



- (51) International Patent Classification:
B65D 21/02 (2006.01) *B21D 51/30* (2006.01)
B65D 8/20 (2006.01)
- (21) International Application Number:
PCT/US2012/060856
- (22) International Filing Date:
18 October 2012 (18.10.2012)
- (25) Filing Language: English
- (26) Publication Language: English
- (30) Priority Data:
13/284,100 28 October 2011 (28.10.2011) US
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(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

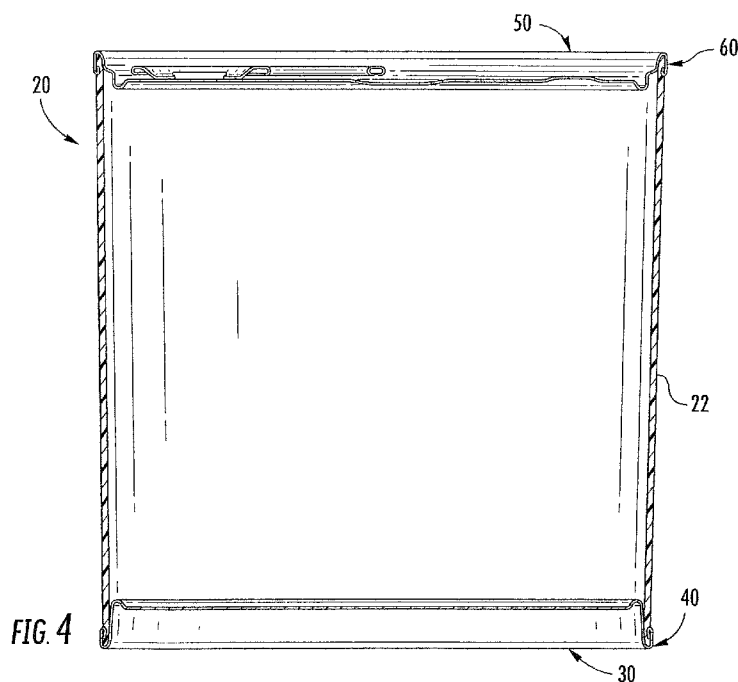
(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Declarations under Rule 4.17:

- as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))

[Continued on next page]

(54) Title: THREE-PIECE CAN AND METHOD OF MAKING SAME



(57) Abstract: A stackable three-piece can comprises a first end (30) and a second end (50), both double-seamed to a can body (22). The first end has a single countersink, and the second end has a double countersink, resulting in the outside diameter of the first double seam (40) being sized to fit within the inside diameter of the second double seam (60). A method of making a can assembly includes double-seaming a double-countersink metal end onto a can body and reforming the double-countersink metal end so as to effectively yield a single-counter sink metal end of smaller diameter. In the process, the region of the can body adjacent the metal end becomes necked-in.



Published:

— *with international search report (Art. 21(3))*

THREE-PIECE CAN AND METHOD OF MAKING SAME

BACKGROUND OF THE INVENTION

The present disclosure is related to containers for products such as foods. More specifically, the disclosure concerns three-piece cans that are configured to be stacked one upon another.

5 The three-piece can has long been a common type of container for products such as canned vegetable, canned fruits, canned meats, dry food products, liquids, etc. Three-piece cans have typically consisted of a metal can body and two metal ends that are seamed onto the ends of the can body by forming a double-seam.

10 Stackability of such metal three-piece cans has generally been achieved by necking in one end of the can body to a smaller diameter than the other end prior to application of the metal ends, and applying a smaller-diameter metal end to the necked-in end of the can body and a larger-diameter metal end to the opposite end of the can body. Accordingly, the smaller-diameter end of one such can will fit within the larger-diameter end of another such can, which provides stability to the cans stacked one on another. It
15 is relatively easy to neck-in a metal can body because metal can be plastically deformed and will hold its deformed shape after the deforming forces are removed.

 It would be desirable to be able to achieve stackability of three-piece cans without having to neck-in one end of the can body before application of the ends. This would enable the technique to be applied not only to metal can bodies but also to non-metallic
20 can bodies (e.g., paper-based composite can bodies, and plastic can bodies) that are not capable of being plastically deformed and holding their deformed shape after the deforming forces are removed.

BRIEF SUMMARY OF THE DISCLOSURE

The present disclosure describes a method for making a stackable three-piece can that is applicable to can bodies of any composition. In one embodiment described herein, a method for making a stackable three-piece can comprises the steps of:

5 providing a can body having a top opening and a bottom opening;

 providing a first end and a second end each having a curl and a countersink region, wherein at least the first end is a metal end;

 wherein the countersink region of the first end comprises a double-countersink, the double-countersink comprising an outer chuck wall adjacent the curl and extending axially and radially inwardly from the curl, a transition portion
10 joined to the outer chuck wall and extending generally radially inwardly therefrom, and an inner chuck wall joined to the transition portion and extending axially and radially inwardly therefrom and terminating in a countersink radius;

 forming a first double-seam between the first end and one end of the can
15 body such that the first end closes the opening at said end, and forming a second double-seam between the second end and the other end of the can body such that the second end closes the opening at said end, each of the double-seams having an inside diameter and an outside diameter; and

 deforming the first double-seam and the outer chuck wall and transition
20 portion of the first end radially inwardly so as to generally straighten out the countersink region of the first end and such that the outside diameter of the first double-seam is sized to fit within the inside diameter of the second double-seam.

 With this method, the deforming of the first end to reduce the diameter of the first end causes the attached end of the can body to be necked-in, similar to the necking-in of
25 a metal can body. The key difference, however, is that the first end, being metal, will hold its deformed shape and thus will hold the can body in the necked-in condition. Accordingly, the method can be applied to can bodies of non-metal construction such as composite or plastic can bodies that cannot be necked-in prior to the application of the ends. Of course, the method can also be applied to metal can bodies.

30 In some embodiments, the step of forming the first double-seam comprises the steps of using a first seaming chuck engaged with the outer chuck wall of the first end

and a first seaming roll engaged with the curl so as to partially form the first double-seam, and using the first seaming chuck with a second seaming roll to complete the formation of the first double-seam. Then, the step of deforming the first double-seam comprises using a third seaming member together with a second seaming chuck differing from the first
5 seaming chuck, wherein the second seaming chuck engages the inner chuck wall and the third seaming member engages the first double-seam and urges the first double-seam radially inwardly.

The method can include the step of sealing the ends to the can body. Sealing can be accomplished by compressing a rubbery compound (e.g., a conventional seaming
10 compound) between the ends and can body in the seam regions. Alternatively, sealing can be accomplished by thermally fusing the ends to the can body by at least one heat-activated material disposed between opposing surfaces of the can body and each end.

As an example, the can body can be constructed substantially of thermoplastic, or the can body can include a non-thermoplastic layer (e.g., paper or metal) and a
15 thermoplastic coating or layer on its interior-facing surface. The thermoplastic comprises the heat-activated material. In this case, the thermal fusing step can comprise heating and melting the thermoplastic in contact with the ends so as to thermally fuse the ends to the can body.

Alternatively or additionally, the ends can include an interior-facing layer or
20 coating of heat-sealable material, and the thermal fusing step can additionally comprise heating and melting the layer of heat-sealable material on each end in contact with the can body, such that the heat-sealable material layers and the thermoplastic of the can body are thermally fused together.

It is also possible for one or both of the ends to have a bare metal interior-facing
25 surface. A heat-activated material on the can body (e.g., a thermoplastic) can be thermally fused to the bare metal surface to seal the end(s) to the can body.

As still another variation, a hot-melt material can be provided as a circumferentially extending bead or the like, located beneath the curl region of the metal end, similar to the placement of conventional seaming compounds. The metal end can
30 be heated after application to the container, to soften or melt the hot-melt material so that it flows to fill in any gaps that may be present in the seam region that could provide a pathway between the interior and exterior of the container.

The present disclosure also describes a stackable three-piece can. In one embodiment, a stackable three-piece can comprises:

a can body of tubular configuration having a top opening and a bottom opening;

5 a first end having a curl and a countersink region, and a second end having a curl and a countersink region, at least the first end being a metal end;

a first double-seam formed between the first end and one end of the can body such that the first end closes the opening at said end, and a second double-seam formed between the second end and the other end of the can body such that
10 the second end closes the opening at said end, each of the double-seams having an inside diameter and an outside diameter;

wherein the countersink region of the first end comprises a single-countersink and the countersink region of the second end comprises a double-countersink, the single-countersink comprising a single chuck wall adjacent the curl
15 and extending axially and radially inwardly from the curl and terminating in a countersink radius, the double-countersink comprising an outer chuck wall adjacent the curl and extending axially and radially inwardly from the curl, a transition portion joined to the outer chuck wall and extending generally radially inwardly therefrom, and an inner chuck wall joined to the transition portion and extending axially and
20 radially inwardly therefrom and terminating in a countersink radius, the outside diameter of the first double-seam being sized to fit within the inside diameter of the second double-seam.

As noted, the can body can be constructed of various materials, including but not limited to plastic, paper-based composite, metal, and coated metal.

25 BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWING(S)

Having thus described the invention in general terms, reference will now be made to the accompanying drawings, which are not necessarily drawn to scale, and wherein:

FIGS. 1A through 1G respectively depict various steps of a process for making a stackable three-piece can in accordance with one embodiment of the invention;

30 FIG. 2 is a cross-sectional view of a double-countersink metal end prior to seaming;

FIG. 3 is a cross-sectional view of a double-countersink metal end in accordance with an alternative embodiment;

FIG. 4 is a cross-sectional view of a stackable three-piece can in accordance with one embodiment of the invention;

FIG. 5 is a cross-sectional view of a stackable three-piece can in accordance with another embodiment of the invention; and

5 FIG. 6 is a cross-sectional view of a stackable three-piece can in accordance with a further embodiment of the invention.

DETAILED DESCRIPTION OF THE DRAWINGS

The present invention now will be described more fully hereinafter with reference to the accompanying drawings in which some but not all embodiments of the inventions
10 are shown. Indeed, these inventions may be embodied in many different forms and should not be construed as limited to the embodiments set forth herein; rather, these embodiments are provided so that this disclosure will satisfy applicable legal requirements. Like numbers refer to like elements throughout.

FIGS. 1A through 1G respectively depict a number of steps of a method for
15 making a stackable three-piece can in accordance with one embodiment of the present invention, and a completed can **20** is shown in FIG. 4. The three-piece can **20** comprises a can body **22**, a first end **30**, and a second end **50**. In the embodiment illustrated in FIG. 4, the can body **22** is made of plastic and at least the first end **30** is a metal end. A “metal end” is defined herein as an end (i.e., an end closure) that has a metal layer in at least
20 the part of the end that will be double-seamed to the can body, and that metal layer has sufficient thickness to form a double-seam strong enough to withstand the stresses that are anticipated to be placed on the double-seam during filling and processing of the can and during subsequent handling, shipping, and storage of the can until the can is opened by the consumer. In general, the metal layer should have a thickness between about
25 0.005 inch and about 0.014 inch. The metal end can include additional layers, such as exterior and/or interior coatings of polymer materials.

As illustrated in FIG. 4, the metal end **30** is double-seamed to the can body **22** at one end thereof, and the end **50** is double-seamed to the opposite end of the can body. The three-piece can **20** has the metal end **30** as the bottom closure, and the end **50** as
30 the top closure. FIGS. 1A through 1G illustrate the method steps by which the metal end **30** is applied, double-seamed, and reduced in diameter so that the can **20** is stackable.

Before describing the method, the structure of the metal end **30** is explained with reference to FIG. 2, which is a magnified view of the outer peripheral portion of a metal end **30**. The metal end **30** has a double-countersink. The outer peripheral portion defines a curl **32** that is configured for receiving a flanged end portion of a can body, as further described below. Joined to the curl **32** is an outer chuck wall **34** that extends radially inwardly and axially downwardly from the curl **32** (where “downwardly” will be understood to refer to the orientation of the metal end **30** in FIG. 2, without regard to how the end will be oriented in an upright completed three-piece can). That is, the outer chuck wall **34** is inclined at a non-zero angle with respect to an axial direction of the metal end **30**. Joined to the outer chuck wall **34** is a transition portion **36** that extends radially inwardly from the outer chuck wall **34**. Joined to the transition portion **36** is an inner chuck wall **38** that extends radially inwardly and axially downwardly from the transition portion **36** and terminates in a countersink radius **39**. The structure of the end **30** radially inwardly of the countersink radius **39** can vary depending on the intended application of the three-piece can to which the end will be applied.

As shown in FIG. 2, in one embodiment the metal end **30** can have a metal layer **31** and a coating or layer **33** of a heat-sealable material (such as thermoplastic) on the interior-facing side. It is also within the scope of the invention, however, to employ a metal end that does not include such a heat-sealable material.

Now referring to FIG. 1A, the process of assembling the three-piece can includes the step of applying the metal end **30** to the can body **22**. In the applying step, a flange **24** of the can body is received into the channel defined by the curl **32** of the metal end **30**. A first seaming chuck **C1** is engaged with the metal end **30**. The first seaming chuck **C1** seats on the transition portion **36** and has a radially outer surface that is generally conical, becoming smaller in diameter in the downward axial direction.

As shown in FIG. 1B, a first seaming roll **R1** works together with the first seaming chuck **C1** to deform the curl **32** of the metal end such that the curl forms an end hook **EH** and the flange **24** forms a body hook **BH** that overlap. In the process, the outer chuck wall **34** is deformed to substantially conform to the conical outer surface of the first seaming chuck **C1**, but the transition portion **36** and the inner chuck wall **38** remain essentially unaffected.

The next step, depicted in FIG. 1C, is to employ a second seaming roll **R2** together with the first seaming chuck **C1** to further deform the curl region of the metal end so as to form a double-seam **40** firmly interlocking the end hook **EH** and the body hook

BH. Again, the transition portion **36** and the inner chuck wall **38** remain essentially unaffected.

FIG. 1D depicts the next step of the process. The first seaming chuck is removed and a second seaming chuck **C2** is engaged with the metal end **30**. As better seen in the magnified view of FIG. 1E, the second seaming chuck **C2** seats in the countersink radius **39** and has a radially outer surface that is generally conical, becoming smaller in diameter in the downward axial direction. The second seaming chuck **C2** is of smaller diameter than the first seaming chuck **C1**. The radially outer surface of the second seaming chuck thus is radially spaced from the outer chuck wall **34**. As FIGS. 1E and 1F depict, a third seaming member **R3** is used in conjunction with the second seaming chuck **C2** to deform the double-seam **40**, the outer chuck wall **34**, and the transition portion **36** radially inwardly so as to generally straighten out the countersink region of the metal end **30** as illustrated in FIG. 1F. That is, what formerly were distinct, differently oriented portions **34**, **36**, **38** of the countersink region are reformed into a generally straight chuck wall that extends from the double-seam **40** radially inwardly and axially downwardly and terminates in the countersink radius **39**. In essence, then, the reforming operation converts the double-countersink metal end **30** into a single-countersink metal end. The third seaming member **R3** can be a roll, or alternatively can be a stationary (i.e., non-rotating) member effective for deforming the double-seam **40** and chuck wall as noted above.

As a result of this reduction in diameter of the metal end **30**, the can body **22** becomes necked-in as shown in FIG. 1G. Even if the can body **22** is formed of a material that would tend to spring back to its original shape when deformed in this fashion, the can body is held in this necked-in shape by the metal end **30**. Thus, the can body could be formed of non-metallic materials such as plastic or paper-based composite, although the method of course can also be applied to metal can bodies. For example, the can body **22** can be formed substantially of thermoplastic, as either a mono-layer construction or a multi-layer construction.

As noted, FIG. 4 shows a completed three-piece can **20** made in accordance with the method described above. In this embodiment, the bottom end is the metal end **30** processed as described above. The opposite end **50** can also be a double-countersink metal end that is double-seamed onto the can body generally as shown in FIGS. 1A-C, to form a double-seam **60**. Unlike the metal end **30**, however, the metal end **50** is not reduced in diameter and thus it retains its double-countersink configuration. Accordingly, the diameter of the metal end **50** is greater than that of the metal end **30**. In particular,

the reforming operation on the metal end **30** as shown in FIGS. 1E and 1F is carried out such that the outside diameter of the double-seam **40** is smaller than the inside diameter of the double-seam **60**. This allows one can **20** of FIG. 4 to be stacked atop another such can, with the double-seam **40** being received within the double-seam **60** and resting on the transition portion **36** of the metal end **50**. The metal end **50** is shown as being of the well-known easy-open (EZO) type having a score line delineating a severable panel, and an opening tab attached to the end by an integrally formed rivet.

It may be advantageous, for purposes of reforming the double-countersink metal end **30** into a single-countersink metal end, to configure the metal end **30** as shown in FIG. 3. The transition portion **36** is depicted as being inclined at a non-zero angle θ with respect to the radial direction of the end **30**, such that the transition portion **36** extends both radially inwardly and axially downwardly from the outer chuck wall **34**. This "pre-folded" transition portion **36** may reduce or eliminate any tendency for the transition portion to buckle during the reforming operation. As used herein when referring to the direction in which the transition portion **36** extends, "generally radially inwardly" means that the transition portion can extend either with no axial component of direction (as in FIG. 2) or with some axial component of direction (as in FIG. 3) in addition to the radial component of direction.

The method described above can be applied to various can constructions. As one example, FIG. 5 shows a three-piece can **20'** made in accordance with the method. The can includes a can body **22'** that has a paper-based composite construction. Specifically, the can body includes a body ply **26** of paper and an inner liner **28** of plastic. It is also possible for the liner **28** to include one or more additional layers such as a metal foil layer, but the innermost layer of the liner is plastic. FIG. 5 also illustrates that various types or styles of the top end are possible in accordance with the invention. Thus, the top end **50'** in the illustrated embodiment is a metal ring and membrane type of end, having a generally annular metal ring **52** that is double-seamed onto the can body **22'**. A flexible membrane lid **54** is sealed to the upper surface of the metal ring **52** in a fashion that allows the lid **54** to be peeled off the ring **52** in order to open the can. The metal ring **52** has a single-countersink configuration. The bottom metal end **30** is applied and reformed in accordance with the method of the invention, such that the bottom double-seam **40** will fit within the top double-seam **60** when the cans are stacked.

FIG. 6 depicts another exemplary can embodiment in accordance with the invention. The three-piece can **20''** has a can body **22''** that is metal and a top end **50** that is a sanitary metal end of double-countersink configuration. The bottom metal end

30 is applied and reformed in accordance with the method of the invention, such that the bottom double-seam **40** will fit within the top double-seam **60** when the cans are stacked.

The invention is not limited to the particular can configurations described and illustrated herein. The method of double-seaming and reforming a double-countersink metal end so as to effectively yield a single-countersink metal end of smaller diameter is
5 applicable in various ways to provide a wide variety of can configurations and types.

A further aspect of some embodiments of the invention entails thermally fusing the metal end to the can body by at least one heat-activated material disposed between opposing surfaces of the can body and the metal end. Specifically, after the double-
10 seaming and reforming operations on the metal end, the metal end is thermally fused to the can body in the region of the double-seam. This can be accomplished in various ways. As one example, and as already described in connection with FIG. 2, the metal end **30** can have a coating **33** of a heat-sealable material (e.g., a thermoplastic) on the interior-facing surface of the metal end. The other metal end **50** can similarly have a
15 heat-sealable interior coating. Additionally, as described in connection with FIGS. 4 and 5, the can body can have heat-sealable material on its interior-facing surface. In FIG. 4, the heat-sealable material can be provided by the material of the plastic can body **22**. In FIG. 5, the heat-sealable material can be provided by the material of the liner **28**. These heat-sealable materials on the metal ends and can body contact each other in the double-
20 seam regions **40**, **60** and are pressed against each other by the clamping pressure of the double-seams. Heating of these heat-sealable materials causes them to melt and the clamping pressure causes them to flow together, such that upon cooling they are fused together. The heating can be accomplished, for example, by induction heating of the metal layer of the metal end. Heat is then conducted from the metal layer to the heat-
25 sealable materials.

As another example, each of the metal ends can have a bare metal surface as its interior-facing surface, and the interior-facing surface of the can body can have a heat-sealable material that is heat-sealable to the bare metal surface. For example, ionomers (such as SURLYN®) can be heat-sealed to a bare metal surface such as electrolytic tin
30 plate (ETP) steel.

The can embodiments described and illustrated above have metal ends on both ends of the can body. It is within the scope of the invention, however, for the end that is not reformed to be a non-metal type of closure, which can be attached to the can body by

means other than double-seaming. For instance, the non-metal closure can be a plastic end that is thermally fused to the can body.

Many modifications and other embodiments of the inventions set forth herein will come to mind to one skilled in the art to which these inventions pertain having the benefit of the teachings presented in the foregoing descriptions and the associated drawings. Therefore, it is to be understood that the inventions are not to be limited to the specific embodiments disclosed and that modifications and other embodiments are intended to be included within the scope of the appended claims. Although specific terms are employed herein, they are used in a generic and descriptive sense only and not for purposes of limitation.

WHAT IS CLAIMED IS:

1. A stackable three-piece can comprising:
 - a can body having a top opening and a bottom opening;
 - a first end having a curl and a countersink region, and a second end having a curl
 - 5 and a countersink region, at least the first end being a metal end;
 - a first double-seam formed between the first end and one end of the can body such that the first end closes the opening at said end, and a second double-seam formed between the second end and the other end of the can body such that the second end closes the opening at said end, each of the double-seams having an inside diameter and
 - 10 an outside diameter;
 - wherein the countersink region of the first end comprises a single-countersink and the countersink region of the second end comprises a double-countersink, the single-countersink comprising a single chuck wall adjacent the curl and extending axially and radially inwardly from the curl and terminating in a countersink radius, the double-
 - 15 countersink comprising an outer chuck wall adjacent the curl and extending axially and radially inwardly from the curl, a transition portion joined to the outer chuck wall and extending generally radially inwardly therefrom, and an inner chuck wall joined to the transition portion and extending axially and radially inwardly therefrom and terminating in a countersink radius, the outside diameter of the first double-seam being sized to fit within
 - 20 the inside diameter of the second double-seam.
2. The stackable three-piece can of claim 1, wherein the single chuck wall is substantially straight from the curl to the countersink radius.
3. The stackable three-piece can of claim 1, wherein the transition portion of the second end extends both radially inwardly and axially toward the first end.
- 25 4. The stackable three-piece can of claim 1, wherein the can body comprises a composite can body having at least one paperboard ply and an impervious liner.
5. The stackable three-piece can of claim 4, wherein the liner has a heat-sealable material forming a radially innermost surface of the can body.
6. The stackable three-piece can of claim 5, wherein the ends are thermally fused to
- 30 the can body via the heat-sealable material of the liner.
7. The stackable three-piece can of claim 1, wherein the can body is constructed substantially of thermoplastic.

8. The stackable three-piece can of claim 1, wherein the can body includes a metal layer.

9. A method for making a stackable three-piece can, comprising the steps of:
providing a can body having a top opening and a bottom opening;

5 providing a first end and a second end each having a curl and a countersink region, wherein at least the first end is a metal end;

wherein the countersink region of the first end comprises a double-countersink, the double-countersink comprising an outer chuck wall adjacent the curl and extending axially and radially inwardly from the curl, a transition portion joined to the outer chuck wall and extending generally radially inwardly therefrom, and an inner chuck wall joined to the transition portion and extending axially and radially inwardly therefrom and terminating in a countersink radius;

forming a first double-seam between the first end and one end of the can body such that the first end closes the opening at said end, and forming a second double-seam
15 between the second end and the other end of the can body such that the second end closes the opening at said end, each of the double-seams having an inside diameter and an outside diameter; and

deforming the first double-seam and the outer chuck wall and transition portion of the first end radially inwardly so as to generally straighten out the countersink region of
20 the first end and such that the outside diameter of the first double-seam is sized to fit within the inside diameter of the second double-seam.

10. The method of claim 9, wherein the step of forming the first double-seam comprises the steps of:

using a first seaming chuck engaged with the outer chuck wall of the first end and
25 a first seaming roll engaged with the curl so as to partially form the first double-seam; and

using the first seaming chuck with a second seaming roll to complete the formation of the first double-seam.

11. The method of claim 10, wherein the step of deforming the first double-seam comprises using a third seaming member together with a second seaming chuck differing
30 from the first seaming chuck, wherein the second seaming chuck engages the inner chuck wall and the third seaming member engages the first double-seam and urges the first double-seam radially inwardly.

12. The method of claim 9, further comprising using a seaming compound to seal the metal end to the can body.

13. The method of claim 9, further comprising the step of thermally fusing the ends to the can body by at least one heat-activated material disposed between opposing surfaces of the can body and each end.

14. The method of claim 13, wherein the can body is constructed substantially of thermoplastic, and the thermal fusing step comprises heating and melting the thermoplastic in contact with the ends so as to thermally fuse the ends to the can body.

15. The method of claim 14, wherein the ends include an interior-facing layer of heat-sealable material, and the thermal fusing step additionally comprises heating and melting the layer of heat-sealable material on each end in contact with the can body, such that the heat-sealable material layers and the thermoplastic of the can body are thermally fused together.

16. A method for making a can assembly, comprising the steps of:
providing a can body having a top opening and a bottom opening;
providing a metal end having a curl and a double-countersink, the double-countersink comprising an outer chuck wall adjacent the curl and extending axially and radially inwardly from the curl, a transition portion joined to the outer chuck wall and extending generally radially inwardly therefrom, and an inner chuck wall joined to the transition portion and extending axially and radially inwardly therefrom and terminating in a countersink radius;
forming a double-seam between the metal end and one end of the can body such that the metal end closes the opening at said end; and
deforming the double-seam and the outer chuck wall and transition portion radially inwardly so as to generally straighten out the countersink region of the metal end and such that the outside diameter of the double-seam is reduced.

17. The method of claim 16, wherein the step of deforming the double-seam comprises using a seaming roll together with a seaming chuck, wherein the seaming chuck engages the inner chuck wall and is spaced from the outer chuck wall, and the seaming roll engages the double-seam and urges the double-seam and outer chuck wall radially inwardly.

18. The method of claim 16, further comprising using a seaming compound to seal the metal end to the can body.

19. The method of claim 16, further comprising the step of thermally fusing the metal end to the can body by at least one heat-activated material disposed between opposing surfaces of the can body and the metal end.

20. The method of claim 19, wherein the can body is constructed substantially of thermoplastic, and the thermal fusing step comprises heating and melting the thermoplastic in contact with the metal end so as to thermally fuse the metal end to the can body.

21. The method of claim 20, wherein the metal end includes an interior-facing layer of heat-sealable material, and the thermal fusing step additionally comprises heating and melting the layer of heat-sealable material on the metal end in contact with the can body, such that the heat-sealable material layer and the thermoplastic of the can body are thermally fused together.

22. The method of claim 19, wherein at least an inner surface of the can body includes a heat-sealable material, and the thermal fusing step comprises heating and melting the heat-sealable material in contact with the metal end so as to thermally fuse the metal end to the can body.

23. The method of claim 22, wherein the can body includes a metal layer in addition to the heat-sealable material.

24. The method of claim 19, wherein the metal end has a heat-sealable surface on an interior-facing surface of the metal end.

25. The method of claim 24, wherein the heat-sealable surface is bare metal and the heat-activated material is thermally fused to the bare metal.

26. The method of claim 24, wherein the metal end comprises thermoplastic-coated metal, the thermoplastic coating providing the heat-sealable surface.

27. The method of claim 24, wherein the metal end comprises metal with a heat-sealable coating, the heat-sealable coating providing the heat-sealable surface.

28. A method of making a can assembly, comprising double-seaming a double-countersink metal end onto a can body and reforming the double-countersink metal end so as to effectively yield a single-countersink metal end of smaller diameter.

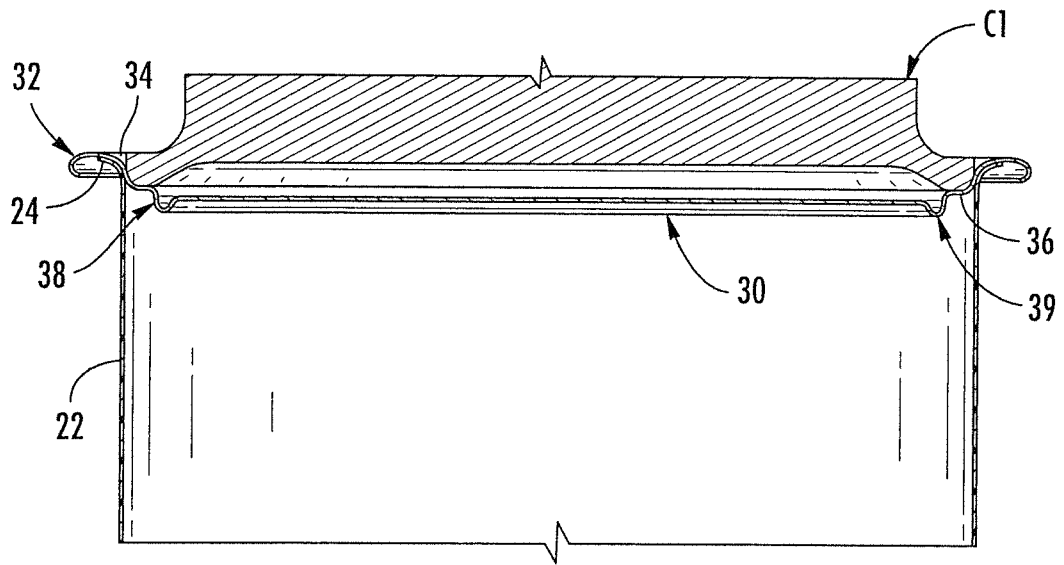


FIG. 1A

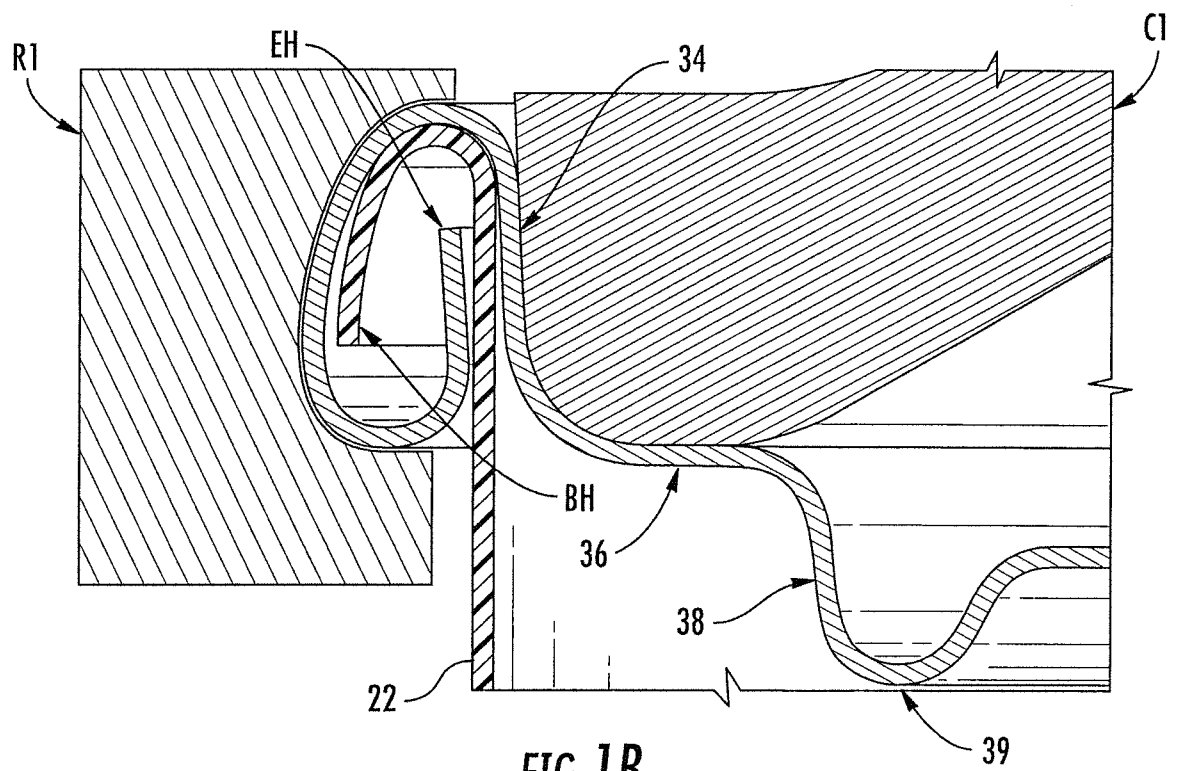


FIG. 1B

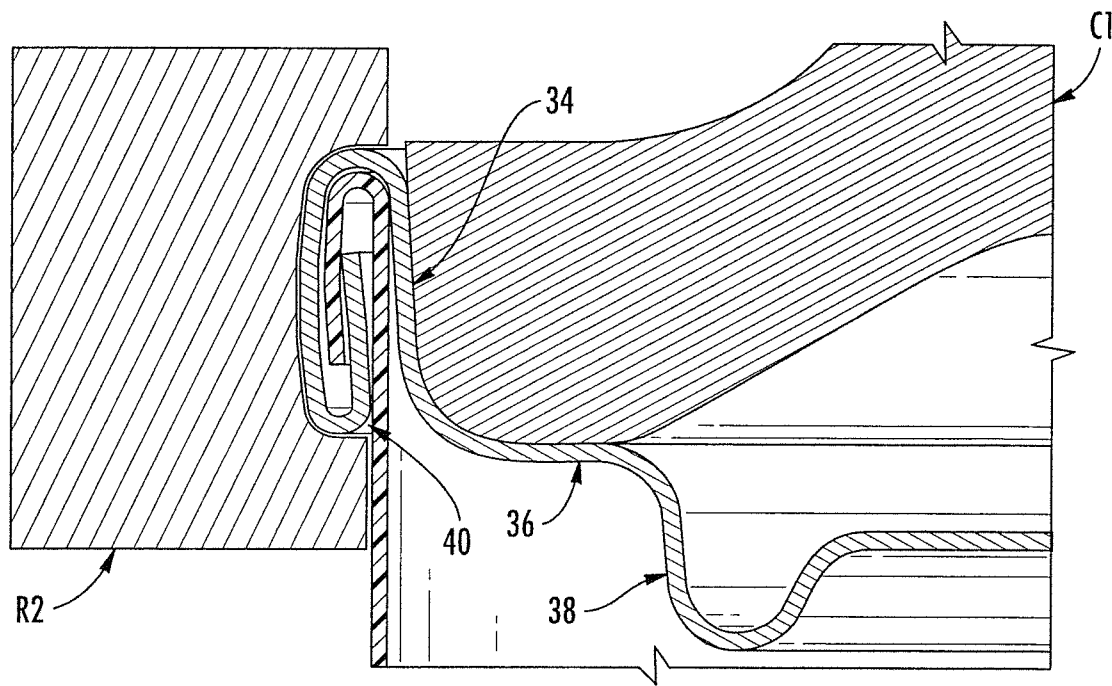


FIG. 1C

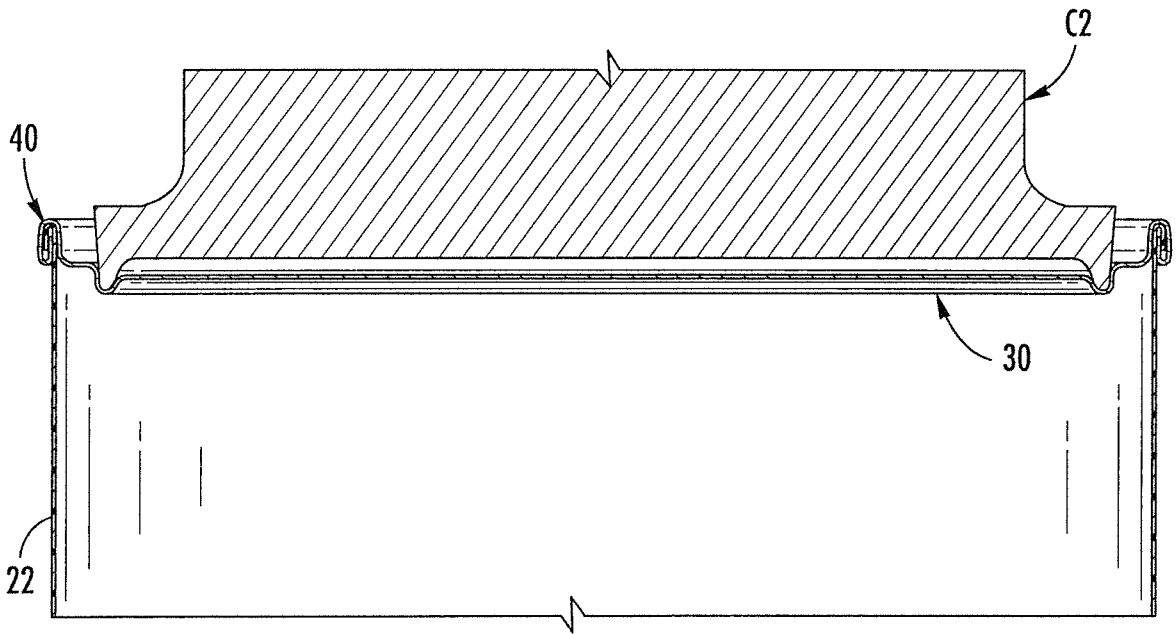
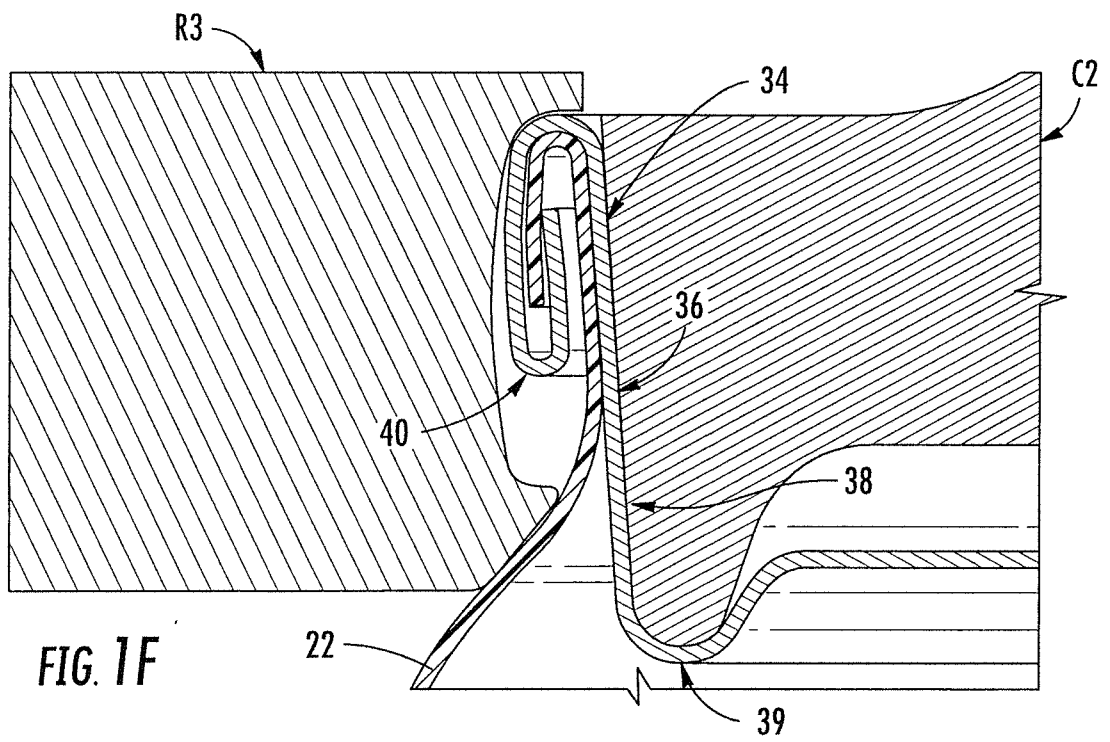
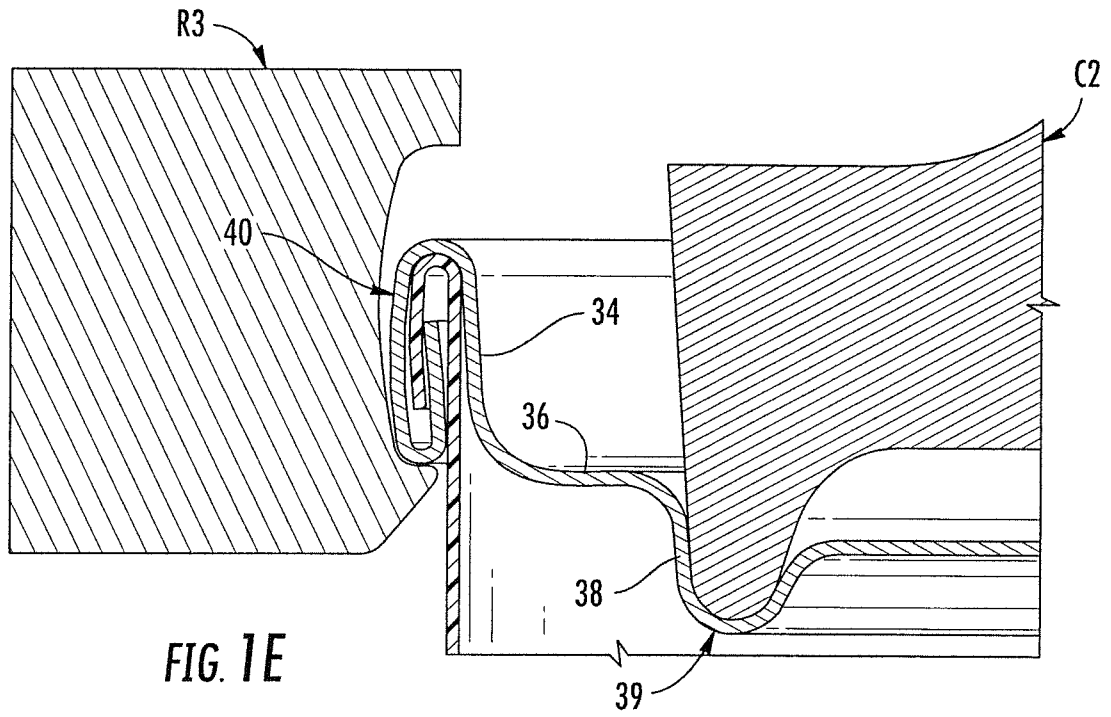


FIG. 1D

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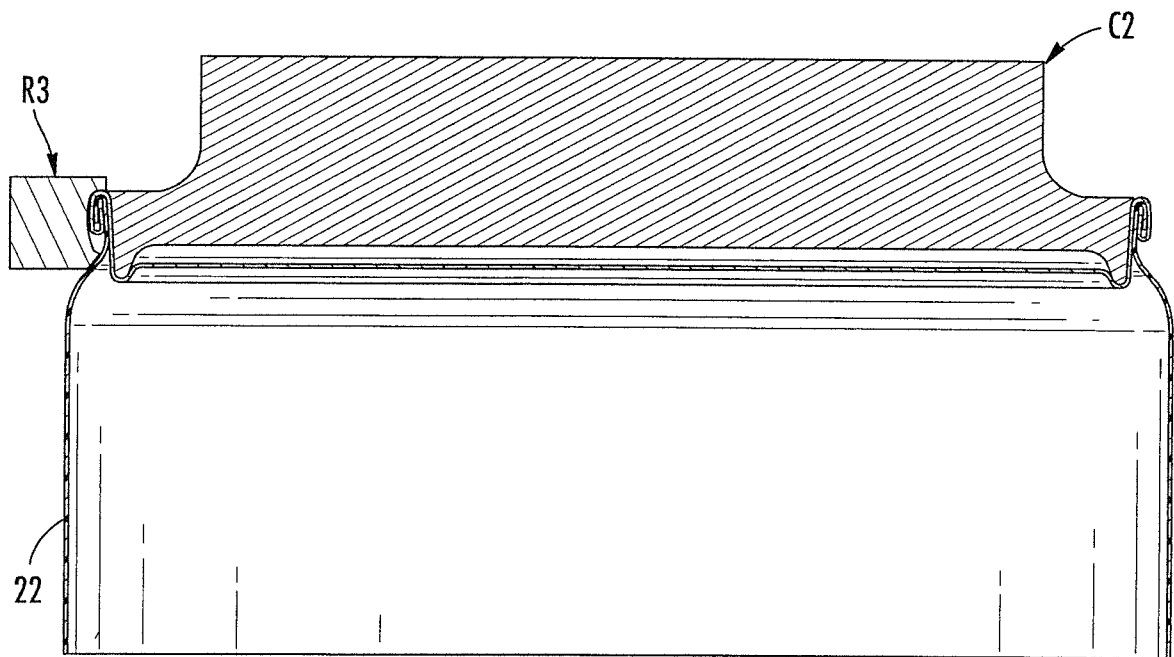


FIG. 1G

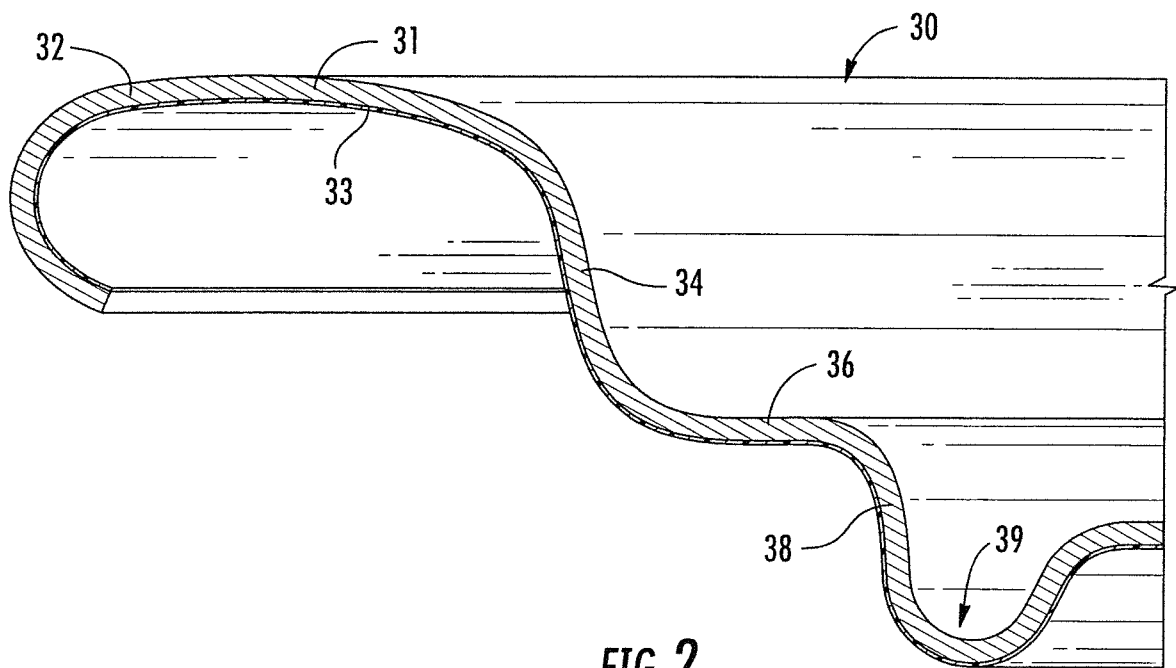
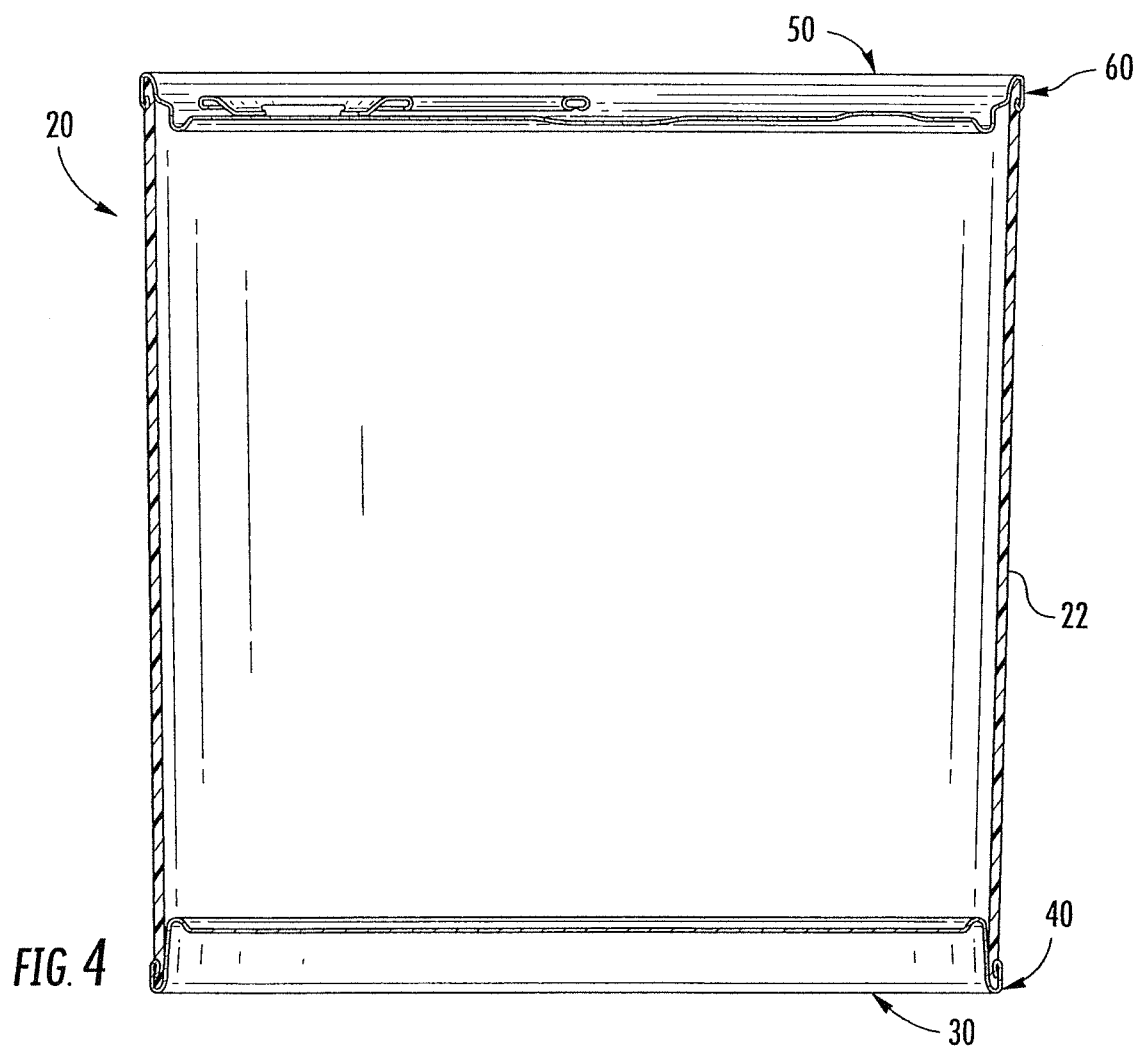
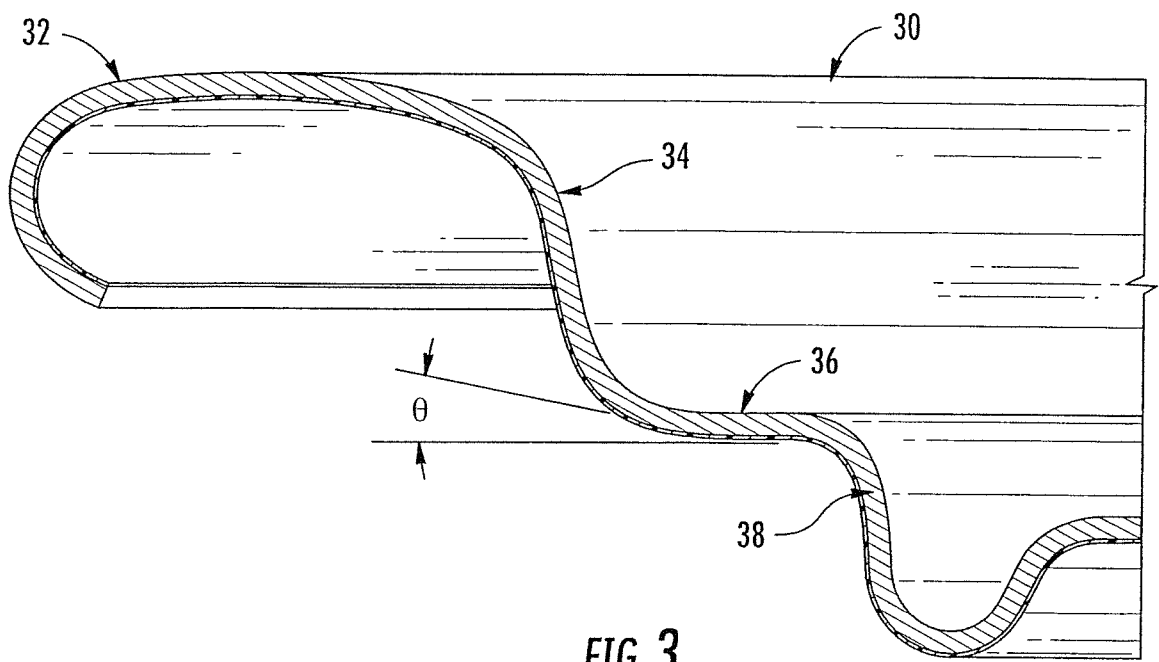


FIG. 2

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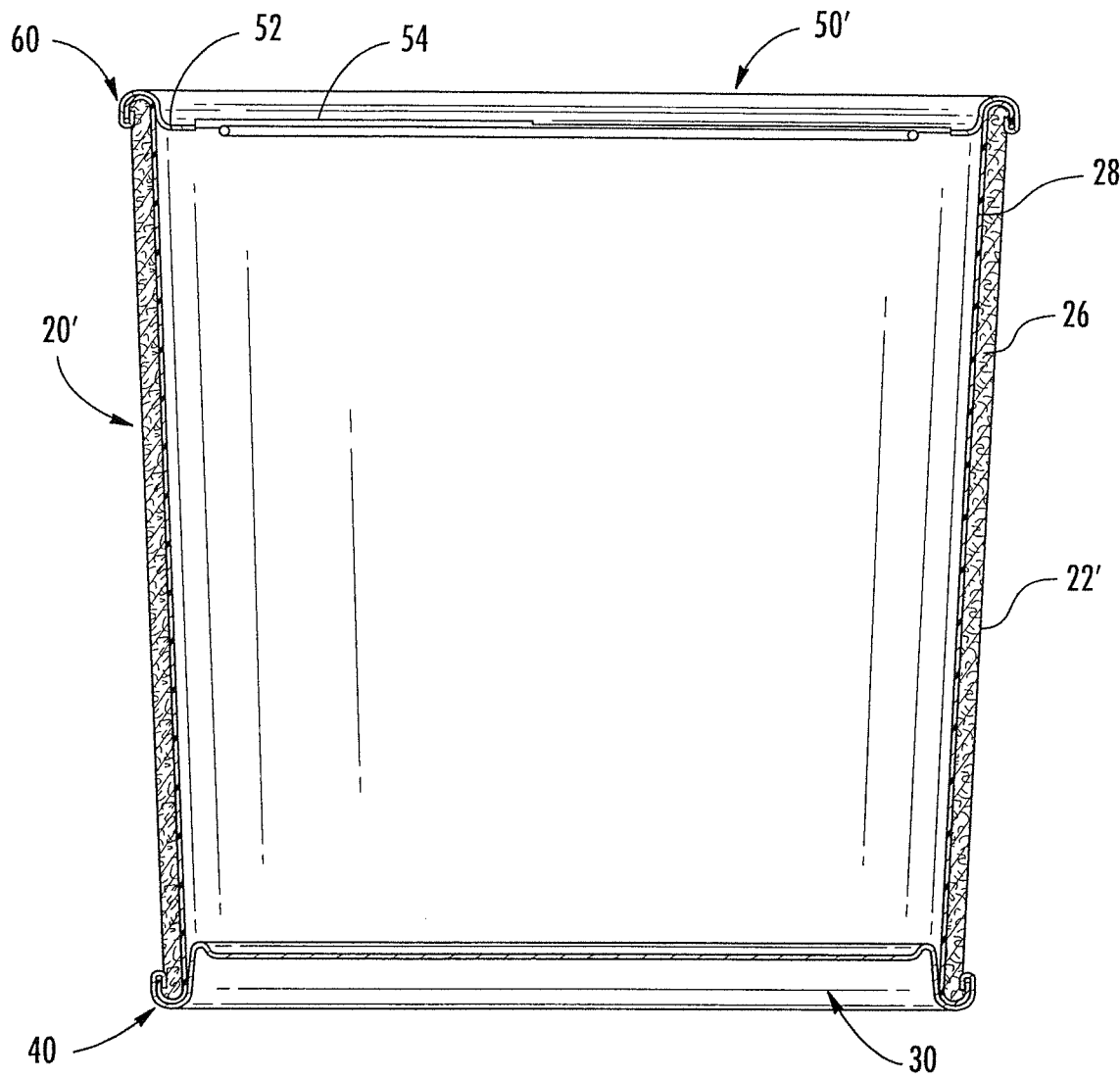


FIG. 5

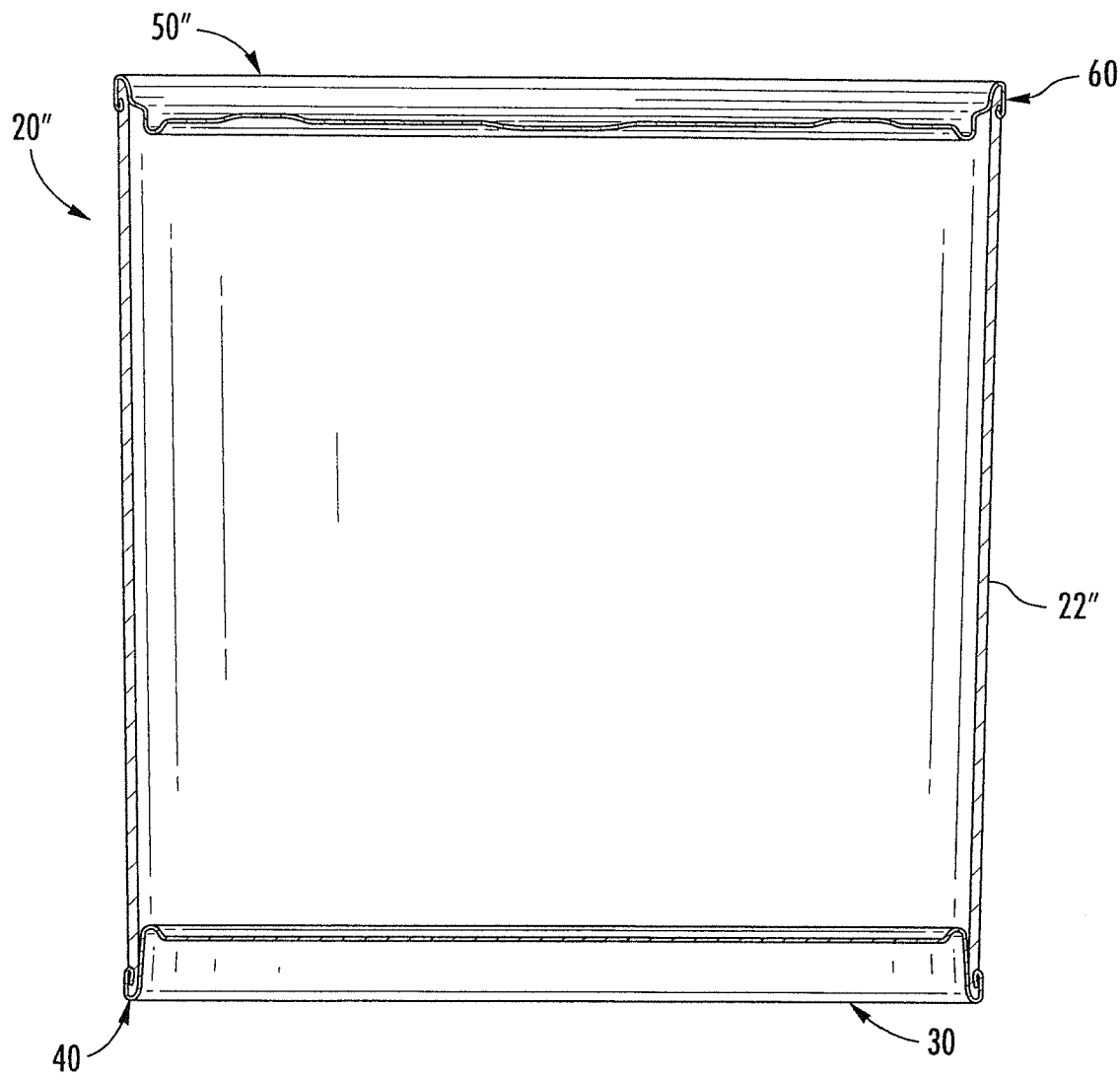


FIG. 6

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2012/060856

A. CLASSIFICATION OF SUBJECT MATTER

INV. B65D21/02 B65D8/20 B21D51/30
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

B65D B21D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	GB 894 007 A (READS LTD) 18 April 1962 (1962-04-18) Figure of the provisional specification; claim 1	1,9,16
A	----- US 2011/095030 A1 (DUNN DAVE [US] ET AL) 28 April 2011 (2011-04-28) figure 3	1
A	----- FR 1 457 858 A (READS LTD) 20 January 1967 (1967-01-20) figures 3, 4	1,9,16, 28



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

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"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

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"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

10 January 2013

Date of mailing of the international search report

22/01/2013

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Authorized officer

Bridault, Alain

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/US2012/060856

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
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			US 2011095030 A1	28-04-2011
			WO 2011053451 A1	05-05-2011

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