No. 2023-2308

United States Court of Appeals for the Federal Circuit

BALL METAL BEVERAGE CONTAINER CORPORATION,
Plaintiff-Counterclaim Defendant-Appellee,

v.

CROWN PACKAGING TECHNOLOGY, INC.,
CROWN CORK & SEAL USA, INC.,
Defendants-Counterclaim Plaintiffs-Appellants,

v.

REXAM BEVERAGE CAN CO.,
Counterclaim Defendant-Appellee.

Appeal from the United States District Court for the Southern District of Ohio in Case No. 3:12-cv-00033-WHR, United States District Judge Walter H. Rice

OPENING BRIEF OF APPELLANTS CROWN PACKAGING TECHNOLOGY, INC. AND CROWN CORK & SEAL USA, INC.

Daniel J. Goettle
Jeffrey W. Lesovitz
Phillip D. Wolfe
Baker & Hostetler LLP
1735 Market Street
Suite 3300
Philadelphia, PA 19103
(215) 568-3100

Attorneys for Appellants Crown Packaging Technology, Inc., and Crown Cork & Seal USA, Inc.

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PATENT CLAIMS AT ISSUE

U.S. Patent Number 6,848,875

50. A method of forming a double seam between a can body and a can end intended for use in packaging a carbonated beverage, said method comprising the steps of:

a) providing a can end having (i) a circumferentially extending peripheral cover hook, said peripheral cover hook comprising a seaming panel to be formed into a portion of said double seam during a seaming operation, (ii) an annular reinforcing bead, and (iii) a circumferentially extending wall extending from said seaming panel to said reinforcing bead, said wall and said reinforcing bead forming a transition therebetween;

b) placing said cover hook of said can end into contact with a circumferentially extending flange of a can body;

c) providing a rotatable chuck comprising first and second circumferentially extending walls, said second chuck wall depending from said first chuck wall so as to form a juncture therebetween;

d) bringing said chuck into engagement with said can end; and

e) performing said seaming operation by placing one or more seaming rolls into contact with said peripheral cover hook of said can end while said can end rotates so as to deform said seaming panel of said cover hook and to bend a portion of said can end wall upwardly around said juncture of said chuck walls at a first location on said can end wall, a straight line extending from said first location on said can end wall to said transition between said can end wall and said reinforcing bead inclined between about 20° and about 60° with respect to said axial centerline both before and after said seaming operation.

52. The method according to claim 50, wherein said line extending from said first location to said transition is inclined between about 30° and about 50° with respect to said axial centerline of said can end both before and after performing said seaming operation.

54. The method according to claim 50, wherein said line extending from said first location to said transition is inclined between about 40° and about

45° with respect to said axial centerline of said can end both before and after performing said seaming operation.

56. The method according to claim 50, wherein at least a portion of said portion of said can end wall bent upwardly during said seaming operation is bent upward into a substantially cylindrical configuration.

58. The method according to claim 50, wherein said first wall of said chuck is oriented so as to be inclined with respect to an axial centerline of said chuck by no more than about 4°.

59. The method according to claim 50, wherein said first wall of said chuck is substantially cylindrical.

U.S. Patent Number 6,935,826

13. A metal can end for use in packaging beverages under pressure and adapted to be joined to a can body by a seaming process so as to form a double seam therewith using a rotatable chuck comprising first and second circumferentially extending walls, said first and second chuck walls forming a juncture therebetween, said can end comprising;

a peripheral cover hook, said peripheral cover hook comprising a seaming panel adapted to be formed into a portion of said double seam during said seaming operation;

a central panel;

a wall extending inwardly and downwardly from said cover hook, a first portion of said wall extending from said cover hook to a first point on said wall, said first wall portion adapted to be deformed during said seaming operation so as to be bent upwardly around said juncture of said chuck walls at said first point on said wall, a second portion of said wall extending from said first point to a second point forming a lowermost end of said wall, a line extending between said first and second points being inclined to an axis perpendicular to said central panel at an angle of between 30° and 60°.

14. The end according to claim 13, further comprising an annular reinforcing bead connected to said wall at said second point, said annular reinforcing bead connecting said wall to said central panel.

UNITED STATES COURT OF APPEALS
FOR THE FEDERAL CIRCUIT

CERTIFICATE OF INTEREST

Case Number 23-2308

Short Case Caption Ball Metal Beverage Container Corporation v. Crown Packaging Technology, Inc.

Filing Party/Entity Crown Packaging Technology, Inc. and Crown Cork & Seal USA, Inc.

Instructions:

1. Complete each section of the form and select none or N/A if appropriate.
2. Please enter only one item per box; attach additional pages as needed, and check the box to indicate such pages are attached.
3. In answering Sections 2 and 3, be specific as to which represented entities the answers apply; lack of specificity may result in non-compliance.
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5. Counsel must file an amended Certificate of Interest within seven days after any information on this form changes. Fed. Cir. R. 47.4(c).

I certify the following information and any attached sheets are accurate and complete to the best of my knowledge.

Date: 09/05/2023

Signature: /s/ Daniel J. Goettle

Name: Daniel J. Goettle

1. Represented Entities. Fed. Cir. R. 47.4(a)(1).	**2. Real Party in Interest.** Fed. Cir. R. 47.4(a)(2).	**3. Parent Corporations and Stockholders.** Fed. Cir. R. 47.4(a)(3).
Provide the full names of all entities represented by undersigned counsel in this case.	Provide the full names of all real parties in interest for the entities. Do not list the real parties if they are the same as the entities. ☐ None/Not Applicable	Provide the full names of all parent corporations for the entities and all publicly held companies that own 10% or more stock in the entities. ☐ None/Not Applicable
Crown Packaging Technology, Inc.	Crown Packaging Technology, Inc.	Crown Holdings Incorporated
Crown Cork & Seal USA, Inc.	Crown Cork & Seal USA, Inc.	Crown Holdings Incorporated

☐ Additional pages attached

4. Legal Representatives. List all law firms, partners, and associates that (a) appeared for the entities in the originating court or agency or (b) are expected to appear in this court for the entities. Do not include those who have already entered an appearance in this court. Fed. Cir. R. 47.4(a)(4).

☐ None/Not Applicable ☐ Additional pages attached

John F. Murphy, Baker & Hostetler LLP	Dale M. Heist, Baker & Hostetler LLP	Jeb B. Oblak, Baker & Hostetler LLP
Alaina J. Lakawicz, Baker & Hostetler LLP	James H. Greer, Bieser, Greer & Landis	
Aaron Bruce Rabinowitz, Baker & Hostetler LLP	David Carr Greer, Bieser, Greer & Landis	

5. Related Cases. Other than the originating case(s) for this case, are there related or prior cases that meet the criteria under Fed. Cir. R. 47.5(a)?

☑ Yes (file separate notice; see below) ☐ No ☐ N/A (amicus/movant)

If yes, concurrently file a separate Notice of Related Case Information that complies with Fed. Cir. R. 47.5(b). **Please do not duplicate information.** This separate Notice must only be filed with the first Certificate of Interest or, subsequently, if information changes during the pendency of the appeal. Fed. Cir. R. 47.5(b).

6. Organizational Victims and Bankruptcy Cases. Provide any information required under Fed. R. App. P. 26.1(b) (organizational victims in criminal cases) and 26.1(c) (bankruptcy case debtors and trustees). Fed. Cir. R. 47.4(a)(6).

☑ None/Not Applicable ☐ Additional pages attached

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TABLE OF ABBREVIATIONS AND DEFINED TERMS

Term	Meaning
Crown	Appellants, Defendants/Counterclaim Plaintiffs Crown Packaging Technology, Inc., and Crown Cork & Seal, USA, Inc.
Ball	Appellees, Plaintiff/Counterclaim Defendant Ball Metal Beverage Container Corporation and its subsidiary Counterclaim Defendant Rexam Beverage Can Co.
’875 patent	Crown’s asserted U.S. Patent No. 6,848,875 (Appx17-33)
’826 patent	Crown’s asserted U.S. Patent No. 6,935,826 (Appx34-46) (which shares a common specification with the ‘875 patent)
’634 patent	Crown’s unasserted U.S. Patent No. 6,065,634 (which shares a common specification with the ‘826 and ‘875 patents)
Asserted Claims	Claims 50, 52, 54, 56, 58 and 59 of the ’875 patent and claim 14 of the ’826 patent
Broad Claims	All Asserted Claims other than claim 54
Second Point	Refers not only to the term “second point” as used in claim 14 of the ’826 patent but also to the term “transition” in the ’875 patent claims
CDL+ Drawing	A product specification sheet having an undisputedly unscaled and dimensionally-inaccurate drawing of a can end that Ball says corresponds to the accused New CDL+ can end and supposedly is relevant ***only*** to claim 54
LOF+ Can End	A dimensionally-accurate photograph of a cross section of an operational LOF+ Can End (the “LOF+” can end) made by Anheuser-Busch that Ball says is relevant ***only*** to claim 54
Patent Drawings	Five unscaled and dimensionally-inaccurate Patent Drawings from four patent documents that Ball says are relevant to the Broad Claims ***but not*** claim 54

’789 patent	U.S. Patent No. 7,100,789 containing two of the five Patent Drawings (figures 4B and 7A)
JP ’371	Published JP Application No. 2018-016371A containing one of the five Patent Drawings (figure 2)
’280 patent	U.S. Patent No. 6,761,280 containing one of the five Patent Drawings (figure 4)
’843 patent	U.S. Patent No. 4,217,843 containing one of the five Patent Drawings (figure 3)

STATEMENT OF RELATED CASES

This appeal stems from this Court's remand in a related prior appeal involving the same parties, *Ball Metal Beverage Container Corp. v. Crown Packaging Tech., Inc., Crown Cork & Seal USA, Inc., v. Rexam Beverage Can Co*., No. 2020-1212, 838 F. App'x 538, decided on December 31, 2020, by Circuit Judges Chen, Wallach, and Taranto.

No other appeal in or from the same civil action or proceeding in the lower court or body was previously before this or any other appellate court. Counsel is aware of no case pending in this or any other court or agency that will directly affect or be directly affected by this Court's decision in the pending appeal.

JURISDICTIONAL STATEMENT

This Court's December 31, 2020 decision vacated a judgment that the asserted claims were indefinite under 35 U.S.C. § 112 ¶ 2 because the district court "erred in its indefiniteness analysis." *See Ball Metal*, 838 F. App'x at 539, 543-44. Consequently, the Court remanded for the district court "to perform the correct analysis." *Id.*

Eighteen months after remand, the district court reopened expert discovery after which Ball filed a motion for summary judgment of indefiniteness as to all asserted claims. Appx2729-2736; Appx2887-3203. On August 3, 2023, thirty-two months after remand, the district court granted Ball's motion, invalidating all

asserted claims as indefinite with a single paragraph of analysis. Appx2-16. The next day, Crown requested that the district court enter final judgment and filed its notice of appeal. Appx3627-3631; Appx1912-1915. On August 7, 2023, the district court entered final judgment. Appx1.

This Court has appellate jurisdiction pursuant to 28 U.S.C. §§ 1291 and 1295(a)(1).

INTRODUCTION

Crown and Ball have been litigating Crown's patents before the same district court judge from almost the moment they issued in 2005 through the day they expired in 2016 and then for seven years after that. In 2019, in an incomplete analysis, the district court held all asserted claims indefinite because there was more than one method of assessing a claimed parameter (*i.e.*, the location of a "second point") and because the patents did not specify which method to use. In 2020, this Court vacated that ruling and remanded for the district court to determine whether use of the different methods mattered or not for infringement.

Thirty-two months later, after 18 years of litigation (none of which involved a trial) including multiple appeals, the district court granted summary judgment holding all asserted claims indefinite in a cursory opinion containing a mere single paragraph of analysis. That one paragraph included numerous statements inconsistent with the summary judgment record and did not address the many briefed

issues. Moreover, the single-paragraph analysis ignored Fed. R. Civ. P. 56, improperly crediting Ball's expert and disregarding Crown's, and resolving credibility and many disputed factual issues arising from application of the different methods to various supposed can ends. These were quintessential factual questions akin to infringement and anticipation. The district court therefore erred in granting summary judgment, and this Court should reverse and remand for trial.

Specifically, the district court appears to have held all asserted claims, including the Broad Claims, indefinite when applied to a can end called the LOF+ Can End. But Ball only contended that claim 54 (and ***only*** claim 54) was indefinite when applied to the LOF+ Can End. There was no record evidence that any of the Broad Claims were indefinite when applied to it.

Ball contended that the Broad Claims were indefinite when applied to certain Patent Drawings. To the extent the district court agreed with Ball in this regard, however, it erred for several other reasons, including a failure to view the evidence in a light most favorable to Crown. The district court also erred in holding claim 54 indefinite when applied to either the LOF+ Can End or CDL+ Drawing, because it failed to view the evidence in a light most favorable to Crown.

Finally, because the history of this dispute reveals not only untimely progress and multiple appeals, but also a lack of urgency on the part of the district court despite mounting prejudice to Crown, this Court should order reassignment as it has

done under similar extraordinary circumstances.

STATEMENT OF THE ISSUES ON APPEAL

I. As to all asserted claims: Did the district court err in concluding that it was free to make fact findings without regard to the nature and complexity of the underlying factual disputes and in contravention of Rule 56 merely because indefiniteness is a legal question?

II. As to the asserted Broad Claims (claims 14, 50, 52, 56, 58, and 59):

A. On summary judgment, the district court appears to have held the Broad Claims indefinite when applied to the LOF+ Can End. Did the district court err in holding the Broad Claims indefinite where Ball never asserted, and there otherwise was no evidence, that any Broad Claim was indefinite when applied to the LOF+ Can End?

B. On summary judgment, Ball relied on its expert's declaration contending that the Broad Claims were indefinite when applied to five Patent Drawings from four different patents. Crown's expert disagreed and demonstrated that the different methods of assessing the claimed parameter (the location of the "Second Point") were ***not*** material to whether products depicted in any of the five Patent Drawings infringed. To the extent it held any Broad Claim indefinite when applied to the Patent Drawings, did the district court err in failing to view this evidence – namely, warring expert declarations – in a light most favorable to Crown?

C. In remanding, this Court stated that for claims to be indefinite, different methods of assessing the Second Point location must matter for infringement to those who make "operational" products that "might realistically be practicing the other claim limitations." To the extent it held any Broad Claim indefinite when applied to the Patent Drawings, did the district court err where Ball offered no admissible evidence that the Patent Drawings depicted (i) "operational" products or (ii) products that might "realistically be practicing the other claim limitations"?

D. On summary judgment, Crown's expert refuted Ball's expert and declared that the Patent Drawings did ***not*** depict "operational" products and that Ball failed to prove that the Patent Drawings might "realistically be practicing the other claim limitations." To the extent it held any Broad Claim indefinite when applied to the Patent Drawings, did the district court err by failing to view this evidence – namely, warring expert declarations – in a manner most favorable to Crown?

III. As to narrow claim 54: On summary judgment, Ball contended that narrow claim 54 was indefinite when applied to the LOF+ Can End and the CDL+ Drawing. Did the district court err in holding claim 54 indefinite because it ignored genuine issues of material fact as to whether the methods of assessing the Second Point on the LOF+ Can End and the CDL+ Drawing were material to the scope of claim 54?

STATEMENT OF THE CASE

I. The invention, the industry's reaction to it, and the procedural history of this dispute

Crown, Ball, and Rexam are competitors in the business of making and selling aluminum beverage cans and can ends to customers such as Coke and Pepsi who fill the cans, seam the can ends to them, and sell their products to downstream customers such as grocery stores. In 1996, Crown invented what was to become its patented "SuperEnd" technology that was destined to transform the industry. The invention challenged the then-industry accepted shape (or geometry) of conventional can ends, creating a can end that used about 10% less metal than conventional can ends, but that was still strong enough to withstand the high pressure typical within beverage cans. *See Anheuser-Busch Cos., Inc. v. Crown Cork & Seal Techs. Corp.*, 121 F. App'x 388, 389, 393 (Fed. Cir. 2004).

In 2000, "Ball learned of Crown's SuperEnd can end [and that] Crown was seeking patent protection for it." *Crown Packaging Tech., Inc. v. Ball Metal Beverage Container Corp.*, No. 3:05-cv-00281-WHR, 2011 WL 13203011, at *2 (S.D. Ohio Dec. 20, 2011). Later in 2000, the first of three U.S. patents, the '634 patent, issued to Crown sharing a common patent specification and effective filing date. The other two, the '875 and the '826 patents in suit, issued in 2005 after intensive examination by the Patent Office.

In 2001, Ball "joined one of its largest customers, Anheuser-Busch . . . to

develop a new can end [called the LOF+ Can End] to compete with Crown's newly developed [SuperEnd can end]." *Id.* In March 2003, Anheuser-Busch sued Crown in Wisconsin for a declaration that Crown's '634 patent did not cover the LOF+ Can End. In December of that year, the Wisconsin court ruled that the LOF+ Can End claims did *not* infringe the '634 patent. *Anheuser-Busch*, 121 F. App'x at 391. Crown appealed and this Court vacated and remanded. *Id.* at 395. "On February 1, 2005, the '875 patent was issued and [that] caused [Anheuser-Busch] to enter into [an August 2005] settlement agreement with Crown under which [Anheuser-Busch] . . . paid royalties [under the '875 and '826 patents] to use the [LOF+] can end [it] had developed with Ball that had been the subject of the [Wisconsin] litigation." *Crown Packaging*, 2011 WL 13203011, at *2.

While the *Anheuser-Busch* case was pending, Ball began selling a different product the parties now call "the original" CDL+ can end. *Id.* Crown's present dispute with Ball began in August 2005, two days after Crown's license to Anheuser Busch, when Crown sued Ball for infringing the asserted patents by virtue of its manufacture and sale of that product.

Discovery closed in the fall of 2006. Sometime thereafter, Ball made a subtle but material change to the design of the then-accused original CDL+ can end but failed to advise Crown or the district court. In 2009, the district court granted summary judgment to Crown ruling that the claims were *not* indefinite. *Crown*

Packaging Tech., Inc. v. Ball Metal Beverage Container Corp., 662 F. Supp. 2d 939, 948-49 (S.D. Ohio 2009). The district court, however, also granted summary judgment to Ball ruling that the asserted claims were invalid for inadequate written description and anticipation. *Id.* Crown appealed and this Court reversed the written description and anticipation rulings and remanded. *Crown Packaging Tech. v. Ball Metal Beverage Container Corp.*, 635 F.3d 1373, 1384 (Fed. Cir. 2011). On remand, the district court took up Ball's motion for summary judgment of non-infringement as to the original CDL+ can end.

In 2011, while that motion was pending, Crown discovered that Ball had secretly changed the design of the then-accused original CDL+ can end after discovery closed. Crown notified the district court that the then-accused original CDL+ can end was no longer within the protection of Ball's noninfringement theory. Appx2004-2006, 3:8-5:19. Ball promised the district court that the parties would confer on appropriate next steps as to adding the actual CDL+ can end — that Ball then dubbed the "New CDL+" can end — into the then-existing litigation. *Id.*

But then, in January 2012, the district court entered summary judgment of noninfringement with regard to the original CDL+ can end. *Crown Packaging Tech., Inc. v. Ball Metal Beverage Container Corp.*, No. 3:05-cv-00281-WHR, 2012 WL 292464, at *8 (S.D. Ohio Jan. 31, 2012). This Court affirmed under Federal Circuit Rule 36. *Crown Packaging Tech., Inc. v. Ball Metal Beverage Container Corp.*, 492

F. App'x 115 (Fed. Cir. 2012). Because Ball had changed the design of the original CDL+ can end, however, its successful noninfringement position (with the Rule 36 affirmance) was largely irrelevant. Appx2004-2006, 3:8-5:19.

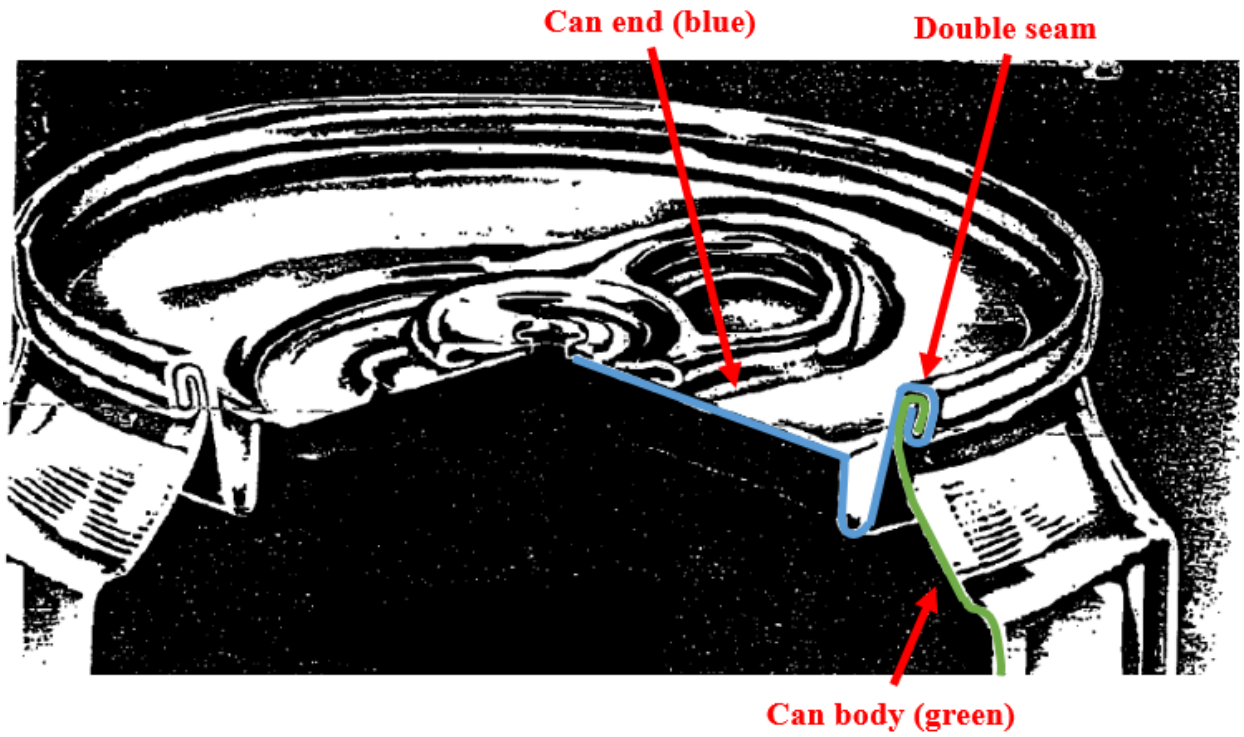
The day after the district court entered its 2012 noninfringement ruling, Ball unilaterally filed another lawsuit, the declaratory-judgment action regarding the New CDL+ can end that underlies the present appeal. Appx2008-2046. This second lawsuit has now been pending for 11 years. This is in addition to the original lawsuit which lasted seven years, for a total of 18 years.

By 2016, when Crown's patents expired, Crown had sold more than 200 billion SuperEnd® can ends in the U.S. alone. Appx2168. Further, the combined U.S. sales of Anheuser-Busch's licensed LOF+ Can Ends as well as Ball's and Rexam's sales of New CDL+ can ends surpassed half a trillion ends during the patent term. *Id.* Crown maintains that about 85% of the can ends sold in the United States during Crown's patent term were covered by Crown's patents, and collectively, those can ends saved more than half a billion dollars in aluminum costs. *Id.*

II. The Asserted Patents

A. Conventional can end design and seaming terminology

Crown's patents claim a can end and a method for seaming it to a can body. This illustration of a prior-art conventional arrangement shows a can end seamed to a can body:



Appx1061 (annotations added).

Figure 1 of Crown's patents, reproduced and annotated below, shows a conventional setup for seaming can ends to can bodies in the prior art. The process begins when a can end 11 (blue) on the top of a can body 12 (green) are pressed against a seaming "chuck" 5 (yellow). The assembly is rotated at high speed while first and second "seaming roll[s]" 6 and 8 (grey) are pressed, consecutively, against the rim of the can end. Appx22; Appx26-27, 2:61-3:10.

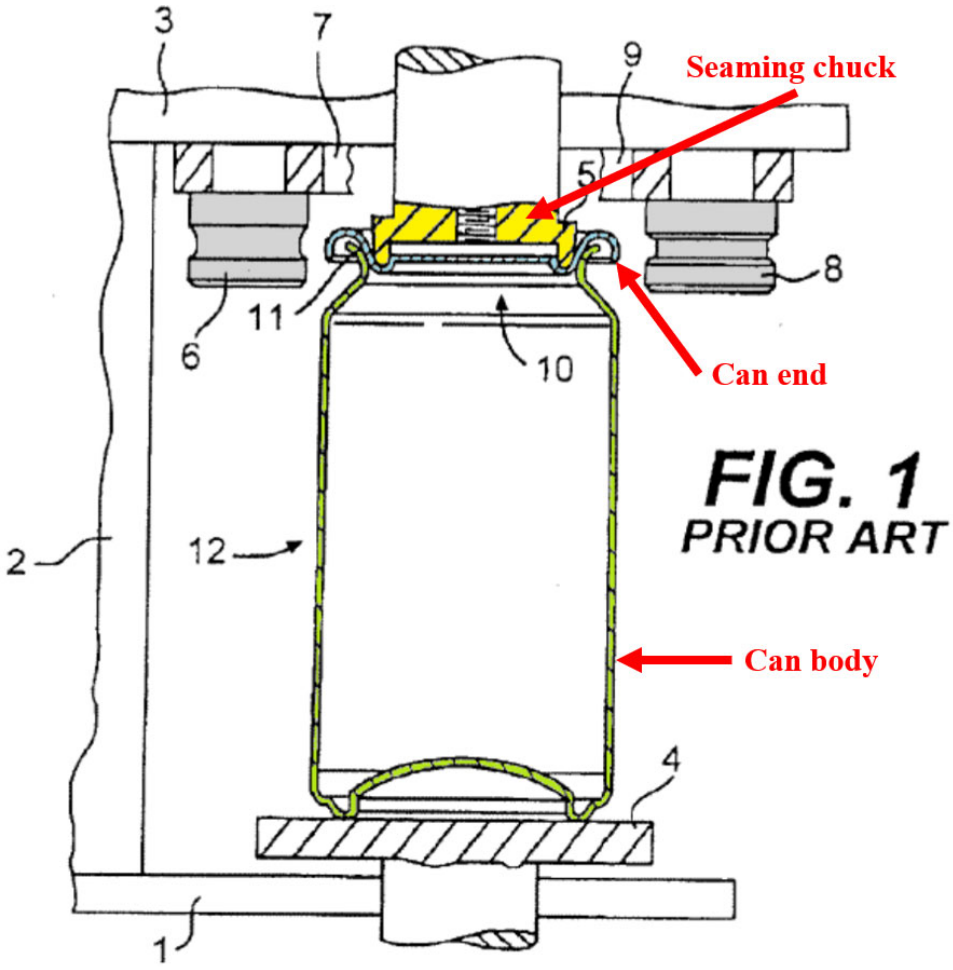
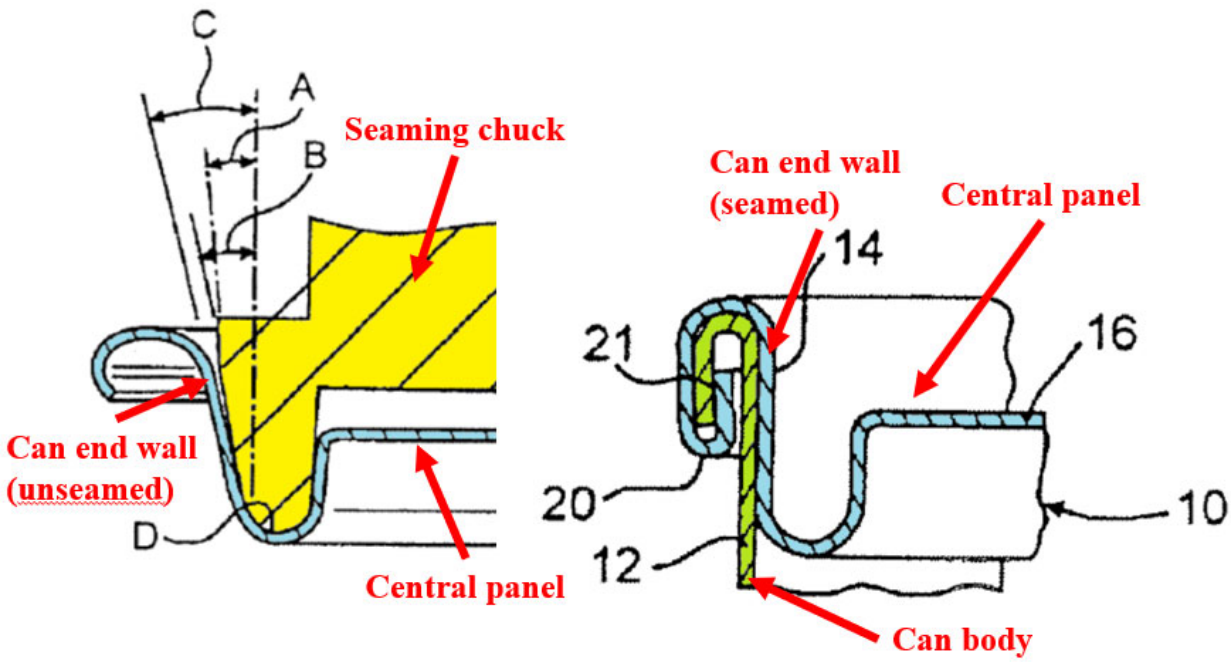


FIG. 1
PRIOR ART

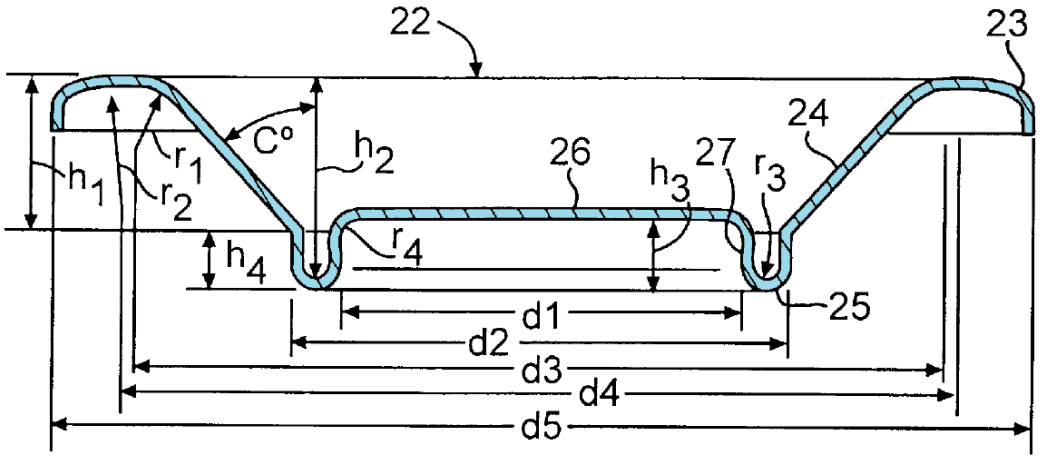
The seaming rolls deform the outer portions of the can end and can body into a double seam by pressing them against the upper portion of the chuck. *Id.* The resulting seam ensures that the contents, even when pressurized, will not leak. Figures 2 and 3 of the patents, reproduced below, show typical prior-art can-end geometry before (left) and after (right) seaming:



Appx22 (annotations added). In prior-art conventional seaming, there was minimal upward bending of the upper portion of the can-end wall against the chuck.

B. Crown's Asserted Patents and the metal-saving geometry

Crown's invention departed sharply from prior art conventions and included substantially more upward bending than prior art seaming. As shown in Figure 4 of the patents, reproduced below, the angle "C" of the new unseamed can end was greatly increased to about 20° to 60° as compared to the conventional 12° to 15°. Appx23 (annotation added); Appx27, 3:39-49.



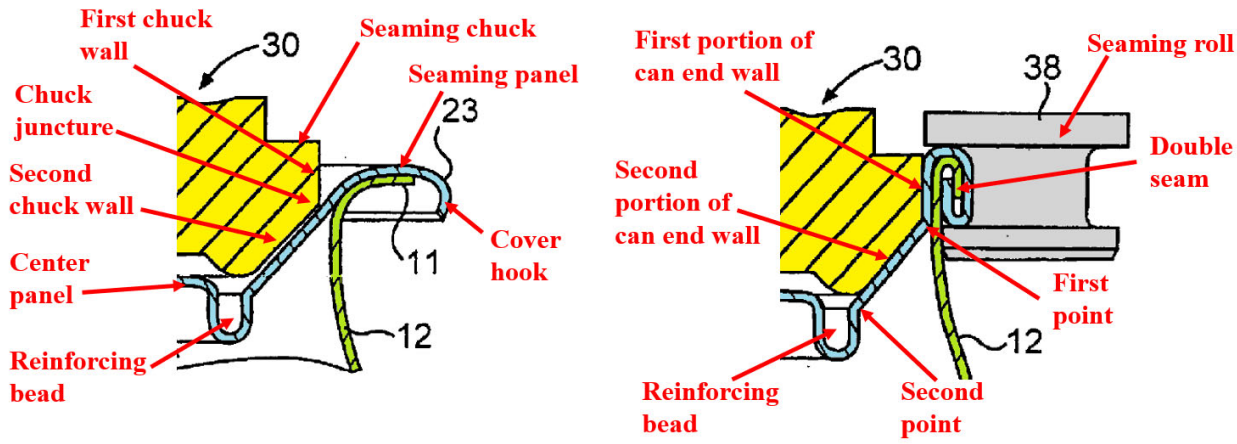
’875 patent at Fig. 4

The patents claim not only a metal-saving geometry but also a new method for seaming these new ends that calls for maintaining the radically-large lower angle of the can-end wall while also bending an upper portion of that wall upwardly in the seamer around a juncture of the seaming chuck. Appx27-28, 4:20-5:3. The outer edge of the can end wall 24 of Crown’s invention is angled with respect to a vertical line h2 extending from the bottom of an annular reinforcing bead 25 and perpendicular to the central panel 26.

The claims require the angle “Cº,” or inclination angle, to fall within a certain range. Claim 50 of the ’875 patent, for example, recites that the angle is “between about 20º and about 60º.” The claimed angle is defined by a “first point” and a “second point” (or a “first location” and a “transition,” respectively) that define a line, the angle of which is then determined based on the line compared to a vertical line, as illustrated by h2 in the above figure. *E.g.*, ’875 patent at claim 50; ’826 patent

at claim 13. The first point is defined by the location where the wall bends upwardly during seaming, and the Second Point is defined by the location where the annular reinforcing bead 25 extends from the lowermost end of the can end wall 24. *Id.*

Claim 14 of the '826 patent, which is representative of the asserted claims, is reprinted below with the language of claim 13 from which it depends in brackets, and the key terminology added in portions of figures 6 and 7 from the patents (Appx40; Appx46, 10:37-65 (emphasis added)):



> 14. [A metal can end for use in packaging beverages under pressure and adapted to be joined to a can body by a seaming process so as to form a double seam therewith using a rotatable chuck comprising first and second circumferentially extending walls, said first and second chuck walls forming a juncture therebetween, said can end comprising;
>
> a peripheral cover hook, said peripheral cover hook comprising a seaming panel adapted to be formed into a portion of said double seam during said seaming operation;
>
> a central panel;
>
> a wall extending inwardly and downwardly from said cover hook, a first portion of said wall extending from said cover hook to a first point on said wall, said first wall portion adapted to be deformed

> during said seaming operation so as to be bent upwardly around said juncture of said chuck walls at said first point on said wall, a second portion of said wall extending from said first point to a second point forming a lowermost end of said wall, ***a line extending between said first and second points being inclined to an axis perpendicular to said central panel at an angle of between 30° and 60°***],
>
> further comprising an annular reinforcing bead connected to said wall at said second point, said annular reinforcing bead connecting said wall to said central panel.

This appeal focuses on the above-emphasized language and primarily on measuring the angle (*i.e.*, inclination angle) of the claimed line to the perpendicular between the "first point"/"first location" and "second point"/"transition." There is no dispute that the terms "second point" and "transition" mean the same thing; this brief therefore refers to both as "Second Point" for simplicity.

III. Procedural history of Ball's summary judgment motion

In 2019, the district court agreed with Ball's summary judgment argument that the patents specified no method for locating the Second Point and that Crown's then-expert, Mr. Higham, had supposedly presented three different methods for locating it: (1) a "change-in-geometry" method; (2) an "across-from-center-panel" method; and (3) a "finite element analysis" method. *See Ball Metal*, 838 F. App'x at 541-42.[1]

[1] This Court previously rejected Crown's contention that there was only one proper method, the across-from-center-panel method, for locating the second point. *Ball Metal*, 838 F. App'x at 541. While Crown respectfully maintains this position, for purposes of this appeal, the position is immaterial.

On appeal, this Court agreed with Ball that the record contained different methods for locating the Second Point and that the patents did not disclose which to use. *Id.* But this Court agreed with Crown that the district court failed to assess whether the different methods actually mattered in the infringement analysis. *Id.* at 543-44. The Court remanded and ordered the district court to review the multiple methods and analyze whether choosing one over another led to materially different inclination angles on "operational" products that might "realistically be practicing the other claim limitations." *Id.* at 542-44.

Eighteen months after remand, and over Crown's objection and request to proceed directly to trial, the district court entered a scheduling order that reopened expert discovery to address this Court's "materially different results" question. Appx2698-2715; Appx2716-2728; Appx2740-2743. The order further invited Ball – but not Crown – to file a "renewed" summary-judgment motion after that discovery period. Appx2742.

After this new round of discovery, Ball filed a summary judgment motion on indefiniteness. Appx2887-3203. Crown sought leave to file its own cross motion for summary judgment on definiteness. Appx2746-2886. The district court refused to entertain Crown's cross motion on procedural grounds. Appx8-11. Briefing on Ball's motion concluded on April 25, 2023. Appx3226-3452; Appx3453-3475; Appx3476-3487; Appx3488-3492.

Ball's summary judgment briefing pointed to seven so-called "examples" of allegedly "operational" can ends and contended that various asserted claims were indefinite when applied to those examples. Appx2898-2906. Ball alleged that particular claims were indefinite when applied to each "example" because there were allegedly materially different inclination angle measurements depending upon whether the across-from-center-panel or change-in-geometry methods were used to locate the Second Point. *Id.* In support, Ball relied on two sources of extrinsic evidence and no intrinsic evidence.

First, as to the LOF+ Can End example (which, according to Ball, established indefiniteness of ***only*** claim 54), Ball relied on angle measurements made by Crown's former expert, Mr. Higham, in 2003 and 2018. Appx2898-2899. Ball's lawyers – but not its expert – compared Mr. Higham's 2003 angle measurement on an LOF+ Can End using the supposed change-in-geometry method with his 2018 angle measurement on a different LOF+ Can End using the across-from-center-panel method and asserted that this comparison proved indefiniteness of claim 54. *Id.*

Second, as to the remaining "examples" addressed in its motion, Ball relied on the declaration of its then expert, Mr. Gillest.[2] Appx2899-2906. Mr. Gillest

[2] After filing its summary judgment motion, Ball informed the district court that Mr. Gillest was resigning from this case for personal reasons. Ball moved to substitute a new expert and that motion was pending when the court granted Ball's summary-judgment motion. Appx3509-3619.

purported to apply the across-from-center-panel and change-in-geometry methods to six of Ball's seven examples (but not the LOF+ Can End). He determined that the choice of Second Point location method was material because supposedly when applying one method, the inclination angle measurement fell within a claimed angle range but, under the other method, the measurement fell outside the angle range. Appx2944-2964.

Crown opposed Ball's motion, supported by a declaration from Crown's current expert, Mr. Biondich. Appx3226-3452. Mr. Biondich's measurements proved that the choice of method of locating the Second Point on any of Ball's seven examples was immaterial to infringement of any asserted claim, thus evidencing a disputed issue of material fact that should have precluded summary judgment. Appx3239-3240; Appx3298-3299; Appx3307-3309; Appx3314-3316; Appx3327-3332; Appx3337-3338; Appx3340-3341; Appx3349-3351; Appx3357. Furthermore, also based on Mr. Biondich's declaration, Crown demonstrated that, despite this Court's mandate, the five Patent Drawings on which Mr. Gillest relied failed to depict not only "operational" can ends but also can ends that might "realistically be practicing the other claim limitations." Appx3240-3245; Appx3304-3305; Appx3310-3313; Appx3316-3319; Appx3320-3321; Appx3322-3326; Appx3334-3340; Appx3342-3349; Appx3351-3357.

As it had twice before, the district court waited until the eve of a September

2023 trial to rule on Ball's summary judgment motion, even though it promised to rule in June. Appx2-16; Appx2742. On August 2, with the trial date looming, both parties requested a status conference. Appx3624-3626. The district court refused their request but the next day, granted Ball's motion as to all asserted claims with only a single paragraph of substantive analysis. Appx15-16.

Before ruling, the district court held no trial or evidentiary hearing and did not even entertain oral argument. Relying on this Court's 2015 decisions in *Nautilus* and *Teva*, the district court noted that, "because 'general principles of claim construction apply to the question of indefiniteness,' . . . any 'subsidiary factual determinations made by the district court based on extrinsic evidence' such as expert testimony are reviewed for clear error." Appx15 (quoting *Biosig Instruments, Inc. v. Nautilus, Inc.,* 783 F.3d 1374, 1377 (Fed. Cir. 2015); citing *Teva Pharm. USA, Inc. v. Sandoz, Inc.,* 789 F.3d 1335, 1341-42 (Fed. Cir. 2015)). After setting forth its substantive analysis in a single paragraph based entirely on extrinsic expert declarations, the district court concluded that "there is no genuine issue of material fact on the sole issue presented to the Court on remand" and found all asserted claims indefinite. Appx16.

SUMMARY OF THE ARGUMENT

This Court should reverse the district court's ruling as to all asserted claims. The district court's single-paragraph analysis contains multiple clear errors.

First, as to all claims, the district court erred in apparently concluding that it

was free to make fact findings in contravention of Rule 56 merely because indefiniteness is a legal question. The district court ignored the many underlying and complex factual disputes that were more in the nature of claim application than claim construction.

Second, as to the Broad Claims, *i.e.,* all asserted claims except claim 54, the district court's opinion suggests that its ruling was based entirely on the LOF+ Can End. Ball contended, however, that only narrow claim 54 was indefinite when applied to the LOF+ Can End. Therefore, the district court erred in holding the Broad Claims indefinite.

Additionally, Ball's indefiniteness arguments for these Broad Claims were limited to the five Patent Drawings. To the extent the district court held the Broad Claims indefinite when applied to the Patent Drawings, it erred for three separate and independent reasons:

A. Crown's expert, Mr. Biondich, demonstrated that when applying the Broad Claims to the Patent Drawings, the method choice for locating the Second Point did not at all matter for infringement. To the extent the district court relied on the Patent Drawings in finding indefiniteness, it improperly disregarded Mr. Biondich's declaration and credited Ball's Mr. Gillest. Because the district court failed to evaluate the evidence – warring expert declarations – in a light most favorable to Crown, it erred in holding the Broad Claims invalid.

B. In remanding, this Court instructed that if the methods used to locate the Second Point always led to an angle within the claimed range for any "operational" can end, the method choice would be immaterial. Furthermore, this Court also stated that, to demonstrate materiality of method choice, differences in methods for locating the Second Point must matter to those who might "realistically be practicing the other claim limitations." But Ball offered no admissible evidence, let alone clear and convincing evidence, that the Patent Drawings upon which it relied depicted either "operational" can ends or can ends that might realistically be practicing the other claim limitations. To the extent the district court based its decision on the Patent Drawings, the only evidence Ball offered as to these two requirements was Mr. Gillest's declaration. But his conclusory opinions do not even qualify as *ipse dixit*, would not survive a *Daubert* motion, and certainly failed to establish patent invalidity by clear and convincing evidence.

C. Furthermore, as to both requirements of the mandate ("operational" products made by those "realistically practicing all other claim limitations"), the district court failed to view the evidence – warring expert declarations – in a light most favorable to Crown, and for this additional reason, erred in holding the Broad Claims indefinite.

Third, the district court clearly erred in holding narrow claim 54 indefinite.

A. The district court erred by holding claim 54 indefinite when applied to

the LOF+ Can End. Notably, Ball's expert, Mr. Gillest, offered no opinions regarding that product. Thus, Ball only relied upon prior statements of Crown's former expert, Mr. Higham. But there was a genuine factual issue as to whether Mr. Higham's measurement of the LOF+ Can End was correct.

B. Ball also contended that claim 54 was indefinite when applied to the CDL+ Drawing. But Crown's Mr. Biondich squarely disagreed with Ball's Mr. Gillest. Because the district court failed to evaluate the warring expert declarations on this issue in a light most favorable to Crown, it erred in holding claim 54 indefinite based on the CDL+ Drawing.

Crown respectfully asks this Court to reverse the grant of summary judgment as to all asserted claims. If there are unresolved fact issues relevant to indefiniteness, those issues should be resolved by the jury.

Furthermore, Crown respectfully requests that, upon remand, this Court order reassignment of this case. Reassignment is warranted because of the extraordinary delays in resolving this case, the severe prejudice those delays have caused and continue to cause, and the seeming lack of urgency on the part of the district court.

STANDARD OF REVIEW

The Federal Circuit reviews the grant of summary judgment under the law of the regional circuit. *Ball Metal*, 838 F. App'x at 541 (citing *Lexion Med., LLC v. Northgate Techs., Inc.*, 641 F.3d 1352, 1358 (Fed. Cir. 2011)). The Sixth Circuit

reviews an order granting summary judgment *de novo*. *Id.* (citing *Savage v. Gee*, 665 F.3d 732, 737 (6th Cir. 2012)). "In deciding a motion for summary judgment, the [district] court must view the factual evidence and draw all reasonable inferences in favor of the nonmoving party." *Savage*, 665 F.3d at 737 (quotations and citations omitted).

ARGUMENT

I. The district court's analysis was limited to a six-sentence paragraph that was inconsistent with the summary judgment record.

On summary judgment, Ball pointed to seven so-called "examples" of allegedly "operational" can ends and contended that various asserted claims were indefinite when applied to those example products. Appx2898-2906; Appx2946. The seven examples were:

- **The LOF+ Can End**. A dimensionally-accurate photograph of a cross section of an operational LOF+ Can End sold by Anheuser-Busch under license from Crown. Ball alleged that narrow claim 54, and ***only*** claim 54, was indefinite when applied to this can end;[3]
- **A CDL+ Drawing**. A specification sheet having an undisputedly unscaled and dimensionally-inaccurate drawing of a can end that Ball's expert claimed corresponded to the accused "New CDL+" can end. Ball alleged that ***only*** narrow claim 54 was indefinite when applied to this drawing;[4]
- **Patent Drawings**. Five unscaled and dimensionally-inaccurate Patent Drawings from four patent documents. Ball alleged that

[3] Appx2898-2899.
[4] Appx2899-2900.

> when the Broad Claims (but ***not*** claim 54) were applied to these five Patent Drawings, the claims were indefinite as follows:
>
> - **U.S. patent no. 7,100,789**. Ball alleged that Broad Claim 52 was indefinite when applied to Fig. 4B and that Broad Claims 50, 56, 58, 59 and 14 were indefinite when applied to Fig. 7A;[5]
> - **JP 2018-016371A**. Ball alleged that Broad Claims 52 and 14 were indefinite when applied to Fig. 2;[6]
> - **U.S. patent no. 6,761,280**. Ball alleged that Broad Claims 52 and 14 were indefinite when applied to Fig. 4;[7] and
> - **U.S. patent no. 4,217,843**. Ball alleged that Broad Claims 50, 56, 58, and 59 were indefinite when applied to Fig. 3.[8]

Ball's motion contended that the asserted claims were indefinite when applied to each of its seven examples because the "across-from-center-panel" method and the "change-in-geometry" method supposedly resulted in materially different inclination angles. Appx2898-2906; Appx2946.[9]

The substantive analysis in the district court's opinion was confined to a single

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[5] Appx2900; Appx2905-2906.
[6] Appx2901-2902; Appx2906.
[7] Appx2902-2904; Appx2906.
[8] Appx2904-2905. In a footnote, Ball further stated that its expert had also "evaluated four other examples: (1) JP 2015-042411A, (2) JP 4388726B2, (3) Figure 6 from U.S. Patent No. 8,490,825, and (4) Figure 10 from the same patent" and that these patent documents were "relevant to claim 52 . . . and claim 14 . . . ." Appx2906 n. 4. But on summary judgment, Ball failed to raise any of these other Patent Drawings as rendering any asserted claim indefinite and in any event, they fail at least for all of the reasons that the other Patent Drawings fail.
[9] While this Court concluded that Crown's Mr. Higham opined as to a supposed third method, finite element analysis, Ball never raised it in its motion. *Ball Metal*, 838 F. App'x at 541-42.

paragraph having only six sentences. Each is quoted below in bold followed by Crown's commentary:

> [1] **"Here, the Court finds that Ball and Rexam have sufficiently addressed and satisfied the remand order of the Federal Circuit by showing through Mr. Gillest that 'application of the different methods' of Mr. Higham 'result in materially different outcomes for the claim's scope such that a product or method may infringe the claim under one method but not infringe when employing another method.'"**

Appx15 (quoting *Ball Metal*, F. App'x at 542-43).

Comment: The district court appears to have ignored that Ball's expert, Mr. Gillest, never addressed the LOF+ Can End and that Ball only raised the LOF+ Can End as to claim 54. Nonetheless, the LOF+ Can End appears to have been the sole basis for the district court's indefiniteness ruling as to ***all*** asserted claims.[10]

> [2] **"Crown, through its new expert, Mr. Biondich, disputed these 'materially different outcomes' by using measurements that were different from those originally made by Mr. Higham."**

[10] The district court's single-paragraph analysis refers to three experts, Crown's former expert, Mr. Higham, Crown's current expert, Mr. Biondich, and Ball's former expert, Mr. Gillest. Mr. Higham was Crown's expert up until this Court's remand on indefiniteness. Appx3204-3225. The day after the remand, Crown informed Ball that Mr. Higham, now in his 80s, would be resigning from the case because of reduced stamina and mental acuity, the pandemic, and the distance between the Ohio courthouse and Mr. Higham's home in South Africa. Appx3214-3218. Mr. Biondich, who was already a Crown expert in this case, has since substituted for Mr. Higham (without Ball objection and with approval of the district court) and responded to Ball's former expert, Mr. Gillest, as to indefiniteness. Appx3206; District Court Notation Order dated March 23, 2023, authorizing substitution.

Appx15.

Comment: Here, the district court could only have been referring to the LOF+ Can End because (as shown below) Crown's current expert, Mr. Biondich, disagreed with Crown's former expert, Mr. Higham, only as to the LOF+ Can End. Additionally, the LOF+ Can End was the only example Ball raised on summary judgment about which Mr. Higham performed any relevant analysis.

> [3] **"In doing so, however, Crown's expert did not create a genuine issue of material fact but, instead, effectively disregarded the earlier finding by the Federal Circuit that different methodologies were used to determine the location of the Second Point and that the only remaining issue was whether they resulted in materially different outcomes."**

Appx15-16.

Comment: Crown's current expert, Mr. Biondich, nowhere disregarded this Court or its conclusion that Crown's former expert, Mr. Higham, used different methods to determine the location of the Second Point. To the contrary (as shown below), Mr. Biondich applied ***both*** methods to ***all*** seven of Ball's examples and disagreed with Ball's expert, Mr. Gillest, (and Ball's lawyers as to the LOF+ Can End), concluding instead that the method choice was immaterial as to each (and thereby demonstrating a disputed issue of material fact that should have precluded summary judgment). Appx3298-3299; Appx3307-3309; Appx3314-3316; Appx3327-3332; Appx3337-3338; Appx3340-3341; Appx3349-3351; Appx3357.

[4] **"Crown's arguments that the can ends are not operational is also without merit."**

Appx16.

Comment: As shown below, Crown disputed that Ball had shown that the Patent Drawings upon which it relied depicted operational can ends. Appx3242-3245; Appx3477-3478; Appx3480. But Crown never contended that the LOF+ Can End was not operational, and in fact readily admitted that the LOF+ Can End was an operational can end. Appx3230; Appx3235.

[5] **"At a minimum the LOF+ is an 'operational' end and, Mr. Gillest has defined operational as something that is capable of being manufactured, filled and seamed, a definition not contradicted by Mr. Biondich."**

Appx16.

Comment: Again, Crown readily admitted that the LOF+ Can End was an operational can end, as shown below. Furthermore, while this Court's mandate did not define what it meant by an "operational" product, Mr. Gillest's expansive definition of "operational" products to include Patent Drawings of can ends because they supposedly are merely "capable" of being used is not only unsupportable but also irrelevant because the meaning of the mandate is a legal question. *Engel Indus., Inc. v. Lockformer Co.*, 166 F.3d 1379, 1382 (Fed. Cir. 1999).

[6] **"Finally, Crown's argument that Ball and Rexam's use of Patent Drawings in certain examples and not others, does not address the issue on remand, *i.e.*, whether the different methodologies of Mr. Higham result in materially different**

outcomes."

Appx16.

Comment: The issue on remand was whether Ball could show that application of different Second-Point-location methods to operational products resulted in materially different infringement outcomes. Crown's argument, which the district court apparently misapprehended (or ignored), was that Ball's expert (who, again, never referenced the LOF+ Can End) failed to analyze actual, operational products. Rather, he analyzed Patent Drawings without first demonstrating that they depicted actual, operational products. Appx3242-3245; Appx3477-3478; Appx3480. In any event, it appears the district court did not base its indefiniteness ruling on any of the Patent Drawings, as shown below, and therefore could not have properly invalidated any of the Broad Claims (claims 14, 50, 52, 56, 58, or 59).

II. The district court erred in holding all claims invalid because it was not free to resolve the numerous disputed material factual issues presented here in contravention of Rule 56.

The district court properly cited *Anderson v. Liberty Lobby, Inc.*, 477 U.S. 242 (1986) for the proposition that summary judgment is improper where a genuine factual dispute exists. Appx12-13. Under Rule 56, "the judge's function is not himself to weigh the evidence and determine the truth of the matter but to determine whether there is a genuine issue for trial." *Anderson*, 477 U.S. at 249. Summary judgment does not lie "[i]f reasonable minds could differ as to the import of the

evidence . . . .” *Id.* at 250-51. Thus, as the district court acknowledged, it was required to view the evidence presented in a light most favorable to Crown. *Id*. at 255; Appx13. It was ***not*** permitted to “weigh the evidence and determine the truth of the matter but to determine whether there is a genuine issue for trial.” *Sagan v. U.S.*, 342 F.3d 493, 497 (6th Cir. 2003) (quotations and citation omitted). Further, given the burden of proving indefiniteness by “clear and convincing evidence,” the district court had a “duty . . . to consider [that] burden when deciding whether to send a case to the jury.” *Anderson*, 477 U.S. at 254.

But after citing the correct law, the district court dove headlong into the many complex factual issues presented. That was error. *See id.* at 254-55; *ImmunoGen, Inc. v. Hirshfeld*, No. 2021-1939, 2022 WL 885774, at *3 (Fed. Cir. Mar. 25, 2022) (reversing district court’s summary judgment of indefiniteness, concluding that “there are still disputed questions of material fact and summary judgment is therefore inappropriate”); *Bombardier Recreational Prod. Inc. v. Arctic Cat Inc.*, 785 F. App’x 858, 867 (Fed. Cir. 2019) (“The evidence presented . . . was almost exclusively extrinsic, in large part encompassing ***warring expert testimony***. The question of definiteness thus required the resolution of critical factual issues and was properly before the jury.”) (emphasis added).[11]

[11] Many lower courts are in accord. *E.g.*, *Smarte Carte Inc. v. Innovative Vending Sols., LLC*, No. 1:19-cv-08681-NLH-AMD, 2023 WL 2263511, at *21 (D.N.J.

The district court seems to have found comfort in its approach through reference to inapposite appellate-review standards. It stated that, because indefiniteness is subject to "general principles of claim construction" and is a legal issue subject to *de novo* review, any "subsidiary" factual determinations based on extrinsic evidence "such as expert testimony" are reviewed for clear error. Appx15. But this is not a case of indefiniteness based on ambiguity in the meaning or construction of a claim term. The material facts here are not "subsidiary" but are instead primary and essential. Specifically, this Court mandated that the indefiniteness inquiry required analysis of (1) "operational" products that (2) "might realistically be practicing the other claim limitations." *Ball*, 838 F. App'x at 542-43. And after identifying products meeting these two requirements, the indefiniteness inquiry further required applying different Second-Point-location methods to determine whether the methods were material to an infringement determination. *Id*. at 544.

Feb. 28, 2023) ("Indefiniteness, while a question of law, can only be determined at the summary judgment stage if there is no genuine factual dispute underlying the legal question.") (citing *Bombardier*, 785 F. App'x at 867); *Geospatial Tech. Assocs., LLC v. U.S.*, 164 Fed. Cl. 267, 276 (2023) ("The parties rely on conflicting expert reports, creating a disputed material fact . . . [Both] motions for summary judgment on the issue of . . . indefiniteness are thus denied."); *Viva Healthcare Packaging USA Inc. v. CTL Packaging USA Inc.*, 197 F. Supp. 3d 837, 858 (W.D.N.C. 2016) ("[W]here, as here, 'expert evidence addressing what one skilled in the art would have understood by looking at [the] patent is in conflict,' summary judgment is inappropriate.") (collecting cases).

On remand, the parties' experts applied the claims to each of Ball's seven "examples." They disputed whether: (1) the examples satisfied this Court's "operational" requirement and "realistically practiced the other claim limitations"; and (2) the choice of Second-Point-location-method was material to infringement. *See* Appx3298-3299; Appx3304-3305; Appx3307-3313; Appx3314-3332; Appx3334-3357. That is, in applying the claims to each of the examples, the experts disputed numerous issues of material fact, which should have precluded summary judgment. *Anderson*, 477 U.S. at 249; *ImmunoGen*, 2022 WL 885774, at *3.

Not only was summary judgment improper, but because this indefiniteness inquiry required claim application (similar to infringement and anticipation) – long held to be a jury issue – the district court erred in failing to submit the indefiniteness issue to a jury. *See Markman v. Westview Instruments, Inc.*, 52 F.3d 967, 984 (Fed. Cir. 1995) (*en banc*) ("[P]atentee's right to a jury trial on the application of the properly construed claim . . . is preserved as it was in 1791."), *aff'd*, 517 U.S. 370 (1996); *In re Lockwood*, 50 F.3d 966, 980 (Fed. Cir. 1995) (finding that patent owner who seeks damages for infringement is entitled to jury trial on factual issues underlying validity); *Bombardier*, 785 F. App'x at 867; *BJ Servs. Co. v. Haliburton Energy Servs., Inc.,* 338 F.3d 1368, 1372 (Fed. Cir. 2003) (indefiniteness "is

amenable to resolution by the jury where the issues are factual in nature.").[12]

Even if this Court concludes that the district court was not required to submit definiteness to a jury, certainly, it was required to try the issue to the bench and not summarily resolve disputed issues of material fact. The parties were not simply debating the meaning of claim terms but instead were and are contesting the effect of ***applying*** the claims to allegedly operational products, including whether different methods of assessing infringement were material and whether Ball's examples were realistically practicing other claim limitations. Because the district court instead decided a myriad of disputed factual issues, this Court should reverse as to all asserted claims.

III. The district court erred in holding Broad Claims 14, 50, 52, 56, 58, and 59 (that is, all asserted claims other than claim 54) indefinite.

The district court erred in holding the Broad Claims indefinite regardless of whether it relied on the LOF+ Can End or the Patent Drawings in doing so.

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[12] Again, many lower court cases are in accord. *E.g.*, *Vascular Sols. LLC v. Medtronic, Inc.*, No. 0:19-cv-01760, 2022 WL 17959845, at *4 (D. Minn. Dec. 27, 2022) ("While indefiniteness is a matter of law, . . . a jury may be required to resolve factual disputes before a court can reach that legal conclusion.") (citations omitted); *Shure Inc., v. ClearOne, Inc.*, No. 1:19-cv-01343-RGA-CJB, 2021 WL 3772138, at *4 (D. Del. Aug. 23, 2021) ("A jury should weigh the competing evidence [on indefiniteness] and render a final decision on which side has the better of it."), *report and recommendation adopted*, 2021 WL 4624488 (D. Del. Oct. 7, 2021); *see also Geospatial*, 164 Fed. Cl. at 276 ("[Because] [t]he parties rely on conflicting expert reports, creating a disputed material fact[,] [t]he question of whether the . . . patent is indefinite must go to trial.").

A. Because Ball never contended that the Broad Claims were indefinite when applied to the LOF+ Can End, the district court erred in holding them indefinite when applied to it.

Ball contended that claim 54, and ***only*** claim 54, was indefinite when applied to the LOF+ Can End. Appx2898-2906; Appx2946. The district court's single-paragraph analysis resulting in judgment that ***all*** asserted claims were indefinite was, however, apparently based entirely on the LOF+ Can End. Appx15-16. Therefore, even if the district court's indefiniteness ruling as to claim 54 based on the LOF+ Can End was sustainable – it is not as shown below – that ruling would apply only to narrow claim 54 and to none of the Broad Claims. For this reason, the district court's indefiniteness ruling as to all claims other than claim 54 was unsupported, clearly erroneous, and must be reversed.

While the district court's single-paragraph analysis is not without ambiguity, one inescapable conclusion is that the court's opinion was focused on the LOF+ Can End that was relevant only to claim 54. Various reasons support this interpretation.

First, the LOF+ Can End was the only one of Ball's seven examples specifically mentioned in the district court's opinion. Appx15-16.

Second, the opinion references the LOF+ Can End, and no other example, as being "operational." Appx16 ("At a minimum the LOF+ is an 'operational' end . . . ."); *Ball Metal*, 838 F. App'x at 543-44 (ordering district court to evaluate

methodologies in view of "operational" products).[13] While the parties briefed the issue of whether the Patent Drawings depicted "operational" can ends, the district court made no mention of those disputed issues, let alone addressed them. Appx15.

Third, the last sentence of the district court's single-paragraph analysis, where it apparently dismissed Crown's argument that no Patent Drawing showed an operational can end, suggests that the district court found the Patent Drawings irrelevant. Appx16 ("Crown's argument that Ball and Rexam's use of Patent Drawings in certain examples and not others, does not address the issue on remand, *i.e.*, whether the different methodologies of Mr. Higham result in materially different outcomes.").

Fourth, the district court noted that Crown's current expert, Mr. Biondich, arrived at measurements different from its former expert, Mr. Higham. Appx15-16 ("Crown, through its new expert, Mr. Biondich, disputed these 'materially different outcomes' by using measurements that were different from those originally made by Mr. Higham."). But the LOF+ Can Ends were the ***only*** can end examples as to which

[13] The district court incorrectly implied that, on summary judgment, Crown contended that the LOF+ Can End was not operational. Appx16 ("Crown's arguments that the can ends are not operational is also without merit. At a minimum the LOF+ is an 'operational' end . . . ."). The district court was wrong – Crown actually said the exact opposite twice in its brief, including on the first page. Appx3230 ("And as for the ***LOF+ can end, the only operational can end*** for which Ball shows scaled imaging, Ball's expert never before mentioned it on indefiniteness . . . ."); Appx3235 (acknowledging LOF+ Can End was "operational").

both Mr. Higham and Mr. Biondich applied the supposed change-in-geometry method and therefore, the only one of the seven examples that even could (and did) result in "different outcomes" between these two experts. Appx2898; Appx3371-3372; Appx3406.

Thus, even though the district court's opinion cited Ball's Mr. Gillest with approval, the entirety of the opinion suggests that it was based ***only*** on the LOF+ Can End that Mr. Gillest pointedly ignored. Consequently, if this Court agrees with Ball's position as to the LOF+ Can End, the judgment of invalidity for indefiniteness should apply only to narrow claim 54. 35 U.S.C. § 282 ("Each claim of a patent . . . shall be presumed valid independently of the validity of other claims."); *Ortho Pharm. Corp. v. Smith*, 959 F.2d 936, 942 (Fed. Cir. 1992) (explaining that invalidity must be assessed on claim-by-claim basis). On this basis, this Court should reverse the district court's ruling that Broad Claims 14, 50, 52, 56, 58, and 59 were indefinite. *Id*.

B. Alternatively, to the extent it invalidated the Broad Claims based on any of the five Patent Drawings, the district court erred for several independent reasons.

1. The district court erred in failing to view the evidence regarding the application of the Broad Claims to the Patent Drawings – warring expert declarations – in a light most favorable to Crown.

Ball's motion contended that, unlike narrow claim 54, all six Broad Claims were indefinite when applied to the five Patent Drawings. Appx2900-2906. The sole

evidentiary basis for Ball's contentions regarding the Patent Drawings was Mr. Gillest's declaration. Appx2946-2961; Appx2963-2964. The district court ruled that "Crown's expert [Mr. Biondich] did not create a genuine issue of material fact . . . ." Appx14-15. But Mr. Biondich refuted Mr. Gillest as to virtually every material issue. As to each of the five Patent Drawings, Mr. Biondich declared, based on his own analysis, that the method choice for locating the Second Point was immaterial to infringement. Appx3241-3242; Appx3307-3309; Appx3314-3316; Appx3327-3332; Appx3337-3338; Appx3340-3341; Appx3349-3351; Appx3357. To the extent the district court ruled that any of the Broad Claims were indefinite when applied to any of the Patent Drawings, that ruling must have been based exclusively, and improperly, on Mr. Gillest's declaration. On summary judgment, the district court was required to view all evidence – including warring expert declarations – in a light most favorable to Crown. Because the district court failed to do this, it clearly erred. Consequently, if the district court's invalidity ruling as to Broad Claims 14, 50, 52, 56, 58 and 59 was based on the Patent Drawings, it must be reversed.

The following summary chart shows that when the experts applied each of the Broad Claims to the Patent Drawings, there were genuine issues of material fact as to whether or not the choice of method for locating the Second Point was material to claim scope:

Claims	Ball's Contention	Ball's Mr. Gillest			Crown's Mr. Biondich		
		CIG#	ACP*	Material?	CIG	ACP	Material?
Claim 52 (≈ 30° to ≈ 50°)	789 patent, Fig. 4B	44°	52°	Yes[14]	45°	40°	No[15]
	JP371, Fig. 2	35°	26°	Yes	28°	25°	No[16]
	280 patent, Fig. 4	30°	22°	Yes	29°	29°	No[17]
Claims 50, 56, 58, 59 (≈ 20° to ≈ 60°)	789 patent, Fig. 7A	63°	60°	Yes	51°	52°	No[18]
	843 patent, Fig. 3	21°	19°	Yes	19°	19°	No[19]
Claim 14 (≈ 30° to ≈ 60°)	JP371, Fig. 2	35°	26°	Yes	28°	25°	No[20]
	789 patent, Fig. 7A	63°	60°	Yes	51°	52°	No[21]
	280 patent, Fig. 4	30°	22°	Yes	29°	29°	No[22]

CIG = Change-in-Geometry
* ACP = Across-From-Center-Panel

As shown, Mr. Gillest concluded that the method choice was material to the scope of the Broad Claims because, in his view, using one method resulted in an angle

[14] Appx2946 (table showing all of Mr. Gillest's angle measurements/materiality determinations).
[15] Appx3330-3332.
[16] Appx3340-3341.
[17] Appx3349-3351.
[18] Appx3326-3330.
[19] Appx3307-3309.
[20] Appx3340-3341.
[21] Appx3326-3330.
[22] Appx3349-3351.

measurement within a claim range while using the other resulted in a measurement outside the claim range. Crown's Mr. Biondich, however, refuted Mr. Gillest point for point and demonstrated that for ***each*** of the Patent Drawings, the method choice ***was not*** material because the angle ranges under ***both*** methods were either inside the claim range or outside the range.

To the extent the district court held any Broad Claim indefinite based on any Patent Drawing, it clearly erred in ignoring or discrediting Mr. Biondich as to these disputed fact issues because it was required to view the warring expert declarations in a light most favorable to Crown. *ImmunoGen*, 2022 WL 885774, at *3; *Bombardier,* 785 F. App'x at 866-67; *see also Smarte Carte*, 2023 WL 2263511, at *21; *Geospatial*, 164 Fed. Cl. at 276; *Viva Healthcare*, 197 F. Supp. 3d at 858. The district court was required to draw all reasonable inferences in Crown's favor and view Mr. Biondich's measurements and conclusions in the "most favorable" light. *Sagan*, 342 F.3d at 497. It failed to do so and for this reason, its summary judgment ruling as to the Broad Claims must be reversed.

2. Ball offered no admissible evidence that any of the Patent Drawings depicted an "operational" can end or "realistically practiced all other limitations" of the Broad Claims, as this Court required.

To the extent the district court held any Broad Claim indefinite when applied to any of the five Patent Drawings, summary judgment must also be reversed for the independent reasons that Ball failed to proffer admissible evidence that any Patent

Drawing depicted either an "operational" can end or a can end that "might realistically be practicing the other claim limitations." *Ball Metal*, 838 F. App'x at 542-44.

This Court's remand instructions stated that where an indefiniteness analysis involves multiple potential methods for measuring a parameter, a "mere possibility of different results" would not render the claims indefinite. *Id.* at 542. Rather, to avoid delving into hypothetical worlds of mere possibility, this Court instructed the district court to evaluate "operational" can ends that "might realistically be practicing the other claim limitations." *Id*. at 542-43. This Court stated, for example:

> [I]f the evidence established that any conceivable choice of a second point through the different methodologies used by Mr. Higham would always lead to an angle that was within 30º to 60º ***for any operational can end***, then whether different methods yield different second point locations would be immaterial to understanding the scope of claim [14] of the '826 patent.

Id. at 543 (emphasis added). This Court further instructed that the "differences in measurement methods must matter for determining whether or not a claim limitation is met by those who might ***realistically be practicing the other claim limitations***." *Id*. at 542 (emphasis added). If the other claim limitations are not practiced, the method choice cannot have been material because, no matter which method was chosen, a product would always fall outside the claim's scope.

Only by evaluating operational can ends that practice all other claim limitations can one determine whether, in the words of this Court, the "application

of the different methods result in ***materially*** different outcomes for the claim's scope such that a ***product or method*** may infringe the claim under one method but not infringe when employing another method." *Id.* (emphasis added).

Operational. The district court failed to expressly address whether any of the Patent Drawings depicted "operational" can ends because its opinion was focused only on the LOF+ Can End, which was undisputedly an operational can end. Appx15-16. But to the extent the district court may have silently agreed with Ball and held claims indefinite based on the Patent Drawings, it clearly erred. Ball's "evidence" that the Patent Drawings were more than mere possibilities and depicted actual "operational" can ends fell well short of clear and convincing admissible evidence.

Rather than depict "operational" can ends, the Patent Drawings at most depicted "possible" can ends. Thus, Ball presented a "mere possibility of different results" from application of different methods to the Patent Drawings, which was insufficient to demonstrate indefiniteness. *Ball Metal*, 838 F. App'x at 542 (citation omitted). In contrast, the LOF+ Can End was a real world commercial product and the evidence regarding it was a dimensionally-accurate photograph of it. Appx2898; Appx3366 ¶¶ 27-28; Appx3406. The product and the photograph were actualities rather than mere possibilities.

Mr. Gillest strained to satisfy this Court's "operational" requirement with

vague and conclusory statements that would be inadmissible at trial. He claimed that the Patent Drawings "covered" or were "very similar to" specified real-world operational can ends. Appx2948; Appx2950; Appx2955; Appx2957; Appx2958. But Patent Drawings do not "cover" anything, and Mr. Gillest failed to analyze the specified actual products themselves.

First, with regard to the '789 patent, Mr. Gillest never said that Figures 7A or 4B depicted the accused product. Rather, he merely said that he "understood" that the can ends depicted in both Figures each "covers (or, at a minimum, is very similar to) Ball's CDL+ can end." Appx2950; Appx2958. That understanding, however, was not only conclusory but internally inconsistent. Mr. Gillest provided no explanation for his not-even-*ipse-dixit* "understanding" regarding a relationship between the '789 patent drawings and the accused product. Tellingly, he never explained why he failed to evaluate the actual accused product in the first place.

In sharp contrast, ***both*** Mr. Higham (Crown's former expert) and Mr. Biondich (Crown's current expert) located the Second Point on the accused New CDL+ can end itself using ***both*** methods. The undisputed record demonstrated that the methods were immaterial to infringement. *E.g.*, Appx3298-3299.

Mr. Gillest's conclusory opinion that the '789 patent drawings supposedly "covered" or were "similar to" the accused product should have been inadmissible. *See TQ Delta, LLC v. CISCO Sys., Inc.*, 942 F.3d 1352, 1359 (Fed. Cir. 2019)

("[C]onclusory expert testimony is inadequate to support an [invalidity] determination . . . .").

Furthermore, Mr. Gillest's understanding as to the supposed relationship between the '789 patent and the accused product was internally inconsistent. He stated, for example, that his angle measurements of Figure 7A using the two methods (63° and 60°) conflicted with his measurements of Figure 4B (44° and 52°). Appx2948; Appx2957. And each of these measurements, which appear materially different from and hardly "very similar" to one another, were both different from his angle measurements of the CDL+ Drawing (37° and 43°) even though both Figures 7A and 4B were supposedly "very similar to" the CDL+ can end. Appx2962. Mr. Gillest nowhere tried to square these disparate results, and offered no explanation for them.

Second, Mr. Gillest also claimed that '280 and '843 patent drawings supposedly "covered" or were "substantially similar to" Millenium and Dynamic III can ends. Both products were made at one time by Rexam. Rexam developed the Millenium can end in 2001 but never sold it. Appx3342-3343. Rexam's predecessor made and sold Dynamic III can ends until the mid-1980's when they were abandoned. Appx3303-3304. But Mr. Gillest nowhere evaluated these actual products, and instead was content to rely only on dimensionally inaccurate Patent Drawings and vague "understandings" without first comparing the drawings to the

actual products themselves. Appx2948; Appx3310-3311.

Finally, his "analysis" of Figure 2 of the JP '371 patent was even more conclusory and far-fetched. There, Mr. Gillest vaguely pronounced that Figure 2 "looks to be one that could be" operational. Appx2955. And yet again, he provided no further explanation for this not-even-*ipse dixit* vagueness. Mr. Gillest's "operational" opinions were insufficient to satisfy the reliability standard of *Daubert* let alone the clear-and-convincing standard for indefiniteness. *See TQ Delta*, 942 F.3d at 1359.

Far from showing that the five Patent Drawings depicted operational can ends, Mr. Gillest never even considered whether any of the Patent Drawings were to-scale versions of actual products even though he located first and Second Points, measured angles of lines drawn between them, and opined as to indefiniteness based on them. Appx3421 at 42:7-15. This Court "has repeatedly cautioned against overreliance on [patent] drawings that are neither expressly to scale nor linked to quantitative values in the [patent] specification." *Krippelz v. Ford Motor Co.*, 667 F.3d 1261, 1268 (Fed. Cir. 2012). "[I]t is well established that Patent Drawings do not define the precise proportions . . . and may not be relied on to show particular sizes if the specification is completely silent on the issue." *Hockerson-Halberstadt, Inc. v. Avia Group International, Inc*., 222 F.3d 951, 956 (Fed. Cir. 2000). Failing to consider whether the can ends shown in the Patent Drawings were scaled, dimensionally-accurate

renderings of operational can ends, Mr. Gillest had no basis to contend that any Patent Drawing depicted a real-world, operational can end.

Realistically practicing all other claim limitations. Mr. Gillest similarly concluded, with no explanation or support, that the Patent Drawings "would realistically be practicing the other claim limitations." Appx2948; Appx2950; Appx2955; Appx2957; Appx2958. But he performed no analysis showing that can ends depicted in the Patent Drawings would necessarily practice all other claim limitations. *See id.* (Mr. Gillest merely concluding, without discussion, that the Patent Drawings "would realistically be practicing the other claim limitations").

As this Court explained, in the anticipation context requiring claim application, "[t]ypically, testimony concerning [claim coverage] . . . must identify each claim element, state the witnesses' interpretation of the claim element, and explain in detail how each claim element is disclosed in the prior art reference. The testimony is insufficient if it is merely conclusory." *Schumer v. Lab'y Computer Sys., Inc.*, 308 F.3d 1304, 1315-16 (Fed. Cir. 2002); *see also Koito Mfg. Co. v. Turn-Key-Tech, LLC*, 381 F.3d 1142, 1151-52 (Fed. Cir. 2004) ("General and conclusory testimony . . . does not suffice as substantial evidence of invalidity."); *TechSearch, L.L.C. v. Intel Corp.*, 286 F.3d 1360, 1372 (Fed. Cir. 2002) ("Mere denials or conclusory statements are insufficient."). The same should be required when the indefiniteness inquiry requires claim application. But Mr. Gillest's conclusory

opinions, with no analysis as to the remaining claim limitations, could not have satisfied Ball's burden of proof.

The district court erred if it relied on the Patent Drawings in holding the Broad Claims indefinite because Ball presented no admissible evidence that any Patent Drawing depicted (1) an operational can end, or (2) a can end that might realistically practice all other claim limitations, as this Court's remand required.

3. The district court erred because it failed to view evidence that the Patent Drawings did not depict operational products that practiced the other claim limitations in a manner most favorable to Crown.

Even if Mr. Gillest's conclusory opinions regarding the Patent Drawings were admissible and sufficient to show that they depicted operational products that otherwise satisfied the claim limitations – and they were not – Crown presented its own evidence refuting Mr. Gillest's conclusory opinions relating to both issues. The district court therefore erred in failing to consider Crown's evidence in a light most favorable to Crown, the non-movant.

Crown's Mr. Biondich stated, with respect to each of the five Patent Drawings, that none depicted an operational can end. For example, Mr. Biondich disputed that Figures 4B and 7A of the '789 patent depicted operational New CDL+ can ends, explaining that: (1) "whether or not a can end design shown in a patent drawing is 'covered' by a patent, or 'similar' to a different design, or might be commercially viable is entirely irrelevant to whether or not the design is, or even

might be, 'operational'"; and (2) "the evidence of record suggests that the New CDL+ is not related to either the figure 4B or figure 7A embodiments of the 789 patent." Appx3321 ¶ 138; Appx3322-3325.

Similarly, Mr. Biondich stated as to Figure 2 of JP '371 that: (1) "there needs to be more than a mere drawing of a can end"; and (2) there was no evidence that the can end shown in the Japanese patent document is or could be made into an operational product. Appx3334 ¶ 165.

Further, Mr. Biondich disputed that Figure 4 of the '280 patent depicted the supposedly operational "Millenium" can end. In fact, he compared engineering drawings for the Millenium can end with Figure 4 and concluded that the Millenium can end had nothing to do with that figure. Appx3342-3347.

Finally, Mr. Biondich demonstrated not only that Figure 3 of the '843 patent did ***not*** depict a "Dynamic III" can end, but also that the record evidence indicated that the two were "substantially different." Appx3310-3313; Appx3316-3317 ¶ 122.

Mr. Biondich also opined, based on detailed analysis, that Mr. Gillest failed to show the Patent Drawings realistically practiced the claim limitations other than the inclination angle requirements. Appx3305-3307; Appx3319 ¶ 130; Appx3326-3329; Appx3330; Appx3333; Appx3335 ¶ 167; Appx3340-3341; Appx3349. In fact, as to Figure 3 of the '843 patent, the district court itself previously held that whether the '843 patent satisfied the claim elements was a disputed issue of material fact for

the jury to decide. *Crown Packaging*, 662 F. Supp. 2d at 961.

To the extent the district court held the Broad Claims indefinite when applied to the five Patent Drawings, it clearly erred because there were genuine issues of material fact as to whether any of the Patent Drawings depicted operational products that realistically practiced the other claim limitations. Accordingly, summary judgment should be reversed as to at least the Broad Claims.

IV. The district court erred in holding narrow claim 54 indefinite when applied to either the LOF+ Can End or the CDL+ Drawing.

Ball contended that claim 54 was indefinite when applied to either the LOF+ Can End or the CDL+ Drawing. Appx2898-2900. A summary of the record applying claim 54 (reciting an angle of between about 40° and about 45°) to those two examples is set forth below:

Claim 54								
	Mr. Gillest			Mr. Biondich			Mr. Higham	
	CIG[#]	ACP[*]	Material?	CIG	ACP	Material?	CIG	ACP
LOF+	–	–	–	53°	52°	No[23]	45° (2003)	48° (2018)[24]
CDL+ Drawing	37°	43°	Yes[25]	41°	43°	No[26]	–	–

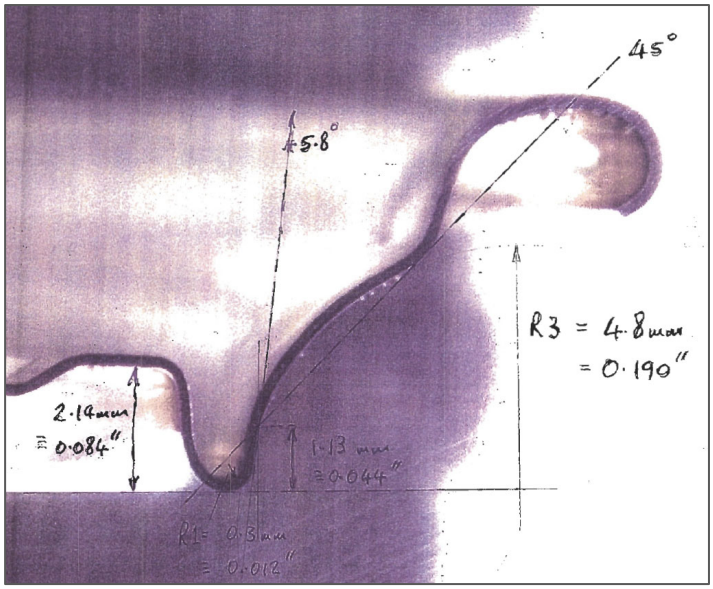
CIG = Change-in-Geometry
* ACP = Across-From-Center-Panel

[23] Appx3264-3265.
[24] Appx3263; Appx2898.
[25] Appx2961-2963.
[26] Appx3298-3301.

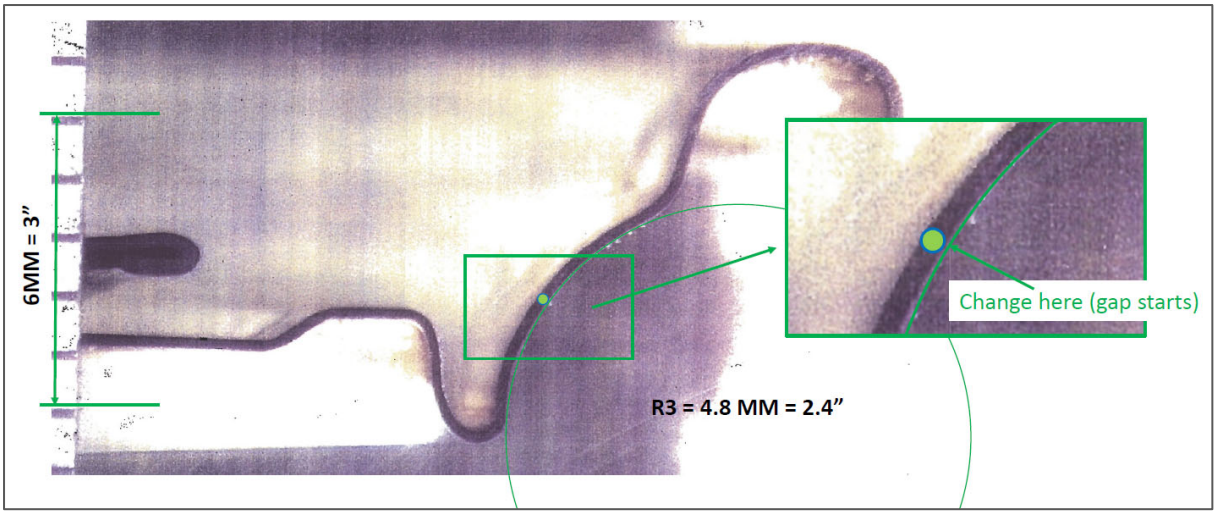
A. The district court erred in holding claim 54 indefinite when applied to the LOF+ Can End because there was a genuine issue of material fact as to the location of the Second Point using the change-in-geometry method.

Ball's Mr. Gillest offered no opinion as to whether claim 54 was indefinite when applied to the LOF+ Can Ends. Crown's former expert, Mr. Higham, used the change-in-geometry method to locate the Second Point on an LOF+ Can End in 2003 in Crown's infringement suit against Anheuser-Busch. Appx3263. In 2018 in this case, Mr. Higham used the across-from-center-panel method to locate the Second Point on a different LOF+ Can End. Appx2898. Mr. Higham, however, never opined as to the materiality of the method choice. Crown's current expert, Mr. Biondich, was the only expert to declare that, when claim 54 was applied to the LOF+ Can End, the choice of second-point-location method was or was not material to infringement. Appx3264 ¶ 14.

Crown submitted Mr. Biondich's declaration revealing that Mr. Higham's 2003 application of the change-in-geometry method to an LOF+ Can End was wrong. Appx3262-3265. Mr. Biondich demonstrated that Mr. Higham had erred because he had relied on a blurry, small-scale photograph. Specifically, Mr. Higham had performed his 2003 analysis using a printout of a photo along with a pencil and protractor to arrive at his 45° opinion, shown here:



Appx3406. Mr. Biondich, however, repeated Mr. Higham's analysis in 2022 but only after first transferring Mr. Higham's photographic image to Microsoft PowerPoint where it could be enlarged and viewed in more detail. Appx3264 ¶ 15. Using PowerPoint, Mr. Biondich was able to enlarge Mr. Higham's image and determine that the geometry change occurred higher on the can-end wall than Mr. Higham had previously determined twenty years before. Appx3264-3265 ¶¶ 16-23; Appx3414; Appx3416. Mr. Biondich's PowerPoint, with the correct Second Point identified by a green dot, is shown below:



Appx3410. Mr. Higham's 2003 eyes simply could not see what Mr. Biondich could see from an enlarged PowerPoint image in 2022 – that the relevant geometry change on the LOF+ Can End occurred higher on the can-end wall than Mr. Higham supposed. Therefore, there was a genuine issue of material fact when comparing Mr. Higham's 2003 and 2018 pre-remand analyses of the LOF+ Can End with Mr. Biondich's post-remand analysis. Appx3264 ¶ 14; Appx3414; Appx3416. On summary judgment, the district court erred in failing to view the evidence in a manner most favorable to Crown, the non-movant, in resolving this disputed issue of material fact.

B. To the extent the district court ruled that claim 54 was indefinite when applied to the CDL+ Drawing, it erred by failing to view conflicting evidence in a light most favorable to Crown.

As shown in the above chart, the parties' experts disagreed as to whether the method of locating the Second Point on the CDL+ Drawing was material to

infringement. To the extent the district court held claim 54 indefinite when applied to the CDL+ Drawing, it failed to consider the evidence – warring expert declarations – in a light most favorable to Crown. As explained with respect to the Patent Drawings, that failure was erroneous.

For all of the foregoing reasons, this Court should reverse the district court's indefiniteness rulings as to ***all*** asserted claims and remand for trial.

V. Crown respectfully requests that, upon remand, this Court order reassignment of this case.

The district court's work in this case reflects a diligent march to resolution. But that march has been proceeding at a glacial pace, and the tempo appears to be holding steady. The district court has shown no proclivity for speed and has, instead, demonstrated a lack of urgency in reaching resolution. Because the delay in this case has unduly prejudiced Crown and further delay will inflict further undue prejudice, Crown respectfully requests that, upon remand, this Court order reassignment.

Crown does not make this request for such extraordinary relief lightly, but the cliché that "justice delayed is justice denied" is no cliché here; instead, it is particularly apt. Crown stands unduly prejudiced by the long delay in bringing this case to trial, and while that prejudice cannot be undone, further prejudice can be minimized with reassignment and an immediate jury trial.

Crown cannot here recite the entire 18-year history of this dispute to justify its request for the extraordinary remedy of reassignment. The district court's docket

speaks for itself. Appx1920-1953; Appx2008-2046. How the parties ended up in an 18-year-old case is less important than avoiding further delays and impediments to trial. But one example is emblematic of the delay in this dispute. After this Court's mandate in February 2021, the district court let 18 months pass before performing the simple ministerial task of entering a scheduling order. Appx1911; Appx2740-2743.

The delays in this case have severely prejudiced Crown in several ways.

First (loss of lead counsel). Crown's first lead counsel, who represented it not only through the first 14 years of this dispute but also in its prior dispute with Anheuser-Busch, retired in 2019. Appx2696-2697. Its second lead counsel was confirmed to the federal bench late last year, and with his ascension to the bench, Crown lost another decade's worth of institutional knowledge about the case. Appx2744-2745.

Second (loss of experts). Crown's longtime technical expert, Mr. Higham, resigned from the case immediately after this Court's last remand. Appx3204-3225. Mr. Higham, who is in his 80s, resigned for a myriad of reasons including his health, the pandemic, and the distance from his home in South Africa to Dayton, Ohio. Appx3217-3218. Involved in this dispute since its inception in 2005, Mr. Higham also served as Crown's lead technical expert in Crown's previous case against Anheuser-Busch. Appx3217 ¶ 4. Losing Mr. Higham, a true expert in the field of

can manufacturing, delivered a hefty blow to Crown's trial preparations.

Then, only a few months ago and after moving for summary judgment, Ball informed Crown that its primary technical expert, Mr. Gillest, and its only damages expert who had been involved in this matter since inception were both resigning. Appx3493-3619. Consequently, when the district court ruled on Ball's motion leading to this appeal, the parties were in the midst of re-doing virtually all expert discovery simply because the case has outlasted the original experts.

Third (loss of key fact witnesses). Important fact witnesses have died or have otherwise become unavailable for trial. One of the primary reasons Crown filed this case in the Southern District of Ohio was that Peter Stodd, who developed the CDL can end after having learned of Crown's patents, could be compelled to testify there. He died in 2020.

Furthermore, all three inventors died long ago and therefore would have been unavailable to testify at trial in any event. But Mr. Higham was their supervisor at the time the invention was made and was expected to provide some trial testimony as to the making of the invention. That potential testimony has now been lost.

Further, of Crown's four primary (if not exclusive) fact witnesses, one retired and likely is no longer available to testify at trial, and two more (one located in the United Kingdom) are retiring at the end of 2023, making their availability to testify at trial questionable. As more time passes, the likelihood that Crown will be

successful in persuading former employees to participate at trial diminishes, as does their recollection of relevant events.

Fourth (jury confusion). The long delay in bringing this case to trial will complicate the jury's task. The invention was made in 1996 and first patented in 2000. Appx19. The Asserted Patents issued in 2005. *Id.*; Appx35. Crown alleges that Ball began infringing in 2006. Because of Ball's concealment of relevant facts, Crown did not learn of that infringement until 2011. Appx2004-2006, 3:8-5:19. The patents expired in 2016. And yet a jury will not be sitting in judgment until sometime (hopefully) in the middle of this decade likely wondering why it is being asked to decide such old questions. The longer this pretrial period lasts, the more difficult it is for Crown to explain.

Reassignment is also warranted given the district court's cursory summary judgment ruling. The district court's single-paragraph analysis and approach to this case supports reassignment. This Court has ordered reassignment where a district court previously has been reversed, where its analysis is perfunctory, and where the history of the case reveals an unusual lack of timely progress toward resolution. *TriMed, Inc. v. Stryker Corp.*, 608 F.3d 1333, 1344 (Fed. Cir. 2010) (applying Ninth Circuit reassignment law identical to that in the Sixth Circuit and reassigning case because district court had been "reversed twice after entering summary judgment against [plaintiff], . . . [and] simply signing [the defendant's] proposed statement of

law and facts"); *Howe v. City of Akron*, 801 F.3d 718, 756-57 (6th Cir. 2015) (laying out Sixth Circuit reassignment law identical to Ninth Circuit law that this Court applied in *TriMed*, and concluding that reassignment was warranted where "history of the case reveals an alarming lack of timely progress toward resolving this case—a case that began nearly a decade ago") (internal quotation marks and citation omitted).

If this Court reverses, this will be the third time (out of four appeals) that it will have declined to affirm the district court. *Ball Metal*, 838 F. App'x at 544; *Crown Packaging*, 492 F. App'x at 115; *Crown Packaging*, 635 F.3d at 1384. The district court's one-paragraph analysis here is on par with that of the district court in *TriMed* that simply signed the defendant's proposed statement of law and facts. Furthermore, not only was the district court's analysis cursory here, the court was also wrong in invalidating all claims based on the LOF+ Can End that Ball raised as to only one claim.

Reassignment is an extraordinary remedy. But for all of these reasons, including case longevity, the undue prejudice to Crown, the district court's single-paragraph, cursory, clearly-erroneous analysis in its recent ruling, and this Court's prior reversals and remands, Crown submits that this case is extraordinary and warrants reassignment.

CONCLUSION

For the reasons stated, Crown respectfully asks this Court to reverse the district court's grant of summary judgment and remand for a long-awaited jury trial, as justice demands. Furthermore, Crown respectfully submits that this Court should order reassignment.

October 20, 2023

/s/ Daniel J. Goettle
Daniel J. Goettle
Jeffrey W. Lesovitz
Phillip D. Wolfe
Baker & Hostetler LLP
1735 Market St., Suite 3300
Philadelphia, PA 19103
(215) 568-3100
Attorneys for Appellants

ADDENDUM

AO 450 (Rev. 11/11) Judgment in a Civil Action

UNITED STATES DISTRICT COURT

for the

Southern District of Ohio

Ball Metal Beverage Container Corporation, *Plaintiff*
v.
Crown Packaging Technology, Inc. et al *Defendant*

Civil Action No. 3:12-cv-00033

JUDGMENT IN A CIVIL ACTION

The court has ordered that *(check one)*:

☐ the plaintiff *(name)* _____ recover from the defendant *(name)* _____ the amount of _____ dollars ($ _____), which includes prejudgment interest at the rate of _____ %, plus post judgment interest at the rate of _____ % per annum, along with costs.

☐ the plaintiff recover nothing, the action be dismissed on the merits, and the defendant *(name)* _____ recover costs from the plaintiff *(name)* _____ .

☑ other: Judgment is entered in favor of Plaintiff/Counterclaim Defendant Ball Metal Beverage Container Corp., and Counterclaim Defendant Rexam Beverage CanCompany and against Crown Packaging Technology, Inc., and Crown Cork & Seal USA, Inc. Case terminated on Court's docket.

This action was *(check one)*:

☐ tried by a jury with Judge _____ presiding, and the jury has rendered a verdict.

☐ tried by Judge _____ without a jury and the above decision was reached.

☑ decided by Judge Walter H. Rice on a motion for Summary Judgment

Date: 8/7/2023

CLERK OF COURT

Sophia R. Bryan
Signature of Clerk or Deputy Clerk

IN THE UNITED STATES DISTRICT COURT
FOR THE SOUTHERN DISTRICT OF OHIO
WESTERN DIVISION

BALL METAL BEVERAGE CONTAINER CORP.,	:	
Plaintiff/Counterclaim Defendant,	:	
vs.	:	Case No. 3:12-cv-033
CROWN PACKAGING TECHNOLOGY, INC. AND CROWN CORK & SEAL USA, INC.,	:	JUDGE WALTER H. RICE
Defendant/Counterclaim Plaintiffs,	:	
vs.	:	
REXAM BEVERAGE CAN COMPANY,	:	
Counterclaim Defendant.	:	

DECISION AND ENTRY (1) OVERRULING DEFENDANTS/ COUNTERCLAIM PLAINTIFFS CROWN PACKAGING TECHNOLOGY, INC., AND CROWN CORK & SEAL, USA., INC.'S MOTION FOR LEAVE TO FILE A MOTION FOR PARTIAL SUMMARY JUDGMENT ON PLAINTIFF/COUNTERCLAIM DEFENDANT BALL METAL BEVERAGE CONTAINER CORPORATION AND COUNTERCLAIM DEFENDANT REXAM BEVERAGE CAN COMPANY'S INDEFINITENESS DEFENSE REGARDING THE "SECOND POINT" OR "TRANSITION" (DOC. #195); (2) SUSTAINING PLAINTIFF/COUNTERCLAIM DEFENDANT BALL METAL BEVERAGE CONTAINER CORPORATION AND COUNTERCLAIM DEFENDANT REXAM BEVERAGE CAN COMPANY'S RENEWED MOTION FOR SUMMARY JUDGMENT ON INDEFINITENESS (DOC. #196); AND (3) OVERRULING AS MOOT PLAINTIFF/COUNTERCLAIM DEFENDANT BALL METAL BEVERAGE CONTAINER CORPORATION'S AND COUNTERCLAIM DEFENDANT REXAM BEVERAGE CAN COMPANY'S MOTION FOR LEAVE TO SUBSTITUTE FOR EXPERT WITNESS ANDREW CARTER (DOC. #210) AND MOTION FOR LEAVE TO SUBSTITUTE FOR EXPERT WITNESS EDMUND GILLEST (DOC. #209); JUDGEMENT TO BE ENTERED ACCORDINGLY; TERMINATION ENTRY

This matter is before the Court pursuant to the following motions: (1) Motion for Leave to File a Motion for Partial Summary Judgment filed by Crown Packaging Technology, Inc. ("Crown Technology"), and Crown Cork & Seal USA, Inc. ("Crown USA") (collectively "Crown"), on the Indefiniteness Defense Regarding the "Second Point" or "Transition" asserted by Plaintiff/ Counterclaim Defendant Ball Metal Beverage Container Corp. ("Ball") and Counterclaim Defendant Rexam Beverage Can Company ("Rexam"), Doc. #195; (2) Ball and Rexam's Renewed Motion for Summary Judgment on Indefiniteness, Doc. #196; and (3) Ball and Rexam's Motion for Leave to Substitute for Expert Witness Andrew Carter, Doc. #210, and Motion for Leave to Substitute Expert Witness Edmund Gillest. Doc. #209. The parties have filed responses opposing the motions, Doc. ##198, 199, 211 and 212, replies, Doc. ##200, 201, 213 and 214 and, concerning the Renewed Motion, a sur-reply, Doc. #203, and a response. Doc. #206.

For the reasons set forth below, Crown's Motion for Leave to File a Motion for Partial Summary Judgment on the Indefiniteness Defense Regarding the "Second Point" or "Transition" asserted by Ball and Rexam, Doc. #195, is overruled, Ball and Rexam's Renewed Motion for Summary Judgment on Indefiniteness, Doc. #196, is sustained and their Motions for Leave to Substitute for Expert Witness Andrew Carter, Doc. #210, and Edmund Gillest, Doc. #209, are overruled as moot.

I. Procedural Background

On September 25, 2019, the Court issued a Decision and Entry, entering judgment in favor of Ball Metal, a manufacturer and seller of metal beverage can components, including can ends and can bodies, and Rexam, Ball's wholly owned subsidiary, and against Defendants Crown Technology and Crown USA, the assignee and exclusive licensee, respectively, of two patents, to wit: U.S. Patent No. 6,848,875 (the "'875 Patent") and U.S. Patent No. 6,935,826 (the "'826 Patent") (collectively, "asserted patents.").[1] Ball and Crown are competitors in the business of manufacturing and selling the metal can ends and the can body to "fillers," companies that would then fill the cans. Ball's Complaint sought a declaratory judgment on the validity of the '875 Patent and the '826 Patent. Doc. #1. The Court found that the "second point" in the '826 Patent and the "transition" in the '875 Patent were invalid for indefiniteness pursuant to 35 U.S.C. § 112 and, therefore, the manufacture, sale, seaming and related activity of CDL-W and New COL+ Can Ends did not infringe the said patents. Judgment was entered in favor of Ball Metal and Rexam on Crown's infringement counterclaims, "given that one

[1] The asserted patents "... relate to the ends of metal beverage cans [the '826 Patent] used for beer and soft drinks and the method of securing the ends of the cans onto the bodies of the cans [the '875 Patent], [a process] which the parties and the patents refer to as seaming." *Crown Packaging Tech., Inc. v. Ball Metal Beverage Container Corporation*, 662 F. Supp. 2d at 941-942 *rev'd,* 635 F.3d 1373 (Fed. Cir. 2011). The metal can ends and the can body are manufactured separately and sold to fillers who fill and seal the beverage cans and can ends.

cannot infringe upon patents that are invalid for indefiniteness." Doc. #166.[2] Ball and Rexam's Motion for Summary Judgment that the asserted claims[3] of the '875 and '826 Patents were invalid for obviousness pursuant 35 U.S.C. § 103 were rendered moot.[4]

Crown appealed the Court's Decision and on December 31, 2020, the Federal Circuit vacated this Court's "grant of summary judgment "and remanded "for further proceedings consistent with this opinion." *Ball Metal Beverage Container Corporation v. Crown Packaging Tech. Inc.*, 838 Fed. Appx. 538, 544 (Fed. Cir. 2020). It stated the following as the test for determining when a claim is invalid for being indefinite:

> Under our case law, then, a claim may be invalid as indefinite when (1) different known methods exist for calculating a claimed parameter, (2) nothing in the record suggests using one method in particular, and (3) application of the different methods result in materially different outcomes for the claim's scope such that a product or method may infringe the claim under one method but not infringe when employing another method. Such a claim lacks the

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[2] Crown filed a Second Amended Answer and Counterclaims alleging infringement against Ball and Rexam. It sought a judgment holding that Ball and Rexam infringed the asserted patents pursuant to 35 U.S.C. § 271, damages for the infringement, including willfulness and treble damages, and attorney fees as provided by 35 U.S.C. §§ 284 and 285. Doc. #56. Crown's Counterclaims alleged that Ball's New CDL+ and the Rexam CDL can ends infringe claims 16, 18, 20, 24, 28, 29, 50, 52, 54, 56, 58 and 59 of the '875 Patent and claim 14 of the '826 Patent. Doc. #56, PageID##5834-5839.

[3] Ball and Rexam have defined "asserted claims" in their Reply to the Motion for Summary Judgment on Validity, Doc. #104, PageID#8162, as consisting of claims 50, 52, 54, 56, 58 and 59 of the '875 Patent and claim 14 of the '826 Patent.

[4] Crown's Counterclaims, Doc. #56, PAGEID# 5831, do not allege infringement as to Ball's CDL-W can end referenced in Ball's declaratory judgment complaint. Doc. #56.

> required degree of precision 'to afford clear notice of what is claimed, thereby apprising the public of what is still open to them.'"

Id. at p. 542-543 (quoting *Nautilus Inc. v. Biosig Instruments, Inc.*, 572 U.S. 898, 909, 134 S.Ct. 2120, 189 L.Ed.2d 37 (2014).

As stated in the opinion by the Federal Circuit, this Court's analysis was "incomplete" since it did not address the third element of the test.

> The district court's opinion states '[b]ecause all asserted claims require measuring the angle, from vertical, of a hypothetical line that connects two points, one of which is a second point/transition, and because the methods do not always produce the same results, the method chosen for locating the second point/transition could affect whether or not a given product infringes the claims.'. . . This analysis is incomplete, however, because it does not establish in any meaningful way what material difference in angle range outcome, if any, exists among Mr. Higham's different methodologies.

Ball Metal, 838 Fed. Appx at 543-544 (emphasis added).

Importantly, the Federal Circuit agreed with this Court on the first point, that Crown's expert, Martin J. Higham, used different methodologies to determine the location of the second point in various cases. It specifically rejected Crown's argument to the contrary and cited three examples from the record of Crown's expert using different methodologies to determine the location of the second point. It further noted that "contrary to Crown's argument" these different methodologies of Crown's expert "do not necessarily result in selection of the same location for the second point." *Id.* at 542.

The Federal Circuit stated it was vacating the Court's decision because it did not "establish in any meaningful way what material difference in angle range outcome, if any, exists among Mr. Higham's different methodologies." *Id.* at 544.

The decision concluded with the following statement: "[W]e emphasize that on remand the [D]istrict [C]ourt should review Mr. Higham's methodologies and analyze whether the methods lead to materially different results for the angle."

Based on the limited remand issued by the Federal Circuit to which this Court is bound, *United States v. Campbell*, 168 F.3d 263, 265, 269 (6th Cir. 1999) ("The court cannot go beyond the scope of the remand and reexamine previously decided issues unless one of the narrow exceptions to the mandate rule applies), on August 25, 2021, the Court filed an "Entry and Order Reopening the Record for Limited Discovery on Issue of What, if any, Material Difference in Angle Range Outcome Exists among Different Methodologies." Doc.#181. Following further briefing by the parties, on August 30, 2022, a Scheduling Order was filed. Doc. #188. The Order stated, *inter alia*, "Ball shall file its renewed motion for summary judgment on indefiniteness within 21 days following the close of the expert deposition period" and that the Court will issue its decision on Ball's renewed motion for summary judgment on indefiniteness by June 13, 2023. *Id.* Unfortunately, that date has passed and no decision has yet to be rendered. Trial is scheduled for September 11, 2023. *Id.*

II. Legal Analysis

A. Crown's Motion for Leave to File a Motion for Partial Summary Judgment, Doc. #195

On March 1, 2023, Crown filed a Motion for Leave to File a Motion Partial Summary Judgment pursuant to F. R. Civ. P. 16(b)(4), on Ball and Rexam's indefiniteness defense "regarding the "second point" or "transition" limitations recited in asserted claims." Doc. #195. Such motion, if granted, would, of necessity, impact the presently operative scheduling order.

A motion to modify the scheduling order is granted if "good cause" is shown, the Court consents and consideration is given as to whether the other party will be prejudiced. Good cause is established if there is diligence in attempting to meet the case management order's requirements. *Inge v. Rock Fin, Corp.*, 281 F3d 613, 625 (6th Cir 2002). Crown argues that discovery was reopened on "what, if any, material difference in angle range outcome exists among the different methodologies" for locating the second point, Doc. No. 181, PageID#10467-68, and was concluded on February 20, 2023. It asserts that following discovery it realized "Ball cannot show, by clear-and-convincing evidence, that the different supposed methodologies for determining the second point lead to any material difference." Crown further contends that it could not have foreseen this lack of evidence when the parties previously filed dispositive motions or submitted briefing concerning the remand schedule, and, further, has only recently discovered that "Ball has no evidence that any of the ten drawings supposedly depicting can ends was drawn to scale" which it alleges is "a

requirement of black-letter Federal Circuit jurisprudence in situations like this." Doc. #195, PageID#10513. It has attached its proposed Motion for Partial Summary Judgment, which, itself, has been fully briefed.

Ball and Rexam oppose Crown's motion and argue primarily that Crown waited too long to file this motion, stating it had "plenty of occasions to make that desire known" and therefore cannot establish "good cause." Doc. #198, PageID#10992. It argues Crown could have filed a motion before the case went up on appeal or after the case was remanded and that "nothing in the Federal Circuit's decision suggested that, on remand, this Court should reopen the summary judgment deadline to give Crown another chance to file its own motion on indefiniteness." *Id.* Ball and Rexam also argue that Crown's reason that it could not have foreseen that "any of the can end drawings [Ball and Rexam] are relying on to show materiality are 'drawn to scale'" is not well-taken, since "Ball and Rexam advised the Court and Crown that they were going to be relying, in part, on patent drawings as early as April 2021, when they filed their reply statement on how the case should proceed on remand. *Id.*, PageID#10993. Doc. 179, Ball/Rexam Remand Reply Br., PageID 10400-01. Thus, Crown has been on notice for at least two years of this allegedly "new" issue. Crown's response to this particular issue is somewhat confusing:

> But even if Crown had given Ball's earlier submissions any thought in this regard, Crown was **not** on notice that Ball's reliance on patent drawings would run afoul of binding law. When performing the types of angle measurements that Ball's expert performed on patent drawings, the law requires confirmation from within the patents

> themselves that such drawings are dimensionally accurate. *Krippelz v. Ford Motor Co.*, 667 F.3d 1261, 1268 (Fed. Cir. 2012) (noting the Federal Circuit's repeated caution "against overreliance on drawings that are neither expressly to scale nor linked to quantitative values in the specification."); see also Doc. No. 195-2, Gillest Tr., PageID 10574-75 (42:7-43:19) . . . Crown does not have a crystal ball and had perceived no intent on Ball's part to flout this clear and binding law. (emphasis in original).

Doc. #200, PageID#11223.

Ball and Rexam filed their Renewed Motion for Summary Judgment on Indefiniteness ("Ball's Renewed Motion"), Doc. #196, nine days after Crown's Motion for Leave to File Motion for Partial Summary Judgment and addressed Crown's argument that the patent drawings relied on by them are not to scale and cannot be relied by them in their invalidity argument. Crown also addresses this issue in its Response to Ball and Rexam's Renewed Motion. Doc. #199.

The standard of review for denial of Crown's motion is abuse of discretion. Here, Crown could have requested leave to file a motion for partial summary judgment in the scheduling order, since Ball and Rexam did disclose in their Reply Brief Regarding Remand Procedures, Doc. #179, filed April 21, 2021, that they would be using patent drawings and devoted several pages to not only explaining the tests that would be used to show materially different angle measurements,[5] but also identified two of the examples, LOF+, the "Kraska" patent, including the

[5] "In fact, while this Court found three different tests for locating the second point, Doc. No. 162, PAGEID 10301, Ball and Rexam's supplemental submission would focus only on two: the "across-from-the-center-panel" test and the "change-in-geometry" test. Doc. #179, PageID#10438.

measurements and diagrams. Doc. #179, PageID##10438-10441. Additionally, the remand order of the Federal Circuit only directed this court to consider one issue, i.e., whether a "material difference in angle range outcome. . .exists among Mr. Highman's different methodologies." Ball Metal, 838 fed. Appx at 543-544 (emphasis added). Accordingly, Crown has failed to demonstrate that, with due diligence, it could not have reasonably met the dates set from the Scheduling Order. *Ross v. Am. Red Cross,* 567 F. App'x 296 (6th Cir. 2014). Finally, as noted above, Crown has briefed this issue in their Response, Doc. #199, and Sur-Reply, Doc. #203, to Ball and Rexam's Renewed Motion.[6]

Accordingly, Crown's Motion for Leave to File a Motion for Partial Summary Judgment, Doc. #195, is overruled.

B. Ball and Rexam's Renewed Motion for Summary Judgment on Indefiniteness, Doc. #196

1. Standard of Review

Summary judgment must be entered "against a party who fails to make a showing sufficient to establish the existence of an element essential to that party's case, and on which that party will bear the burden of proof at trial." *Celotex Corp.v. Catrett*, 477 U.S. 317, 322 (1986). The moving party always bears the

[6] Additionally, by permitting Crown to file its Motion for Partial Summary Judgment, both parties would be prejudiced since the trial date scheduled for September 11, 2023, would need to be continued.

initial responsibility of informing the court of the basis for its motion and identifying those portions of the record which it believes demonstrate the absence of a genuine issue of material fact. *Id.* at 323; *see also Boretti v. Wiscomb*, 930 F.2d 1150, 1156 (6th Cir. 1991).

"Once the moving party has met its initial burden, the nonmoving party must present evidence that creates a genuine issue of material fact making it necessary to resolve the difference at trial." *Talley v. Bravo Pitino Rest., Ltd.*, 61 F.3d 1241, 1245 (6th Cir. 1995); *see also Anderson v. Liberty Lobby, Inc.*, 477 U.S. 242, 250 (1986). Once the burden of production has so shifted, the party opposing summary judgment cannot rest on its pleadings or merely reassert its previous allegations. It is not sufficient to "simply show that there is some metaphysical doubt as to the material facts." *Matsushita Elec. Indus. Co. v. Zenith Radio Corp.*, 475 U.S. 574, 586 (1986). Rule 56 "requires the nonmoving party to go beyond the [unverified] pleadings" and present some type of evidentiary material in support of its position. *Celotex*, 477 U.S. at 324. "The plaintiff must present more than a scintilla of evidence in support of his position; the evidence must be such that a jury could reasonably find for the plaintiff." *Michigan Prot. & Advocacy Serv., Inc. v. Babin*, 18 F.3d 337, 341 (6th Cir. 1994).

Summary judgment shall be granted "if the movant shows that there is no genuine dispute as to any material fact and the movant is entitled to judgment as a matter of law." Fed. R. Civ. P. 56(a). "Summary judgment will not lie if the dispute about a material fact is 'genuine,' that is, if the evidence is such that a

reasonable jury could return a verdict for the nonmoving party." *Anderson*, 477 U.S. at 248. In determining whether a genuine dispute of material fact exists, a court must assume as true the evidence of the nonmoving party and draw all reasonable inferences in favor of that party. *Id.* at 255. If the parties present conflicting evidence, a court may not decide which evidence to believe. Credibility determinations must be left to the fact-finder. 10A Wright, Miller & Kane, *Federal Practice and Procedure* Civil 3d § 2726 (1998).

In determining whether a genuine dispute of material fact exists, a court need only consider the materials cited by the parties. Fed. R. Civ. P. 56(c)(3). "A district court is not . . . obligated to wade through and search the entire record for some specific facts that might support the nonmoving party's claim." *InterRoyal Corp. v. Sponseller*, 889 F.2d 108, 111 (6th Cir. 1989), *cert. denied*, 494 U.S. 1091 (1990). If it so chooses, however, the Court may also consider other materials in the record. Fed. R. Civ. P. 56(c)(3).

2. Ball Has Established Material Differences in Angle Range Outcome Through Two of Mr. Higham's Different Methodologies

Ball and Rexam's Renewed Motion, Doc. #196, argues that the '826 Patent and the '875 Patent are invalid for indefiniteness pursuant to 35 U.S.C. § 112. Consistent with the scope of the remand from the Federal Circuit and through their expert Mr. Gillest, they have applied two of Mr. Higham's methods, the change-in-geometry and across the center point ("ACP") methods, to the following asserted claims: (1) claim 54 of the '875 Patent requiring a 40°-45° range;

(2) claim 52 of the '875 Patent requiring a 30°-50° range; (3) claims 50, 56, 58, and 59 of the '875 Patent requiring a 20°-60° range; and (4) claim 14 of the '826 Patent requiring a 30°-60° range. Doc. #196-3, PageID##10709-10729. Ball and Rexam's Renewed Motion identifies each claim and indicates the measurements for each using the two methods of Mr. Higham. As asserted by Ball and Rexam in the Renewed Motion, "materially different" results exist for the angle of the hypothetical depending on which of Mr. Higham's methods is used. Doc. #193, PageID##10662-10671. Mr. Gillest opined in his Supplemental Report as follows:

> The angle measurements clearly show the dependence of the infringement outcome upon the location of the second point/transition and upon which method is used to locate it. When the second point/transition is located using one of methods, the angle is within the claims. When it is located using another one of Mr. Highams's methods, the angle is outside the claims. Thus, using one method versus the other leads to materially different measurement results for the angle. Therefore, in my opinion, after applying the instructions from the Court of Appeals, the asserted claims of the '826 and '875 Patents are indefinite.

Doc. #196-3, PageID#10708.

In response, Crown argues that there is no clear and convincing evidence of indefiniteness. Specifically, they assert that none of the can-end drawings are operational, the drawings used by Ball and Rexam are not "dimensionally-accurate renderings of a can end," and that material factual issues exist because Crown's new expert, Scott Biondich ("Mr. Biondich"), disputes the measurements of Mr. Gillest.

As stated by the Federal Circuit in its decision, "[T]he ultimate conclusion that a claim is indefinite under 35 U.S.C. § 112 ¶ 2 is a legal conclusion" reviewed *de novo*. *Eidos Display, LLC v. AU Optronics Corp.*, 779 F.3d 1360, 1364 (Fed. Cir. 2015) (emphasis added). '[A] patent is invalid for indefiniteness if its claims, read in light of the specification delineating the patent, and the prosecution history, fail to inform, with reasonable certainty, those skilled in the art about the scope of the invention.'" *Nautilus Inc. v. Biosig Instruments, Inc.*, 572 U.S. 898, 901, 134 S.Ct. 2120, 189 L.Ed.2d 37 (2014). Because "general principles of claim construction apply to the question of indefiniteness," *Biosig Instruments, Inc. v. Nautilus, Inc.*, 783 F.3d 1374, 1377 (Fed. Cir. 2015) (internal quotation marks omitted), any "subsidiary factual determinations made by the district court based on extrinsic evidence" such as expert testimony are reviewed for clear error. *Id.*; *see also Teva Pharm. USA, Inc. v. Sandoz, Inc.*, 789 F.3d 1335, 1341-42 (Fed. Cir. 2015).

Here, the Court finds that Ball and Rexam have sufficiently addressed and satisfied the remand order of the Federal Circuit by showing through Mr. Gillest that "application of the different methods" of Mr. Higham "result in materially different outcomes for the claim's scope such that a product or method may infringe the claim under one method but not infringe when employing another method." *Ball Metal*, 838 Fed. Appx. at 542-543. Crown, through its new expert, Mr. Biondich, disputed these "materially different outcomes" by using measurements that were different from those originally made by Mr. Higham. In doing so, however, Crown's expert did not create a genuine issue of material fact

but, instead, effectively disregarded the earlier finding by the Federal Circuit that different methodologies were used to determine the location of the second point and that the only remaining issue was whether they resulted in materially different outcomes. Crown's arguments that the can ends are not operational is also without merit. At a minimum the LOF+ is an "operational" end and, Mr. Gillest has defined operational as something that is capable of being manufactured, filled and seamed, a definition not contradicted by Mr. Biondich. Finally, Crown's argument that Ball and Rexam's use of patent drawings in certain examples and not others, does not address the issue on remand, i.e., whether the different methodologies of Mr. Higham result in materially different outcomes.

Following discovery by the parties of their respective experts and further briefing, the Court finds there is no genuine issue of material fact on the sole issue presented to the Court on remand. Accordingly, the Renewed Motion of Ball and Rexam, Doc. #196, is sustained.

C. Ball and Rexam's Motion for Leave to Substitute for Expert Witness Andrew Carter, Doc. #210, and Motion for Leave to Substitute Expert Witness Edmund Gillest Doc. #209

Because the Court has sustained the Renewed Motion of Ball and Rexam, the Motions of Ball and Rexam for Leave to Substitute for Expert Witness Andrew Carter, Doc. #210, and Motion for Leave to Substitute Expert Witness Edmund Gillest, Doc. #209, are overruled as moot.

III. Conclusion

For the reasons set forth above, the Motion for Leave to File a Motion for Partial Summary Judgment filed by Crown on the Indefiniteness Defense Regarding the "Second Point" or "Transition" asserted by Plaintiff/ Counterclaim Defendant Ball and Counterclaim Defendant Rexam, Doc. #195, is OVERRULED; Ball and Rexam's Renewed Motion for Summary Judgment on Indefiniteness, Doc. #196, is SUSTAINED; and Ball and Rexam's Motion for Leave to Substitute for Expert Witness Andrew Carter, Doc. #210, and Motion for Leave to Substitute Expert Witness Edmund Gillest, Doc. #209, are OVERRULED as moot.

Judgment is entered in favor of Plaintiff/Counterclaim Defendant Ball Metal Beverage Container Corp., and Counterclaim Defendant Rexam Beverage Can Company and against Crown Packaging Technology, Inc., and Crown Cork & Seal USA, Inc.

The captioned cause is hereby ordered terminated upon the docket records of the United States District Court for the Southern District of Ohio, Western Division, at Dayton.

AUGUST 2, 2023

WALTER H. RICE
UNITED STATES DISTRICT JUDGE

U 7632008

THE UNITED STATES OF AMERICA

TO ALL TO WHOM THESE PRESENTS SHALL COME:

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office

April 24, 2017

THIS IS TO CERTIFY THAT ANNEXED HERETO IS A TRUE COPY FROM THE RECORDS OF THIS OFFICE OF:

U.S. PATENT: *6,848,875*
ISSUE DATE: *February 01, 2005*

By Authority of the
Under Secretary of Commerce for Intellectual Property
and Director of the United States Patent and Trademark Office

SYLVIA HOLLEY
Certifying Officer

US006848875B2

(12) **United States Patent**
Brifcani et al.

(10) **Patent No.: US 6,848,875 B2**
(45) **Date of Patent: Feb. 1, 2005**

(54) **CAN END AND METHOD FOR FIXING THE SAME TO A CAN BODY**

(75) Inventors: **Mouayed Mamdooh Brifcani**, Oxfordshire (GB); **Peter James Hinton**, Swindon Wiltshire (GB); **Mark Christopher Kysh**, Wantage (GB)

(73) Assignee: **Crown Cork & Seal Technologies Corporation**, Alsip, IL (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 5 days.

(21) Appl. No.: **10/024,862**

(22) Filed: **Dec. 18, 2001**

(65) **Prior Publication Data**

US 2003/0150866 A1 Aug. 14, 2003

Related U.S. Application Data

(63) Continuation of application No. 09/650,664, filed on Aug. 30, 2000, now abandoned, which is a continuation of application No. 09/552,668, filed on Apr. 19, 2000, now abandoned, which is a continuation of application No. 08/945,698, filed as application No. PCT/GB96/00709 on Mar. 25, 1996, now Pat. No. 6,065,634.

(30) **Foreign Application Priority Data**

May 24, 1995 (GB) 9510515

(51) **Int. Cl.**[7] **B21D 51/32**
(52) **U.S. Cl.** **413/6**; 413/31
(58) **Field of Search** 413/31, 36, 37, 413/43, 2, 4, 6, 8

(56) **References Cited**

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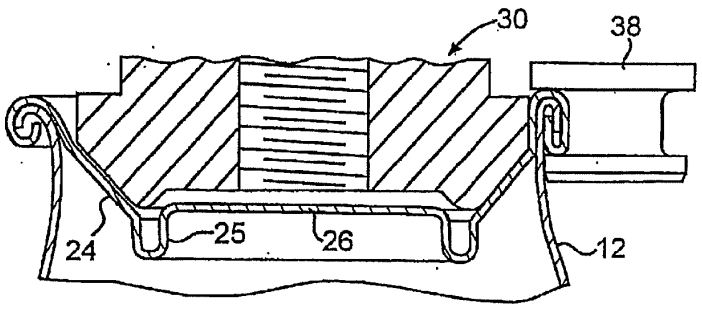
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Primary Examiner—Lowell A. Larson
(74) *Attorney, Agent, or Firm*—Woodcock Washburn LLP

(57) **ABSTRACT**

A can end comprising a peripheral cover hook, a chuck wall dependent from a first point on the interior of the cover hook, an outwardly concave annular reinforcing bead extending radially inwards from a second point on the interior of the chuck wall, and a central panel supported by an inner portion of the reinforcing bead, characterized in that, a line connecting the first point and the second point is inclined to an axis perpendicular to the exterior of the central panel at an angle between 30° and 60°.

62 Claims, 4 Drawing Sheets



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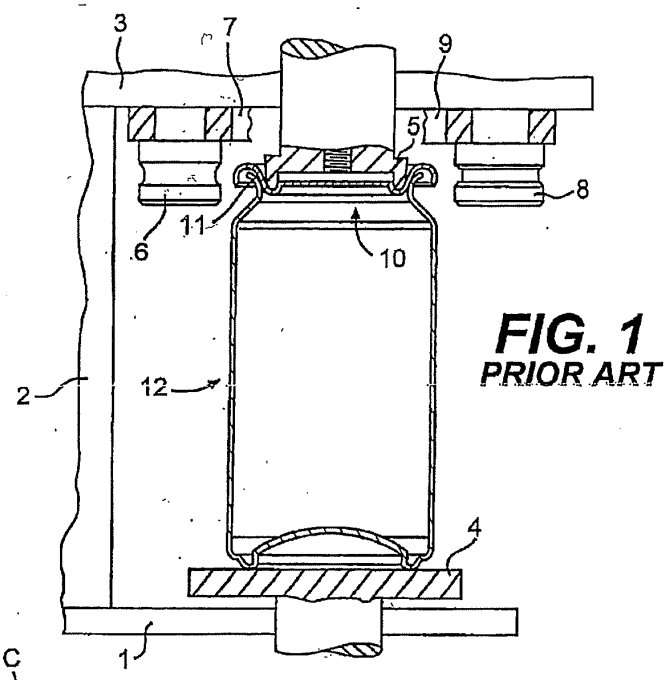


FIG. 1
PRIOR ART

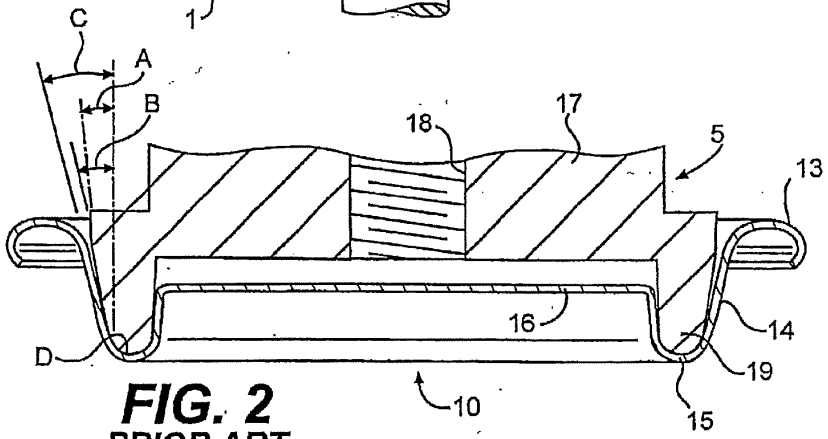


FIG. 2
PRIOR ART

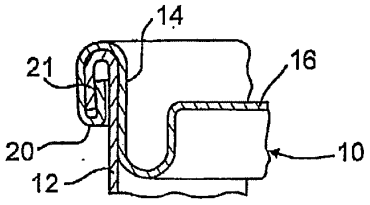


FIG. 3
PRIOR ART

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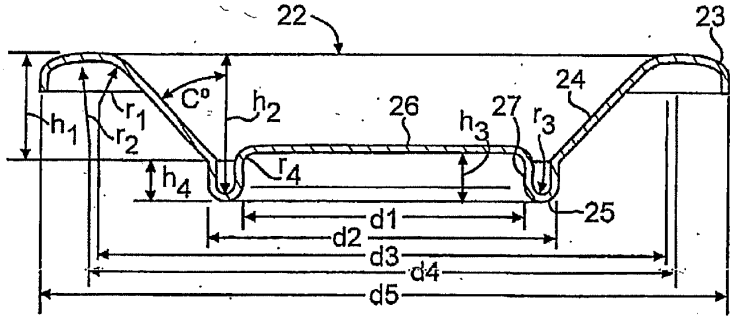


FIG. 4

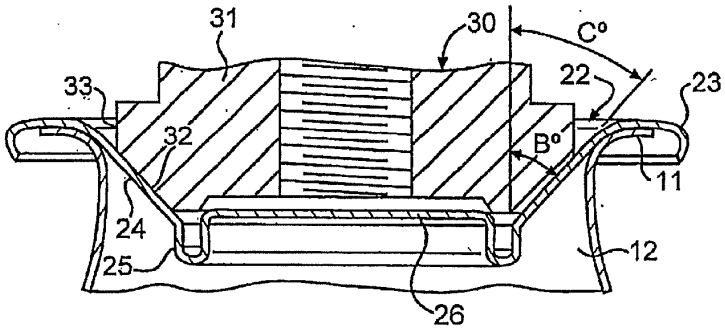


FIG. 5

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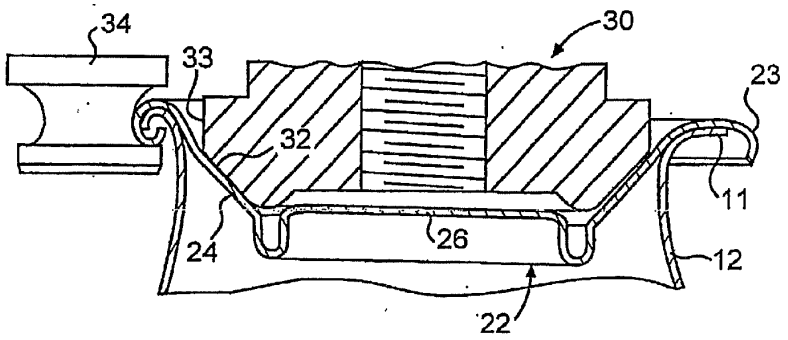


FIG. 6

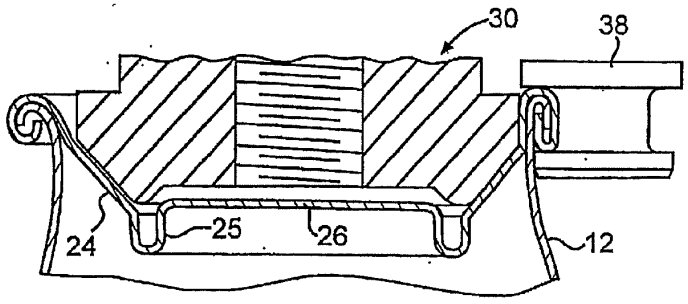


FIG. 7

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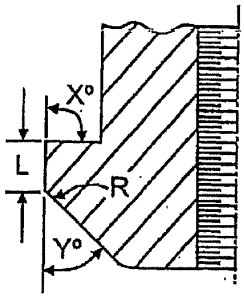


FIG. 8

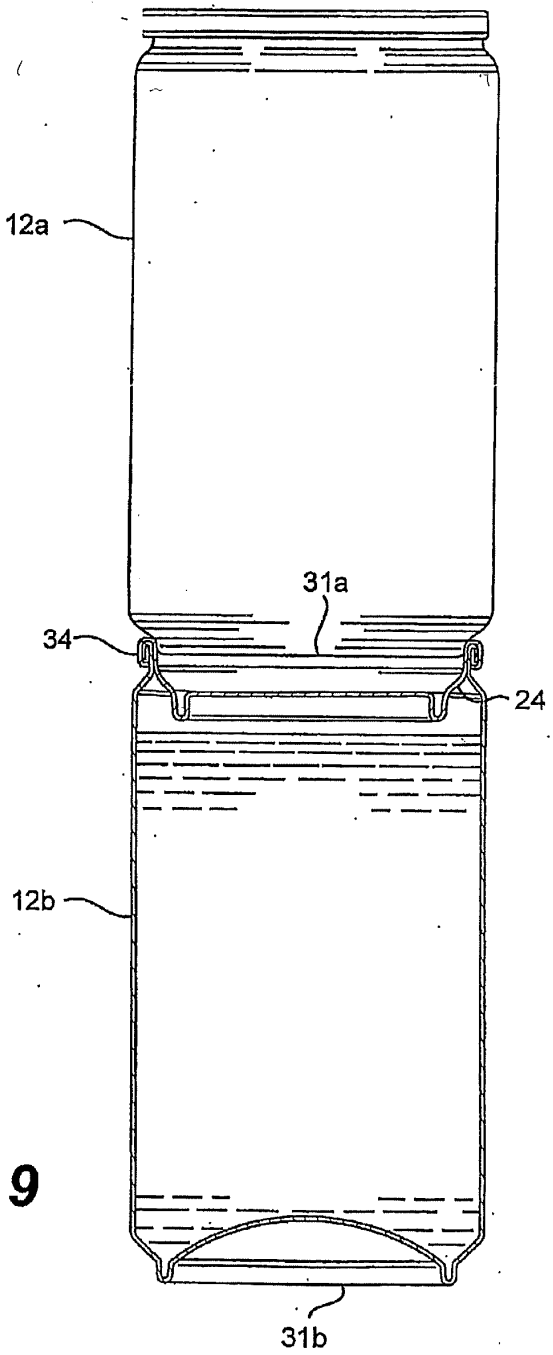


FIG. 9

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CAN END AND METHOD FOR FIXING THE SAME TO A CAN BODY

CROSS-REFERENCE TO RELATED APPLICATIONS

This is a continuation of U.S. patent application Ser. No. 09/650,664, filed Aug. 30, 2000 now abandoned, which is a continuation of U.S. patent application Ser. No. 09/552,668, filed Apr. 19, 2000, now abandoned, which is a continuation of U.S. patent application Ser. No. 08/945,698, filed Nov. 21, 1997, which issued May 23, 2000 as U.S. Pat. No. 6,065,634, which is the U.S. National Phase of PCT/GB96/00709, filed Mar. 25, 1996, which claims priority to UK 9510515.1, filed May 24, 1995.

This invention relates to an end wall for a container and more particularly but not exclusively to an end wall of a can body and a method for fixing the end wall to the can body by means of a double seam.

U.S. Pat. No. 4,093,102 (KRASKA) describes can ends comprising a peripheral cover hook, a chuck wall dependent from the interior of the cover hook, an outwardly concave annular re-inforcing bead extending radially inwards from the chuck wall and a central panel joined to an inner wall of the reinforcing bead by an annular outwardly convex bead. This can end is said to contain an internal pressure of 90 psi by virtue of the inclination or slope of the chuck wall, bead outer wall and bead inner wall to a line perpendicular to the centre panel. The chuck wall slope D° is between 14° and 16°, the outer wall slope E is less than 4° and the inner wall slope C° is between 10 and 16° leading into the outwardly convex bead. We have discovered that improvements in metal usage can be made by increasing the slope of the chuck wall and limiting the width of the anti peaking bead.

U.S. Pat. No. 4,217,843 (KRASKA) describes an alternative design of can end in which the countersink has inner and outer flat walls, and a bottom radius which is less than three times the metal thickness. The can end has a chuck wall extending at an angle of approximately 24° to the vertical. Conversely, the specification of our U.S. Pat. No. 5,046,637 describes a can end in which the chuck wall extends at an angle of between 12° and 20° to the vertical.

The detailed description of our U.S. Pat. No. 4,571,978 describes a method of making a can end suitable for closing a can body containing a beverage such as beer or soft drinks. This can end comprises a peripheral flange or cover hook, a chuck wall dependant from the interior of the cover hook, an outwardly concave reinforcing bead extending radially inwards from the chuck wall from a thickened junction of the chuck wall with the bead, and a central panel supported by an inner portion of the reinforcing bead. Such can ends are usually formed from a prelacquered aluminum alloy such as an aluminum magnesium manganese alloy such as alloy 5182.

The specification of our U.S. Pat. No. 5,582,319 describes a can end suitable for a beverage can and formed from a laminate of aluminum/manganese alloy coated with a film of semi crystalline thermoplastic polyester. This polyester/aluminum alloy laminate permitted manufacture of a can end with a narrow, and therefore strong reinforcing bead in the cheaper aluminum manganese alloy.

Continuing development of a can end using less metal, whilst still permitting stacking of a filled can upon the end of another, this invention provides a can end comprising a peripheral cover hook, a chuck wall dependant from the interior of the chuck wall, an outwardly concave annular reinforcing bead extending radially inwards from the chuck wall, and a central panel supported by an inner portion of the reinforcing bead, characterised in that, the chuck wall is inclined to an axis perpendicular to the exterior of the central panel at an angle between 30° and 60°, and the concave bead narrower than 1.5 mm (0.060"). Preferably, the angle of the chuck wall to the perpendicular is between 40° and 45°.

In a preferred embodiment of the can end an outer wall of the reinforcing bead is inclined to a line perpendicular to the central panel at an angle between −15° to +150 and the height of the outer wall is up to 2.5 mm.

In one embodiment the reinforcing bead has an inner portion parallel to an outer portion joined by said concave radius.

The ratio of the diameter of the central panel to the diameter of the peripheral curl is preferably 80% or less.

The can end may be made of a laminate of thermoplastic polymer film and a sheet aluminium alloy such as a laminate of a polyethylene teraphthalate film on an aluminium-manganese alloy sheet or ferrous metal typically less than 0.010 (0.25 mm) thick for beverage packaging. A lining compound may be placed in the peripheral cover hook.

In a second aspect this invention provides a method of forming a double seam between a can body and a can end according to any preceding claim, said method comprising the steps of:

placing the curl of the can end on a flange of a can body supported on a base plate, locating a chuck within the chuck wall of the can end to centre the can end on the can body flange, said chuck having a frustoconical drive surface of substantially equal slope to that of the chuck wall of the can end and a cylindrical surface portion extending away from the drive surface within the chuck wall, causing relative motion as between the assembly of can end and can body and a first operation seaming roll to form a first operation seam, and thereafter causing relative motion as between the first operation seam and a second operation roll to complete a double seam, during these seaming operations the chuck wall becoming bent to contact the cylindrical portion of the chuck.

Various embodiments will now be described by way of example and with reference to the accompanying drawings in which:

FIG. **1** is a diagrammatic sketch of known apparatus for forming a double seam;

FIG. **2** is an enlarged sectioned side view of a known chuck and can end before seaming;

FIG. **3** is a sectioned view of a fragment of a known double seam;

FIG. **4** is a sectioned side view of a can end according to this invention before edge curling;

FIG. **5** is a sectioned side view of the can end of FIG. **4** on a can body before forming of a double seam;

FIG. **6** is a like view of the can end and body during first operation seaming;

FIG. **7** is a like view of the can end and body during final second operation seaming to create a double seam;

FIG. **8** is a fragmentary section of a chuck detail; and

FIG. **9** is a side view of the cans stacked one on the other.

In FIG. **1**, apparatus for forming a double seam comprises a base plate **1**, an upright **2** and a top plate **3**.

A lifter **4** mounted in the base plate is movable towards and away from a chuck **5** mounted in the top plate. The top plate supports a first operation seaming roll **6** on an arm **7** for pivotable movement towards and away from the chuck. The top plate also supports a second operation seaming roll **8** on

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an arm **9** for movement towards and away from the chuck after relative motion as between the first operation roll and can end on the chuck creates a first operation seam.

As shown in FIG. **1** the chuck **5** holds a can end **10** firmly on the flange **11** of a can body **12** against the support provided by the lifter plate **4**. Each of the first operation roll **6** and second operation roll **7** are shown clear of chuck before the active seam forming profile of each roll is moved in turn to form the curl of the can end and body flange to a double seam as shown in FIG. **3**.

FIG. **2** shows on an enlarged scale the chuck **5** and can end **10**. The can end comprises a peripheral curl **13**, a chuck wall **14** dependent from the interior of the curl, an outwardly concave anti-peaking bead **15** extending inwards from the chuck wall to support a central panel **16**. Typically the chuck wall flares outwardly from the vertical at an angle C about 12° to 15°.

The chuck **5** comprises a body **17** having a threaded bore **18** permitting attachment to the rest of the apparatus (not shown). An annular bead **19** projects from the body **17** of the chuck to define with the end face of the body a cavity to receive the central panel **16** of the can end. The fit of panel **16** in annulus **19** may be slack between panel wall and chuck.

The exterior surface of the projecting bead **19** extends upwards towards the body at a divergent angle B of about 12° to the vertical to join the exterior of the chuck body **17** which tapers off an angle A° of about 4° to a vertical axis perpendicular to the central panel. The outer wall of the chuck **5** engages with the chuck wall at a low position marked "D" within the 12° shaped portion of the chuck bead **15**.

As can ends are developed with narrower anti-peaking beads the chuck bead **19** becomes narrower and more likely to fracture. There is also a risk of scuffing of the can end at the drive position D which can leave unacceptable unsightly black marks after pasteurisation.

FIG. **3** shows a sectioned fragment of a typical double seam showing a desirable overlap of body hook **21** and end hook **20** between the can end **10** and can body **12**.

FIG. **4** shows a can end, according to the invention, comprising a peripheral cover hook **23**, a chuck wall **24** extending axially and inwardly from the interior of the peripheral cover hook, an outwardly concave reinforcing or anti-peaking bead **25** extending radially inwards from the chuck wall, and a central panel **26** supported or an inner portion panel with **27**. The panel wall is substantially upright allowing for any metal spring back after pressing. The chuck wall is inclined to an axis perpendicular to the exterior of the central panel at an angle C, between 20° and 60°; preferably between 40° and 45°. Typically the cross sectional radius of the antipeaking bead is about 0.5 mm.

Preferably the anti-peaking bead **25** is parallel sided, however the outer wall may be inclined to a line perpendicular to the central panel at an angle between −15° to +15° and the height h_4 of the outer wall may be up to 2.5 mm.

This can end is preferably made from a laminate of sheet metal and polymeric coating. Preferably the laminate comprises an aluminium magnesium alloy sheet such as 5182, or aluminium manganese alloy such as 3004 with a layer of polyester film on one side. A polypropylene film may be used on the "other side" if desired.

Typical dimensions of the example of the invention are:

d5	overall diameter (as stamped)	65.83 mm
d4	PC diameter of seaming panel radius	61.54 mm
d3	PC diameter of seaming panel/chuck wall radius	59.91 mm
r_1	seaming panel/chuck wall radius	1.27 mm

-continued

r_2	seaming panel radius	5.56 mm
r_3	concave radius in antipeaking bead	<1.5 mm
d_2	maximum diameter of antipeaking bead	50.00 mm
d_1	minimum diameter of antipeaking bead	47.24 mm
h_2	overall height of can end	6.86 mm
h_1	height to top of antipeaking bead	5.02 mm
h_3	panel depth	2.29 mm
h_4	outer wall height	1.78 mm
c	chuck wall angle to vertical	43°

From these dimensions it can be calculated that the ratio of central panel diameter of 47.24 mm to overall diameter of can end 65.84 is about 0.72 to 1.

For economy the aluminium alloy is in the form of sheet metal less than 0.010" (0.25 mm). A polyester film on the metal sheet is typically 0.0005" (0.0125 mm).

Although this example shows an overall height h_2 at 6.86 mm we have also found that useful can ends may be made with an overall height as little as 6.35 mm (0.25").

FIG. **5** shows the peripheral flange **23** of can end **22** of FIG. **4** resting on the flange **11** of a can body **12** before formation of a double seam as discussed with reference to FIG. **1**.

In FIG. **5** a modified chuck **30** comprises a chuck body **31** having a frustoconical drive surface **32** engaging with the chuck wall **24** of the can end **22**.

The frustoconical drive surface is inclined outwardly and axially at an angle substantially equal to the angle of inclination C° of between 20° and 60°; in this particular example on chuck angle C of 43° is preferred. The drive surface **32** is a little shorter than the chuck wall **24** of the chuck body. The substantially cylindrical surface portion **33**, rising above the drive surface **32**, may be inclined at an angle between +4° and −4° to a longitudinal axis of the chuck. As in FIG. **2**, this modified chuck **30** has a threaded aperature to permit attachment to the rest of the double seam forming apparatus (not shown).

In contrast to the chuck of FIG. **2** the modified chuck **30** is designed to drive initially on the relatively large chuck wall **32** without entering deeply into the anti-peaking bead **25**. Further drive is obtained at the juncture of chuck wall **32** and cylindrical wall **33** as chuck wall of end **24** is deformed during 1st and 2nd operation seaming FIGS. **6** and **7**. The chuck **30** shown in FIG. **5** has an annular bead of arcuate cross section but this bead is designed to enter the chuck wall without scratching or scuffing a coating on the can end; not to drive on the concave bead surface as shown in FIG. **2**.

It will be understood that first operation seaming is formed using apparatus as described with reference to FIG. **1**.

FIG. **6** shows the modified can end and chuck during formation of a first operation seam shown at the left of FIG. **2** as formed by a first operation roll **34** adjacent the interfolded peripheral flange of the can end and flange **11** body **12**.

During relative rotation as between the can end **22** and first operation roll **34** the edge between the chuck drive wall **32** and cylindrical wall **33** exerts a pinching force between chuck **30** and roll **34** to deform the chuck wall of the can end as shown.

After completion of the first operation seam the first operation roll is swung away from the first operation seam and a second operation roll **38** is swung inwards to bear upon the first operation seam supported by the chuck **30**. Relative rotation as between the second operation roll **38** and first operation seam supported by a chuck wall **30** completes a double seam as shown in FIG. **7** and bring the upper portion **24** of the chuck wall **24** to lie tightly against the can body

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neck in a substantially upright attitude as the double seam is tightened by pinch pressure between the second operation roll **38** and chuck **30**.

Can ends according to the invention were made from aluminium alloy 5182 and an aluminium alloy 3004/ polymer laminate sold by CarnaudMetalbox under the trade mark ALULITE. Each can end was fixed by a double seam to a drawn and wall ironed (DWI) can body using various chuck angles and chuck wall angle as tabulated in Table 1 which records the pressure inside a can at which the can ends failed:

TABLE 1

	CAN END DATA			PRESSURE IN BAR (PSIG) TO FAILURE FOR VARIOUS SEAMING CHUCK ANGLES B°				
Sample Code	Material Thickness mm	Minimum Diameter D1 mm	CHUCK Wall Angle "C"	23°	10°/23°	4°/23°	23° with D. Seam Ring	10°/23° with D. Seam Ring
A	ALULITE 0.23	52.12 (2.052")	21.13°	5.534 (80.20)	5.734 (83.10)	5.311 (76.97)	6.015 (87.17)	5.875 (85.14)
B	5182 0.244	52.12 (2.052")	21.13°	5.599 (81.15)	5.575 (80.79)	5.381 (77.99)	5.935 (86.01)	5.895 (85.43)
C	5182 0.245	52.12 (2.052")	21.13°	6.004 (87.02)	5.910 (85.65)	5.800 (84.06)	6.224 (90.21)	6.385 (92.54)
D	ALULITE 0.23	51.92 (2.044")	21.13°	5.334 (77.31)	5.229 (75.78)	5.238 (75.91)	5.730 (83.04)	5.404 (78.32)
E	5182 0.224	51.92 (2.044")	21.13°	5.555 (80.50)	5.514 (79.92)	5.354 (77.60)	5.895 (85.43)	5.930 (85.94)
F	5182 0.245	51.92 (2.044")	23°	5.839 (84.63)	5.804 (84.12)	5.699 (82.59)	6.250 (90.58)	6.435 (93.26)
G	ALULITE 0.23	51.92 (2.044")	23°			5.123 (74.25)		
H	5182 0.224	(51.92) (2.044")	23°			5.474 (79.34)		
I	5182 0.245	51.92 (2.044")	23°			5.698 (82.58)		

All pressures on unaged shells in bar (psig). 5182 is an aluminium-magnesium-manganese alloy lacquered. The "ALULITE" used is a laminate of aluminium alloy and polyester film.

The early results given in Table 1 showed that the can end shape was already useful for closing cans containing relatively low pressures. It was also observed that clamping of the double seam with the "D" seam ring resulted in improved pressure retention. Further tests were done using a chuck wall angle and chuck drive surface inclined at nearly 45°: Table 2 shows the improvement observed:

TABLE 2

	h_2	h_3		Chuck Angles B°	
Sample Code	mm (inches)	mm (inches)	h_4 mm (inches)	43°	43° with seam ring
J	6.86 (0.270)	2.39 (0.094)	2.29 (0.09)	4.89 (70.9)	6.15 (89.1)
K	7.11 (0.280)	2.64 (0.104)	2.54 (0.10)	4.83 (70.0)	5.98 (86.6)
L	7.37 (0.290)	2.90 (0.114)	2.79 (0.11)	4.74 (68.7)	6.44 (93.3)

Table 2 is based on observations made on can ends made of aluminium coated with polymer film (ALULITE) to have a chuck wall length of 5.029 mm (0.198") up the 43° slope.

It will be observed that the container pressures achieved for samples J, K, L, 4.89 bar (70.9 psig), 4.83 bar (70.0 psig) and 4.74 bar (68.7 psig) respectively were much enhanced by clamping the double seam.

In order to provide seam strength without use of a clamping ring, modified chucks were used in which the drive slope angle C° was about 43° and the cylindrical surface **33** was generally +4° and −4°. Results are shown in Table 3.

TABLE 3

	Results			
SAMPLE CODE	MATERIAL	LINING COMPOUND	CHUCK ANGLES DRIVE/ WALL	PRESSURE
c	0.224 5182	with	43°	4.60 (66.7)
g	0.23 Alulite	with	43°/4°	5.45 (79.0)
h	0.224 5182	with	43°/4°	6.46 (93.6)
j	0.23 Alulite	without	43°/4°	5.91 (85.6)
k	0.244 5182	without	43°/4°	6.18 (89.6)
l	0.23 Alulite	without	43°/−4°	5.38 (77.9)
m	0.25 Alulite	without	43°/−4°	6.20 (89.8)
n	0.23 Alulite	without	43°/0°	6.11 (88.5)
o	0.25 Alulite	without	43°/0°	6.62 (95.9)

ALL PRESSURES IN BAR (PSIG)

ALL CODES

Reform Pad Dia. 47.24 mm (1.860") (202 Dia).

6.86 mm (0.270") unit Depth h_2 2.39 mm (0.094") Panel Depth

Table 3 shows Code "0" made from 0.25 mm Alulite to give 6.62 bar (95 psi) Pressure Test Result indicating a can end suitable for pressurised beverages. Further chucks with various land lengths (slope) were tried as shown in Table 4.

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TABLE 4

	CHUCK WALL ANGLE			
	43°/0° 1.9 mm LAND SHARP TRANSITION		43°/0° 1.27 MM LAND R. 0.5 MM BLEND	
VARIABLE CODE	NO. D.SEAM RING	WITH D.SEAM RING	NO. D.SEAM RING	WITH D.SEAM RING
7	6.699 (97.08)	7.017 (101.7)	6.779 (98.24)	7.006 (101.54)
8	6.315 (91.52)	6.521 (94.5)	6.293 (91.2)	6.236 (90.37)
9	6.095 (88.33)	6.30 (91.3)	6.238 (90.4)	6.719 (97.38)

ALL PRESSURES IN BAR (PSIG)
CODE

7=0.25 mm Alulite, 47.24 mm (1.860") Reform Pad, 6.86 mm (0.270") h_2 Depth, 2.38 mm (0.094") Panel; h_4 depth=2.29 mm (0.09")

8=0.23 mm Alulite, 47.24 mm (1.860") Reform Pad, 7.11 mm (0.280") h_2 Depth, 2.64 mm (0.104") Panel; h_4 depth=2.54 mm (0.10")

9=0.23 mm Alulite, 47.24 mm (1.860") Reform Pad, 7.37 mm (0.290") h_2 Depth, 2.90 mm (0.114") Panel; h_4 depth=2.79 mm (0.11")

Table 4 shows results of further development to seaming chuck configuration to bring closer the pressure resistance of ring supported and unsupported double seams.

Table 4 identifies parameters for length of generally vertical cylindrical surface **33** on the seaming chuck **30**, and also identifies a positional relationship between the chuck wall **24** of the end and the finished double seam. It will be understood from FIG. **7** shows that the forces generated by thermal processing or carbonated products are directed towards and resisted by the strongest portions of the completed double seam.

Table 5 shows results obtained from a typical seam chuck designed to give double seam in accordance with parameters and relationships identified in Table 4. Typically:—As shown in FIG. **8** the chuck comprises a cylindrical land of length '1' typically 1.9 mm (0.075") and frustoconical drive surface **32** inclined at an angle Y°, typically 43°, to the cylindrical to which it is joined by a radius R typically 0.5 mm (0.020"). Angle "X" is typically 90°.

TABLE 5

		DIMENSIONS mm		PRESSURE	
CODE	GAUGE	h_2	h_3	bar	(psi)
20	.23 mm	7.37 (.290")	2.36 (.093")	6.383	(92.6)
21	.23 mm	7.37 (.290")	2.36 (.093") with compound	6.402	(92.8)
26	.23 mm	6.87 (.2705")	2.37 (.0935")	6.144	(89.88)
27	.23 mm	6.87 (.2705")	2.37 (.0934") with compound	6.071	(88.0)
28	.23 mm	7.37 (.290")	2.36 (.093")	6.414	(93.0)
29	.23 mm	7.37 (.290")	2.84 (.112")	6.725	(97.5)
30	.23 mm	6.86 (.270")	2.37 (.0935")	6.062	(87.9)
31	.23 mm	6.86 (.270")	2.37 (.0935")	6.013	(87.2)
34	.25 mm	7.37 (.290")	2.87 (.113")	7.787	(112.9)
36	.25 mm	7.32 (.288")	2.34 (.092")	7.293	(105.8)
37	.25 mm	7.32 (.288")	2.34 (.092") with compound	7.402	(107.3)
38	.25 mm	6.87 (.2705")	2.41 (.095")	7.077	(102.6)
516	.25 mm	6.35 (.250")	2.34 (.092") with compound	6.937	(100.6)

All variables made from Alulite, 10 Cans per variable.

The can ends may be economically made of thinner metal if pressure retention requirements permit because these can ends have a relatively small centre panel in a stiffer annulus.

FIG. **9** shows a can **12***a*, closed according to this invention, stacked upon a like can **12***b* shown sectioned so that stacking of the upper can on the lower can end is achieved by a stand bead **31***a* of the upper can fits inside the chuck wall **24** of the lower can end with the weight of the upper can resting on the double seam **34** of the lower can end.

The clearance between the bottom of the upper can body and lower can end may be used to accommodate ring pull features (not shown) in the can end or promotional matter such as an coiled straw or indicia.

Using the experimental data presented above, a computer programme was set up to estimate the resistance to deformation available to our can ends when joined to containers containing pressurised beverage. The last two entries on the table relate to a known 206 diameter beverage can end and an estimate of what we think the KRASKA patent teaches.

TABLE 6

END SIZE Bead OD:1D	OVERALL DIA mm	PANEL DIA d_1 mm	RATIO OVERALL DIA: PANEL DIA	CHUCK WALL ANGLE ° C.	CHUCK WALL LENGTH L mm	RE-INFORCING RAD r_3 mm	INNER WALL HEIGHT h_3 mm	OUTER WALL HEIGHT h_4 mm	PREDICTED CUT EDGE Ø (*DENOTES ACTUAL)	ACTUAL THICK-NESS TO CONTAIN PSI
206-204	64.39 (2.535")	49.49 (1.9485")	1.3010	33.07°	4.22 (0.166")	0.52 (0.204")	2.34 (0.092")	1.78 (0.070")	75.230 (2.9618")	0.255
206-202	64.39 (2.535")	47.33 (1.8634")	1.3604	42.69°	4.95 (0.195")	0.52 (0.0204")	2.34 (0.092")	1.78 (0.070")	74.272 (2.9241")*	0.255
206-200	64.39 (2.535")	45.07 (1.7744")	1.4287	50.053°	5.82 (0.229")	0.52 (0.0204")	2.34 (0.092")	1.78 (0.070")	73.13 (2.9021")	0.255
204-202	62.18 (2.448")	47.33 (1.8634")	1.3137	29.78°	3.96 (0.156")	0.52 (0.0204")	2.34 (0.092")	1.78 (0.070")	73.767 (2.9042")	0.24

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TABLE 6-continued

END SIZE Bead OD:1D	OVERALL DIA mm	PANEL DIA d_1 mm	RATIO OVERALL DIA: PANEL DIA	CHUCK WALL ANGLE ° C.	CHUCK WALL LENGTH L mm	RE-INFORCING RAD r_3 mm	INNER WALL HEIGHT h_3 mm	OUTER WALL HEIGHT h_4 mm	PREDICTED CUT EDGE Ø (*DENOTES ACTUAL)	ACTUAL THICK-NESS TO CONTAIN PSI
204-200	62.18 (2.448")	45.07 (1.7744")	1.3796	40.786°	4.70 (0.185")	0.52 (0.0204")	2.34 (0.092")	1.78 (0.070")	72.911 (2.8705")	0.24
202-200	71.98 (2.834")	45.07 (1.7744")	1.597	30.266°	4.09 (0.161")	0.52 (0.0204")	2.34 (0.092")	1.78 (0.070")	71.984 (2.834")	0.225
206 std	64.69 (2.547")	51.92 (2.044")	1.2461	15.488°	4.39 (0.173")	0.56 (0.022")	2.03 (0.080")	—	76.454 (3.010")*	0.28
KRASKA ESTIMATE	64.39 (eg 2.535")	—	—	15°	2.54 (0.100")	0.81 (0.032")	1.65 (0.065")	2.29 (0.090")	78.080 (3.074")	0.292 (0.0115")

All experiments modelled on a notional aluminium alloy of yield strength 310 mpa 0.25 mm thick. The standard was also 310 mpa BUT 0.275 mm thick.

What is claimed is:

1. A method of forming a double seam between a can body and a can end, said method comprising the steps of:

a) providing a can end having a circumferentially extending peripheral curl and a wall extending circumferentially and radially inward from said curl and an annular reinforcing bead extending radially inward from said wall, said reinforcing bead having an interior surface, said peripheral curl comprising a seaming panel and a radiused portion extending from said seaming panel to said wall, said wall inclined between about 20° and about 60° with respect to an axial centerline of said can end;

b) placing said curl of said can end into contact with a circumferentially extending flange of a can body;

c) providing a rotatable chuck having first and second circumferentially extending walls, said first and second walls forming a juncture therebetween; bringing said chuck into engagement with said can end so that said juncture of said first and second walls of said chuck contacts said inclined wall of said can end;

d) rotating said chuck;

e) performing a first seaming operation by placing a first seaming roll into contact with said can end curl while rotating said can end so as to partially deform said curl and said can body flange into a partial seam, said rotation of said can end during said first seaming operation driven by said rotating chuck through driving contact between said juncture of said first and second walls of said chuck and said inclined wall of said can end without driving contact between said chuck and said can end bead interior surface;

f) performing a second seaming operation by placing a second seaming roll into contact with said partially deformed can end curl so as to further deform said curl and said can body flange so as to further form said seam.

2. The method according to claim **1**, wherein said first and second seaming operations reform said can end inclined wall by bending a first portion of said inclined wall upward by an angle of at least about 16°.

3. The method according to claim **1**, wherein as a result of said first and second seaming operations said can end inclined wall is reformed so that a first portion of said wall is oriented substantially cylindrically.

4. The method according to claim **1**, wherein prior to performing said first seaming operation said wall of said can end is inclined between about 30° and about 50° with respect to said axial centerline of said can end.

5. The method according to claim **4**, wherein as a result of said first and second seaming operations said can end inclined wall is reformed so that a first portion of said wall is oriented substantially cylindrically.

6. The method according to claim **4**, wherein said first and second seaming operations reform said can end inclined wall by bending a first portion of said inclined wall upward by an angle of at least about 26°.

7. The method according to claim **1**, wherein prior to performing said first seaming operation said wall of said can end is inclined between about 40° and about 45° with respect to an axial centerline of said can end.

8. The method according to claim **7**, wherein as a result of said first and second seaming operations said can end inclined wall is reformed so that a first portion of said wall is oriented substantially cylindrically.

9. The method according to claim **7**, wherein said first and second seaming operations reform said can end inclined wall by bending a first portion of said inclined wall upward by an angle of at least about 36°.

10. The method according to claim **1**, wherein said first circumferentially extending wall of said chuck is oriented so as to be substantially cylindrical.

11. The method according to claim **10**, wherein said substantially cylindrical first wall of said chuck is oriented so as to be inclined with respect to an axial centerline of said chuck by no more than about 4°.

12. The method according to claim **1**, wherein the distance from the lowermost point on said annular bead to the uppermost point on said curl defines a height of said can end, and wherein as a result of said first and second seaming operations said can end inclined wall is reformed so that a first portion of said wall is bent upwardly so as to substantially increase said height of said can end.

13. The method according to claim **1**, wherein said chuck second wall is inclined with respect to an axial centerline of said chuck that substantially matches said inclination of said can end wall, and wherein said rotation of said can end during said first seaming operation is aided by driving contact between said second wall of said chuck and said inclined wall of said can end.

14. A method of forming a double seam between a can body and a can end intended for use in packaging a carbonated beverage, said method comprising the steps of:

a) providing a can end having (i) a circumferentially extending peripheral cover hook, said peripheral cover hook comprising a seaming panel to be formed into a portion of said double seam during a seaming operation, (ii) an annular reinforcing bead, and (iii) a circumferentially extending wall extending from said

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seaming panel to said reinforcing bead, said wall comprising first and second wall portions, said first wall portion to be formed into another portion of said double seam during said seaming operation, said first wall portion extending from said seaming panel to a first location on said wall and comprising a radiused portion extending from said seaming panel, said second wall portion extending from said first wall portion at said first wall location to a second location on said wall that forms a transition with said reinforcing bead, whereby said first and second locations form end points of said second wall portion, and wherein a straight line extending between said first and second locations on said wall is inclined between about 20° and about 60° with respect to an axial centerline of said can end;

b) placing said cover hook of said can end into contact with a circumferentially extending flange of a can body;

c) providing a rotatable chuck comprising a first circumferentially extending wall, said chuck first wall being substantially cylindrical;

d) bringing said chuck into engagement with said can end; and

e) performing said seaming operation by placing one or more seaming rolls into contact with said peripheral cover hook of said can end while said can end rotates so as to deform said seaming panel of said cover hook and said first wall portion and said can body flange into said double seam, said seaming operation deforming said first wall portion such that at least a portion of said first wall portion after seaming is substantially cylindrical, said first location on said wall after said seaming operation forming the transition from said substantially cylindrical wall portion to said second wall portion, said line between said first and second locations on said wall remaining inclined between about 20° and about 60° with respect to said axial centerline after completion of said seaming operation.

15. The method according to claim **14**, wherein during said seaming operation at least a portion of said can end wall first portion is reformed by bending upward by an angle of at least about 16°.

16. The method according to claim **14**, wherein said line between said first and second locations on said wall of said can end is inclined between about 30° and about 50° with respect to an axial centerline of said can end prior to performing said seaming operation.

17. The method according to claim **16**, wherein during said seaming operation at least a portion of said can end wall first portion is reformed by bending upward by an angle of at least about 26°.

18. The method according to claim **14**, wherein said line between said first and second locations on said second wall of said can end is inclined between about 40° and about 45° with respect to an axial centerline of said can end.

19. The method according to claim **18**, wherein during said seaming operation at least a portion of said can end wall first portion is reformed by bending upward by an angle of at least about 36°.

20. The method according to claim **14**, wherein said substantially cylindrical first wall of said chuck is oriented so as to be inclined with respect to an axial centerline of said chuck by no more than about 4°.

21. The method according to claim **14**, wherein the distance from the lowermost point on said annular bead to the uppermost point on said cover hook defines a height of said can end, and wherein as a result of said seaming operation at least a portion of said can end first wall portion is bent upwardly into said substantially cylindrical orientation so as to substantially increase said height of said can end.

22. The method according to claim **14**, wherein

f) said annular bead has an interior surface thereof;

g) said chuck further comprises a second wall, said first and second walls of said chuck form a juncture therebetween;

h) said seaming operation comprises (i) performing a first seaming operation by placing a first seaming roll into contact with said can end cover hook while said can end is rotated so as to partially deform said cover hook and said first wall portion and said can body flange into a partial seam, and (ii) performing a second seaming operation by placing a second seaming roll into contact with said partially deformed can end cover hook so as to further deform said cover hook and said first portion and said can body flange so as to further form said seam;

i) said rotation of said can end during said first seaming operation is accomplished by imparting driving contact between said juncture of said first and second walls of said chuck and said wall of said can end but without imparting driving contact between said chuck and said can end bead interior surface.

23. The method according to claim **14**, further comprising the step of filling the can body with a carbonated beverage prior to performing said seaming operation.

24. The method according to claim **14**, wherein said chuck further comprises a second chuck wall depending from said substantially cylindrical first chuck wall, said second chuck wall not being substantially cylindrical whereby said first and second chuck walls form a juncture therebetween, and wherein the step of bringing said chuck into engagement with said can end comprises bringing said chuck wall juncture into engagement with said can end wall proximate said first location on said can end wall.

25. The method according to claim **24**, wherein the step of performing said seaming operation further comprises bending said first wall portion of said can end upwardly around said chuck wall juncture so as to permanently deform said first wall portion.

26. The method according to claim **14**, wherein said wall of said can end is substantially frustoconical prior to performing said seaming operation.

27. The method according to claim **14**, wherein said first and second portions of said wall of said can end lie along a substantially straight line prior to performing said seaming operation.

28. The method according to claim **14**, wherein said line between the first and second locations on said second wall remains inclined between about 30° and about 50° after seaming.

29. The method according to claim **14**, wherein said line between the first and second locations on said second wall remains inclined between about 40° and about 45° after seaming.

30. The method according to claim **14**, wherein, in said step c) of performing the seaming operation, rotation of said can end is achieved without imparting driving contact between said chuck and a bottom interior surface of said reinforcing bead.

31. The method according to claim **14**, wherein said chuck further comprises a second chuck wall depending from said substantially cylindrical first chuck wall, said second chuck wall being substantially frustoconical.

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32. A method of forming a double seam between a can body and a can end intended for use in packaging a carbonated beverage, said method comprising the steps of:

a) providing a can end having (i) a circumferentially extending peripheral cover hook, said peripheral cover hook comprising a seaming panel to be formed into a portion of said double seam during a seaming operation and (ii) a circumferentially extending wall comprising first and second portion, said first wall portion to be formed into another portion of said double seam during said seaming operation, said first wall portion extending from said seaming panel to a first location on said wall and comprising a radiused portion extending from said seaming panel, said second wall portion extending from said first wall portion at said first wall location on said wall to a second location on said wall, whereby said first and second locations form end points of said second wall portion, said second wall location being the lowermost point of said wall, and wherein a straight line extending between said first and second locations on said wall is inclined between about 20° and about 60° with respect to an axial centerline of said can end;

b) placing said cover hook of said can end into contact with a circumferentially extending flange of a can body;

c) providing a rotatable chuck comprising a first circumferentially extending wall, said first chuck wall being substantially cylindrical;

d) bringing said chuck into engagement with said can end; and

e) performing said seaming operation by placing one or more seaming rolls into contact with said peripheral cover hook of said can end so as to deform said seaming panel of said cover hook and said first wall portion and said can body flange into said double seam, said first portion of said can end wall being pressed against said chuck first wall so that at least a portion of said first portion of said can end wall is bent upward through an angle of at least about 16°, said first location on said wall after said seaming operation forming the transition from said double seam to said second wall portion, said line between said first and second locations remaining inclined between about 20° and about 60° with respect to said axial centerline.

33. The method according to claim 32, wherein said line between said first and second locations on said wall of said can end is inclined between about 30° and about 50° with respect to said axial centerline of said can end prior to performing said seaming operation.

34. The method according to claim 33, wherein during said seaming operation at least a portion of said can end wall first portion is reformed by bending upward by an angle of at least about 26°.

35. The method according to claim 33, wherein said line between the first and second locations on said second wall portion remains inclined between about 30° and about 50° after seaming.

36. The method according to claim 32, wherein said line between said first and second locations on said wall of said can end is inclined between about 40° and about 45° with respect to said axial centerline of said can end prior to performing said seaming operation.

37. The method according to claim 36, wherein during said seaming operation at least a portion of said can end wall first portion is reformed by bending upward by an angle of at least about 36°.

38. The method according to claim 36, wherein said line between the first and second locations on said second wall portion remains inclined between about 40° and about 45° after seaming.

39. The method according to claim 32, wherein the can end further comprises a reinforcing bead extending radially inward from said second portion of said wall at said second wall location, the distance from a lowermost point on said annular bead to the uppermost point on said cover hook defines a height of said can end, and wherein said upward bending of said first portion of can end wall during said seaming operation substantially increases said height of said can end.

40. The method according to claim 32, wherein

f) said can end comprises an annular reinforcing bead extending radially inward from said wall, said annular bead having an interior surface thereof;

g) said chuck further comprises a second wall, said first and second walls of said chuck form a juncture therebetween;

h) said seaming operation comprises (i) performing a first seaming operation by placing a first seaming roll into contact with said can end peripheral cover hook while said can end is rotated so as to partially deform said cover hook and said first wall portion and said can body flange into a partial seam, and (ii) performing a second seaming operation by placing a second seaming roll into contact with said partially deformed can end cover hook so as to further deform said cover hook and said first wall portion and said can body flange so as to further form said seam;

i) said rotation of said can end during said first seaming operation is accomplished by imparting driving contact between said juncture of said first and second walls of said chuck and said wall of said can end but without imparting driving contact between said chuck and said can end bead interior surface.

41. The method according to claim 32, further comprising the step of filling the can body with a carbonated beverage prior to performing said seaming operation.

42. The method according to claim 32, wherein said chuck further comprises a second chuck wall depending from said substantially cylindrical first chuck wall, said second chuck wall not being substantially cylindrical whereby said first and second chuck walls form a juncture therebetween, and wherein the step of bringing said chuck into engagement with said can end comprises bringing said chuck wall juncture into engagement with said can end wall proximate said second location on said can end wall.

43. The method according to claim 42, wherein said bending of said first wall portion during said seaming operation comprises bending said first wall portion upwardly around said chuck wall juncture.

44. The method according to claim 42, wherein said end includes an annular reinforcing bead extending from said second wall portion and, in said step e) of performing the seaming operation, rotation of said can end is achieved without imparting driving contact between said chuck and a bottom interior surface of said reinforcing bead.

45. The method according to claim 32, wherein the can end includes a reinforcing bead extending radially inward from said lowermost point of said second portion of the wall.

46. The method according to claim 32, wherein said wall of said can end is substantially frustoconical prior to performing said seaming operation.

47. The method according to claim 32, wherein said first and second portions of said wall of said can end lie along a substantially straight line prior to performing said seaming operation.

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48. The method according to claim 32, wherein after said seaming operation said first and second portions of said can end wall intersect at an obtuse angle.

49. The method according to claim 32, wherein said chuck further comprises a second chuck wall depending from said substantially cylindrical first chuck wall, said second chuck wall being substantially frustoconical.

50. A method of forming a double seam between a can body and a can end intended for use in packaging a carbonated beverage, said method comprising the steps of:

a) providing a can end having (i) a circumferentially extending peripheral cover hook, said peripheral cover hook comprising a seaming panel to be formed into a portion of said double seam during a seaming operation, (ii) an annular reinforcing bead, and (iii) a circumferentially extending wall extending from said seaming panel to said reinforcing bead, said wall and said reinforcing bead forming a transition therebetween;

b) placing said cover hook of said can end into contact with a circumferentially extending flange of a can body;

c) providing a rotatable chuck comprising first and second circumferentially extending walls, said second chuck wall depending from said first chuck wall so as to form a juncture therebetween;

d) bringing said chuck into engagement with said can end; and

e) performing said seaming operation by placing one or more seaming rolls into contact with said peripheral cover hook of said can end while said can end rotates so as to deform said seaming panel of said cover hook and to bend a portion of said can end wall upwardly around said juncture of said chuck walls at a first location on said can end wall, a straight line extending from said first location on said can end wall to said transition between said can end wall and said reinforcing bead inclined between about 20° and about 60° with respect to said axial centerline both before and after said seaming operation.

51. The method according to claim 50 wherein at least a portion of said portion of said can end wall bent upwardly during said seaming operation is bent upward through an angle of at least about 16°.

52. The method according to claim 50, wherein said line extending from said first location to said transition is inclined between about 30° and about 50° with respect to said axial centerline of said can end both before and after performing said seaming operation.

53. The method according to claim 52, wherein at least a portion of said portion of said can end wall bent upwardly during said seaming operation is bent upward through an angle of at least about 26°.

54. The method according to claim 50, wherein said line extending from said first location to said transition is inclined between about 40° and about 45° with respect to said axial centerline of said can end both before and after performing said seaming operation.

55. The method according to claim 54, wherein at least a portion of said portion of said can end wall bent upwardly during said seaming operation is bent upward through an angle of at least about 36°.

56. The method according to claim 50, wherein at least a portion of said portion of said can end wall bent upwardly during said seaming operation is bent upward into a substantially cylindrical configuration.

57. The method according to claim 50, wherein said wall of said can end is substantially frustoconical prior to performing said seaming operation.

58. The method according to claim 50, wherein said first wall of said chuck is oriented so as to be inclined with respect to an axial centerline of said chuck by no more than about 4°.

59. The method according to claim 50, wherein said first wall of said chuck is substantially cylindrical.

60. The method according to claim 59, wherein said said second chuck wall being substantially frustoconical.

61. The method according to claim 50, wherein the distance from a lowermost point on said annular bead to the uppermost point on said cover hook defines a height of said can end, and said seaming operation increases said height of said can end.

62. The method according to claim 50, wherein

f) said annular bead has an interior surface thereof;

g) said seaming operation comprises (i) performing a first seaming operation by placing a first seaming roll into contact with said can end curl while said can end is rotated so as to partially deform said cover hook and a first portion of said can end wall and said can body flange into a partial seam, and (ii) performing a second seaming operation by placing a second seaming roll into contact with said partially deformed can end cover hook so as to further deform said cover hook and said can end wall first portion and said can body flange so as to further form said seam;

h) said rotation of said can end during said first seaming operation is accomplished without imparting driving contact between said chuck and said can end bead interior surface.

* * * * *

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TO ALL TO WHOM THESE PRESENTS SHALL COME:

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office

April 24, 2017

THIS IS TO CERTIFY THAT ANNEXED HERETO IS A TRUE COPY FROM THE RECORDS OF THIS OFFICE OF:

U.S. PATENT: *6,935,826*
ISSUE DATE: *August 30, 2005*

By Authority of the
Under Secretary of Commerce for Intellectual Property
and Director of the United States Patent and Trademark Office

SYLVIA HOLLEY
Certifying Officer

US006935826B2

(12) **United States Patent**
Brifcani et al.

(10) **Patent No.: US 6,935,826 B2**
(45) **Date of Patent: Aug. 30, 2005**

(54) **CAN END AND METHOD FOR FIXING THE SAME TO A CAN BODY**

(75) Inventors: **Mouayed Mamdooh Brifcani**, Oxfordshire (GB); **Peter James Hinton**, Swindon (GB); **Mark Christopher Kysh**, Wantage (GB)

(73) Assignee: **Crown Cork & Seal Technologies Corporation**, Alsip, IL (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **10/417,980**

(22) Filed: **Apr. 17, 2003**

(65) **Prior Publication Data**

US 2003/0202862 A1 Oct. 30, 2003

Related U.S. Application Data

(63) Continuation of application No. 10/024,862, filed on Dec. 18, 2001, now Pat. No. 6,848,875, which is a continuation of application No. 09/650,664, filed on Aug. 30, 2000, now abandoned, which is a continuation of application No. 09/552,668, filed on Apr. 19, 2000, now abandoned, which is a continuation of application No. 08/945,698, filed as application No. PCT/GB96/00709 on Mar. 25, 1996, now Pat. No. 6,065,634.

(30) **Foreign Application Priority Data**

May 24, 1995 (GB) 9510515

(51) **Int. Cl.**[7] **B21D 51/32**; B21D 51/44

(52) **U.S. Cl.** **413/31**; 220/619; 220/620; 220/623; 220/906

(58) **Field of Search** 413/2, 4, 8, 31, 413/27, 36, 37, 43; 220/268, 269, 270, 619, 620, 623, 621, 617, 62.22, 62.12, 906

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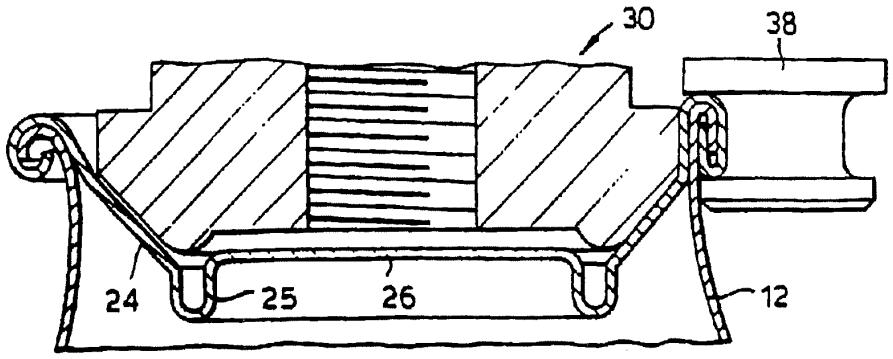
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Primary Examiner—Lowell A. Larson
Assistant Examiner—Jimmy T Nguyen
(74) *Attorney, Agent, or Firm*—Woodcock Washburn LLP

(57) **ABSTRACT**

A can end includes a peripheral cover hook a chuck wall dependent from the interior of the cover hook, an outwardly concave annular reinforcing bead extending radially inwards from the chuck wall, and a central panel supported by an inner portion of the reinforcing bead, characterized in that, the chuck wall is inclined to an axis perpendicular to the exterior of the central panel at an angle between 20° and 60°, and the concave cross-sectional radius of the reinforcing bead is less than 0.75 mm.

14 Claims, 4 Drawing Sheets



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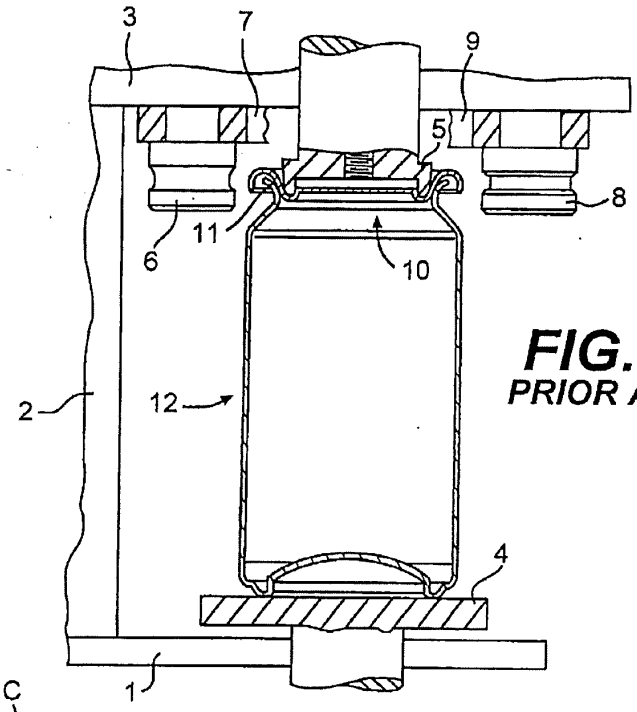


FIG. 1
PRIOR ART

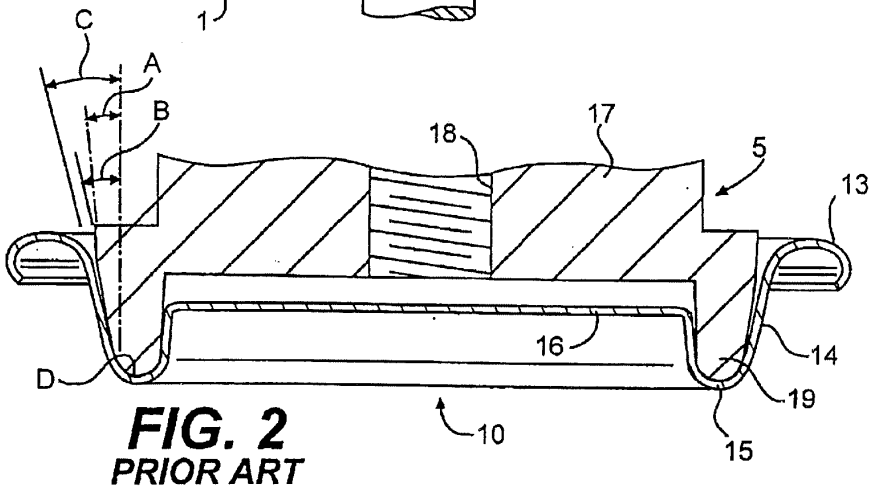


FIG. 2
PRIOR ART

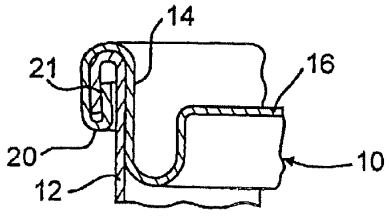


FIG. 3
PRIOR ART

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Fig.4.

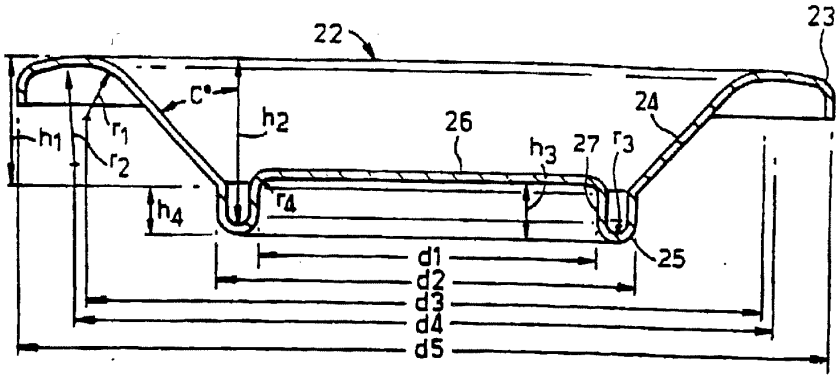
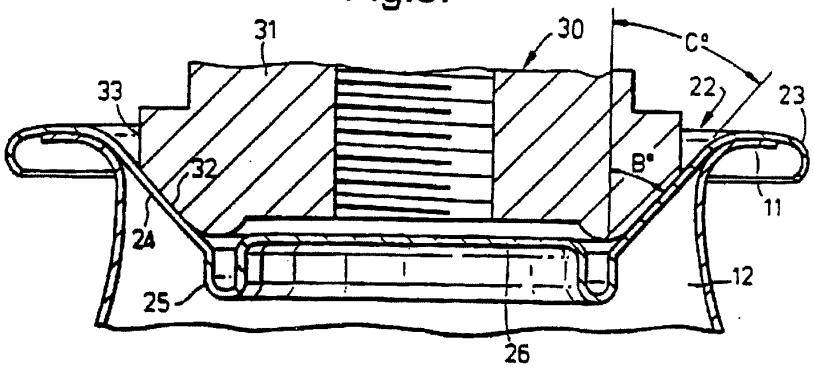


Fig.5.



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Fig.6.

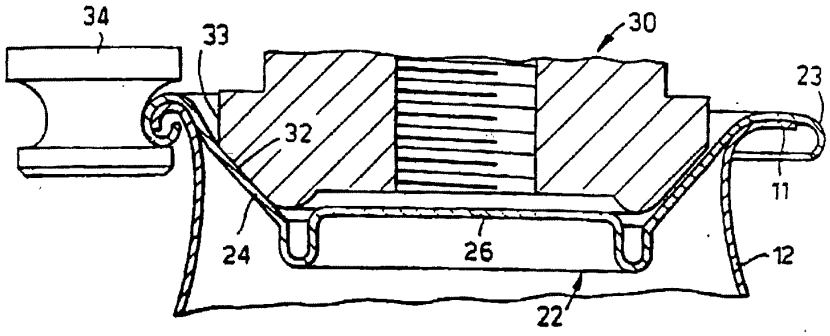
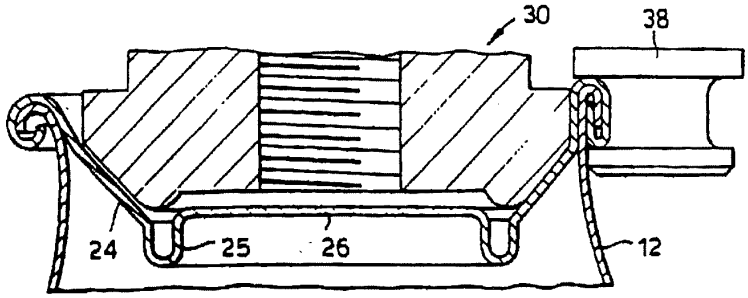


Fig.7.



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Fig.8.

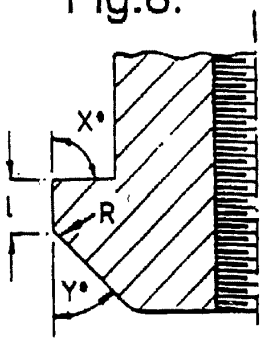
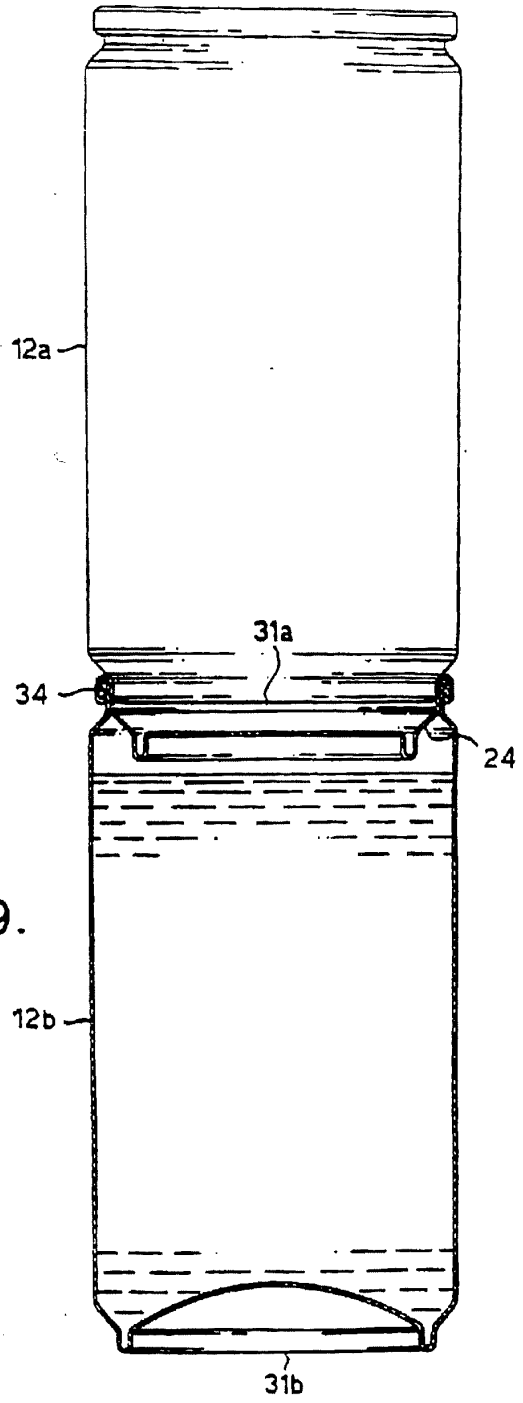


Fig.9.



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CAN END AND METHOD FOR FIXING THE SAME TO A CAN BODY

This is a continuation of U.S. patent application Ser. No. 10/024,862, which issued Feb. 1, 2005 as U.S. Pat. No. 6,848,875, filed Dec. 18, 2001, which is a continuation of U.S. patent application Ser. No. 09/650,664, filed Aug. 30, 2000, now abandoned which is a continuation of U.S. patent application Ser. No. 09/552,668, filed Apr. 19, 2000, now abandoned, which is a continuation of U.S. patent application Ser. No. 08/945,698, filed Nov. 21, 1997, which issued May 23, 2000 as U.S. Pat. No. 6,065,634, which is the U.S. National Phase of PCT/GB96/00709, filed Mar. 25, 1996, which claims priority to UK 9510515.1, filed May 24, 1995.

BACKGROUND OF THE INVENTION

This invention relates to an end wall for a container and more particularly but not exclusively to an end wall of a can body and a method for fixing the end wall to the can body by means of a double seam.

U.S. Pat. No. 4,093,102 (KRASKA) describes can ends comprising a peripheral cover hook, a chuck wall dependent from the interior of the cover hook, an outwardly concave annular reinforcing bead extending radially inwards from the chuck wall and a central panel joined to an inner wall of the reinforcing bead by an annular outwardly convex bead. This can end is said to contain an internal pressure of 90 psi by virtue of the inclination or slope of the chuck wall, bead outer wall and bead inner wall to a line perpendicular to the centre panel. The chuck wall slope D° is between 14° and 16°, the outer wall slope E is less than 4° and the inner wall slope C° is between 10 and 16° leading into the outwardly convex bead. We have discovered that improvements in metal usage can be made by increasing the slope of the chuck wall and limiting the width of the anti peaking bead.

U.S. Pat. No. 4,217,843 (KRASKA) describes an alternative design of can end in which the countersink has inner and outer flat walls, and a bottom radius which is less than three times the metal thickness. The can end has a chuck wall extending at an angle of approximately 24° to the vertical. Conversely, the specification of our U.S. Pat. No. 5,046,637 describes a can end in which the chuck wall extends at an angle of between 12° and 20° to the vertical.

The detailed description of our U.S. Pat. No. 4,571,978 describes a method of making a can end suitable for closing a can body containing a beverage such as beer or soft drinks. This can end comprises a peripheral flange or cover hook, a chuck wall dependant from the interior of the cover hook, an outwardly concave reinforcing bead extending radially inwards from the chuck wall from a thickened junction of the chuck wall with the bead, and a central panel supported by an inner portion of the reinforcing bead. Such can ends are usually formed from a prelacquered aluminum alloy such as an aluminum magnesium manganese alloy such as alloy 5182.

The specification of our U.S. Pat. No. 5,582,319 describes a can end suitable for a beverage can and formed from a laminate of aluminum/manganese alloy coated with a film of semi crystalline thermoplastic polyester. This polyester/aluminum alloy laminate permitted manufacture of a can end with a narrow, and therefore strong reinforcing bead in the cheaper aluminum manganese alloy.

These known can ends are held during double seaming by an annular flange of chuck, the flange being of a width and height to enter the anti-peaking bead. There is a risk of scuffing if this narrow annulus slips. Furthermore a narrow annular flange of the chuck is susceptible to damage.

Continuing development of a can end using less metal, whilst still permitting stacking of a filled can upon the end of another, this invention provides a can end comprising a peripheral cover hook, a chuck wall dependant from the interior of the chuck wall, an outwardly concave annular reinforcing bead extending radially inwards from the chuck wall, and a central panel supported by an inner portion of the reinforcing bead, characterized in that, the chuck wall is inclined to an axis perpendicular to the exterior of the central panel at an angle between 30° and 60°, and the concave bead narrower than 1.5 mm (0.060"). Preferably, the angle of the chuck wall to the perpendicular is between 40° and 45°.

In a preferred embodiment of the can end an outer wall of the reinforcing bead is inclined to a line perpendicular to the central panel at an angle between −15° to +15° and the height of the outer wall is up to 2.5 mm.

In one embodiment the reinforcing bead has an inner portion parallel to an outer portion joined by said concave radius.

The ratio of the diameter of the central panel to the diameter of the peripheral curl is preferably 80% or less.

The can end may be made of a laminate of thermoplastic polymer film and a sheet aluminum alloy such as a laminate of a polyethylene terephthalate film on an aluminum-manganese alloy sheet or ferrous metal typically less than 0.010 (0.25 mm) thick for beverage packaging. A lining compound may be placed in the peripheral cover hook.

In a second aspect this invention provides a method of forming a double seam between a can body and a can end according to any preceding claim, said method comprising the steps of:

placing the curl of the can end on a flange of a can body supported on a base plate, locating a chuck within the chuck wall of the can end to centre the can end on the can body flange, said chuck having a frustoconical drive surface of substantially equal slope to that of the chuck wall of the can end and a cylindrical surface portion extending away from the drive surface within the chuck wall, causing relative motion as between the assembly of can end and can body and a first operation seaming roll to form a first operation seam, and thereafter causing relative motion as between the first operation seam and a second operation roll to complete a double seam, during these seaming operations the chuck wall becoming bent to contact the cylindrical portion of the chuck.

BRIEF DESCRIPTION OF THE FIGURES

Various embodiments will now be described by way of example and with reference to the accompanying drawings in which:

FIG. **1** is a diagrammatic sketch of known apparatus for forming a double seam;

FIG. **2** is an enlarged sectioned side view of a known chuck and can end before seaming;

FIG. **3** is a sectioned view of a fragment of a known double seam;

FIG. **4** is a sectioned side view of a can end according to this invention before edge curling;

FIG. **5** is a sectioned side view of the can end of FIG. **4** on a can body before forming of a double seam;

FIG. **6** is a like view of the can end and body during first operation seaming;

FIG. **7** is a like view of the can end and body during final second operation seaming to create a double seam;

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FIG. **8** is a fragmentary section of a chuck detail; and

FIG. **9** is a side view of the cans stacked one on the other.

DETAILED DESCRIPTION

In FIG. **1**, apparatus for forming a double seam comprises a base plate **1**, an upright **2** and a top plate **3**.

A lifter **4** mounted in the base plate is movable towards and away from a chuck **5** mounted in the top plate. The top plate supports a first operation seaming roll **6** on an arm **7** for pivotable movement towards and away from the chuck. The top plate also supports a second operation seaming roll **8** on an arm **9** for movement towards and away from the chuck after relative motion as between the first operation roll and can end on the chuck creates a first operation seam.

As shown in FIG. **1** the chuck **5** holds a can end **10** firmly on the flange **11** of a can body **12** against the support provided by the lifter plate **4**. Each of the first operation roll **6** and second operation roll **8** are shown clear of chuck before the active seam forming profile of each roll is moved in turn to form the curl of the can end and body flange to a double seam as shown in FIG. **3**.

FIG. **2** shows on an enlarged scale the chuck **5** and can end **10**. The can end comprises a peripheral curl **13**, a chuck wall **14** dependent from the interior of the curl, an outwardly concave anti-peaking bead **15** extending inwards from the chuck wall to support a central panel **16**. Typically the chuck wall flares outwardly from the vertical at an angle C about 12° to 15°.

The chuck **5** comprises a body **17** having a threaded bore **18** permitting attachment to the rest of the apparatus (not shown). An annular bead **19** projects from the body **17** of the chuck to define with the end face of the body a cavity to receive the central panel **16** of the can end. The fit of panel **16** in annulus **19** may be slack between panel wall and chuck.

The exterior surface of the projecting bead **19** extends upwards towards the body at a divergent angle B of about 12° to the vertical to join the exterior of the chuck body **17** which tapers off an angle A° of about 4° to a vertical axis perpendicular to the central panel. The outer wall of the chuck **5** engages with the chuck wall at a low position marked "D" within the 12° shaped portion of the chuck bead **15**.

As can ends are developed with narrower anti-peaking beads the chuck bead **19** becomes narrower and more likely to fracture. There is also a risk of scuffing of the can end at the drive position D which can leave unacceptable unsightly black marks after pasteurization.

FIG. **3** shows a sectioned fragment of a typical double seam showing a desirable overlap of body hook **21** and end hook **20** between the can end **10** and can body **12**.

FIG. **4** shows a can end, according to the invention, comprising a peripheral cover hook **23**, a chuck wall **24** extending axially and inwardly from the interior of the peripheral cover hook, an outwardly concave reinforcing or anti-peaking bead **25** extending radially inwards from the chuck wall, and a central panel **26** supported or an inner portion panel with **27**. The panel wall is substantially upright allowing for any metal spring back after pressing. The chuck wall is inclined to an axis perpendicular to the exterior of the central panel at an angle C_1 between 20° and 60°; preferably between 40° and 45°. Typically the cross sectional radius of the antipeaking bead is about 0.5 mm.

Preferably the anti-peaking bead **25** is parallel sided, however the outer wall may be inclined to a line perpendicular to the central panel at an angle between −15° to +15° and the height h_4 of the outer wall may be up to 2.5 mm.

This can end is preferably made from a laminate of sheet metal and polymeric coating. Preferably the laminate comprises an aluminum magnesium alloy sheet such as 5182, or aluminum manganese alloy such as 3004 with a layer of polyester film on one side. A polypropylene film may be used on the "other side" if desired.

Typical dimensions of the example of the invention are:

d5	overall diameter (as stamped)	65.83 mm
d4	PC diameter of seaming panel radius	61.54 mm
d3	PC diameter of seaming panel/chuck wall radius	59.91 mm
r_1	seaming panel/chuck wall radius	1.27 mm
r_2	seaming panel radius	5.56 mm
r_3	concave radius in antipeaking bead	<1.5 mm
d_2	maximum diameter of antipeaking bead	50.00 mm
d_1	minimum diameter of antipeaking bead	47.24 mm
h_2	overall height of can end	6.86 mm
h_1	height to top of antipeaking bead	5.02 mm
h_3	panel depth	2.29 mm
h_4	outer wall height	1.78 mm
c	chuck wall angle to vertical	43°

From these dimensions it can be calculated that the ratio of central panel diameter of 47.24 mm to overall diameter of can end 65.84 is about 0.72 to 1.

For economy the aluminum alloy is in the form of sheet metal less than 0.010" (0.25 mm). A polyester film on the metal sheet is typically 0.0005" (0.0125 mm).

Although this example shows an overall height h_2 at 6.86 mm we have also found that useful can ends may be made with an overall height as little as 6.35 mm (0.25").

FIG. **5** shows the peripheral flange **23** of can end **22** of FIG. **4** resting on the flange **11** of a can body **12** before formation of a double seam as discussed with reference to FIG. **1**.

In FIG. **5** a modified chuck **30** comprises a chuck body **31** having a frustoconical drive surface **32** engaging with the chuck wall **24** of the can end **22**.

The frustoconical drive surface is inclined outwardly and axially at an angle substantially equal to the angle of inclination C° of between 20° and 60°; in this particular example on chuck angle C of 43° is preferred. The drive surface **32** is a little shorter than the chuck wall **24** of the chuck body. The substantially cylindrical surface portion **33**, rising above the drive surface **32**, may be inclined at an angle between +4° and −4° to a longitudinal axis of the chuck. As in FIG. **2**, this modified chuck **30** has a threaded aperture to permit attachment to the rest of the double seam forming apparatus (not shown).

In contrast to the chuck of FIG. **2** the modified chuck **30** is designed to drive initially on the relatively large chuck wall **32** without entering deeply into the anti-peaking bead **25**. Further drive is obtained at the juncture of chuck wall **32** and cylindrical wall **33** as chuck wall of end **24** is deformed during 1^{st} and 2^{nd} operation seaming FIGS. **6** and **7**. The chuck **30** shown in FIG. **5** has an annular bead of arcuate cross section but this bead is designed to enter the chuck

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wall without scratching or scuffing a coating on the can end; not to drive on the concave bead surface as shown in FIG. **2**.

It will be understood that first operation seaming is formed using apparatus as described with reference to FIG. **1**.

FIG. **6** shows the modified can end and chuck during formation of a first operation seam shown at the left of FIG. **2** as formed by a first operation roll **34** adjacent the inter-folded peripheral flange of the can end and flange **11** body **12**.

During relative rotation as between the can end **22** and first operation roll **34** the edge between the chuck drive wall **32** and cylindrical wall **33** exerts a pinching force between chuck **30** and roll **34** to deform the chuck wall of the can end as shown.

After completion of the first operation seam the first operation roll is swung away from the first operation seam and a second operation roll **38** is swung inwards to bear upon the first operation seam supported by the chuck **30**. Relative rotation as between the second operation roll **38** and first operation seam supported by a chuck wall **30** completes a double seam as shown in FIG. **7** and bring the upper portion **24** of the chuck wall **24** to lie tightly against the can body neck in a substantially upright attitude as the double seam is tightened by pinch pressure between the second operation roll **38** and chuck **30**.

Can ends according to the invention were made from aluminum alloy 5182 and an aluminum alloy 3004/polymer laminate sold by CarnaudMetalbox under the trade mark ALULITE. Each can end was fixed by a double seam to a drawn and wall ironed (DWI) can body using various chuck angles and chuck wall angle as tabulated in Table 1 which records the pressure inside a can at which the can ends failed:—

TABLE 1

	CAN END DATA			PRESSURE IN BAR (PSIG) TO FAILURE FOR VARIOUS SEAMING CHUCK ANGLES B°				
Sample Code	Material Thickness mm	Minimum Diameter D1 mm	CHUCK Wall Angle "C"	23°	10°/23°	4°/23°	23° with D. Seam Ring	10°/23° with D. Seam Ring
A	ALULITE	52.12	21.13°	5.534	5.734	5.311	6.015	5.875
	0.23	(2.052")		(80.20)	(83.10)	(76.97)	(87.17)	(85.14)
B	5182	52.12	21.13°	5.599	5.575	5.381	5.935	5.895
	0.244	(2.052")		(81.15)	(80.79)	(77.99)	(86.01)	(85.43)
C	5182	52.12	21.13°	6.004	5.910	5.800	6.224	6.385
	0.245	(2.052")		(87.02)	(85.65)	(84.06)	(90.21)	(92.54)
D	ALULITE	51.92	21.13°	5.334	5.229	5.238	5.730	5.404
	0.23	(2.044")		(77.31)	(75.78)	(75.91)	(83.04)	(78.32)
E	5182	51.92	21.13°	5.555	5.514	5.354	5.895	5.930
	0.224	(2.044")		(80.50)	(79.92)	(77.60)	(85.43)	(85.94)
F	5182	51.92	23°	5.839	5.804	5.699	6.250	6.435
	0.245	(2.044")		(84.63)	(84.12)	(82.59)	(90.58)	(93.26)
G	ALULITE	51.92	23°			5.123		
	0.23	(2.044")				(74.25)		
H	5182	(51.92)	23°			5.474		
	0.224	(2.044")				(79.34)		
I	5182	51.92	23°			5.698		
	0.245	(2.044")				(82.58)		

All pressures on unaged shells in bar (psig). 5182 is an aluminum-magnesium-manganese alloy lacquered. The "ALULITE" used is a laminate of aluminum alloy and polyester film.

The early results given in Table 1 showed that the can end shape was already useful for closing cans containing relatively low pressures. It was also observed that clamping of the double seam with the "D" seam ring resulted in improved pressure retention. Further tests were done using a chuck wall angle and chuck drive surface inclined at nearly 45°: Table 2 shows the improvement observed:—

TABLE 2

	h_2	h_3	h_4	Chuck Angles B°	
Sample Code	mm (inches)	mm (inches)	mm (inches)	43°	43° with seam ring
J	6.86	2.39	2.29	4.89	6.15
	(0.270)	(0.094)	(0.09)	(70.9)	(89.1)
K	7.11	2.64	2.54	4.83	5.98
	(0.280)	(0.104)	(0.10)	(70.0)	(86.6)
L	7.37	2.90	2.79	4.74	6.44
	(0.290)	(0.114)	(0.11)	(68.7)	(93.3)

Table 2 is based on observations made on can ends made of aluminum coated with polymer film (ALULITE) to have a chuck wall length of 5.029 mm (0.198") up the 43° slope.

It will be observed that the container pressures achieved for samples J, K, L, 4.89 bar (70.9 psig), 4.83 bar (70.0 psig) and 4.74 bar (68.7 psig) respectively were much enhanced by clamping the double seam.

In order to provide seam strength without use of a clamping ring, modified chucks were used in which the drive slope angle C° was about 43° and the cylindrical surface **33** was generally +4° and −4°. Results are shown in Table 3.

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TABLE 3

SAMPLE CODE	MATERIAL	LINING COMPOUND	CHUCK ANGLES DRIVE/ WALL	PRESSURE
		Results		
c	0.224 5182	with	43°	4.60 (66.7)
g	0.23 Alulite	with	43°/4°	5.45 (79.0)
h	0.224 5182	with	43°/4°	6.46 (93.6)
j	0.23 Alulite	without	43°/4°	5.91 (85.6)
k	0.244 5182	without	43°/4°	6.18 (89.6)
l	0.23 Alulite	without	43°/–4°	5.38 (77.9)
m	0.25 Alulite	without	43°/–4°	6.20 (89.8)
n	0.23 Alulite	without	43°/0°	6.11 (88.5)
o	0.25 Alulite	without	43°/0°	6.62 (95.9)

ALL PRESSURES IN BAR (PSIG)
ALL CODES
Reform Pad Dia. 47.24 mm (1.860") (202 Dia).
6.86 mm (0.270") unit Depth h_2 2.39 mm (0.094") Panel Depth

Table 3 shows Code "O" made from 0.25 mm Alulite to give 6.62 bar (95 psi) Pressure Test Result indicating a can end suitable for pressurized beverages. Further chucks with various land lengths (slope) were tried as shown in Table 4.

TABLE 4

VARIABLE CODE	CHUCK WALL ANGLE 43°/0° 1.9 mm LAND SHARP TRANSITION NO. D. SEAM RING	WITH D. SEAM RING	43°/0° 1.27 MM LAND R 0.5 MM BLEND NO. D. SEAM RING	WITH D. SEAM RING
7	6.699 (97.08)	7.017 (101.7)	6.779 (98.24)	7.006 (101.54)
8	6.315 (91.52)	6.521 (94.5)	6.293 (91.2)	6.236 (90.37)
9	6.095 (88.33)	6.30 (91.3)	6.238 (90.4)	6.719 (97.38)

ALL PRESSURES IN BAR (PSIG) CODE
7 = 0.25 mm Alulite, 47.24 mm (1.860") Reform Pad, 6.86 mm (0.270") h_2 Depth, 2.38 mm (0.094") Panel; h_4 depth = 2.29 mm (0.09")
8 = 0.23 mm Alulite, 47.24 mm (1.860") Reform Pad, 7.11 mm (0.280") h_2 Depth, 2.64 mm (0.104") Panel; h_4 depth = 2.54 mm (0.10")
9 = 0.23 mm Alulite, 47.24 mm (1.860") Reform Pad, 7.37 mm (0.290") h_2 Depth, 2.90 mm (0.114") Panel; h_4 depth = 2.79 mm (0.11")

Table 4 shows results of further development to seaming chuck configuration to bring closer the pressure resistance of ring supported and unsupported double seams.

Table 4 identifies parameters for length of generally vertical cylindrical surface **33** on the seaming chuck **30**, and also identifies a positional relationship between the chuck wall **24** of the end and the finished double seam. It will be understood from FIG. **7** shows that the forces generated by

thermal processing or carbonated products are directed towards and resisted by the strongest portions of the completed double seam.

Table 5 shows results obtained from a typical seam chuck designed to give double seam in accordance with parameters and relationships identified in Table 4. Typically:—As shown in FIG. **8** the chuck comprises a cylindrical land of length '1' typically 1.9 mm (0.075") and frustoconical drive surface **32** inclined at an angle Y°, typically 43°, to the cylindrical to which it is joined by a radius R typically 0.5 mm (0.020"). Angle "X" is typically 90°.

TABLE 5

CODE	GAUGE	DIMENSIONS mm h_2	h_3	PRESSURE bar	(psi)
20	.23 mm	7.37 (.290")	2.36 (.093")	6.383	(92.6)
21	.23 mm	7.37 (.290")	2.36 (.093") with compound	6.402	(92.8)
26	.23 mm	6.87 (.2705")	2.37 (.0935")	6.144	(89.88)
27	.23 mm	6.87 (.2705")	2.37 (.0934") with compound	6.071	(88.0)
28	.23 mm	7.37 (.290")	2.36 (.093")	6.414	(93.0)
29	.23 mm	7.37 (.290")	2.84 (.112")	6.725	(97.5)
30	.23 mm	6.86 (.270")	2.37 (.0935")	6.062	(87.9)
31	.23 mm	6.86 (.270")	2.37 (.0935")	6.013	(87.2)
34	.25 mm	7.37 (.290")	2.87 (.113")	7.787	(112.9)
36	.25 mm	7.32 (.288")	2.34 (.092")	7.293	(105.8)
37	.25 mm	7.32 (.288")	2.34 (.092") with compound	7.402	(107.3)
38	.25 mm	6.87 (.2705")	2.41 (.095")	7.077	(102.6)
516	.25 mm	6.35 (.250")	2.34 (.092") with compound	6.937	(100.6)

All variables made from Alulite, 10 Cans per variable.

The can ends may be economically made of thinner metal if pressure retention requirements permit because these can ends have a relatively small centre panel in a stiffer annulus.

FIG. **9** shows a can **12***a*, closed according to this invention, stacked upon a like can **12***b* shown sectioned so that stacking of the upper can on the lower can end is achieved by a stand bead **31***a* of the upper can fits inside the chuck wall **24** of the lower can end with the weight of the upper can resting on the double seam **34** of the lower can end.

The clearance between the bottom of the upper can body and lower can end may be used to accommodate ring pull features (not shown) in the can end or promotional matter such as an coiled straw or indicia.

Using the experimental data presented above, a computer program was set up to estimate the resistance to deformation available to our can ends when joined to containers containing pressurized beverage. The last two entries on the table relate to a known 206 diameter beverage can end and an estimate of what we think the KRASKA patent teaches.

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TABLE 6

END SIZE Bead OD:ID	OVERALL DIA mm	PANEL DIA d_1 mm	RATIO OVERALL DIA: PANEL DIA	CHUCK WALL ANGLE C°	CHUCK WALL LENGTH L mm	RE-ENFORC-ING RAD r_3 mm	INNER WALL HEIGHT h_3 mm	OUTER WALL HEIGHT h_4 mm	PREDICTED CUT EDGE Ø (*DENOTES ACTUAL)	ACTUAL THICK-NESS TO CONTAIN PSI
206–204	64.39 (2.535")	49.49 (1.9485")	1.3010	33.07°	4.22 (0.166")	0.52 (0.0204")	2.34 (0.092")	1.78 (0.070")	75.230 (2.9618")	0.255
206–202	64.39 (2.535")	47.33 (1.8634")	1.3604	42.69°	4.95 (0.195")	0.52 (0.0204")	2.34 (0.092")	1.78 (0.070")	74.272 (2.9241")*	0.255
206–200	64.39 (2.535")	45.07 (1.7744")	1.4287	50.053°	5.82 (0.229")	0.52 (0.0204")	2.34 (0.092")	1.78 (0.070")	73.713 (2.9021")	0.255
204–202	62.18 (2.448")	47.33 (1.8634")	1.3137	29.78°	3.96 (0.156")	0.52 (0.0204")	2.34 (0.092")	1.78 (0.070")	73.767 (2.9042")	0.24
204–200	62.18 (2.448")	45.07 (1.7744")	1.3796	40.786°	4.70 (0.185")	0.52 (0.0204")	2.34 (0.092")	1.78 (0.070")	72.911 (2.8705")	0.24
202–200	71.98 (2.834")	45.07 (1.7744")	1.597	30.266°	4.09 (0.161")	0.52 (0.0204")	2.34 (0.092")	1.78 (0.070")	71.984 (2.834")	0.225
206 std	64.69 (2.547")	51.92 (2.044")	1.2461	15.488°	4.39 (0.173")	0.56 (0.022")	2.03 (0.080")	—	76.454 (3.010")*	0.28
KRASKA estimate	64.39 (eg 2.535")	—	—	15°	2.54 (0.100")	0.81 (0.032")	1.65 (0.065")	2.29 (0.090")	78.080 (3.074")	0.292 (0.0115")

All experiments modeled on a notional aluminum alloy of yield strength 310 mpa 0.25 mm thick. The standard was also 310 mpa BUT 0.275 mm thick.

What is claimed is:

1. A metal can end adapted to be joined to a can body for packaging beverages under pressure, said can end comprising;

a peripheral cover hook adapted to be seamed onto a can body so as to form a joint therewith;

a wall extending inwardly and downwardly from the cover hook;

an outwardly concave annular reinforcing bead extending inwardly and downwardly from the wall; and

a central panel supported by and extending inwardly from the reinforcing bead;

wherein, prior to being joined to said can body: (i) the location at which said wall extends from said peripheral cover hook defines a first point, (ii) the location at which said reinforcing bead extends from said wall defines a second point, and (iii) a line extending between the first point and the second point is inclined to an axis perpendicular to the exterior of the central panel at an angle of between 30° and 60°.

2. The can end of claim **1**, wherein a base of the concave reinforcing bead is arcuate in cross-section and has a cross-sectional radius of less than 0.75 mm.

3. The can end of claim **1**, wherein the base of the concave reinforcing bead is approximately semi-circular in cross section.

4. The can end of claim **1**, wherein the reinforcing bead comprises an outer wall that is inclined to said axis at an angle between −15° and +15°.

5. The can end of claim **1**, wherein the reinforcing bead has inner and outer walls, a lower portion of the outer wall spaced apart from a lower portion of the inner wall by less than 1.5 mm.

6. The can end of claim **1**, wherein the reinforcing bead has an outer wall and an inner wall that is parallel to the outer wall, said inner wall and said outer wall being joined by a concave radius.

7. The can end of claim **1**, wherein the wall extends between said first and second points along an essentially straight line.

8. The can end of claim **7**, wherein the line extending between the first point and the second point is inclined to said axis at an angle between 40° and 45°.

9. The can end of claim **1**, wherein the ratio of the diameter of the central panel to the diameter of the peripheral cover hook is 80% or less.

10. The can end of claim **1**, wherein the can end is made of a laminate of thermoplastic polymer film and a sheet aluminium alloy.

11. The can end of claim **1**, wherein the can end is made of tinplate.

12. The can end of claim **1**, wherein the can end is made of electrochrome coated steel.

13. A metal can end for use in packaging beverages under pressure and adapted to be joined to a can body by a seaming process so as to form a double seam therewith using a rotatable chuck comprising first and second circumferentially extending walls, said first and second chuck walls forming a juncture therebetween, said can end comprising;

a peripheral cover hook, said peripheral cover hook comprising a seaming panel adapted to be formed into a portion of said double seam during said seaming operation;

a central panel;

a wall extending inwardly and downwardly from said cover hook, a first portion of said wall extending from said cover hook to a first point on said wall, said first wall portion adapted to be deformed during said seaming operation so as to be bent upwardly around said juncture of said chuck walls at said first point on said wall, a second portion of said wall extending from said first point to a second point forming a lowermost end of said wall, a line extending between said first and second points being inclined to an axis perpendicular to said central panel at an angle of between 30° and 60°.

14. The end according to claim **13**, further comprising an annular reinforcing bead connected to said wall at said second point, said annular reinforcing bead connecting said wall to said central panel.

* * * * *

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FORM 19. Certificate of Compliance with Type-Volume Limitations **Form 19**
July 2020

UNITED STATES COURT OF APPEALS
FOR THE FEDERAL CIRCUIT

CERTIFICATE OF COMPLIANCE WITH TYPE-VOLUME LIMITATIONS

Case Number: 2023-2308

Short Case Caption: Ball Metal Beverage Container Corporation v. Crown Packaging Technology, Inc.

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Name: Daniel J. Goettle