

Jan. 21, 1969

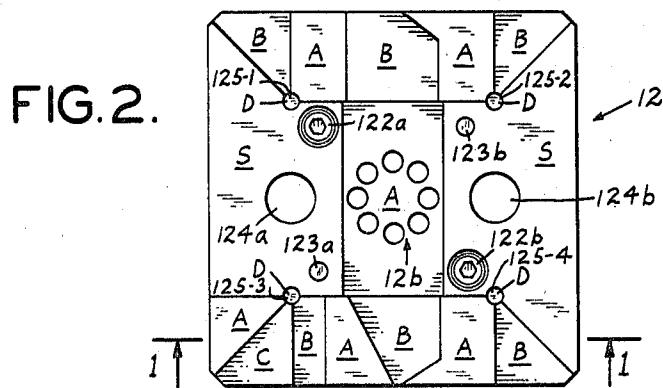
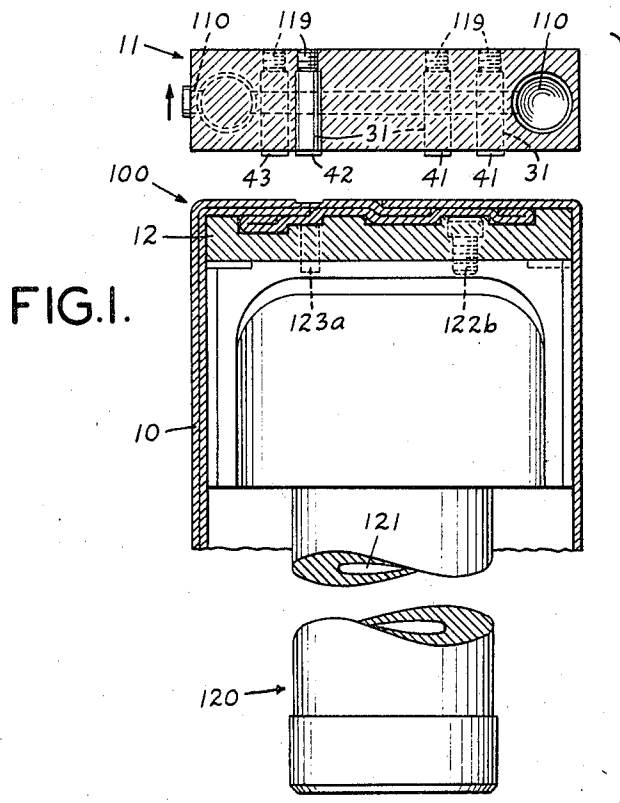
R. C. MITZELFELT ETAL

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CONTAINER FABRICATING APPARATUS

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FIG.3.

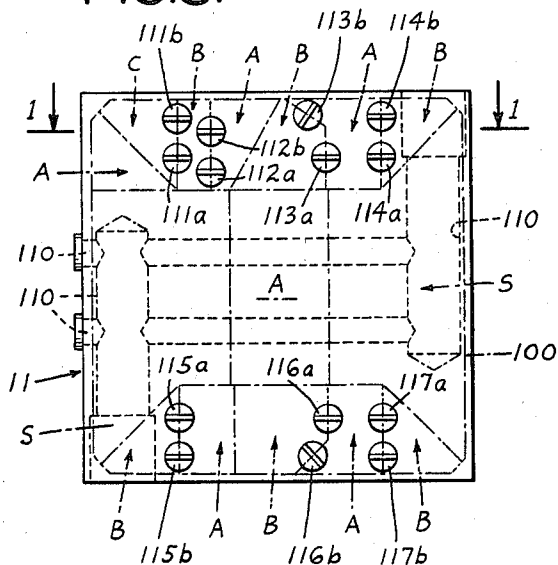


FIG.4.

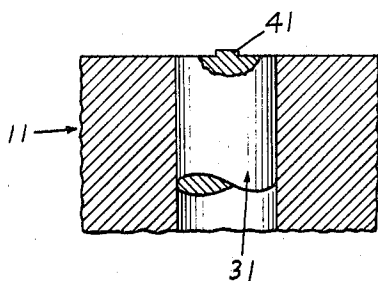


FIG.5.

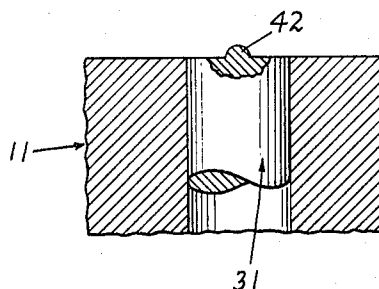
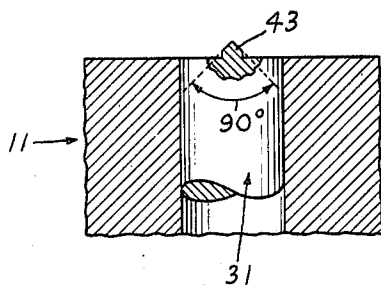


FIG.6.



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CONTAINER FABRICATING APPARATUS

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Filed Dec. 7, 1966, Ser. No. 599,768

U.S. Cl. 93—36

7 Claims

Int. Cl. B31b 1/02, 1/28, 1/44

ABSTRACT OF THE DISCLOSURE

Apparatus for closing the bottom of a paperboard container which includes a mandrel over which the paperboard container, with both ends open, is placed and the end closure of the container is folded, and a pressure pad for engaging the folded end closure of the container and, with said mandrel, applying pressure thereto, the mandrel having a predetermined configuration of areas selected ones of which are inwardly relieved to various depths to receive in the inwardly relieved mandrel areas multiple layers of the container end closure, the pressure pad having a flat surface for engagement with the folded container end closure and a plurality of pairs of projecting pressure stakes extending outwardly from the flat surface for applying increased pressure to corresponding points in the container end closure.

This invention relates to the fabrication of paperboard containers, and in particular to the fabrication of the bottom closure of paperboard containers.

Paperboard containers are widely used for packaging a variety of products, including foods and beverages, one well known paperboard container being the so-called gable top container of the type shown in C. R. Alden Patent No. 2,750,095, issued June 12, 1956. Such containers are typically erected or assembled from blanks of a predetermined geometrical configuration which have been cut from a roll of paper sheet stock having a coating of a protective thermoplastic material such as wax or polyethylene. Also, score lines are impressed on the blanks to define the top closure, bottom closure, and side wall elements of the assembled container. Ordinarily, a paperboard container of this type is assembled on automatic machinery by folding and sealing a blank into a tubular body open at both ends, sealing together the bottom closure panels of the blank, filling the container with the desired product, and finally sealing together the gable top closure panels of the blank.

Since the bottom of a paperboard container is especially susceptible to damage, it is particularly important to fabricate the bottom closure of the container to have sufficient strength and leak resistance to maintain the integrity of the container even under severe conditions of use. One of the important factors in constructing a bottom closure to have sufficient strength and leak resistance is the structure of the bottom closure panels, an example of a unique bottom closure structure being described in the co-pending application filed on even date herewith. Another important factor in fabricating a bottom closure to have sufficient strength and leak resistance is the manner in which the bottom closure panels are sealed together. Patent No. 2,357,535, issued to C. Z. Monore on Sept. 5, 1944, discloses one well known arrangement for sealing together

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the bottom closure panels, in which a container blank, previously formed into a tubular body open at both ends, is positioned over a mandrel, the bottom closure panels are folded over one end of the mandrel, and a pressure pad is forced with a desired degree of pressure against the bottom closure flaps folded over the mandrel end. In the case of containers constructed from paperboard stock coated with a heat and pressure sensitive thermoplastic material, the application of heat renders the thermoplastic coating of the bottom closure panels adhesive, so that the subsequent application of pressure by the pressure pad produces a more effective sealing together of those portions of the bottom closure panels which are forced into contact with one another.

Because of the folding of the various panels which comprise the bottom closure structure, potential leak paths for packaged fluids are created between the folded plies of paperboard in the bottom closure structure. One approach to preventing leakage through such paths is described in Patent No. 3,120,335 issued to H. B. Egleston et al. on Feb. 4, 1964, in which increased pressure is applied to selected areas of the bottom during the sealing operation in order to produce on these areas indentations or embossments which block potential leak paths. Increased pressure may be applied to selected areas of a container during the sealing operation by constructing the surface of the mandrel end to be flat, and by constructing the surface of the pressure pad to have raised areas and projecting pressure stakes. In this manner, more pressure is applied to those portions of the bottom closure structure which are pressed between the mandrel end and the raised areas and stakes of the pressure pad than to the other portions of the bottom closure structure. However, with this arrangement it is necessary to align the pressure pad with the mandrel end to fairly close tolerances, since relatively small errors in alignment will result in applying increased pressure to portions of the bottom which do not need it and in failing to apply increased pressure to those portions of the bottom which require it. Further, by constructing the surface of the mandrel end to be flat and the surface of the pressure pad to have raised areas, the application of pressure on the bottom closure panels between the mandrel and pressure pad tends to force overlapping plies of the bottom closure elements outward, that is, toward the exterior of the container, wherever the flat mandrel end opposes unraised or relieved portions of the pressure pad surface, thereby to form bulges on the exterior surface of the container bottom. These bulges on the bottom of the completed container are undesirable because they are likely to receive relatively more wear and scuffing than other portions of the bottom. Also, the presence of bulges on the container bottom tends to make the container somewhat unstable, which not only is an undesirable characteristic from the standpoint of consumer acceptance but also contributes to excessive wear and scuffing of the container bottom.

In the present invention there is provided a unique mandrel and pressure pad arrangement which produces a strong, leak-resistant bottom closure having a relatively flat outer surface without requiring highly accurate alignment between mandrel end and pressure pad. The surface of the pressure pad of this invention is totally flat except for projecting pressure stakes, and the surface of the opposing mandrel end is divided into a pattern of relieved and unrelieved areas corresponding to the pattern of

multiple layer areas of various thickness in a particular, folded bottom closure. In this manner, the application of pressure on the bottom closure panels between the mandrel end and the pressure pad of this invention tends to force overlapping plies of the bottom closure elements inward, that is, toward the interior of the container, wherever the flat surface of the pressure pad opposes relieved portions of the surface of the mandrel end. By this construction, whatever bulges are formed appear in the interior of the container where they do not affect the stability or durability of the container. Also, since the tubular carton blank is positioned over the mandrel end before the bottom closure is sealed, by providing the pattern of relieved and unrelieved areas in the surface of the mandrel end rather than in the surface of the pressure pad, a more positive and more consistent alignment is established between the pattern of overlapping plies of various thicknesses in the folded bottom closure and the corresponding relieved and unrelieved areas. This more positive alignment not only results in more accurate application of increased pressure to those portions of the bottom which require it, which results in better sealing of the bottom closure elements, but also makes the accuracy of the alignment between the pressure pad and the mandrel end substantially less critical.

Further, the more positive alignment between overlapping plies of various thicknesses in the folded bottom closure and the relieved and unrelieved portions of the mandrel end surface also permits more effective blocking of potential leak paths by the projecting pressure stakes in the pressure pad. In addition, more effective blocking is obtained because of the formation of a relatively flat outer surface of the bottom closure which thereby allows the pressure stakes in the pressure pad to penetrate relatively evenly into the outer surface of the container bottom rather than differentially over "steps" or folds in the bulged portions of the outer surface of conventionally formed bottom closures.

Another important feature of the pressure pad of this invention is the construction of the projecting pressure stakes to have specialized blade edges to block potential leak paths in different folds in the bottom closure panels. Thus each of those stakes which must reach especially remote potential leak paths is provided with a relatively sharp blade edge having two substantially planar sides which include an angle of about ninety degrees and a greater height than any of the other stakes. Further, those stakes which have a reduced force available to them, for example, those in the proximity of the stakes with relatively sharp blade edges, are provided with fully radiused blade edges, that is, an approximately semi-circular cross-section, and a somewhat greater height than the other stakes except the relatively sharp blade edge stakes, in order to make effective use of the reduced force available.

Those skilled in the art will immediately recognize from the following description and appended drawings that the principles of the present invention may be applied with advantage to the fabrication of bottom closures of various structures, sizes, and materials, it being understood that this description is intended for illustrative purposes only and in no manner to limit the invention.

The invention will be fully understood from the following detailed description of illustrative embodiments thereof taken in connection with the appended drawings, in which:

FIG. 1 is a sectional view of a mandrel and pressure pad arrangement embodying the principles of this invention, including a sectional view of a folded bottom closure positioned over the end of the mandrel;

FIG. 2 is a plan view of the surface of a mandrel end embodying the principles of this invention;

FIG. 3 is a plan view of the surface of a pressure pad embodying the principles of this invention; and

FIGS. 4, 5 and 6 are fragmentary sectional views illustrating the special configurations of the various blade

edges with which the pressure stakes are provided in the pressure pad of this invention.

Referring to FIGS. 1, 2 and 3, FIG. 1 shows a container 10 positioned over the end 12 of mandrel 120 with pressure pad 11 above the sealed bottom closure 100 of container 10. Details of a complete container forming machine in which mandrel 120 and pressure pad 11 may be employed have been omitted, since a mandrel and pressure pad arrangement embodying the principles of this invention may be employed with various kinds of container forming equipment, including the type exemplified by the C. Z. Monroe patent referred to above.

Mandrel 120 may be provided with a hollow interior 121 which is in communication with holes 126 in the end of mandrel 120 shown in FIG. 2, by means of which compressed air may be introduced in order to release a container from the mandrel after the bottom closure has been sealed; it is to be understood, of course, that other techniques well known to those skilled in the art may be employed to release a container from the mandrel. The end 12 of mandrel 120 has an exterior surface which is divided into a selected pattern of relieved and unrelieved areas, the sectional views of the surface of mandrel end 12 and pressure pad 11 being taken along section lines 1—1 in FIGS. 2 and 3. Opposing the exterior surface of mandrel end 12 is pressure pad 11 which has a totally flat surface except for projecting pressure stakes 111a, 111b, 112a, 112b, 113a, 113b, 114a, 114b, 115a, 115b, 116a, 116b, 117a, 117b, so that whatever bulges are formed in the completed bottom closure 100 by forcing pressure pad 11 against a bottom closure of a container positioned over mandrel end 12, are caused to appear in the interior of the container, and so that the outer surface of the container bottom is substantially flat. It is to be noted that the alignment of pressure pad 11 and mandrel end 12 in FIG. 1 is obtained by positioning the upper portion of the pressure pad 11 shown in FIG. 3 over the lower portion of the mandrel 120 in FIG. 2 so that section lines 1—1 in the two drawings coincide.

The particular configuration of relieved and unrelieved areas in the exterior surface of mandrel end 12 depends, of course, on the shapes, thicknesses and patterns of the folded bottom closure panels which constitute the bottom closure structure of the container being assembled. The bottom closure structure 100 illustrated in FIGS. 1, 2 and 3 is a version of the unique short bottom panel structure shown in the above-mentioned co-pending application filed on even date herewith. Thus in FIG. 2, the areas denoted A, B and C represent portions of the mandrel end 12 which have been relieved below the surface S by various amounts, the exact amounts depending upon the thickness of the paperboard stock and the number of overlapping layers or plies in the folded bottom closure. One suitable set of values for A, B and C, for a container with a bottom closure structure of the type shown in the drawings, may be on the order of the following:

Table 1

	Inches
A -----	0.016
B -----	0.032
C -----	0.048

In addition, the circular symbols 125-1 through 125-4 in FIG. 2 represent a plurality of recessed areas of depth D to provide pressure relief at each of a corresponding plurality of points of high stress concentration. Such points are typically located where interior paperboard panels are folded into multiple layers and come together at points in the interior of the container to press against a single paperboard layer which forms the exterior layer of the container bottom. In the bottom closure structure disclosed in the above-mentioned co-pending application, there are four principal points of high stress concentration and it is at these points that recessed areas 125-1 through 125-4 are located in the surface of the mandrel end in

FIG. 2. For such points, the depth D of recessed areas 125-1 through 125-4 may be on the order of 0.062 inch.

The mandrel end 12 is shown in FIGS. 1 and 2 as a separate cap attached to mandrel 120 by way of cap screws 122a and 122b, and dowels 123a and 123b, but it is to be understood that mandrel 120 may be constructed with mandrel end 12 integral with the remainder of mandrel 120. Openings 124a and 124b may be provided through the mandrel end, if desired, in order to allow for drainage of solvents or other solutions which have been applied to clean the container forming equipment.

Pressure pad 11, as previously pointed out, has a totally flat surface except for projecting pressure stakes 111a and 111b through 117a and 117b. These stakes may be constructed from cylindrical shaft elements 31 each terminating in a blade or die-shaped cutting edge which is provided with a special configuration as explained below in connection with FIGS. 4, 5 and 6. Each stake is located at a selected point in pressure pad 11 by positioning each cylindrical portion into an opening at a selected point in the pressure pad, where the shafts may be positioned by either a press fit, a keyway, or other well known technique. Selection of the points at which the stakes are located depends upon the location of potential leak paths in the bottom closure structure at which it is desired to apply increased pressure to compress the paperboard layers and thereby block the potential leak path. Such paths are most likely to occur along folds in the bottom panels and along the interior edges of bottom panels. In pressure pad 11 shown in FIG. 3, pressure stakes are located in pairs along the edges of gusset portions and tuck-in and fold-over extensions of the various bottom panels, with the blade edge of each stake being positioned at right angles across the potential leak channel which is to be blocked.

The height of each blade edge above the surface of pressure pad 11 depends upon the depth to which it is desired to penetrate the outer surface of the container bottom in order to compress the layers of paperboard which form the potential leak path. For a relatively small degree of penetration, a conventional blade edge 41 of rectangular section, as shown in FIG. 4, is satisfactory. However, for deep penetration, it is desirable to employ a relatively sharp blade edge with two planar sides that include about a ninety degree angle and with a sufficient height above the surface of the pressure pad to cut through the first layer of paperboard and reach an especially remote leak channel within a paperboard fold in the interior of the formed container bottom. Such a blade edge 43 is illustrated in FIG. 6, and in conjunction with the particular bottom structure 100 illustrated in FIGS. 1, 2 and 3, stakes 111a and 111b may be provided with this blade edge configuration.

Another blade edge design is shown in FIG. 5, in which the blade edge 42 is fully radiused or rounded to have an approximately semicircular cross-section. This blade edge may be employed where reduced force is available to penetrate to paperboard layers in the interior of the formed container bottom, such as may occur with stakes which are located in close proximity to stakes having the deep penetration design shown in FIG. 6. Thus stakes 112a and 112b in pressure pad 11 may be provided with blade edge configuration 42 where stakes 111a and 111b are provided with blade edge structure 43. The height of stakes 112a and 112b may be intermediate to the height of shallow penetration stakes with conventional rectangular blades 41 and the height of stakes with deep penetration blades 43. As indicated in FIG. 1, pressure pad 11 may be provided with set screws 119 behind the stakes so that the heights of the stakes may be adjusted as desired.

In addition, the interior of pressure pad 11 may be provided with a conventional system of chambers 110 to accommodate a flow of cooling water to maintain pressure pad 11 at a desired temperature.

The terms and expressions that have been employed herein are used as terms of description and not of limitation, and there is no intention in the use of such terms

and expressions to exclude any equivalents of the features shown and described or portions thereof, but it is recognized that various modifications are possible within the scope of the invention claimed.

What is claimed is:

1. Mandrel and pressure pad apparatus for sealing together the bottom closure elements of a paperboard container and for forming a flattened outer surface on the container bottom closure sealed therebetween which comprises

a mandrel cap for each of a plurality of corresponding mandrels, the exterior surface of each mandrel cap being divided into a predetermined configuration of areas selected ones of which are inwardly relieved to various depths to correspond to the configuration of multiple layer areas of various thicknesses of a predetermined container bottom closure structure in its folded position to receive in said inwardly relieved areas said multiple layer container bottom areas, means for attaching each mandrel cap to its corresponding mandrel, and

a pressure pad associated with each mandrel cap for cooperating with said mandrel cap to apply selected amounts of pressure to said bottom closure structure interposed between said mandrel cap and said pressure pad, said pressure pad being provided with a totally flat surface opposing said exterior surface of said mandrel cap, and a plurality of pairs of projecting pressure stakes located at selected points in said surface for applying increased pressure to corresponding pairs of points in said bottom closure structure.

2. Apparatus as defined in claim 1 wherein each of said projecting pressure stakes is provided with a shaft element terminating at one end in a blade edge of predetermined configuration, said shaft elements being fitted into complementary recesses in the surface of said pressure pad so that said blade edge projects above the surface of said pressure pad by a predetermined amount.

3. In combination with the apparatus defined in claim 2, means positioned in said pressure pad behind the other end of said shaft element for adjusting the amount by which said blade edge projects above the surface of said pressure pad.

4. Apparatus as defined in claim 2 wherein said blade edge has two planar sides which include an angle of about ninety degrees.

5. Apparatus as defined in claim 2 wherein said blade edge has an approximately semicircular cross-section.

6. In an automatic container fabricating mechanism, apparatus for sealing together the bottom closure elements of a thermoplastic coated paperboard container and for forming a flattened outer surface on the container bottom closure formed therebetween which comprises,

a plurality of rotatable mandrels over each of which there is positioned a tubular container blank with its bottom closure elements projecting beyond the end of said mandrel so that said bottom closure elements may be folded together over the end of said mandrel, the surface of said mandrel end being divided into a predetermined configuration of inwardly relieved and flat unrelieved areas corresponding to a predetermined pattern of areas of overlapping plies of various thicknesses in the folded bottom closure of said container to receive, in said inwardly relieved areas, said overlapping plies of said bottom container closure, and

a pressure pad associated with said mandrels and having a totally flat surface which successively opposes the end of each of said mandrels as said mandrels rotate, for cooperating with said mandrels to seal together said folded bottom closure elements by applying selected amounts of pressure to said folded bottom closure elements between said mandrel end and said pressure pad, said pressure pad being provided with projecting pressure stakes at selected points in its surface to apply increased pressure at corresponding points in the bottom of said container in order to

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block potential leak paths in the folded portions of said bottom closure, wherein the totally flat surface of said pressure pad causes the exterior surface of the sealed bottom of said container to be substantially flat except for the points at which said projecting pressure stakes compress said container bottom.

7. In combination with the apparatus defined in claim 6 a selected plurality of recessed areas in said surface of said mandrel end to provide pressure relief at each of a corresponding plurality of points of high stress concentration in the folded bottom of said container.

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BERNARD STICKNEY, *Primary Examiner*.

U.S. Cl. X.R.