United States Patent [19]

Chapman et al.

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[45] **Jan. 23, 1973**

[54] **PACKAGE AND METHOD OF FORMING**

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[73] Assignee: **The Mead Corporation**

[22] Filed: **Nov. 3, 1970**

[21] Appl. No.: **49,270**

[52] **U.S. Cl.** .....**206/65 S,** 53/30, 206/45.33, 229/DIG. 12, 264/92

[51] **Int. Cl.**.....**B65d 65/16,** B65d 85/62

[58] **Field of Search**.....206/65 S, 45.33, 45.34, 46 Y, 206/46 F, 80 A; 229/2.5, DIG. 12; 220/4 E, 72; 53/30, 184; 264/92, 234, 342, DIG. 71

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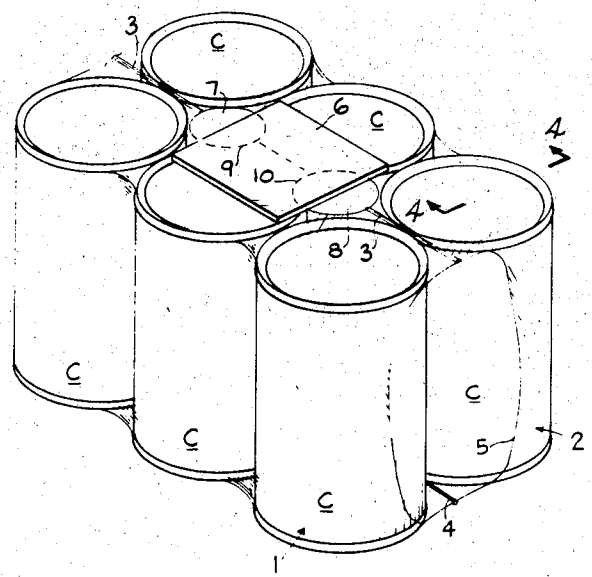
[57] **ABSTRACT**

An article package comprises a pair of complementary cavity defining half sections constituting opposite portions of an article enveloping structure, and a pair of seams forming oppositely disposed junctions between a pair of opposite edges of one half section and the corresponding edges of the other half section. The package half sections are formed of heat shrinkable sheet material which is stretched initially to form the cavities and the heating pattern and stretching operation are such that the corners of the resulting cavity defining half sections are not stretched to an unduly thin condition. After the package is formed heat is applied in a predetermined manner so as to shrink the half sections into conformity with the packaged items and so as to control the thickness of certain areas of both half sections.

7 Claims, 13 Drawing Figures



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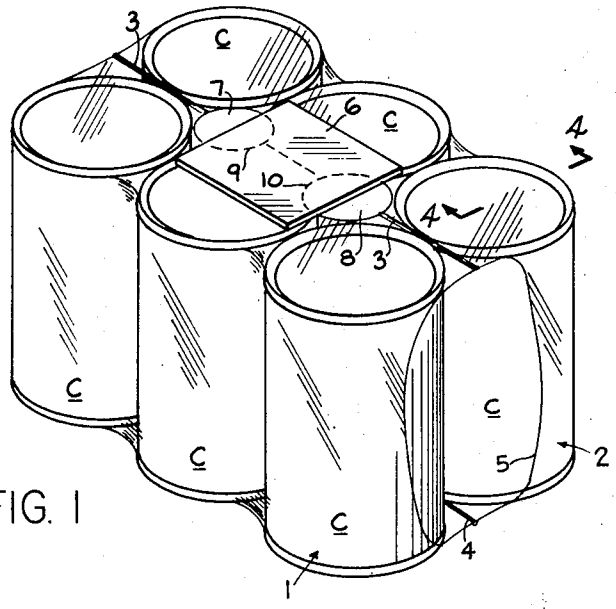

FIG. 1

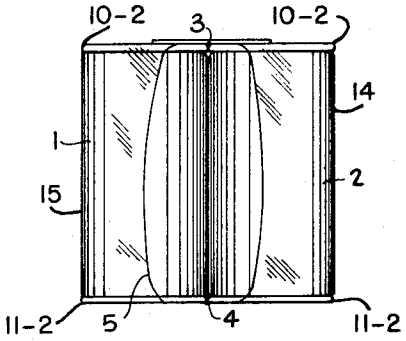

FIG. 2

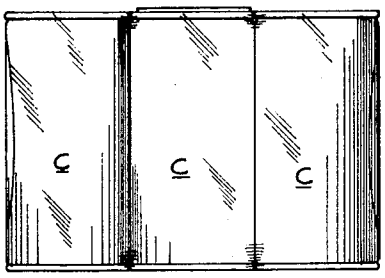

FIG. 3

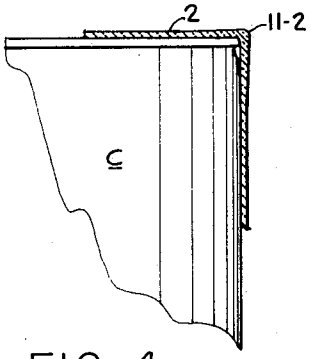

FIG. 4

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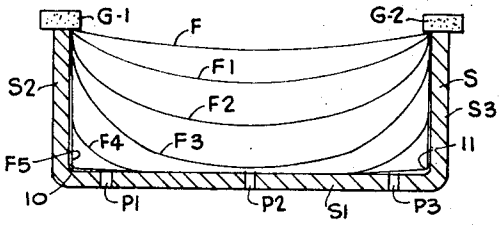

FIG. 5

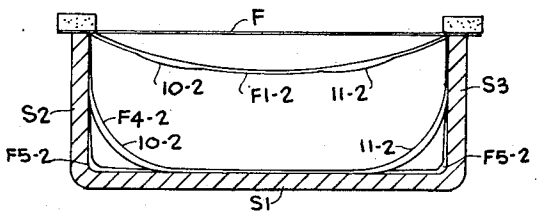

FIG. 6

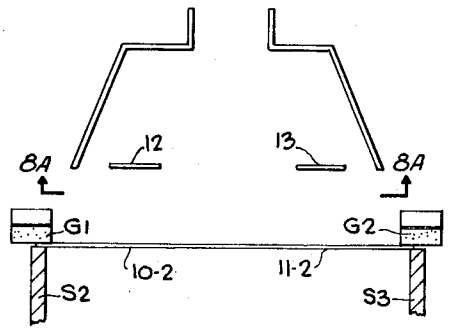

FIG. 7

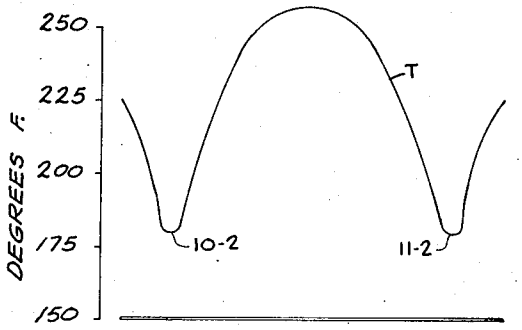

FIG. 9A

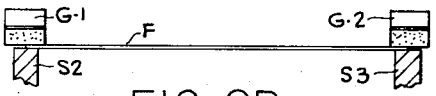

FIG. 9B

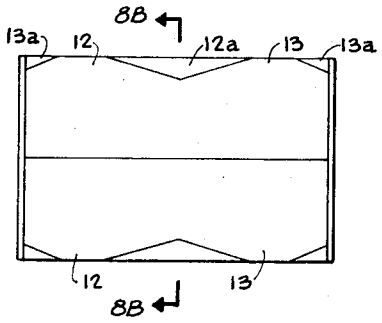

FIG. 8A

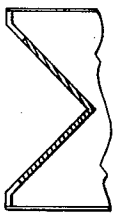

FIG. 8B

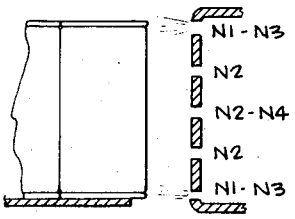

FIG. 10B

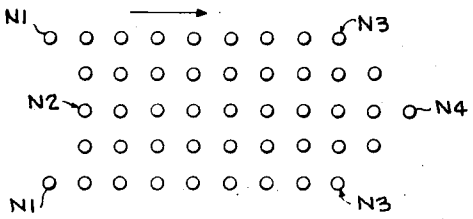

FIG. 10A

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PACKAGE AND METHOD OF FORMING

According to the invention a pair of half sections are individually formed by a heating and stretching operation, and such half sections constitute complementary portions of a completed article enveloping structure, the half sections being secured to each other along a pair of seams disposed medially of the package. According to a feature of the invention, the half sections are formed in such manner that the portions thereof which constitute the corners of the completed package are not unduly thin and hence are sufficiently strong and after assembly of a package, an application of heat is made to cause the half sections to shrink into conformity with the packaged items. If desired, a combination reinforcing and labeling sheet may be secured to the half sections and disposed astride one of the seams. Perforate areas may be formed in the reinforcing and labeling sheet and in the half sections and disposed astride one of the seams to form finger gripping apertures when ruptured.

For a better understanding of the invention reference may be had to the following detailed description taken in conjunction with the accompaning drawings in which

FIG. 1 is a perspective view of a completed package constructed according to the invention;

FIG. 2 is an end view of the package depicted in FIG. 1;

FIG. 3 is a side view of the package depicted in FIG. 1;

FIG. 4 is an enlarged sectional view taken along the line designated 4—4 in FIG. 1;

FIG. 5 is a cross sectional view of a straight-walled mold and a schematic representation of four stages of the forming process whereby a sheet of stretchable and heat shrinkable film is formed into a cavity defining half section wherein the film is at uniform temperature,

FIG. 6 is a view similar to FIG. 5 wherein certain areas of the film are heated to higher temperatures than other areas;

FIG. 7 is a schematic cross sectional view of a hot air nozzle employed to effect differential heating of the film;

FIG. 8A is a view along line 8A—8A in FIG. 7;

FIG. 8B is a sectional view taken on line 8B—8B in FIG. 8A;

FIGS. 9A is a diagrammatic representation of the temperature gradient across the width of a strip of plastic film heated by the nozzle of FIGS. 7, 8A and 8B;

FIG. 9B is a cross sectional view of the plastic film and its side clamping means;

FIG. 10A is a side elevation view of a schematically represented nozzle structure for applying heat to the sides and corners of the completed package to shrink the package into conformity with the packaged items.

FIG. 10B is an end view of the carton and nozzle arrangement of FIG. 10A;

In the drawings the packaged cans are designated at C and are enveloped by a pair of half sections generally designated by the numerals 1 and 2. These half sections 1 and 2 define a pair of cavities which envelope the primary packages designated C. As is apparent in the drawings, the half section 1 is complementary to the half section 2 and is secured thereto along top seam 3 and bottom seam 4. The seams 3 and 4 could constitute any suitable type of known junction such as is formed

by directing a blast of hot air or the like against closely secured edges of the half sections 1 and 2. The ends of the package are open as indicated at 5 although for some applications of the invention it may be desirable to provide a package having closed ends.

For the purpose of reinforcing seam 3 and in order to provide suitable labeling means, a sheet of material designated by the numeral 6 may be disposed astride the seam 3 and secured to the adjacent portions of half sections 1 and 2. Thus the combination reinforcing and labeling sheet 6 strengthens the package along the seam 3 and provides suitable means for labeling the primary packages C and, if desired, affords a limited amount of billboard space.

In order to render the package readily portable, a pair of perforate areas designated by the numerals 7 and 8 are formed in the portions of half sections 1 and 2 which are disposed immediately adjacent the seam 3 and such areas extend into the reinforcing and labeling sheet 6 as indicated by the perforated semi-circular lines 9 and 10. In order to lift and carry the package, fingers are simply inserted against the areas 7 and 8 and pushed downwardly to rupture the material along the perforate lines and to cause the portions enclosed within the circular areas 7 and 8 to swing downwardly and inwardly and thus form a suitable carrying mechanism for the package as is obvious from FIG. 1.

The half sections 1 and 2 preferably are formed by a vacuum process which when applied to a cavity defining half shell to the edges of which a strip of heat sealable stretchable material is secured causes the material to conform with the inner surface of the half shell. During or immediately prior to the formation of the half sections by a vacuum stretching operation, an application of heat is made to the plastic sheet. Care must be taken to control the application of heat so as to prevent undue thinning of the sheet as the forming operation is completed at the corners of the half shell.

The material F is ordinarily a sheet of non-oriented plastic film of substantially uniform thickness. The half shell is designated by the letter S and a pair of gripping elements G1 and G2 engage the edges of Film F and hold the edges in secure engagement with the edges of the half shell.

Vacuum is applied from outside the shell S through the ports schematically shown at P1, P2 and P3. Thus as is apparent from FIG. 5, the film F is caused to assume a bowed configuration through various stages designated for example by F1, F2, F3, F4, and F5. At Stage F4, the center portion of the film is in secure engagement with the bottom portion S1 of the shell S and the film F is also in engagement with the sides S2 and S3 of shell S. Thus substantial heat is given up by the film by conduction to the bottoms and sides of shell S when stage F4 is reached. Continued application of vacuum pressure through ports P1 and P3 thus tends to impart a substantial stretching and thinning action to the corner portion of Film F until it arrives at the complete stage designated at F5. If the operation proceeded as described in connection with FIG. 5, it is obvious that the corner portions of the half shell would be quite weak in the areas designated generally by the numerals 10 and 11.

In order to guard against undue thinning of the half shell at the corners such as 10 and 11, a patterned ap-

plication of heat is made to the film F so as to achieve the result designated schematically in FIG. 6. For example the stage of formation designated at F1–2 indicates that the film has retained substantially its original thickness in the region designated by the numerals 10–2 and 11–2. Thus when the intermediate stage is passed as designated in FIG. 6 at F4–2 the corner portions 10–2 and 11–2 are somewhat thicker than the remaining portions of the half section. When the shell is completely formed, the corner portions designated as F 5–2 are perhaps of the same general thickness as the remaining portions of the half section. Actually the corner portions may be slightly thicker than the remaining portions depending on the particular degree and manner of application of heat as by a special nozzle. For example and as is shown by the nozzle designated schematically as FIG. 7 and FIG. 8A, baffles such as 12 and 13 are utilized in the hot air nozzle so as to reduce the heating of the film F in the regions which ultimately become the corners and which in the drawings are designated by the numerals 10–2 and 11– 2. Openings 12A and 13A allow the flow of air. Since these areas are heated to a lesser degree than other areas of the film, the areas 10–2 and 11–2 do not stretch and become thin as much as other areas during the final stages of the stretching operation represented at F5 in FIG. 5 and at F5–2 in FIG. 6.

FIG. 7 is schematic and FIGS. 8A and 8B simply represent front and side views of the nozzle shown schematically in FIG. 7.

The temperature of the film across its width is represented by FIG. 9A. FIG. 9B simply is a schematic cross sectional representation of FILM F and of the edges S2 and S3 of the shell S as well as grippers 1 and 2. FIG. 9A represents the temperature of film F from one side to the other. The low points of the temperature diagram T are represented by the numerals 10–2 and 11–2 and as is obvious from the above description and from FIG. 6 correspond to the portions of the film which ultimately become the corners of the half section.

In FIG. 9A the data represents a film having a high modulus of elasticity and a high glass transition temperature. For materials having lower modulus and lower glass transition, lower temperatures can be used.

After the half sections are formed, they are secured together along opposite edge portions to produce a package generally of the type shown in FIGS. 1, 2 and 3.

In order to cause the half sections 1 and 2 to conform snugly to the exterior of the package group and to maintain the desired degree of orientation in the top panel and the maximum retention of film thickness at the critical outer edges of the top and bottom panels, designated 10–2 and 11–2 in FIG. 11, shrinkage heat is deployed in a specific manner.

Because the top panel which extends between corners 10–2 and 10–2 and the bottom panel which extends between corners 11–2 and 11–2 in FIG. 2, received less orientation than side panels between corners 10–2 and 11–2, it is desired to shrink this area less and thereby maintain maximum impact strength. The desired effect can be achieved by first directing heat at the package corners to allow material in these areas to thicken before any appreciable shrink tension is developed in the film shell. After the corners have been allowed to thicken, heat is then directed at the side panels (14 and 15) to increase tension of the film by shrinking over a much larger area, thereby producing a tight package by stressing the material around the package corners and to produce required tension in the top panel. Heat is deployed by a nozzle design depicted in FIG. 10A and FIG. 10B. As the package moves across the stationary nozzle of FIG. 10A, the corners are first heated at N1 and after shrinking locally heat is applied to the sides at N2.

For most polyvinyl film formulations having a modulus of elasticity between 75,000 pounds per square inch and 240,000 pounds per square inch, the temperature of the film should be in the range between 130° F. and 225° F for a period from 1 to 4 seconds. In order to prevent over heating at the corners the heating nozzle is discontinued at the corners at position N3 but intermediate parts of the side panels are heated until N4 is transversed.

Such heat application provides balanced orientation by not destroying orientation in areas of low initial orientation such as the top and bottom panels.

From the above description, it is apparent that the strength and reliability of the package formed according to the invention is significantly enhanced by the patterned application of heat during the formation of the half sections and during the shrinking operation performed following completion of the assembly operation of the package whereby the half sections are drawn into snug conformity with the exterior portions of the articles packaged within the enclosure formed by the half sections 1 and 2.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. A package comprising a group of articles arranged in side-by-side rectilinear relation with their axes generally parallel to each other, a pair of complementary cavity defining half sections formed of non-oriented polyvinyl chloride and forming opposite portions of an article enveloping structure disposed about the article group, a pair of seams forming oppositely disposed junctions between a pair of opposite edges of one of said half sections with the corresponding edges of the other half section, said half sections being stretch formed of heat sealable and orientable sheet material and said seams being disposed generally medially of the package and adjacent the ends of the packaged articles, the corner portions of said half sections which interconnect the side walls of the article enveloping structure with the top and bottom walls being heated to a lower temperature than the adjacent portions of said structure during the forming process thereby to limit the thinning of such corner portions during stretching, and a combination reinforcing and labeling sheet disposed astride one of said seams and secured to adjacent portions of said half sections.

2. A package according to claim 1 wherein the sides of the package are heated sufficiently to impart article conforming shrinkage thereto, the heating of the sides of the package being initiated and terminated after the heating of the corner portions of the package is initiated and terminated respectively.

3. A package according to claim 1 wherein the corner portions of the package are heated after formation of the package to cause shrinkage and thickening of said corner portions.

4. A package according to claim 1 wherein the corner portions of the package are heated after formation of the package to cause shrinkage and thickening of said corner portions and wherein the sides of the package are heated following heating of the corner portions sufficiently to impart article conforming shrinkage thereto but without restoring said side walls to a fully non-oriented condition.

5. A method of forming a package comprising the steps of heating a pair of sheets of heat shrinkable plastic material of substantially uniform thickness in such manner that certain areas thereof adjacent the corner portions are heated to higher temperatures than the corner areas, imparting a sheet stretching force to said sheets to form two series of package half sections and so as to impart a greater degree of stretch to the areas heated to higher temperatures than said corner areas whereby the thickness of said certain areas is reduced to a greater extend than the thickness of said corner areas, securing complementary half sections together about the contents of a package and heating the corners of both half sections prior to heating other portions while continuing the heating of said other portions after cessation of heating of said corner portions to shrink the half sections about the contents of the package.

6. A method of forming a package comprising the steps of drawing each of a pair of sheets of plastic material into cavity defining cube-like shells respectively to form a pair of half sections, heating said sheets during and prior to the drawing of said sheets into said shells in such manner that areas thereof adjacent the corner forming portions thereof are heated to higher temperatures than the corner forming portions, moving said half sections into enveloping relation relative to one or more articles to be packaged, securing opposite edges of said half sections together, and heating the package sequentially and in such manner that the corners of the package are heated first and in a manner to cause thickening thereof and so as to cause article conforming shrinkage of the package following heating of the corners.

7. A method according to claim 6 wherein the sides of the package are subsequently heated sufficiently to cause article conforming shrinkage without causing substantial change in the orientation of said plastic material due to the drawing thereof into said shells.

* * * * *