels; the invention characterized by the steps of: 15
- (e) applying a first sealing pressure to first portions of the first and said second roof rib panels (50,52) sufficient for reciprocal sealing of the first and second roof rib panels and the first and the second gable rib panels of the container to seal the container; and 20
- (f) applying a second sealing pressure on portions (50',52') of the first and the second gable rib panels overlying said stiffening fillet (56) during sealing of the container sufficient for reciprocal sealing of facing portions of the stiffening fillet and the first and the second roof rib panels and the first and the second gable rib panels without substantially displacing the stiffening fillet from the desired location on one or more of the first and the second roof rib panels and the first and the second gable rib panels. 25 30 35 40 45
2. A gable-top container (1) constructed according to the method of claim 1.
3. The method of claim 1, the invention further characterized by the steps of: 50
- (a) providing a pair of sealing jaws (100,102) including opposed sealing surfaces (104,106) for compressive contact with exterior surfaces of the heated first and second roof rib panels (50,52); 55
- (b) forming opposed recesses (112,114) in the sealing surfaces of the pair of sealing

jaws, the recesses being aligned with portions of the first and the second roof rib panels overlying said stiffening fillet; and

(c) compressing the sealing jaws against the exterior of the first and the second roof rib panels (48,54) after heating in step (d) in claim 1 so that during sealing of the first and the second roof rib panels the first sealing pressure is applied to the first portions of the first and the second roof rib panels in step (e) of claim 1 and the second sealing pressure is applied to the second portions of the first and the second roof rib panels in step (f) of claim 1 for reciprocal sealing of facing portions of the first and the second roof rib panels, the first and the second gable rib panels and the stiffening fillet (56) without substantially displacing the stiffening fillet from the desired location.

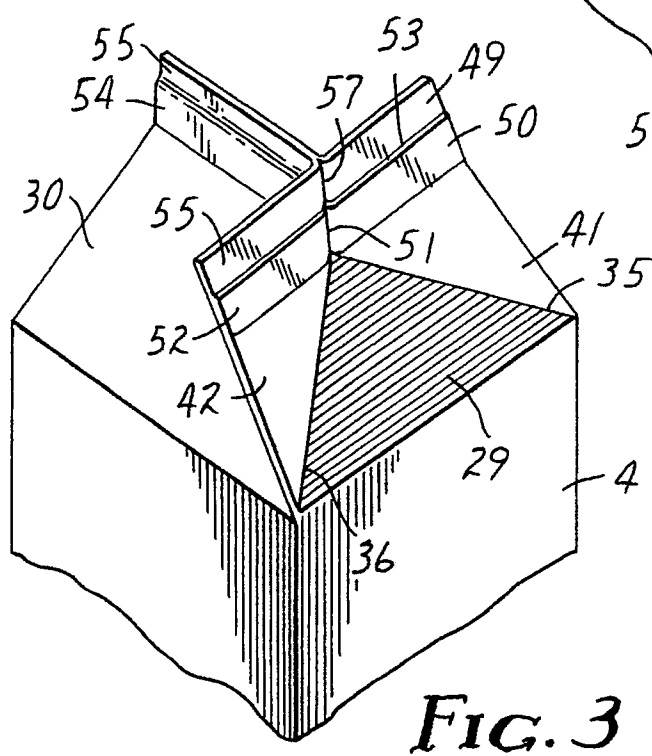
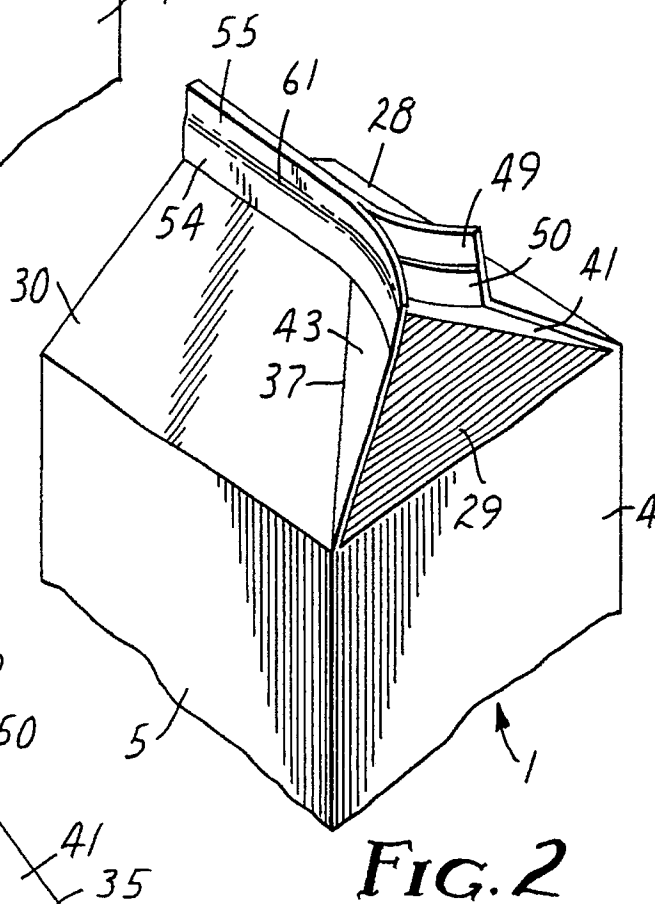
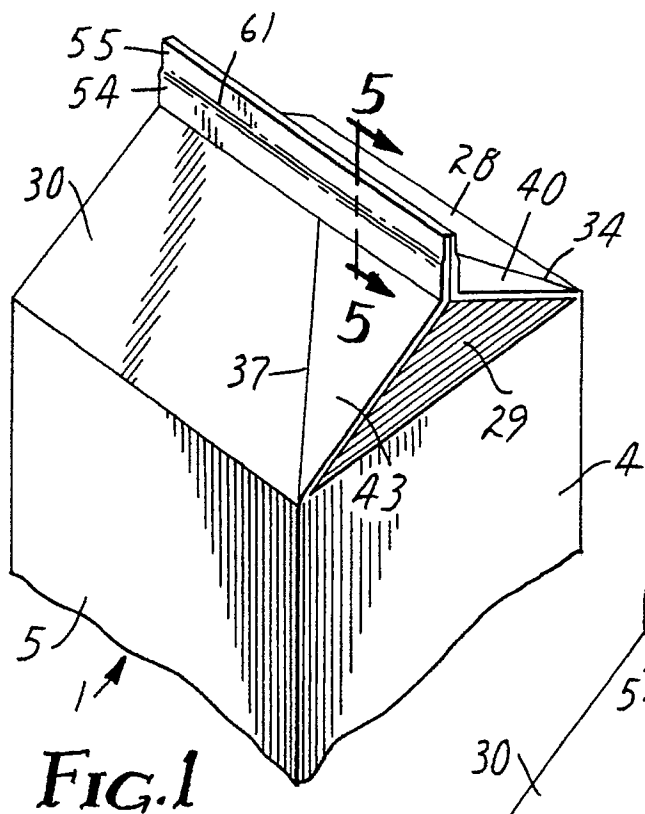
4. A gable-top container constructed according to the method of claim 3.
5. Apparatus for use with a gable-top container including a container body (1) having sides (2,3,4,5), a bottom and a top; an extensible pouring spout including a generally triangular end panel (29) connected to the container body top and extending upwardly therefrom, first and second foldback panels (41,42), the first foldback panel connected to the container body top and to one lateral edge of the first triangular end panel, and the second foldback panel connected to the container body top and to the other lateral edge of the first triangular end panel, first roof wing panel (40) adjoining the first foldback panel and connected thereto, a second roof wing panel (43) adjoining the second foldback panel and connected thereto, a first roof rib panel (48) connected to the first roof panel and the first roof wing panel, a second roof rib panel (54) connected to the second roof panel and the second roof wing panel, a first gable rib panel (50) connected to an upper edge of the first foldback panel, a second gable rib panel (52) connected to an upper edge of the second foldback panel, the uppermost end of the first triangular end panel and the first and second foldback panels forming a tip (51) of the pouring spout, a stiffening fillet (56) overlying at least a portion of and bonded to one or more of the first and the second roof rib panels and the first and the second gable rib panels for simultaneously stiffening one or more of the first and the second roof rib panels and the first and second gable rib panels and to transfer applied opening forces therealong and for limiting the force

required to open the container from the sealed condition, the fillet comprising a strip of material resistant to the temperature and pressure of the container sealing process and a layer of adhesive attached to one side of the strip and to the surface of one or more of the first and the second roof rib panels and the first and the second gable rib panels for bonding the strip thereto; the apparatus including:

- (a) a pair of sealing jaws (100,102) including opposed sealing surfaces (104,106) for compressive contact with exterior surfaces of the first and second roof rib panels, 5
- (b) means for heating the to a desired temperature sufficient for reciprocal sealing of the pouring spout of the container, and 10
- (c) means for cooperative movement of the pair of sealing jaws between positions spaced from the container and sealing positions in contact with the exterior of the first and the second roof rib panels, the invention characterized by: 15
- (d) means for compressing said pair of sealing jaws against first portions of the first and the second roof rib panels with a first sealing force sufficient for reciprocal sealing of facing surfaces of the first and the second roof rib panels and the first and the second gable rib panels of the container, while compressing second portions of the first and second roof rib panels generally overlying the stiffening fillet with a second sealing force sufficient for reciprocal sealing of the first and the second roof rib panels and the first and second gable rib panels overlying the stiffening fillet without substantially displacing the stiffening fillet from the desired location. 20 25 30 35

- 6. The apparatus of claim 5, further characterized in that said compressing means includes a recess (112,114) formed in said sealing surface (104,106) of each of said sealing jaws (100,102), said recesses being generally co-extensive with the stiffening fillet (56) when said sealing jaws are in said contact position, whereby said first sealing pressure is applied to said first portions of the first and the second roof rib panels and said second sealing pressure is applied to said second portions of the first and the second roof panels. 40 45 50

55



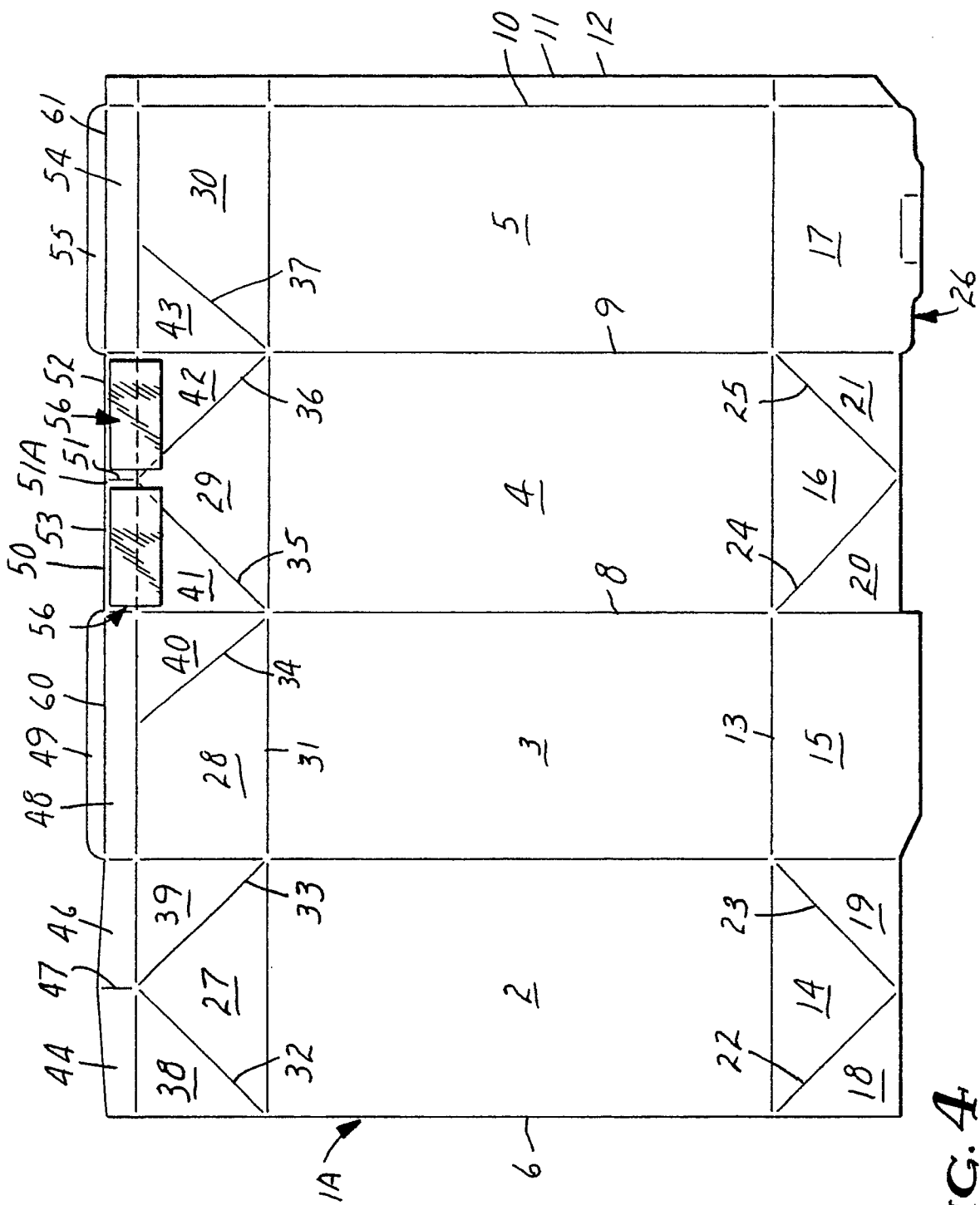


FIG. 4

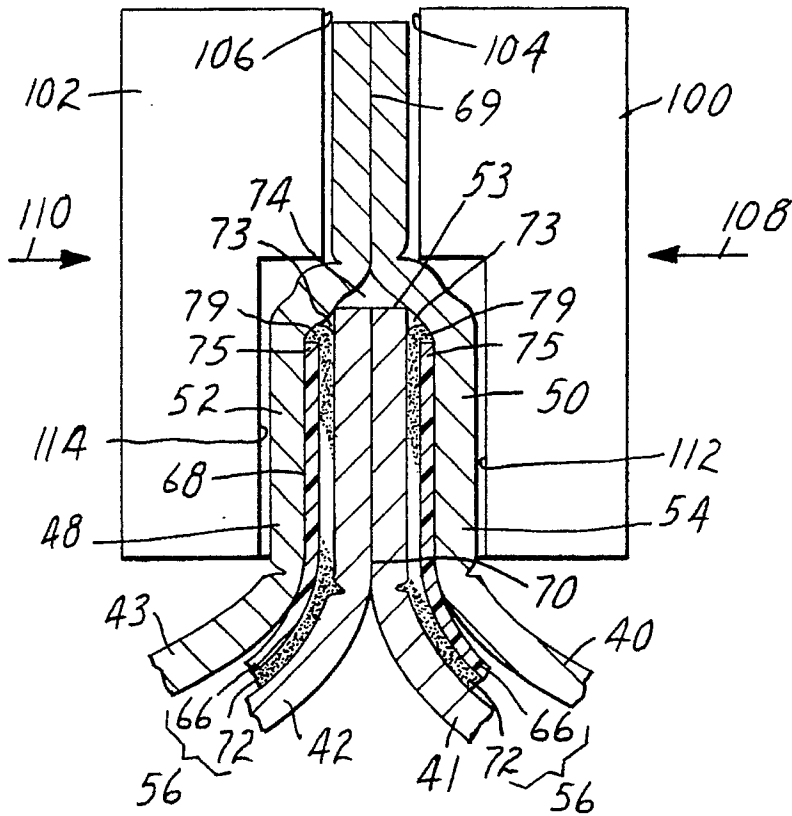


FIG. 5

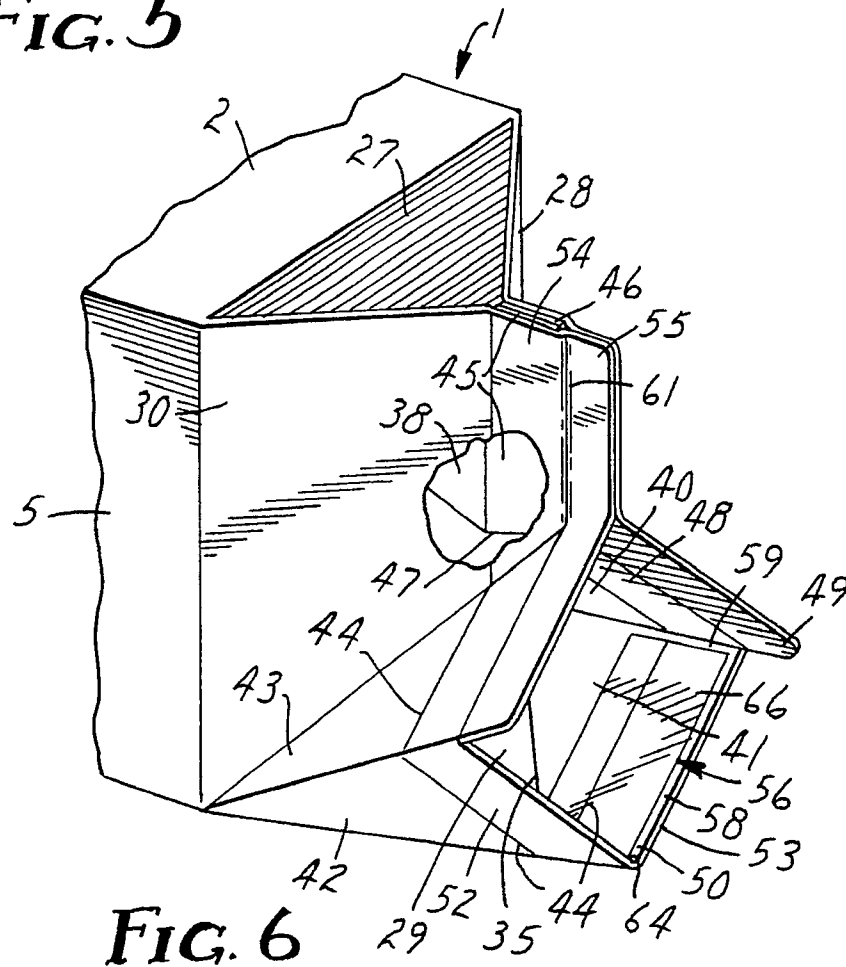
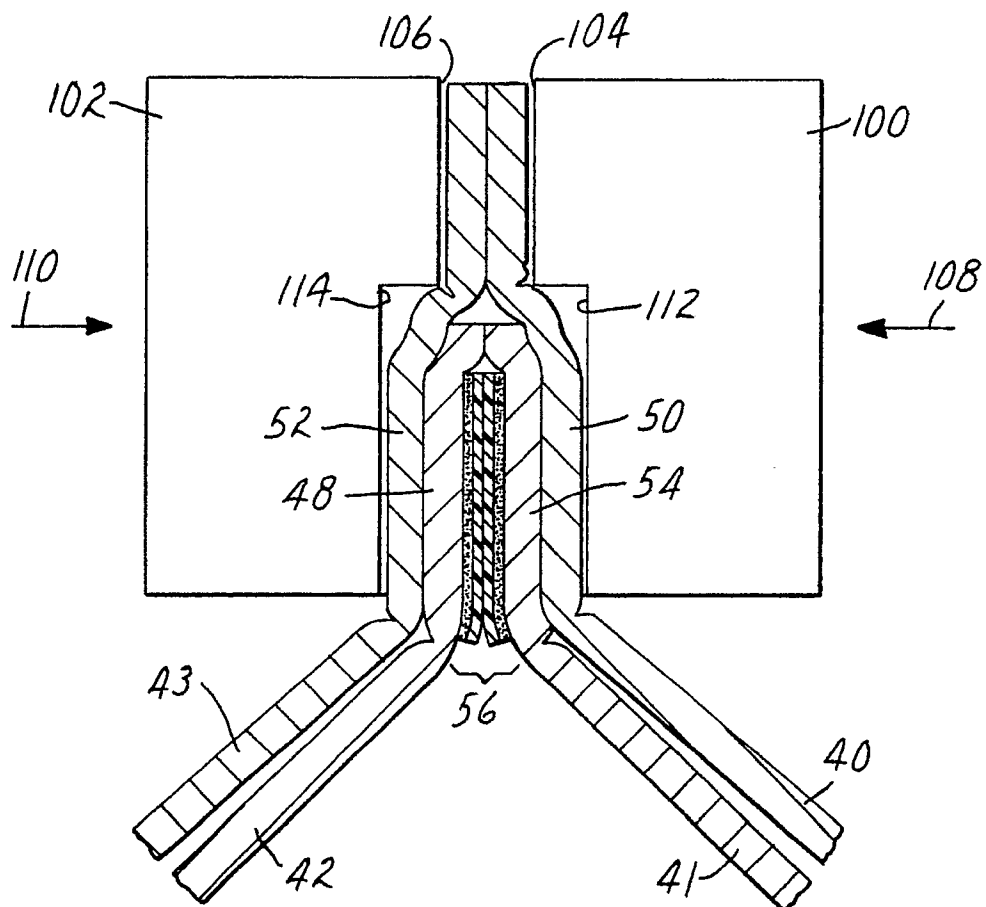
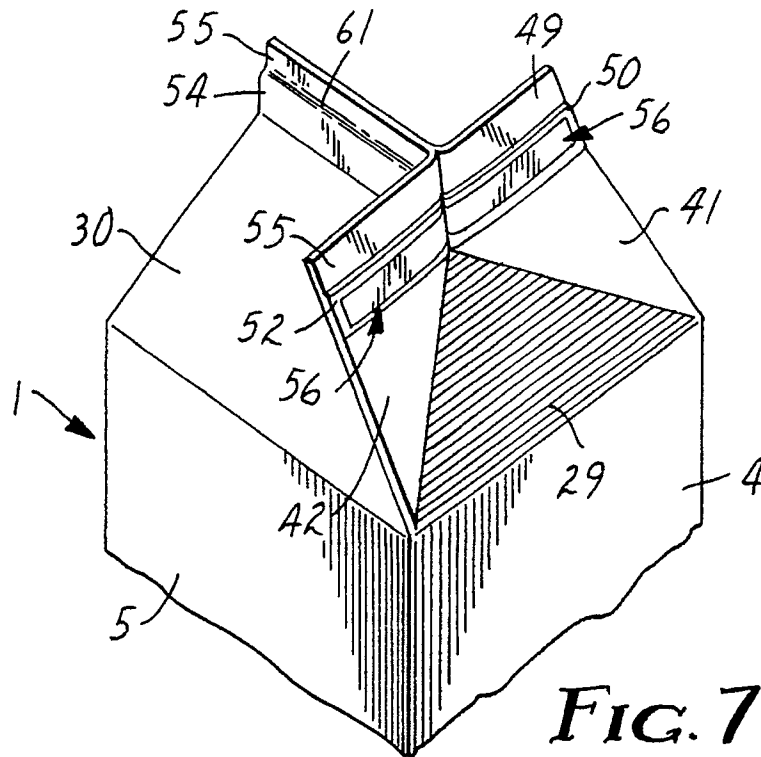
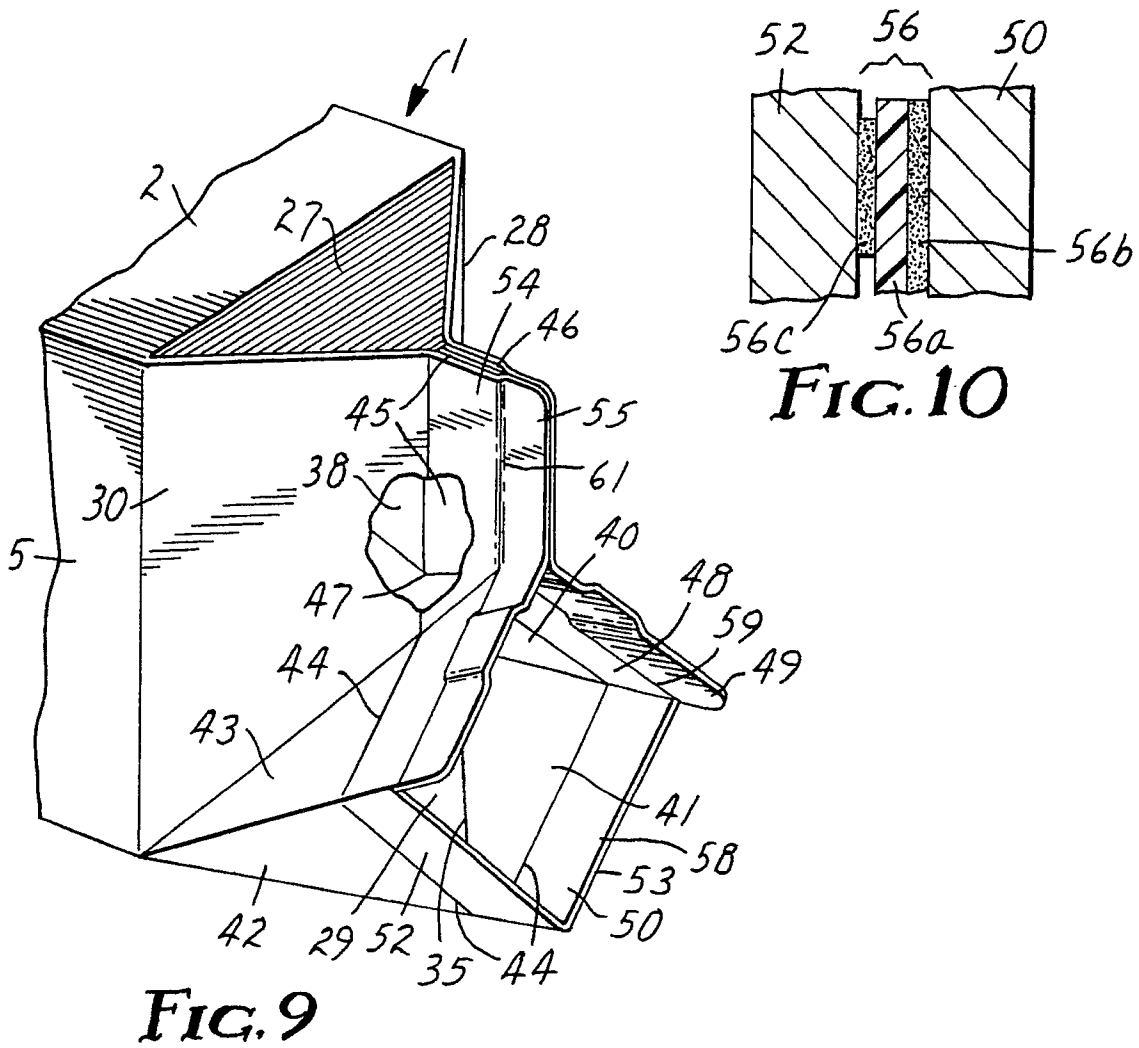
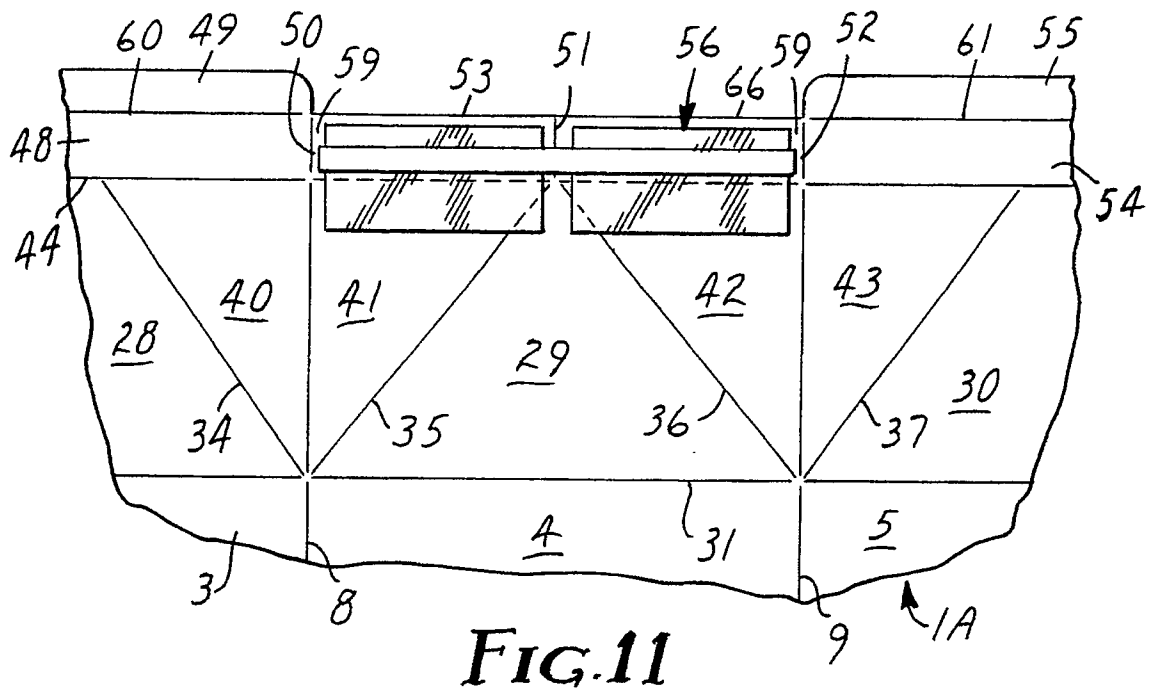


FIG. 6





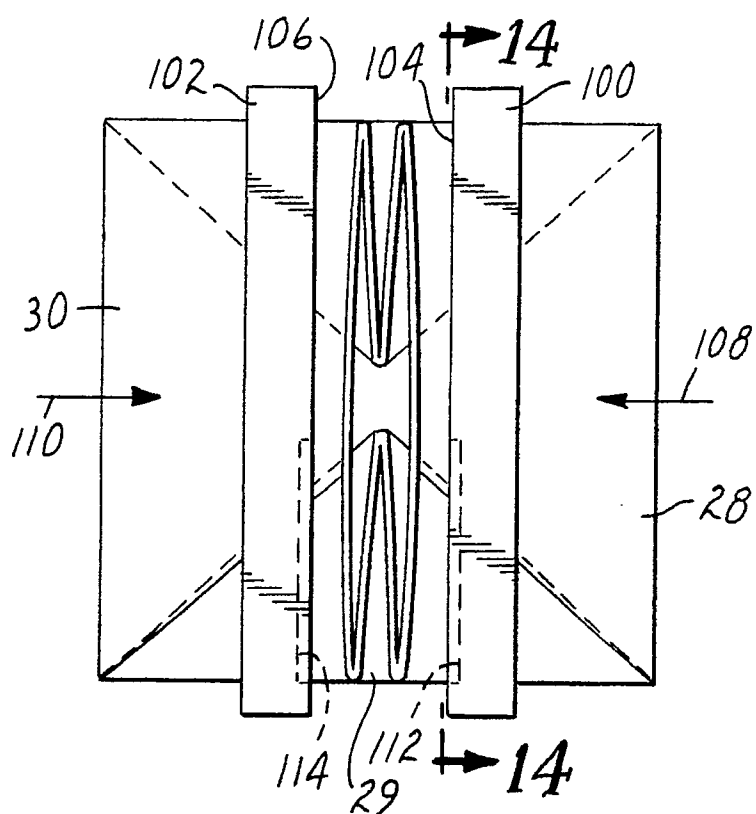


FIG. 12

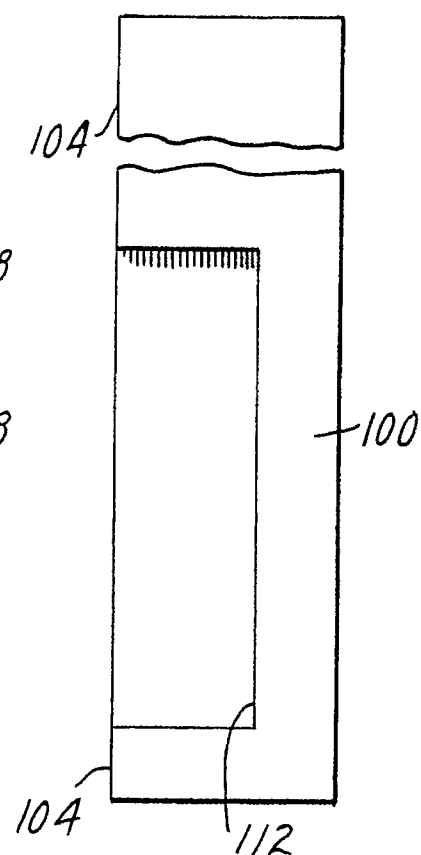


FIG. 14

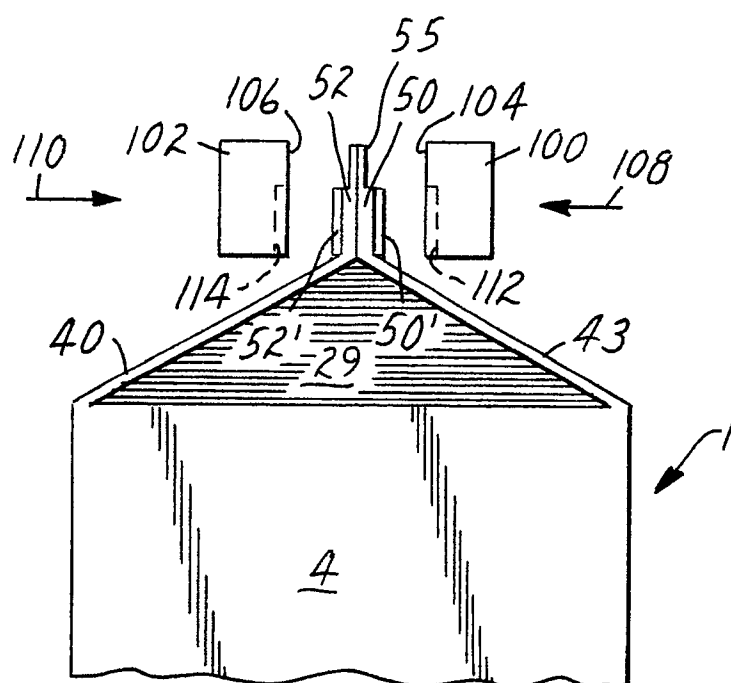
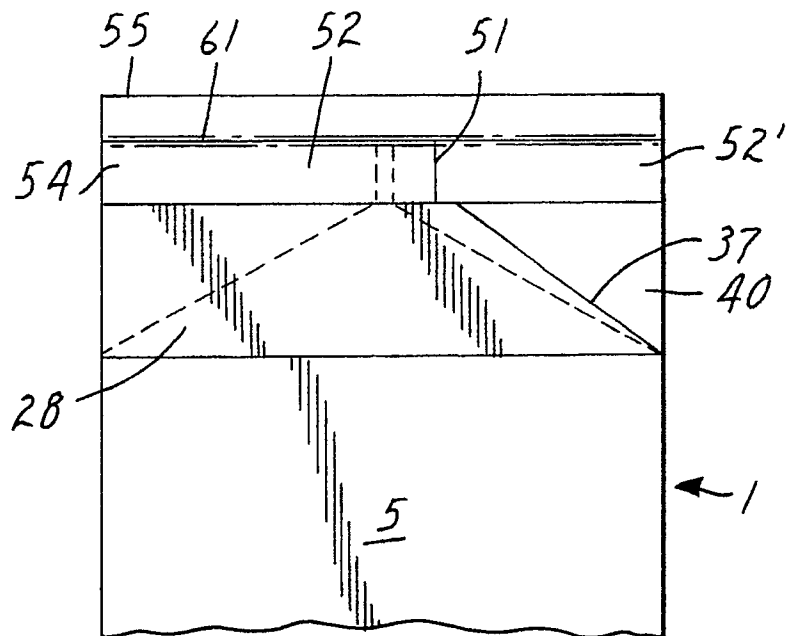
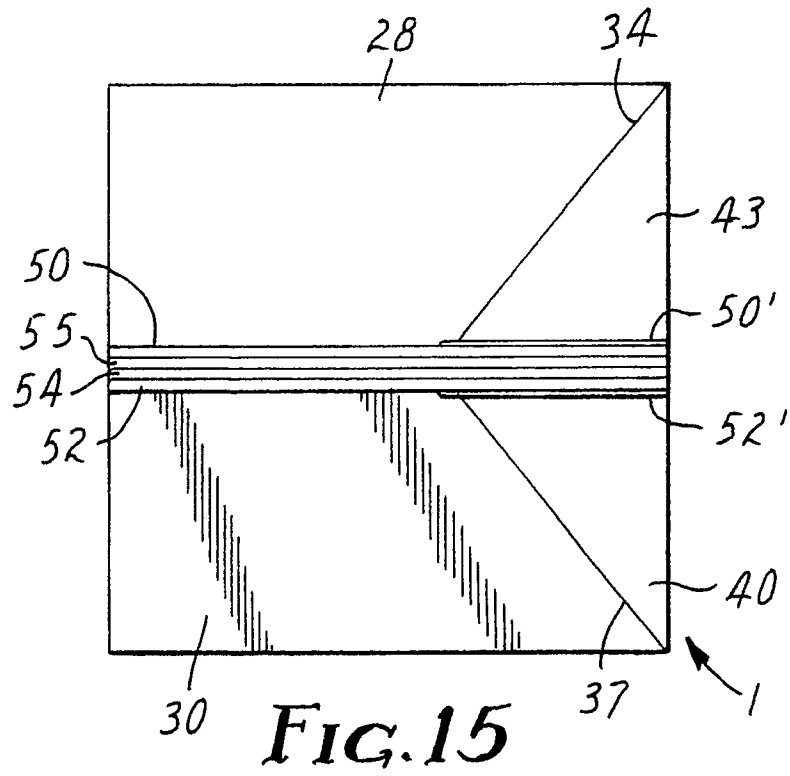


FIG. 13





European
Patent Office

EUROPEAN SEARCH REPORT

Application Number

EP 90 31 4282

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
A	US-A-4 403 465 (BACHNER) * In its entirety * -- --	1,2,3,4,5,6	B 65 D 51/14 B 65 D 5/06
A	EP-A-0 331 792 (FBI BRANDS) * Column 3, line 24 - column 4, line 6 * -- --	1,3,5,6	
A	US-A-3 956 046 (TSUCHIYA et al.) * Abstract; figure 10 * -- -- --	1,3,5,6	
			TECHNICAL FIELDS SEARCHED (Int. Cl.5)
			B 65 B B 65 D
The present search report has been drawn up for all claims			
Place of search		Date of completion of search	Examiner
The Hague		23 April 91	LEONG C.Y.
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