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(54) Benævnelse: **DRIKKEDÅSEENDE MED EN BUET PANELVÆG OG BUET OVERGANGSVÆG**

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# DESCRIPTION

## BACKGROUND

**[0001]** This invention relates to a container technology, and more particularly to a can end for a beverage can and methods for seaming a beverage can end to a can body.

**[0002]** Modern beverage cans include a beverage can body that is drawn and ironed from aluminum stock and a beverage can end that is attached to the body by a double seam. The assignee of the present invention developed lightweight beverage ends, which are generally described in United States Patent Numbers 8328041, 7370774, and 8157119. Some of the ends generally described in the patents are marketed under the trade name SuperEnd™.

**[0003]** Competitors have also developed lightweight ends that often incorporate features developed for SuperEnd. United States Patent Numbers 7673768 and 8313004 disclose various lightweight ends, some of which have been commercialized. WO2012/039433 also describes can ends.

**[0004]** Modern, lightweight beverage ends are rated to withstand internal can pressurization, as measured by a buckle performance test, often of 85 psi (5.86 bar) or more. Failure often includes loss of the circular profile and buckling of the end which, ultimately, leads to eversion of the end profile. Failure may be initiated by dropping or distorting the can end, or by overpressure within the container, such as when the can undergoes thermal processing or is subjected to high ambient temperature.

**[0005]** A version of an end developed by Container Development Limited and marketed by Ball Corporation has been found to have problems with consistency of the seam dimensions upon double seaming to a beverage can.

## SUMMARY

**[0006]** The inventors have developed a light weight beverage can end that they surmise overcomes the seaming problems referred to above, as well as other benefits. The inventors believe that a relationship between the seaming panel configuration, upper panel wall configuration, and a sufficient magnitude of reforming of the end's upper wall in the seamer alleviates the dimensional inconsistency in the seam. Accordingly, an end and corresponding method provide an end that is lightweight, can be used with a current, conventional chuck, and is believed to provide for reliable and consistent seams. The present invention is not limited to these aspects, but rather encompasses other aspects of the end and combination of features disclosed in the description and stated in the claims.

**[0007]** According to a first aspect, there is provided a beverage can end comprising a center panel; an arcuate panel wall that extends outwardly from the center panel; an upwardly-opening annular bead merging into the arcuate panel wall; a lower transition wall extending from an outer end of the annular bead, the lower transition wall being inclined at an angle A2 that is less than 11 degrees from a vertical axis defined when the can end is conventionally oriented; a curved upper transition wall extending outwardly from an upper end of the lower transition wall, the lower transition wall yielding smoothly to the upper transition wall; a substantially flat intermediate wall; a substantially flat upper wall that is inclined more than the intermediate wall and that is inclined at an angle A4 that is at least 13 degrees from said axis; a juncture formed between the intermediate wall and the upper wall; a seaming panel extending from an upper end of the upper wall, the seaming panel having a radius R4 of between 0.050 inches (1.27 mm) and 0.060 inches (1.524 mm); and a curl extending outwardly from an outer end of the seaming panel.

**[0008]** Preferably, angle A2 of the lower transition wall is between 1 degree and 10 degrees, more preferably between 2 degrees and 8 degrees, more preferably, between 3 degrees and 6 degrees, and, in the embodiment in the figures, about 5.5 degrees. Preferably, intermediate wall is inclined at an angle A3 that is between 50 degrees and 63 degrees, more preferably between 52 degrees and 60 degrees, and, in the embodiment in the figures, about 55 degrees. Preferably, the upper wall angle A4 is at least 13 degrees, more preferably at least 15 degrees, and, in the embodiment in the figures, approximately 16 degrees. Preferably, the panel wall is inclined at an angle A1 of between 30 degrees and 60 degrees, more preferably between 40 degrees and 50 degrees, and, in the embodiment in the figures, about 45 degrees. The bead may be approximately symmetric about a vertical centerline.

**[0009]** According to another aspect there is provided a beverage can end and beverage can body combination included the unseamed beverage end according to the first aspect above and a beverage can body. The beverage can body prior to seaming includes a flange that matches the seaming panel shape and dimensions of the seaming panel radius. The seaming panel has a radius R4 that is the sum of the radius R3 of the flange and the flange metal thickness t.

**[0010]** According to another aspect there is provided a method for seaming a beverage can end and a beverage can body together. The method of seaming, which may be applied to the unseamed end according to the first aspect above, includes placing the beverage can end on to a beverage can body, which has a flange that matches the seaming panel shape and dimensions of the seaming panel radius, and the seaming panel having a radius R4 that is the sum of the radius R3 of the flange and the flange metal thickness t. The method includes the step of bringing a chuck into engagement with an exterior surface of the end such that a lowermost point of an anvil of the chuck contacts the juncture of the end and engaging the curl of the end with seaming rolls such that the upper wall is bent up by at least 9 degrees.

**[0011]** Preferably, the upper wall angle A4 is at least 13 degrees. More preferably, the upper wall angle A4 is at least 15 degrees and the upper wall is bent up by at least 11 degrees, and

more preferably the upper wall angle A4 is approximately 16 degrees and the upper wall is bent up by at least 13 degrees.

**[0012]** The disclosed beverage can end preferably is for double seaming by conventional seaming equipment onto a drawn and ironed beverage can body, such as a necked 211 sized can body. The end preferably is a 206, 204, or 200 size, and the inventors contemplate other industry-accepted sizes.

**BRIEF DESCRIPTION OF THE FIGURES**

**[0013]**

Figure 1 is an enlarged cross sectional view of a portion of a beverage can end illustrating aspects of the present invention.

Figure 2 is the cross sectional view of the end of Figure 1 with additional annotation.

**DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS**

**[0014]** Figure 1 illustrates a cross section of a beverage can end 10 illustrating aspects of the present invention. Can end 10 is a cross section of an end shell prepared by encasing a sample end in a polymer, cutting the shell into a cross section, and then photographing, enlarging, and enhancing the image. Accordingly, can end 10 is dimensionally accurate for an embodiment of the present invention.

**[0015]** Can end 10 includes a center panel 12, a curved panel wall 14, a bead 18, a lower transition wall 20, a upper transition wall 22, a intermediate wall 24, a juncture 26, an upper wall 28, a seaming panel 30, and a curl 32.

**[0016]** Center panel 12 is circular and includes a pour opening and an opening mechanism, each of which preferably is conventional. For example, the pour opening may be formed by a score (not shown in the figures) in the shape known in the beverage end industry as a large opening end (LOE). The opening mechanism preferably is a convention stay-on-tab (SOT). Center panel 12 in the illustration of Figure 1 is not flat because the cross section shows beading, as will be understood by persons familiar with can end center panels. The particular end shown in Figure 1 is referred to as a DRT style.

**[0017]** The term "shell" is used in this disclosure to refer to the product of a shell press, including the finished profile. The term "end" is used to refer to the shell after a tab has been applied in a conversion press. Can end 10 is illustrated in its unseamed state, and the present

invention encompasses a combination can body and end combination in the seamed state, the method for forming the combination, and the can body and end combination in which the unseamed end is positioned on the can body ready for seaming.

**[0018]** A curved panel wall 14 extends about center panel 12 such that in transverse cross section, as shown in Figure 1, panel wall extends outwardly and downwardly from center panel 12. The terms "outwardly" and "inwardly" refer to a radial direction. The terms "upwardly" and "downwardly" refer to vertical direction as the end is conventionally oriented. The terms indicating radial direction and vertical direction are not exclusive. Nor do the terms indicate one is dominant over the other. For example, a part A that extends radially outwardly and from another part B and also extends upwardly from part B by a few degrees may be described in this disclosure and claims as extending outwardly, as extending upwardly, or as both extending upwardly and outwardly.

**[0019]** As illustrated in Figure 2, even though panel wall 14 is curved, wall 14 may be defined by end points 40 and 42, which are on wall 14 where wall 14 merges with radii R1 and R2. Preferably, radii R1 and R2 are between 0.015" inches (0.381 mm) and 0.025" inches (0.635 mm). The present invention is not limited to transitions at 40 and 42 that are formed by a single radius. For example, wall 14 may merge smoothly into center panel 12 and the inner bead wall of bead 18 or other configurations. In a configuration in which the transition at 40 and/or at 42 are not formed by a single radius, and there is no dominant radius that can be used as an approximation, points 40 and/or 42 may be identified by eye. A line drawn between end points 40 and 42 may be inclined at an angle A1 that is between 30 degrees and 60 degrees, preferably between 40 degrees and 50 degrees, and most preferably about 45 degrees.

**[0020]** Annular countersink bead 18 preferably forms a semi-circle and preferably is approximately symmetric (within ordinary manufacturing tolerances) about a vertical centerline V-CS. The horizontal dashed line in Figure 2 defines the boundaries of the semi-circular shaped bead 18. The horizontal dashed line may be drawn horizontally from transition point 44 (defined below), from the point at which inner portion of the bead 18 yields to radius R2, or a point chosen such that bead 18 is symmetrical, as will be understood by persons familiar with end reinforcing bead configurations. The semi-circular shape of bead 18 is beneficial in embodiments in which a chuck (now shown in the figures) is positioned in the bead during the seaming process.

**[0021]** Lower transition wall 20 extends upwardly from an outer portion of bead 18. Preferably lower transition wall 20 is straight or nearly straight and is defined between transition points 44 and 46. A line between transition points 44 and 46 is inclined from vertical at an angle A2 that is less than 11 degrees, preferably less than 10 degrees, more preferably between 2 degrees and 8 degrees or between 3 degrees and 6 degrees, and in the embodiment shown in the figures about 5.5 degrees.

**[0022]** A curved upper transition wall 22 extends from transition 46 to yield to a substantially flat intermediate wall portion 24. Intermediate wall portion 24 merges into upper wall portion 28

at juncture 26. Intermediate wall portion 24 preferably is substantially straight and inclined a preferred angle A3 (Figure 2) of between 50 degrees and 63 degrees, more preferably between 52 and 60 degrees, and in most preferably about 55 degrees.

**[0023]** Upper wall portion wall 28 is substantially straight above a transition portion at junction 26 such that a line between the end points of upper wall 28 is inclined at an angle A4 of at least 13 degrees, and more preferably at least 15 degrees. The upper limit of angle A4 is the practical limit on the bending required in the seamer. Because the angle of a conventional chuck is approximately 4 degrees, the magnitude of the angle of deformation during seaming can be calculated by subtracting 4 degrees from A4, such that the magnitude of deflection can be at least 9 degrees and more preferably at least 11 degrees.

**[0024]** Seaming panel 30 and curl 32 extend from transition 50. Seaming panel 30 has a radius R4. As shown in Figure 2, a portion of a flange 90 of a can body is shown in a position in which end 10 is in position on flange 90 for seaming. The shape of seaming panel 30 matches the shape of flange 90 - that is, there is no significant gap between the upper part of the highly curved flange 90 and the seaming panel 30. Further, the radius R4 of the seaming panel is the sum of the radius R3 of the flange and the flange metal thickness t. United States Patent Number 5,911,551 (Moran), which is assigned to a predecessor of the assignee of the present invention, discloses aspects of the relationship between the seaming panel and the can body flange, as will be understood by persons familiar with double seaming technology.

**[0025]** Curl 32 preferably is conventional and is chosen together with seaming roller configuration to achieve an industry suitable double seam at commercial line speeds.

**[0026]** Can end 10 is configured such that a seaming chuck (not shown in the figures) can extend into bead 18 to contact either the bottom radius of bead 18 and/or the outer wall of bead 18 and a lower portion of lower transition wall 20. Also the chuck will have a point at the lower end of its anvil portion that (optionally) may contact juncture 26. In any regard, upper wall 28 to is bent upwardly and inwardly during seaming.

**[0027]** The materials of the can end preferably is a 5000 series aluminum alloy or a tin plate steel and the materials of the can body preferably is a 3000 series aluminum alloy or a tin plate steel.

**[0028]** Aspects of the present invention and their advantages have been described, but the present invention is not limited to any aspect or advantage unless expressly set out in the claims.

# REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not

form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

**Patent documents cited in the description**


- US8328041B [0002]
- US7370774B [0002]
- US8157119B [0002]
- US7673768B [0003]
- US8313004B [0003]
- WO2012039433A [0003]
- US5911551A [0024]

# DRIKKEDÅSEENDE MED EN BUET PANELVÆG OG BUET OVERGANGSVÆG

## PATENTKRAV

1. Drikkedåseende (10), der omfatter:

et midterpanel (12);

en buet panelvæg (14), der strækker sig udefter fra midterpanelet;

en ringformet vulst (18), der åbnes opefter og går over i den buede panelvæg (14);

en nedre overgangsvæg (20), der strækker sig fra en ydre ende af den ringformede vulst, hvor den nedre overgangsvæg hælder i en vinkel A2, der er mindre end 11 grader fra en vertikal akse, der defineres, når dåseenden er konventionelt orienteret;

en buet øvre overgangsvæg (22), der strækker sig udefter fra en øvre ende af den nedre overgangsvæg, hvilken nedre overgangsvæg hælder blidt mod den øvre overgangsvæg;

en i alt væsentligt flad mellemliggende væg (24);

en i alt væsentligt flad øvre væg (28), der hælder mere end den mellemliggende væg, og der hælder i en vinkel A4, der er er mindst 13 grader fra aksen;

en samling (26), der er dannet mellem den mellemliggende væg og den øvre væg (28);

et falspanel (30), der strækker sig fra en øvre ende af den øvre væg (28), hvilket falspanel har en radius R4 på mellem 0,050 tommer (1,27 mm) og 0,060 tommer (1,524 mm);

en krumning (32), der strækker sig udefter fra en ydre ende af falspanelet.

2. Kombination af en drikkedåseende (10) og et drikkedåselegeme, der omfatter:

drikkedåseenden ifølge krav 1; og

et drikkedåselegeme; hvilket drikkedåselegeme har en flange (90), der matcher falspanelformen og -dimensionerne for falspanelets radius, hvilket falspanel har en radius R4, der er summen af radiussen R3 af flangen og flangens metaltykkelse t.

3. Drikkedåseende ifølge krav 1 eller krav 2, hvor vinklen A2 af den nedre overgangsvæg er mellem 1 grad og 10 grader fra aksen.

4. Drikkedåseende ifølge krav 1 eller krav 2, hvor vinklen A2 af den nedre overgangsvæg er mellem 2 grader og 8 grader fra aksen.

5. Drikkedåseende ifølge krav 1 eller krav 2, hvor vinklen A2 af den nedre overgangsvæg er mellem 3 grader og 6 grader fra aksen.

6. Drikkedåseende ifølge krav 1 eller krav 2, hvor vinklen A2 af den nedre overgangsvæg er ca. 5,5 grader fra aksen.

7. Drikkedåseende ifølge krav 1 eller krav 2, hvor vinklen A3 af den mellemliggende væg er mellem 50 grader og 63 grader fra aksen.

8. Drikkedåseende ifølge krav 1 eller krav 2 hvor, vinklen A3 af den mellemliggende væg er mellem 52 grader og 60 grader fra aksen.

9. Drikkedåseende ifølge krav 1 eller krav 2, hvor vinklen A3 af den mellemliggende væg er ca. 55 grader fra aksen.

10. Drikkedåseende ifølge krav 1 eller krav 2, hvor den øvre vægvinkel A4 er mindst 13 grader fra aksen.

11. Drikkedåseende ifølge krav 1 eller krav 2, hvor den øvre vægvinkel A4 er mindst 15 grader fra aksen.

12. Drikkedåseende ifølge krav 1 eller krav 2, hvor den øvre vægvinkel A4 er ca. 16 grader fra aksen.

13. Drikkedåseende ifølge krav 1 eller krav 2, hvor panelvæggen hælder i en vinkel Al på mellem 30 grader og 60 grader fra aksen.

14. Drikkedåseende ifølge krav 1 eller krav 2, hvor panelvæggen hælder i en vinkel Al på mellem 40 grader og 50 grader fra aksen.

15. Drikkedåseende ifølge krav 1 eller krav 2, hvor panelvæggen hælder i en vinkel Al på ca. 45 grader fra aksen.

16. Drikkedåseende ifølge krav 1 eller krav 2, hvor vulsten er omtrent symmetrisk omkring en vertikal centerlinje.

17. Fremgangsmåde til sammenfalsning af en drikkedåseende (10) og et drikkedåselegeme, hvilken fremgangsmåde omfatter:

placering af drikkedåseenden (10) ifølge krav 1 på et drikkedåselegeme; hvilket drikkedåselegeme har en flange (90), der matcher falspanel- (30) formen og -dimensionerne for falspanelets radius, hvilket falspanel har en radius R4, der er summen af radiussen R3 af flangen og flangens metaltykkelse t;

at bringe en patron i indgreb med en ydre overflade af enden, således at et lavest punkt af patronens ambolt bringes i kontakt med endens samling; og

at bringe krumningen (32) af enden i indgreb med falsningsruller, således at den øvre væg (28) bøjes op med mindst 9 grader.

18. Fremgangsmåde ifølge krav 17, hvor vinklen A2 af den nedre overgangsvæg er mellem 1 grad og 10 grader fra en vertikal akse, der defineres, når dåseenden er konventionelt orienteret.

19. Fremgangsmåde ifølge krav 17, hvor vinklen A2 af den nedre overgangsvæg er mellem 2 grader og 8 grader fra en vertikal akse, der defineres, når dåseenden er konventionelt orienteret.

20. Fremgangsmåde ifølge krav 17, hvor vinklen A2 af den nedre overgangsvæg er mellem 3 grader og 6 grader fra en vertikal akse, der defineres, når dåseenden er konventionelt orienteret.

21. Fremgangsmåde ifølge krav 17, hvor vinklen A2 af den nedre overgangsvæg er ca. 5,5 grader fra en vertikal akse, der defineres, når dåseenden er konventionelt orienteret.

22. Fremgangsmåde ifølge krav 17, hvor vinklen A3 af den mellemliggende væg er mellem 50 grader og 63 grader fra en vertikal akse, der defineres, når dåseenden er konventionelt orienteret.

23. Fremgangsmåde ifølge krav 17, hvor vinklen A3 af den mellemliggende væg er mellem 52 grader og 60 grader fra en vertikal akse, der defineres, når dåseenden er konventionelt orienteret.

24. Fremgangsmåde ifølge krav 17, hvor vinklen A3 af den mellemliggende væg er ca. 55 grader fra en vertikal akse, der defineres, når dåseenden er konventionelt orienteret.

25. Fremgangsmåde ifølge krav 17, hvor den øvre vægvinkel A4 er mindst 13 grader fra en vertikal akse, der defineres, når dåseenden er konventionelt orienteret.

26. Fremgangsmåde ifølge krav 17, hvor den øvre vægvinkel A4 er mindst 15 grader fra en vertikal akse, der defineres, når dåseenden er konventionelt orienteret.

27. Fremgangsmåde ifølge krav 17, hvor den øvre vægvinkel A4 er ca. 16 grader fra en vertikal akse, der defineres, når dåseenden er konventionelt orienteret.

28. Fremgangsmåde ifølge krav 26, hvor den øvre væg er bøjet op med mindst 11 grader.

29. Fremgangsmåde ifølge krav 27, hvor den øvre væg er bøjet op med mindst 13 grader.

30. Fremgangsmåde ifølge krav 17, hvor panelvæggen hælder i en vinkel Al på mellem 30 grader og 60 grader fra en vertikal akse, der defineres, når dåseenden er konventionelt orienteret.

31. Fremgangsmåde ifølge krav 17, hvor panelvæggen hælder i en vinkel Al på mellem 40 grader og 50 grader fra en vertikal akse, der defineres, når dåseenden er konventionelt orienteret.

32. Fremgangsmåde ifølge krav 17, hvor panelvæggen hælder i en vinkel Al på ca. 45 grader fra en vertikal akse, der defineres, når dåseenden er konventionelt orienteret.

33. Fremgangsmåde ifølge krav 17, hvor vulsten er omtrent symmetrisk omkring en vertikal centerlinje.

# DRAWINGS

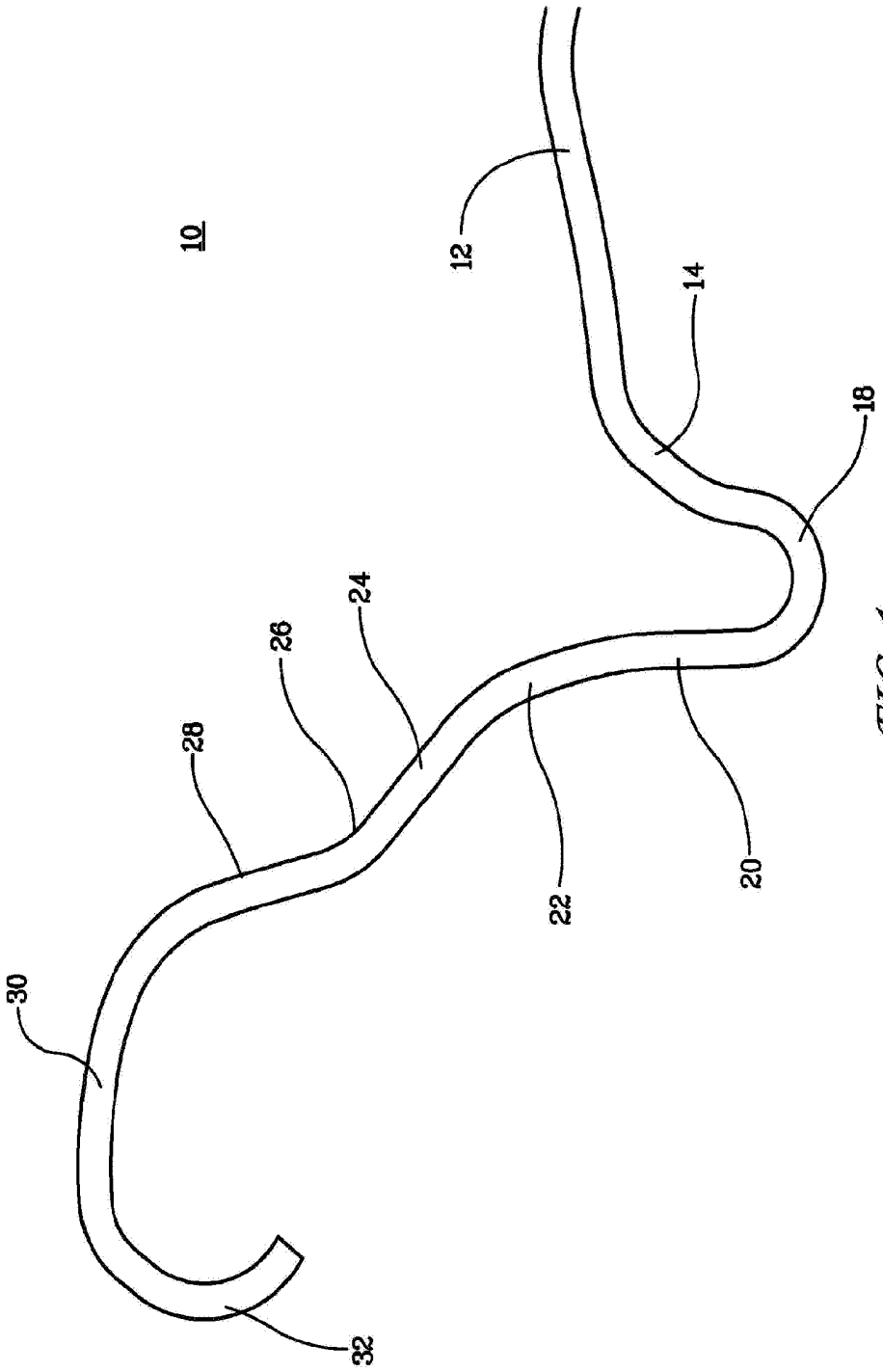


FIG. 1

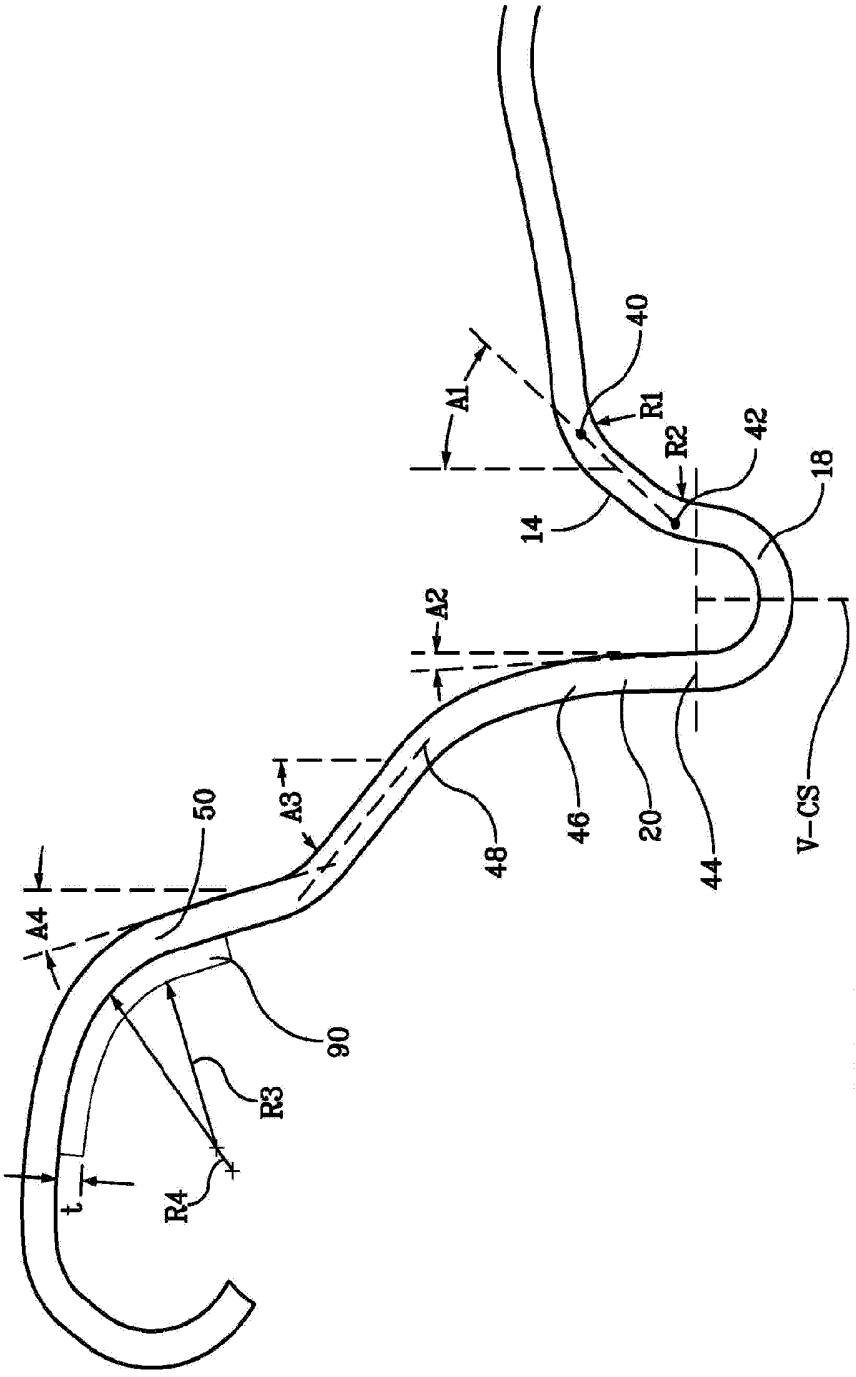


FIG. 2