United States Patent [19]

Collie

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[54] **READILY OPENABLE FOAMED POLYMER CONTAINER**

[75] Inventor: **Stafford D. Collie**, Kansas City, Mo.

[73] Assignee: **Phillips Petroleum Company** Bartlesville, Okla.

[22] Filed: **March 2, 1970**

[21] Appl. No.: **15,346**

[52] **U.S. Cl.**.....**215/32,** 215/1 C, 222/541

[51] **Int. Cl.**.....**B65d 17/24,** B65d 1/00

[58] **Field of Search**.....215/32, 1 C; 222/107, 541; 220/94, 9 F; 264/51, 521; 229/66, 1.5 B, 2.5, 48 T; 206/46 FC

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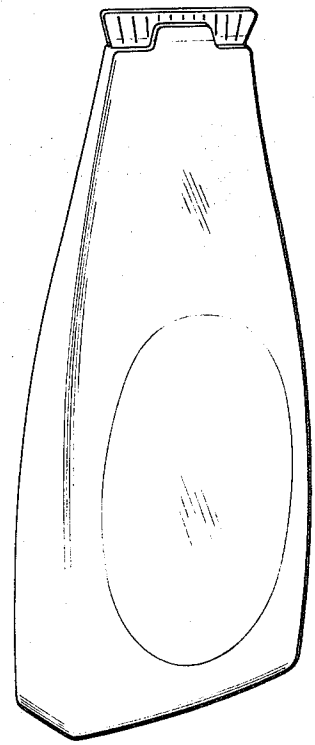
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Primary Examiner—Joseph R. Leclair
Assistant Examiner—Stephen Marcus
Attorney—Young and Quigg

[57] **ABSTRACT**

A container is constructed from a foamed polymer and closed by heat sealing. It is provided with a score line, cut, or notch, as by the sealing apparatus at the plate at which it is to be rendered openable by tearing, cutting, etc. In one embodiment a high density polyolefin, e.g., polyethylene, is foamed and formed into a container or bottle and, when filled, is heat sealed as by bringing together in a sealing head the walls of the container and simultaneously providing the score or tear line.

3 Claims, 7 Drawing Figures



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SHEET 1 OF 2

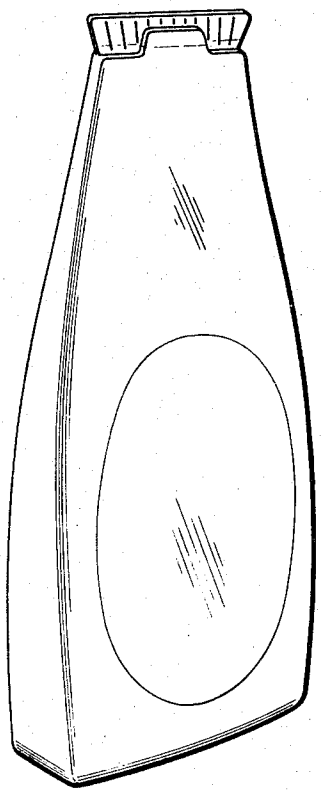


FIG. 1

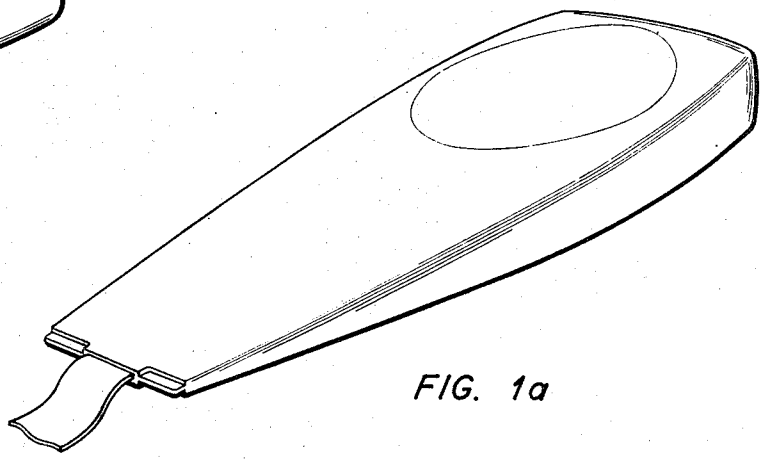


FIG. 1a

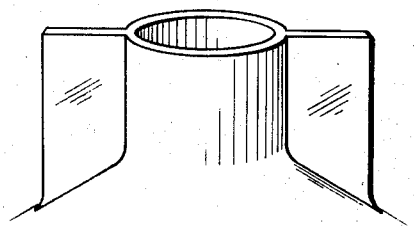


FIG. 2

INVENTOR.
S. D. COLLIE
BY Young & Quigg
ATTORNEYS

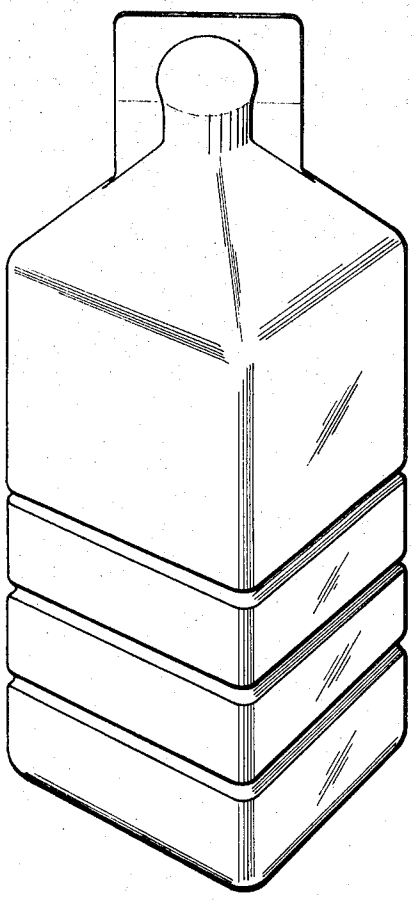


FIG. 2a

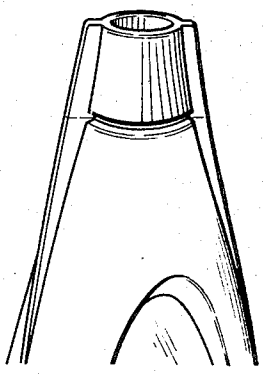


FIG. 3a

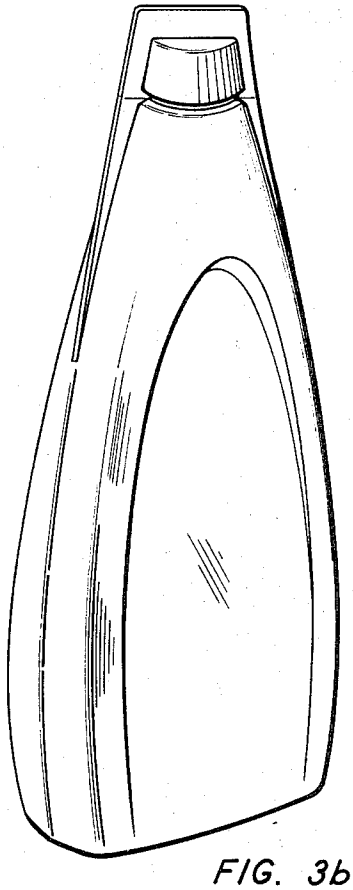


FIG. 3b

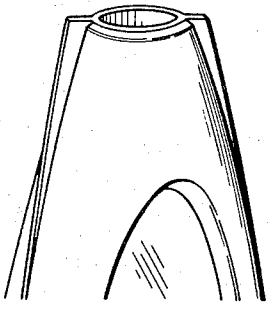


FIG. 3c

INVENTOR.
S. D. COLLIE

BY Young & Quigg

ATTORNEYS

READILY OPENABLE FOAMED POLYMER CONTAINER

This invention relates to a readily openable foamed polymer container. In one of its aspects the invention relates to providing a readily openable foamed polymer container having a place thereon at which opening of the container is facilitated. In another of its aspects the invention relates to a container which can be opened along a tear or score line without deforming the container during such opening thereof.

According to a concept of the invention it provides a foamed polymer container, said container having a score line, cut, or notch at the place at which it is to be rendered openable, said container being openable as by tearing or cutting without deforming the wall of the container at the place at which it is torn or cut open. According to another concept of the invention it provides a container or bottle as herein described made from foamed high density polyolefin, e. g., polyethylene.

The invention will now be described in connection with a foamed high density polyethylene bottle which can be made by bringing together in a mold foamed polyethylene parison, closed by heat sealing the walls adjacent the bottle opening in a manner to bring them together while in one embodiment the top at which normally the screw cap would be provided is notched or cut by the heat sealing head in an area or on the surface adjacent the top seal to serve as a weakened area to aid in initiating a tear or cut along a predetermined path when opening the bottle to remove its contents, at least in part therefrom.

I have now discovered that two sheets of foamed high density polyethylene can be heat sealed together much faster than two sheets of regular high density polyethylene of the same sheet thickness. It appears that the lower cycle time required to heat seal foamed high density polyethylene is due to the air holes or pockets in the plastic sheet. Importantly, I have further discovered that the foamed high density polyethylene, unlike regular high density polyethylene, will tear easily, that it can be cut with a scissor very easily which regular high density polyethylene will not allow and, therefore, with the observations here made as basis have designed a readily openable high density polyethylene bottle as further described herein.

The importance of my invention to the trade can be readily appreciated when it is considered that threads on light-weight foamed bottles have a tendency to strip when torque is applied to the closure. Further, by eliminating the necessity for a closure and a closure cap, considerable savings of time and cost can be made with attendant benefits to all in the useful arts involving the manufacture, sale and use of plastic containers.

It is an object of this invention to provide a readily openable polymer container. It is another object of this invention to provide a polymer container which can be readily opened without deforming the same as by tearing or cutting a portion thereof near the place at which the contents of the container are to be discharged therefrom. It is a further object of this invention to provide a readily openable container made of a polyolefin, e. g., polyethylene. Another object of the invention is to provide a container which does not have a screw cap or other independent closure mechanism thereon. It is

a further object of this invention to provide a container as herein described made of foamed polyolefin, e. g., foamed polyethylene.

Other aspects, concepts, objects and the several advantages of the invention are apparent from a study of this disclosure, the drawing and the appended claims.

According to the present invention there is provided a container made from a polymer, said container being made by first foaming the polymer and then forming it into a desired shape and providing on said container a score line, cut, or notch at which the container can be readily opened without deforming the same as by tearing, cutting, etc. In one embodiment which is now preferred the score line, cut, or notch, is provided by the sealing mechanism used to seal the container when it has been or is being shaped.

It is well known in the art to produce containers made of various polymers. It is also known in the art to provide sealed containers having score lines, cuts or notches therein.

The present invention is based upon the concept or discovery that a foamed polymer, for example, a foamed polyolefin, e. g., foamed polyethylene, can be readily torn without deformation along a score line, cut or notch, etc. provided for the purpose according to methods and with apparatus or means known in the art. As noted above, it would appear that the success of the invention resides in the foamed character of the plastic or polymer which is shaped into the container.

The polymers, and particularly the polyolefins, which are suitable can be, of course, selected by mere routine test. Different materials will give different degrees of result and will be chosen according to the particular degree of result to be accomplished.

The polymers now preferred for use in preparing the container of the invention are the high density polymeric materials prepared from olefins, e. g., ethylene, which in an unfoamed state have a density of at least 0.940 grams/cc (ASTM–D–1505–57T), and preferably 0.960 or higher. The foamed bottles made with these polymers possess particularly preferred properties as compared with other polymers. Thus, this type of ethylene polymer is now preferred for the invention, although as will be appreciated by one skilled in the art in possession of this disclosure having studied the same, conventional polyolefins, especially polyethylenes of lower density, as well as other polymers of aliphatic mono-1-olefins and other plastics and resins are within the scope of the broad concept of the invention.

The polyolefins, especially polyethylenes, which can be employed in the practice of the present invention can be prepared by any of the methods which are usually employed for the preparation of these polymers. The high density polyolefins prepared by the low pressure processes are particularly useful in the preparation of the containers of the invention as already noted above. These high density materials, e. g., high density polyethylene, can be and now are preferably prepared according to the method described and claimed in U. S. Pat. No. 2,825,721, issued Mar. 4, 1958, John Paul Hogan and Robert L. Banks. The preparation of the polymer and its foaming do not form a part of the invention except that the foamed parison or container wall is used in the formation of the con-

tainer with its appropriate score line, cut, or notch, etc. Thus, the particular process of forming the plastic polymer, polyolefin, or particular polyethylene, e. g., the now preferred high density polyethylene, does not form a part of this invention. Accordingly, the processes which can be used can be and are various. U. S. Pat. No. 3,225,127, issued Dec. 21, 1965, John N. Scott, Jr., the disclosure of which is incorporated herein by reference, sets forth various methods for the formation of the various polymers or plastics which can be used in blow molding foam bottles.

Suffice to say here that in the processes for producing the foamed polymers, various gaseous liquid and solid foaming agents can be used effectively. A method for actually forming a foamed thermoplastic is described and claimed in U. S. Pat. No. 3,342,913, issued Sept. 19, 1967, Thomas Paul Engel, the disclosure of which is incorporated herein by reference. In that patent there is set forth, described and claimed a method of producing a foamed thermoplastic which comprises conveying a thermoplastic material at an elevated temperature and pressure (such that it is at least partially plasticized), introducing forcibly into said thermoplastic material being conveyed a compact mass comprising expanding agent in solid particulate form to form a resulting end mixture under conditions of temperature to form a gas by decomposition of the expanding agent in said thermoplastic, but under a pressure to prevent any substantial formation of cells, and then reducing the pressure on the resulting end mixture to allow the expanding agent to expand and to produce said foamed thermoplastic.

Owing to the improved straight line tear or cut which can be obtained according to the present invention, there results a perforate aperture for spreading mustard, liquid margarine, or similar products normally squeezed from a bottle. Further, the type of heat seal closure provided by the invention is ideal in many industrial practices where it may be important to uniformly spread a coating such as an adhesive onto a surface. Also, because of the straight line tear or cut which can be obtained according to the invention, there can be provided a bottle or container which when opened will, nevertheless, be closable for fairly long periods of time without allowing ingress of air which can seriously adversely affect the contents of the bottle in those cases where air should be excluded.

EXAMPLE

A high density polyethylene prepared in cyclohexane in the presence of a chromium oxide catalyst according to the method of Hogan et al, supra, was formed into pellets. The polyethylene had a density of 0.960 gram/cc. (ASTM-D-1505-57T) and a melt index of 5 (ASTM-D-C1238-52T).

The polyethylene pellets were mill blended with 0.25 weight per cent of the powdered foaming agent azodicarbonamide (Celogen AZ). The mixing temperature was controlled between 300° and 340° F. The decomposition temperature of Celogen AZ is about 375°F. The mixing of polyethylene and blowing agent was continued until a homogeneous mixture was obtained. Upon completion of the mixing of the polymer and the blowing agent, the mixture was taken from the mill and then introduced into an extruder wherein the mixture was worked and heated to a temperature of about 380°–400° F.

The molten polyethylene containing Celogen AZ was extruded into the atmosphere through an annular orifice to form a foamed parison (tube) due to expansion of the foaming agent which is volatile at the extrusion temperatures and readily expands the parison outside of the extrusion die. The foamed parison was then placed in a blow mold wherein it was inflated with air and formed into a foamed polyethylene bottle having a bulk density of 32 lbs/ft.^{3}.

After formation of the bottle the bottle was filled with margarine and put into a heat sealer which pressed together and heat sealed the walls together at the top of the bottle and provided a score line thereon. This score line was almost invisible to the naked eye. Upon allowing the bottle head or top to cool so that the bottle was in the condition in which a user may find it, it was found to tear open readily, to provide a straight edge along the tear line and to evenly spread the margarine through the opening.

The parison as extruded and molded was 60 mils thick. The score line was 0.010 inches deep.

In accordance with the process of the invention, high density polyethylene can be formed and blow molded to produce hollow articles having a density as low as 2–5 lbs. per cubic foot as compared to about 60 lbs. per cubic foot for the raw polyethylene. The density of the foamed hollow articles can vary from about 2 to 60 lbs. per cubic foot and preferably from about 5 to 35 lbs. per cubic foot. The density of the product articles can be advantageously controlled by regulating the type and amount of the foaming agent in the extrudate.

The advantages of the present invention are further made evident when it is considered that conventional polyolefin packages of the type which are torn or cut open have been relatively unsatisfactory because of the difficulty experienced in cutting polyolefin sheet with scissors or tearing unoriented polyolefin sheet. Foamed polyolefin, as above described, though it cuts and tears easily, yet has the necessary strength even when relatively thin to serve as a container. Thus, I have found that two thin foamed polyethylene sheets can be readily heat sealed together and used according to the invention.

Referring now to the drawing,

FIG. 1 and FIG. 1*a* show, respectively, a container according to the invention as produced containing a material dispensable therefrom, e.g., margarine, and FIG. 1 the container being upright and sealed and in FIG. 1*a* the container having been opened and being shown dispensing the margarine;

FIG. 2 and 2*a* show another form of container, FIG. 2 showing the container at its top after it has been opened while FIG. 2*a* shows the container in full and before it has been opened;

FIGS. 3*a*, 3*b* and 3*c* show three views of a still different form of container before filling, after filling and sealing and after it has been opened.

Generally referring to the drawing, it will be seen that the cut lines or tear lines result in very even straight edges as already described. The drawings are representative of the results which have been described.

Reasonable variation and modification are possible within the scope of the foregoing disclosure, drawing and the appended claims to the invention the essence of which is that there has been provided a container made from a foamed polymer, for example, a polyolefin, e.g., polyethylene; in one form the container being produced from a high density foamed polyethylene as herein described, said container being heat sealed and marked, scored, lined or notched, etc. to provide for readily tearing open or cutting open the same to produce an even straight edge opening.

I claim:

1. A readily openable completely sealed foamed polymer container, adapted to contain a fluid, made entirely by foaming a high density polyolefin polymer, said container being marked with a line indentation along which the container is readily openable as by cutting or tearing, said indentation being formed during the sealing of said container by heat sealing and by the heat applied to said high density polyolefin polymer during said heat sealing.

2. A container according to claim 1 wherein the container is made from polyethylene.

3. A container according to claim 2 wherein the polyethylene is a high density polyethylene.

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