

PATENT SPECIFICATION

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(54) PLASTIC CONTAINER

(71) We, RHEEM MANUFACTURING COMPANY, a corporation organized and existing under the laws of the State of Delaware, United States of America, of 767 Fifth Avenue, New York, New York 10022, United States of America, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:-

This invention relates to containers for the storage and shipping of materials and to methods for container manufacture.

The manufacture of plastic containers by processing molding material within forming dies has the evident disadvantage of rendering the production of different-sized containers quite costly. Thus, molds of diverse length and volume are required for making each uniquely sized container. Waste also occurs since container thickness is not uniformly maintainable in molding practice, i.e. containers are unnecessarily thick-walled in corner and like areas. Manufacture of containers by other previously proposed techniques is complicated by the need for forming fibrous shells by winding and sealing laminates or joining sections and then applying a sealing lining thereto. Regarding the reference commercially-available drum, the same is a metal-reinforced plastic drum and its manufacture further entails the need for reinforcing its closure member by radial ribs as above considered.

According to one aspect of the invention there is provided a container comprising an elongate cylindrical shell of plastics material having at least one open end and a closure member of plastics material closing such open end, said closure member comprising a single thickness axially extending cylindrical rim portion encircling and sealingly secured exclusively to the radially outer surface of said shell about said open end, an annular hingedly deformable portion continues with

said rim portion extending radially inwardly from said rim portion to the interior of the shell and a central deformable portion of the closure continuous with the annular portion completing closing of the said open end, said annular portion extending radially and axially inwardly of the open end edge of the shell deformably hingedly to support said central portion and comprising a first part continuous with the rim portion and extending radially of the shell, a second part continuous with the first part and extending axially of and substantially parallel to the shell and encircled by the shell and a third part continuous with the second part and extending to a location spaced radially interiorly of and coaxial with said shell, with said central portion being continuous with said third part and having a surface area greater than the planar area encompassed by the juncture of the annular and central portions, the construction being such that the container is resistant to impact by deformation and hingedly unfolding of the annular and central portions.

Containers according to the invention may incorporate shells which are extruded in sheet or tube form and thus have opposed open ends. Alternatively, the shell may be formed with one open end.

According to a further aspect of the invention there is provided a method of making a container comprising the steps of: (a) cutting plastics sheet material into a sheet of predetermined length and width; (b) forming such cut sheet into a hollow shell having a slit extending axially between open ends of said shell and defined by juxtaposed edges of said sheet; (c) sealing said slit to provide an axially extending continuous sealed seam for said shell; (d) forming closure members for said shell open ends by shaping integral plastics material to form a single thickness cylindrical rim portion, an annular hingedly deformable portion continuous with the rim portion extending radially inwardly from the rim

portion and a central deformable portion continuous with the annular portion completing closing of the annular portion with the annular portion extending radially and axially inwardly of the closure member deformably hingedly to support the central portion and with said central portion having a surface area greater than the planar area encompassed by the periphery of the central portion; and (e) sealably securing each said closure member at the periphery thereof exclusively to the outer surface of said shell adjacent a distinct one of said open ends thereof, said annular portion comprising a first part continuous with the rim portion and extending radially of the shell, a second part continuous with the first part and extending axially of and substantially parallel to the shell and encircled by the shell and a third part continuous with the second part and extending to a location spaced radially interiorly of and coaxial with said shell, the construction being such that the container is resistant to impact by deformation and hingedly unfolding of the annular and central portions. Preferably the step (c) is practised by disposing in said slit plastics material containing magnetizable particles and then subjecting said material to an electromagnetic field thereby heating said material to its fusion point and flowing said material into intimate contact with said sheet edges.

The foregoing and other preferred features of the invention will be evident from the following detailed discussion of preferred embodiments thereof and from the drawings wherein like reference numerals identify like parts throughout. In the drawings:

Figure 1 illustrates schematically the extruding and cutting of shell-forming sheet material.

Figure 2 is a top plan view of the Figure 1 sheet material formed into a hollow shell with a strip of bonding material disposed in the shell axial seam and subject to the action of fusing apparatus illustrated in section.

Figure 2a is a perspective view showing a manner of energizing the Figure 2 fusing apparatus.

Figure 3 is a frontal elevation in section of the completed Figure 2 shell with end closure members therefor.

Figure 3a illustrates an alternative end closure member configuration for use with the Figure 2 shell.

Figure 4 is a bottom plan view of the Figure 3 embodiment.

Figure 5 is a top plan view of fusing apparatus for use in securing the Figure 3 end closure members to the shell.

Figure 5a shows tube 40a of the Figure 5 fusing apparatus removed therefrom.

Figure 6 is an enlarged sectional view of the Figure 5 apparatus as seen from the line VI-VI of Figure 5 operative in a fusing

operation.

Referring to Figure 1, extruder head 10 dispenses from die lip slit opening 10a continuous sheet material 12 preferably comprised of high molecular weight high density polyethylene. Cutting apparatus (not shown) selectively cuts sheet material 12 transversely of its issuing direction to form individual sheets 14 having length L and width W. The former of these dimensions is controlled by the cutting apparatus whereas the latter dimension may be varied together with sheet thickness T by substitution of extruder heads or changing the die lip opening. Opposed side edges 14a and 14b of sheet 14 are mitered at an angle of from five to forty-five degrees (Figure 2) and the sheet is then formed into a hollow cylinder. As shown in Figure 2, mitered edges 14a and 14b are spaced slightly from one another and a strip of bonding material 16 is disposed therebetween. Strip 16 is preferably comprised of magnetizable particles, such as iron oxide, dispersed in a plastics base. With strip 16 and sheet 14 disposed as indicated in Figure 2, holding fixtures 18a and 18b, both comprised of electrically insulative material, are clamped in pressure relation to one another. These fixtures support a continuous two-loop coil of axially extending hollow copper tubing 20 which is internally cooled and excited electrically by connection to a radio frequency supply whereby edges 14a and 14b of sheet 14 are fused together, applied pressure causing the bonding agent to flow into intimate contact with the facing surfaces of the sheet edges.

Rubber hose 20a (Figure 2a) conducts coolant (water) from the right hand tubing 20 in fixture 18a to the left hand tubing 20 in fixture 18a. At the remote end of such left hand fixture 18a, the copper tubing conducts coolant and current therefrom to the right hand tubing 20 in fixture 18b. Rubber hose 20b conducts coolant thence to the left hand tubing 20 in fixture 18b. Switch plates 20g and 20h are movable horizontally in Figure 2a to engage switch plates 20c-20f to energize the tubing. On completion of the fusing operation, plates 20g and 20h are moved apart vertically to permit axial removal of the bonded shell.

Referring to Figure 3, the above-discussed seaming operation provides a completed container shell 22 having axially extending seam 22a. End closure members 24a and 24b, formed in configuration shown in Figure 3 and preferably of like material to that of shell 22, are disposed in place on the ends of shell 22 with strips 26 of bonding material situated interiorly of the end closure members and exteriorly of shell 22 as illustrated. With shell 22, members 24a and 24b and strips 26 so arranged, the member 24b end of the assembly is placed in bonding apparatus as

shown in Figure 6. This apparatus has an outer fixture 28 (Figure 5) supported in spaced radially encircling relation to an inner fixture 30, both comprised of electrically insulative material. Fixture 28 is of segmented type, including segments 28a and 28b each spanning approximately one hundred-twenty degrees and segments 28c and 28d, each spanning approximately sixty degrees. The radially outward surfaces of segments 28a-28d engage bladder 32 services on demand from a supply of pressurized air through conduit 34 for displacing the segments radially inwardly. Rigid outer ring 36 provides a reaction bearing surface for bladder 32. At their radially interior surfaces, segments 28a and 28b define grooves 38 (Figure 5) and fixture 30 defines grooves 39 for receiving double loop hollow copper tubes 40a and 40b (Figures 5, 5a). Tubes 40a and 40b are used, as in the case of tubing 20 above-discussed, for applying a radio frequency induction field to unbonded assemblies disposed in channel 42 established between segments 28a-28d and fixture 30.

The manner in which the tubing is routed in the Figure 5 apparatus is seen in Figure 5a which shows tube 40a removed from the Figure 5 apparatus. Tube 40a portion 40a-1 extends into fixture 30 to location L1 and the tubing then proceeds outwardly toward the viewer of Figure 5a to tube portion 40a-2 which extends in an upper groove of fixture 30 clockwise circularly to location L2. At this location, tube 40a proceeds inwardly away from the viewer of Figure 5a to tube portion 40a-3 which extends radially outwardly to segment 28a and thence outwardly towards the viewer to an upper groove in segment 28a. Tube portion 40a-4 proceeds counter-clockwise circularly in such segment 28a groove to location L3 and then proceeds inwardly away from the Figure 5a viewer to tube portion 40a-5 which proceeds radially inwardly of segment 28a to a lower groove of fixture 30. Thereupon tube 40a extends clockwise circularly in fixture 30 to location L4 whereupon tube portion 40a-6 proceeds radially outwardly to a lower groove of segment 28a and therein to location L5. At this location tube portion 40a-7 extends radially outwardly of segment 28a. Fixture 30 and segment 28a have grooves at locations L1-L4 and elsewhere running transverse of and interconnecting their upper and lower grooves to provide for travel of tube 40a between such upper and lower grooves.

With the unbonded assembly of bonded shell 22, closure member 24b and strip 26 disposed in channel 42 (Figure 6), conduit 34 is positively pressurized and segments 28a-28d press the assembly against fixture 30. Segments 28c and 28d serve to equalize pressure around the circumference of the

unbonded assembly. Tubes 40a and 40b are energized whereby the part of the assembly adjacent the tubes is fused together, the applied pressure causing the bonding agent to flow into intimate contact with the surfaces of shell 22 and end closure member 24b which face strip 26.

In the embodiment shown in Figures 5, 5a and 6, tubes 40a and 40b each encompass approximately one hundred degrees of arc, mutually spaced by some eighty degrees. For a complete bonding operation, the work is rotated and two passes are needed. The invention of course contemplates a single continuous double loop tubing assembly whereby the bonding operation may be completed in a single pass mode for joining each closure member to the bonded shell.

Leaf spring 43 between base 44 and the segments urges the segments radially outwardly of channel 42 when bladder 32 is deflated to facilitate removal of bonded assemblies. For automated removal of bonded assemblies from the bonding apparatus, ram assembly 46 is slidably supported on sleeve 44a of base 44 for movement through base opening 44b into channel 42.

Referring to Figures 3 and 4, end closure members 24a and 24b include a first (hinge) portion 24-1 having one rim portion part 24-1a extending exclusively axially of shell 22 and encircling and sealingly secured exclusively to the outer surface of the shell and another part 24-1b extending to an end location spaced radially interiorly of and coaxial with the shell, i.e. as defined by circular locus 24-1c shown in broken lines. As shown in Figures 3 and 3a the part 24-1b comprises a first course continuous with part 24-1a and extending radially of the shell, a second course continuous with the first course and extending axially of and substantially parallel to the shell and encircled by the shell and a third course continuous with the second course and extending to the location 24-1c. The closure members have a second (central) portion 24-2 continuous with portion 24-1 exclusively at such end locations in circle 24-1c whereby portion 24-2 is hingeably supported by portion 24-1. Portion 24-2 is itself bowed axially of shell 22 such that it has linewise surface extent S_1 between diametrically opposed ones, e.g. L_A and L_B , of end locations of portion 24-1 in excess of the diametric spacing S_2 between such end locations. Closure member 24a may have bung hole fittings, one being shown at 24c in Figure 3.

By this arrangement, both portions 24-1 and 24-2 are deformable with an unfolding action to a preselected degree upon subjecting the Figure 3 container to drop testing, the extent of unfolding thereof being greater when portion 24-2 is bowed axially of the

shell. As considered in the examples below, the sealable relation of the closure members and the shell is thereby maintained throughout such testing. While portion 24-2 is bowed axially inwardly of shell 22 or dished in Figure 3, the closure members may also have the configuration shown in Figure 3a, i.e. with portion 24-2' bowed axially outwardly of the shell or domed. In the Figure 3a arrangement the linewise surface extent S_3 of portion 24-2' between diametrically opposed end locations of hinge portions 24-1' exceeds the diametric spacing S_2 between end locations. As will be appreciated, the closure member hinge and central portions are preferably parts of an integral plastic structure formed by a molding operation.

Example 1

The side edges of an extruded sheet of high molecular weight high density polyethylene (HDPE), 38 inches in width, 70.5 inches in length and 0.135 inch in thickness are mitered at an angle of 10° and the sheet is formed into a cylindrical shell as in Figure 2 having a diameter of 22.5 inches and an axially extending slit between the mitered edges. A strip of bonding material comprised of HDPE containing iron oxide particles and having a thickness of 0.015 inch and a width of 0.625 inch is placed in the slit and extends throughout the slit length. Bonding fixtures are next pressed against the shell slit as in Figure 2 and are energized from a radio-frequency supply to subject the bonding material to an electromagnetic field, heating the material to its fusion point and flowing the material into intimate contact with the mitered edges, thus sealing the shell slit throughout its length.

End closure members are molded of high molecular weight HDPE in the configuration shown in Figure 3 and have an average thickness of 0.187 inch. The line surface extent of the end closure member (S_1 in Figure 3) is four percent longer than the spacing (S_2 in Figure 3) between diametrically opposed end locations of the hinge portion. The end closure members are assembled with the shell and with a bonding material strip therebetween as in Figure 3, comprised of HDPE containing iron oxide particles and having a thickness of 0.015 inch and a width of 0.750 inch. Bonding fixtures are next pressed against the assembly as in Figure 6 and are energized from a radio-frequency supply to subject the bonding material to an electromagnetic field, heating the material to its fusion point and flowing the material into intimate contact with the surfaces of the end closure members and shell facing the material.

Containers so formed and with bungs threaded into bung holes in one of the end closure members are subjected to internal hydrostatic pressure of 15 psi. No fluid

leakage is observed on inspection. Containers so formed are filled through the bung holes with 55 gallons of water and water-methanol mixtures. Bungs are threaded into the bung holes and the containers are dropped from a height of 4 feet at an angle of 45° with respect to the container longitudinal axis at temperatures of 70°F and 0°F . No fluid leakage is observed on inspection of the dropped containers.

Example 2

End closure members are molded of high molecular weight HDPE in the configuration shown in Figure 3a with average thickness of 0.187 inch and line surface extent (S_3 in Figure 3a) four percent longer than the spacing (S_2) between diametrically opposed end locations of the hinge portion. End closure members so formed are secured to shells formed as in Example 1 in the manner set forth in Example 1. The resulting containers are subjected to the internal hydrostatic pressure and drop testing set forth in Example 1 without showing fluid leakage.

Example 3

The side edges of an extruded sheet of high molecular weight HDPE, 13.5 inches in width, 36.5 inches in length and .085 inch in thickness are mitered at an angle of 10° and the sheet is formed into a cylindrical shell as in Figure 2 having a diameter of 11.5 inches and an axially extending slit between the mitered edges. A strip of bonding material comprised of HDPE containing iron oxide particles and having a thickness of .010 inch and a width of 0.375 inch is placed in the slit and extends throughout the slit length. The shell slit is sealed throughout its length in the manner set forth in Example 1.

End closure members are molded of high molecular weight HDPE in the configuration shown in Figure 3 and have an average thickness of .085 inch. The line surface extent of the end closure members (S_1 in Figure 3) is two percent longer than the spacing (S_2 in Figure 3) between diametrically opposed end locations of the hinge portion. The end closure members are assembled with the shell and with a bonding material strip therebetween as in Figure 3 comprised of HDPE containing iron oxide particles and having a thickness of .010 inch and a width of 0.5 inch. The assembly is secured in the manner set forth in Example 1.

Containers so formed and with a bung threaded into a bung hole in one of the end closure members are subjected to internal hydrostatic pressure of 15 psi. No fluid leakage is observed on inspection. Containers so formed are filled through the bung hole with 5 gallons of water and water-methanol mixtures. A bung is threaded into the bung hole and the containers are dropped from a height of 4 feet at an angle of 45° with respect to the container longitudinal axis at tempera-

tures of 70°F and 0°F. No fluid leakage is observed on inspection of the dropped containers.

While the invention has been disclosed by way of particularly preferred embodiments, various changes and modifications thereof will be evident to those skilled in the container, bonding and related arts. Where in extruded sheet form the shell axial slit need not have mitered edges nor strip bonding material disposed therein but may have non-mitered edges joined directly to one another by fusion or like techniques or by use of a common backing member joined thereto.

In our copending Divisional Patent Application No. 7911757 (Serial No. 1572400) we claim apparatus for use in securing a closure member to an open end of a shell to form a container, said apparatus including a first fixture and a second fixture supported coaxially interiorly of said first fixture, said fixtures being supported for relative movement jointly to define an annular space therebetween for, in use of the apparatus, receiving an unbonded assembly of said closure member and said shell and bonding material including magnetizable particles dispersed in plastics, at least one of said fixtures being comprised of separate arcuate segments, first means for displacing said fixtures relative to one another whereby said fixtures apply pressure to said assembly in use of the apparatus, and second means for subjecting such pressed assembly to heat energy, said second means comprising an electromagnetic field generator supported at the pressing periphery of at least one of said fixtures immediate to the pressed assembly and adapted for flexure relative to its supporting fixture whereby said particles in the bonding material are responsive to such generated electromagnetic field to heat said plastics to its fusion point for flowing thereof into intimate contact with surfaces of said shell and said closure member in facing relation to said bonding material. In that Divisional Application we also claim a method of making a container comprising the steps of cutting plastics sheet material into a sheet of predetermined length and width; forming such cut sheet into a hollow shell having a slit extending axially between open ends of said shell and defined by juxtaposed edges of said sheet; sealing said slit to provide an axially extending continuous sealed seam for said shell; forming a closure member for one of said shell open ends by shaping integral plastics material; forming an assembly wherein said closure member is disposed in encircling relation to said shell adjacent said one open end and wherein bonding material containing magnetizable particles is disposed about the shell between said closure member and said shell; and securing said assembly by simultaneously

applying pressure to said assembly and disposing a magnetic field generator in immediate juxtaposition with the periphery of said closure member, the pressure being applied in a direction normal to the surface of the shell by means of two fixtures arranged internally and externally of the shell with part of the assembly including the bonding material being located therebetween, thereby heating said material to its fusion point for flowing thereof into intimate contact with said closure member and said shell adjacent said one open end.

WHAT WE CLAIM IS:—

1. A container comprising an elongate cylindrical shell of plastics material having at least one open end and a closure member of plastics material closing such open end, said closure member comprising a single thickness axially extending cylindrical rim portion encircling and sealingly secured exclusively to the radially outer surface of said shell about said open end, an annular hingedly deformable portion continuous with said rim portion extending radially inwardly from said rim portion to the interior of the shell and a central deformable portion of the closure continuous with the annular portion completing closing of the said open end, said annular portion extending radially and axially inwardly of the open end edge of the shell deformably hingedly to support said central portion and comprising a first part continuous with the rim portion and extending radially of the shell, a second part continuous with the first part and extending axially of and substantially parallel to the shell and encircled by the shell and a third part continuous with the second part and extending to a location spaced radially interiorly of and coaxial with said shell, with said central portion being continuous with said third part and having a surface area greater than the planar area encompassed by the juncture of the annular and central portions, the construction being such that the container is resistant to impact by deformation and hingedly unfolding of the annular and central portions.

2. A container as claimed in claim 1, wherein said central portion of the closure member is bowed axially outwardly of said shell.

3. A container as claimed in claim 1, wherein said central portion of the closure member is bowed axially inwardly of said shell.

4. A container as claimed in claim 1, 2 or 3, wherein said shell and said closure member are comprised of high molecular weight high density polyethylene.

5. A container as claimed in any preceding claim, wherein said shell has the opposite open end also closed by a closure member.

6. A container as claimed in any preceding claim, wherein said shell comprises a sheet



tures of 70°F and 0°F. No fluid leakage is observed on inspection of the dropped containers.

While the invention has been disclosed by way of particularly preferred embodiments, various changes and modifications thereof will be evident to those skilled in the container, bonding and related arts. Where in extruded sheet form the shell axial slit need not have mitered edges nor strip bonding material disposed therein but may have non-mitered edges joined directly to one another by fusion or like techniques or by use of a common backing member joined thereto.

In our copending Divisional Patent Application No. 7911757 (Serial No. 1572400) we claim apparatus for use in securing a closure member to an open end of a shell to form a container, said apparatus including a first fixture and a second fixture supported coaxially interiorly of said first fixture, said fixtures being supported for relative movement jointly to define an annular space therebetween for, in use of the apparatus, receiving an unbonded assembly of said closure member and said shell and bonding material including magnetizable particles dispersed in plastics, at least one of said fixtures being comprised of separate arcuate segments, first means for displacing said fixtures relative to one another whereby said fixtures apply pressure to said assembly in use of the apparatus, and second means for subjecting such pressed assembly to heat energy, said second means comprising an electromagnetic field generator supported at the pressing periphery of at least one of said fixtures immediate to the pressed assembly and adapted for flexure relative to its supporting fixture whereby said particles in the bonding material are responsive to such generated electromagnetic field to heat said plastics to its fusion point for flowing thereof into intimate contact with surfaces of said shell and said closure member in facing relation to said bonding material. In that Divisional Application we also claim a method of making a container comprising the steps of cutting plastics sheet material into a sheet of predetermined length and width; forming such cut sheet into a hollow shell having a slit extending axially between open ends of said shell and defined by juxtaposed edges of said sheet; sealing said slit to provide an axially extending continuous sealed seam for said shell; forming a closure member for one of said shell open ends by shaping integral plastics material; forming an assembly wherein said closure member is disposed in encircling relation to said shell adjacent said one open end and wherein bonding material containing magnetizable particles is disposed about the shell between said closure member and said shell; and securing said assembly by simultaneously

applying pressure to said assembly and disposing a magnetic field generator in immediate juxtaposition with the periphery of said closure member, the pressure being applied in a direction normal to the surface of the shell by means of two fixtures arranged internally and externally of the shell with part of the assembly including the bonding material being located therebetween, thereby heating said material to its fusion point for flowing thereof into intimate contact with said closure member and said shell adjacent said one open end.

WHAT WE CLAIM IS:—

1. A container comprising an elongate cylindrical shell of plastics material having at least one open end and a closure member of plastics material closing such open end, said closure member comprising a single thickness axially extending cylindrical rim portion encircling and sealingly secured exclusively to the radially outer surface of said shell about said open end, an annular hingedly deformable portion continuous with said rim portion extending radially inwardly from said rim portion to the interior of the shell and a central deformable portion of the closure continuous with the annular portion completing closing of the said open end, said annular portion extending radially and axially inwardly of the open end edge of the shell deformably hingedly to support said central portion and comprising a first part continuous with the rim portion and extending radially of the shell, a second part continuous with the first part and extending axially of and substantially parallel to the shell and encircled by the shell and a third part continuous with the second part and extending to a location spaced radially interiorly of and coaxial with said shell, with said central portion being continuous with said third part and having a surface area greater than the planar area encompassed by the juncture of the annular and central portions, the construction being such that the container is resistant to impact by deformation and hingedly unfolding of the annular and central portions.

2. A container as claimed in claim 1, wherein said central portion of the closure member is bowed axially outwardly of said shell.

3. A container as claimed in claim 1, wherein said central portion of the closure member is bowed axially inwardly of said shell.

4. A container as claimed in claim 1, 2 or 3, wherein said shell and said closure member are comprised of high molecular weight high density polyethylene.

5. A container as claimed in any preceding claim, wherein said shell has the opposite open end also closed by a closure member.

6. A container as claimed in any preceding claim, wherein said shell comprises a sheet

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of plastics material cylindrically formed and having opposed edges juxtaposed with bonding material therebetween and configured to define a mitre joint extending axially of the shell.

7. A container as claimed in claim 6, wherein said shell is comprised of an extruded sheet with said opposed edges being spaced from one another in the direction of extrusion of the sheet.

8. A container as claimed in claim 6 or 7, wherein said bonding material comprises a plastics substance containing magnetizable particles.

9. A method of making a container comprising the steps of: (a) cutting plastics sheet material into a sheet of predetermined length and width; (b) forming such cut sheet into a hollow shell having a slit extending axially between open ends of said shell and defined by juxtaposed edges of said sheet (c) sealing said slit to provide an axially extending continuous sealed seam for said shell; (d) forming closure members for said shell open ends by shaping integral plastics material to form a single thickness cylindrical rim portion, an annular hingedly deformable portion continuous with the rim portion extending radially inwardly from the rim portion and a central deformable portion continuous with the annular portion completing closing of the annular portion with the annular portion extending radially and axially inwardly of the closure member deformably hingedly to support the central portion and with said central portion having a surface area greater than the planar area encompassed by the periphery of the central portion; and (e) sealably securing each said closure member at the periphery thereof exclusively to the outer surface of said shell adjacent a distinct one of said open ends thereof, said annular portion comprising a first part continuous with the rim portion and extending radially of the shell, a second part continuous with the first part and extending axially of and substantially parallel to the shell and encircled by the shell and a third part continuous with the second part and extending to a location spaced radially interiorly of and coaxial with said shell, the construction being such that the container is resistant to impact by deformation and hingedly unfolding of the annular and central portions.

10. A method as claimed in claim 9, wherein said step (c) is practised by disposing in said slit plastics material containing magnetizable particles and then subjecting said material to an electromagnetic field thereby heating said material to its fusion point and flowing said material into intimate contact with said sheet edges.

11. A method as claimed in claim 9 or 10, wherein said step (e) is practised, for each

such securement of a closure member to an open end of said shell, by disposing said cylindrical rim portion of the closure member in encircling relation to the surface of said shell adjacent such shell open end, disposing plastics material containing magnetizable particles between said rim portion of the closure member and said shell surface adjacent said shell open end and then subjecting said material to an electromagnetic field thereby heating said material to its fusion point and flowing said material into intimate contact with surfaces of said shell and said closure member facing said material.

12. A container constructed and arranged substantially as hereinbefore described, with reference to and as illustrated in the accompanying drawings.

13. A method of making a container substantially as hereinbefore described, with reference to and as illustrated in the accompanying drawings.

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