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D E C I S I O N
of 1 April 2004

Case Number: T 1042/02 - 3.2.1

Application Number: 91117994.3

Publication Number: 0482581

IPC: B21D 51/26

Language of the proceedings: EN

Title of invention:

Apparatus and method for strengthening bottom of container

Patentee:

BALL CORPORATION

Opponent:

Rexam Beverage Can Company

Headword:

-

Relevant legal provisions:

EPC Article 54, 56, 123(2)(3)

Keyword:

"Admissibility of the amendments (yes)"
"Reformatio in pejus"
"Novelty (yes)"
"Inventive step (yes)"

Decisions cited:

G 0001/99

Catchword:

-



Case Number: T 1042/02 - 3.2.1

D E C I S I O N
of the Technical Board of Appeal 3.2.1
of 1 April 2004

Appellant: Rexam Beverage Can Company
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Decision under appeal: Interlocutory decision of the Opposition
Division of the European Patent Office posted
9 August 2002 concerning maintenance of
European patent No. 0482581 in amended form.

Composition of the Board:

Chairman: S. Crane
Members: Y. A. F. Lemblé
G. E. Weiss

Summary of Facts and Submissions

- I. This appeal is directed against the decision of the Opposition Division to maintain in amended form the European patent No. 0 482 581.
- II. The Opposition Division decided that the subject-matter of claims 1 to 16 of the main request did not extend beyond the content of the application as filed (Article 100(c) EPC), that the patent disclosed the invention in a manner sufficiently clear and complete for it to be carried out by a skilled person (Article 100(b) EPC) and that the subject-matter of claims 1 to 16 of the main request met the requirements of novelty and of inventive step (Article 100(a) EPC) having regard to the following prior art documents:
- Ex. B: WO-A-93/01903
- Ex. D: WO-A-91/11275
- Ex. E: WO-A-83/02577
- III. During the oral proceedings held on 1 April 2004 the appellant (opponent) requested that the decision to maintain the patent in amended form be set aside and that the patent be revoked in its entirety. The respondent (patentee) requested that the patent be maintained on the basis of the claims 1 to 16 filed during the oral proceedings.
- IV. Claims 1 and 15 read as follows:

"1. A method for reforming a thin-walled, drawn and ironed container body (11) having a sidewall (12) that is disposed around a container axis (14), a bottom that is attached to said sidewall and that comprises an exteriorly convexly-shaped annular support (16) comprising an annular supporting surface (18), said bottom further comprising an outer connecting portion (28) that integrally interconnects said sidewall (12) and said annular support (16), a bottom recess portion comprising a center panel (38) substantially defined by at least one panel radius, and an inner wall (42) that disposes said center panel (38) above said annular support (16), said inner wall being substantially linear and disposed above said annular support, said container body further comprising an open end distal from said bottom, which said method comprises: a) positioning a tooling element (172) within an exterior space defined by said center panel (38) and said inner wall (42) of said bottom recess of said container body; b) providing relative transverse movement between said tooling element (172) and said container body (11) to engage at least part of said inner wall (42) with said tooling element (172); said method being further characterized by the step of: c) moving said tooling element relative to said container body about said inner wall; and d) reforming by moving said tooling element to displace a part of said inner wall radially outwardly in order to form said inner wall (42) into first, second, and third segments and a hooked portion having a second radius of curvature (R_H) interconnecting said second segment to said third segment using at least said providing relative transverse movement to engage and said moving steps, said first, second and third

segments and said hooked portion being part of a panel positioning portion (82), said first segment being positioned above said annular support surface (18) and extending upwardly relative to said annular support surface (18), said second segment being positioned above said first segment and extending outwardly relative to said container axis (14) from a lower end of said second segment to an upper end of said second segment, said hooked portion extending from said upper end of said second segment to a lower end of said third segment, said third segment being positioned above said second segment and extending inwardly relative to said container axis(14) from a lower end of said third segment to an upper end of said third segment in an orientation which is different from an orientation of said center panel (38) provided by said at least one panel radius, wherein a concave portion of said panel positioning portion (82) interconnecting to said center panel has a first radius (R_{5R}) and said second radius (R_H) being less than said first radius (R_{5R}).

"15. Apparatus (110) for reforming a thin-walled, drawn and ironed container body (11) having a sidewall (12) that is disposed around a container axis (14), a bottom that is attached to said sidewall and that comprises an exteriorly convexly-shaped annular support (16) comprising an annular supporting surface (18), said bottom further comprising an outer connecting portion (28) that integrally interconnects said sidewall (12) and said annular support (16), a bottom recess portion including a center panel (38) and an inner wall (42) that disposes said center panel (38) above said annular support (16), said container body further comprising an open end that is disposed distal from said bottom

recess portion, said apparatus (110) comprising a tooling device (178) having a body and having a tooling element (172) that is operatively attached to said body, which apparatus (110) is characterized by:

said tooling element (172) comprising one reforming roller (172) and another reforming roller (172) positioned 180° apart from said reforming roller, each said reforming roller (172) comprising a cylindrical barrel with a radially extending circumferential disk-shaped lip extending continuously around the top thereof which is engagable with said inner wall (42) and having a vertical extend which is substantially less than the distance in the direction of the container axis between an upper and a lower end of said inner wall (42) whereby at any one time said lip only engages a portion of said inner wall between its upper and lower ends; means for positioning (162, 164, 166, 170) said tooling element (172) within an exterior space defined by said inner wall (42) and said center panel (38) of said bottom recess of said container body;

first means (162, 164, 166, 170) for providing relative transverse movement between said tooling element (172), and all of said container body (11); and means, comprising said tooling element (172), and comprising said first means (162, 164, 166, 170), for reworking at least part (86) of said inner wall (42) into a predetermined position of having an upwardly and outwardly orientation relative to said supporting surface and said container axis, respectively, said means for reworking comprising second means (158) for providing relative movement between said tooling element (172) and said container body (11) to

relatively advance said tooling element (172) about said inner wall (42)."

- V. The appellant's submissions made in writing and at the oral proceedings, insofar as they are relevant to the present decision, can be summarised as follows:

Claim 1 contained subject-matter which extended beyond the content of the application as originally filed and therefore violated Article 100(c) EPC.

More particularly, there was no basis in the originally filed documents for the feature relative to the orientation of the third segment being different from an orientation given by the dome center panel.

Further, the application as filed did not disclose the claimed relationship that the radius R_H was smaller than R_{5R} . This relationship was arbitrarily set up and it was not apparent from the original disclosure that this feature contributed in any way to the solution of the technical problem mentioned in the application as filed.

The subject-matter of claim 1 lacked novelty over Ex. B. The wording of the characterising part of the claim did no more than to define in words a contour which was already disclosed in Ex. B. The teaching of reshaping the inner wall by engagement with a reforming roller such that this wall extended outwardly at a negative angle from the longitudinal axis of the container was known from Figure 12 of Ex. B. Finite Element Analysis simulations made on the basis of a reforming roller having the dimensions derived by scaling from Figure 12 of Ex. B, the roller being used to reform a wall to a negative inclination up to 8° - 10° as mentioned in page 14, lines 1 to 3 of Ex. B, had shown that the so

obtained contour had inevitably all the arbitrarily distinguished segments and portions of the contour claimed in claim 1 and especially a contour having a radius of curvature which passed through a minimum similar to the claimed radius R_H .

The subject-matter of claims 1 and 15 lacked inventive step. Starting from the teaching of Ex. D, which was to reform the inner wall to a "more vertical profile" (page 32, lines 4 to 11) in order to improve buckle resistance and reduce can growth, the skilled person, in an attempt to achieve further improvements, would realise, by making further tests and adjustments, that the mechanical strength of the container could be further improved by going beyond the vertical in a direction which was already shown to be beneficial, up to the formation of a negatively inclined segment and of an indent which is necessarily bound with a certain level of inclination.

As concerned claim 15, it would be obvious to rework the inner wall with two rollers positioned apart by 180° for the formation of the negatively inclined segment mentioned in the paragraph above. The high extent of the deformation linked to this reworking would also necessitate the attacking edge of the reworking roller to be smaller in order to avoid crushing the annular support wall. This would lead in an obvious way to the design of a reforming roller comprising a radially extending circumferential disk-shaped lip extending continuously from the roller barrel and having a small extent in the direction of the container axis.

VI. The respondent countered essentially as follows:

Claim 1 did not contain subject-matter which extended beyond the content of the application as originally filed. The skilled person would immediately realise from the drawings of the application as originally filed that the extent and the nature of the indentation made in the inner wall necessarily led to the feature that the radius R_H of the hooked portion was smaller than the radius R_{5R} of the concave portion.

This feature was of importance in order to achieve the technical effects afforded by the invention and led to an increase in the mechanical strength of the container. Cumulative drop high tests and/or static dome reversal pressure tests on containers having the claimed contour had shown that, under the pressure forces, the wall of the container buckled out at the level of the hooked portion which moved radially outwards. As the hooked portion of the claimed contour moved further, it worked like a buggy spring which locked in and eventually stayed in position under increasing forces. This mode of deformation permitted the adjustment and control of down-growth. The claimed contour also increased buckle resistance and drop resistance, while down-growth was reduced.

Such an effect was not achievable by the prior art containers which had a longer inner wall for supporting the dome panel. Under the pressure forces the inner wall having the known contour would yield over and would collapse under lower solicitations.

Reasons for the Decision

1. *Admissibility of the amendments (Article 123(2) EPC)*

1.1 Claim 15 results from a combination of all of the features of granted claim 19 with further limitations defining the specific form of the reforming roller which engages with the inner wall for reworking its contour.

These limitations do not extend beyond the content of the application as originally filed and were not objected to by the appellant.

1.2 Claim 1 results from a combination of all of the features of granted claim 1 with a further limitation defining the specific contour of the panel positioning portion 82 after reworking.

Accordingly the following portions of this contour are now claimed (see Figure 11):

- a first curved segment as defined in the claim and substantially corresponding to reduced inner convex annular portion 22 mentioned on page 10, line 8 of the originally filed application EP-A-0 482 581;
- a second segment as defined in the claim and substantially corresponding to the negatively sloping part 96 mentioned on page 20, last paragraph of EP-A-0 482 581;

- a third segment as defined in the claim and substantially corresponding to the annular portion 88 shown in Figure 11 and mentioned in page 11, line 10 of EP-A-0 482 581;
- an hooked portion 76 interconnecting the second to the third segments and having a radius of curvature R_H (page 10, lines 9 to 13 of EP-A-0 482 581);
- a concave portion of said panel positioning portion 82 interconnecting said third segment to said center panel 38 and having a radius R_{5R} .

The objections of the appellant that there is no basis in the originally filed documents for the feature that the radius R_H is smaller than R_{5R} and for the feature of the third segment "extending ... in an orientation which is different from an orientation of said center panel (38) provided by said at least one panel radius", are not justified.

Both features result from the way the reworking operation is carried out as described in the original disclosure when departing from the initial shape as also described in the original disclosure.

The initial shape of the bottom recess portion prior to reforming is shown in Figure 4 of EP-A-0 482 581. As depicted therein, the linear inner wall 42 interconnects to the center panel 38 through an inner concave annular portion 44 and extends in an orientation α_1 which is different from an orientation α_3

of the center panel 38 provided by the panel radius R_4 (page 8, lines 12 to 14 of EP-A-0 482 581).

In the reforming operation, the initially linear (page 8, line 2 to 4 of the A-publication) inner wall is indented or displaced radially outward to such an extent as to form the hooked portion 76 and an upper portion 88, i.e. the claimed third segment, having an orientation different from the initial orientation of the inner wall but also still different from the orientation of the terminal part of the center panel to which it is interconnected through the concave portion defined in the characterizing part of claim 1 (see reference numeral 88 in Figure 11 as filed). As can be seen in the originally filed Figures 20 to 26 the radially extending circumferential disk-shaped lip on the reforming roller is engageable with the inner wall 42 to form the hooked portion of radius R_H and has a vertical extent which is substantially less than the linear extent of the inner wall. Accordingly, the radius of curvature of this lip is smaller than the radius R_5 of the inner concave portion 44 which interconnects the inner wall to the center panel before the reforming operation (Figure 4 as filed).

The reworking of the dome positioning portion results in an increase of the radius R_5 of the initial inner concave portion 44 to obtain the claimed concave portion having the claimed radius R_{5R} (see page 11, lines 1 to 5 of the EP-A-0 482 581). This is confirmed by the passage of page 11, lines 10 to 11 of the application as published: "In the reworking process, an annular portion 88 of the dome positioning portion 82, as shown in FIGURE 11, is moved into, and effectively becomes a part of the center panel 38".

As concerns the profiling of the container wall in the reshaping process, the skilled person knows that the amount of curvature of the part to be reworked has to be optimised as to its smoothness and be chosen such as to avoid any incipient superficial fracture in the material to be reworked. Accordingly, as shown in the originally filed Figures 10 and 11, the radius R_H of curvature of the hooked portions 76 is significantly smaller than the radius R_{5R} of the claimed concave portion. This claimed relationship between R_H and R_{5R} is also confirmed by both examples of Table 1 (page 12 of the application as published) mentioning values for the radius R_H of the hooked portion which are smaller than the corresponding radii of the concave portions R_{5R} .

The skilled person would therefore realise from these examples and the global teaching of the application as originally filed that R_H is consistently smaller than R_{5R} .

1.3 Article 123(3) EPC and "Reformatio in pejus"

The Board notes that the amendments made in the independent claims 1 and 15 in replacement of inadmissible amendments held allowable by the Opposition Division introduce originally disclosed features which further limit the scope of the patent as maintained by the Opposition Division. It is to be noted that the feature referring to the third segment's orientation was already present in granted claim 1.

Hence, the amended claims do not put the appellant (opponent) in a worse situation than if it had not appealed and the principle of "Reformatio in pejus"

mentioned in the decision G 1/99 of the Enlarged Board of Appeal had been duly considered.

2. *Novelty*

2.1 The respondent did not challenge the decision of the opposition division that the method and apparatus claims do not benefit from the first priority US 600 943 dated 22 October 1990.

Ex. B is therefore a state of the art according to Article 54(3) EPC for all contracting states to the extent that its content is disclosed in the priority US 735 994 dated 25 July 1991 (Ex. C). Ex.D is a state of the art according to Article 54(2) EPC.

2.2 It is readily apparent to a skilled reader that the profile of the panel positioning portion as defined in claim 1 is that of a curve having different segments or portions, whereby the direction of variation of the radii of curvature of these segments changes from segment to segment. This is not only obvious from the way the claimed contour is obtained, i.e. by indenting an inner wall which was previously linear as mentioned in point 1.2 above, but also from the terminology employed in the claim. The terms "hooked portion" and "segment...extending in an orientation..." already hint at profiled parts which are discernable from each other and have different contributions to the overall effects achieved by the claimed profile (see point "Inventive step" below).

Even if it is assumed, as mentioned by the appellant in his contention, that the contour obtained by the simulations made on the basis of Ex. B belonged to the

state of the art disclosed by Ex. B, this contour only represents a smooth and continuous variation of the radius of curvature from a maximum starting at the dome panel end portion to a minimum just before it merges into a negatively inclined inner portion. It is improper to discern in such a contour the segments and portions claimed in claim 1.

- 2.3 The subject-matter of claim 15 is also novel over Ex. B and the available prior art. Since novelty has not been challenged by the appellant (opponent) in respect of that claim, it is not necessary to substantiate this in details.

3. *Inventive step*

- 3.1 The Board shares the view of the respondent as to the effects obtained by the claimed contour in respect of buckle resistance, down-growth and drop resistance.

The gist of the invention lies in the specific profile of the reworked inner wall which comprises the third segment 88 having the claimed orientation, the lower end of the third segment 88 connected to the negatively inclined second segment 86 by the hooked portion 76 having the radius of curvature R_H , and the second segment 96 connected to the inner convex annular portion 22, as claimed.

As mentioned in paragraphs [121] to [123] of the patent, the hooked portion 76 tends to buckle outwardly under a force caused by pressure. This buckling places a roll-in force on the inner convex annular portion 22 which compensates for the roll-out force caused by pressure

on that portion 22 ("locking-in" effect mentioned by patentee).

In the search for an optimal contour of the bottom of the container in order to fulfil the objectives of having a good combination of cumulative drop height resistance and dome reversal pressure, the contour of the concave inner bottom wall of the container of Ex. D and Ex. E does not depart from a continuous variation of the radius of curvature from a maximum starting at the dome panel end portion and ending with a minimal radius of curvature near the point it merges into a linear vertical inner wall of relatively large extension.

Since the contour of these prior art containers has a relatively long inner wall for supporting the dome panel, this inner wall would collapse earlier than a wall having the claimed contour with the hocked portion inducing the above-mentioned "locking-in" effect. These known contours have apparently been conceived with the aim of smoothening the degree of variation of the singly curved portion involved, on the underlying principle that the more evenly stresses are distributed in the material of the container, the higher the resistance to deformation and fracture. They do not suggest in any way the effect achieved by the invention and mentioned above.

- 3.2 Independent claim 15 refers to the specific apparatus used for reforming the inner wall in order to obtain the contour claimed in claim 1. To this aim, a pair of reforming rollers, positioned 180° apart, comprise each a cylindrical barrel with a narrow, radially extending,

circumferential disk-shaped lip. The purpose of the lip is to indent the inner wall in order to form the hooked portion defined in claim 1.

There is nothing in Ex. D or Ex. E which could lead to that specific apparatus.

- 3.3 The Board concludes that the subject-matter of independent claims 1 and 15 involve an inventive step (Article 56 EPC).

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.
2. The case is remitted to the first instance with the order to maintain the patent on the basis of the following documents:
 - claims 1 to 16 presented at the oral proceedings;
 - description: pages 2, 3, 6 to 18 as granted; pages 4 and 5 presented at the oral proceedings;
 - drawings as granted.

The Registrar:

The Chairman:

D. Sauter

S. Crane

