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(11) **EP 1 332 971 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
06.08.2003 Bulletin 2003/32

(51) Int Cl.7: **B65D 1/16**

(21) Application number: **02075512.0**

(22) Date of filing: **05.02.2002**

(84) Designated Contracting States:
**AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU
MC NL PT SE TR**
Designated Extension States:
AL LT LV MK RO SI

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(54) **Pressurised container dome bottom profile**

(57) Pressurised container including a generally cylindrical body having a side wall and a bottom wall, said bottom wall comprising a central inwardly extending out-

wardly concave dome shaped portion bottom profile characterised in that the dome shaped portion has a equilateral polygonal shape with five comers or more.

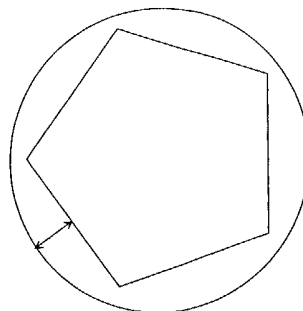


FIG. 2

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Description

[0001] The invention concerns a pressurisable container including a generally cylindrical body having a side wall and a bottom wall, said bottom wall comprising a central inwardly extending outwardly concave dome shaped portion.

[0002] It is known that there is a constant strive to reduce the amount and weight of materials used for packaging products and the consequent desire for down gauging such materials. For example in DWI can making, research and development have led to down gauging packaging steel for packaging purposes from a blank thickness of in the order of e.g. 0.28 mm in the late eighties to in the order of e.g. 0.24 mm in the late nineties of the twentieth century.

[0003] In a pressurisable container having a bottom with a dome construction the decrease in material thickness can lead to difficulties due to low dome buckle strength.

[0004] An object of the invention is to find solutions to remove such bars on down gauging by raising the dome reversal pressure or buckle strength in order to further increase the competitiveness of steel DWI cans.

[0005] In accordance with the invention these objectives are achieved and advantages obtained if the dome shaped portion has a equilateral polygonal shape with five comers or more.

[0006] As the reversal of the dome is inhibited by the corners of the polygon shape, the buckle strength increases.

[0007] It turns out that the buckle strength has a relationship with the number of sides in the polygon shape. In a less than five-sided shape the corners of the polygon are rather sharp, which can give problems with material flow in the corners during dome forming. When a normal punch nose is used to shape the dome, the standing rim is rather wide in the middle of a side between two corners, see e.g. fig 1.

[0008] Therefore, according to the invention, it is preferred to use a polygon with five sides or more and ten sides or less.

[0009] In an aspect the invention provides introduction of a small rib for local strengthening hampering initiation of dome reversal, see e.g. Fig. 10.

[0010] In another aspect the standing rim also on its outside has the shape of a polygon congruent with the polygon shape of the sides of the dome.

EXAMPLE

[0011] For experiments cans provided with a ten side polygon shape according to the invention were compared to conventional cans. Some cans were made using a conventional round punchnose. As it turns out, using a round punch-nose evokes intitiation points for dome reversal in the middle of the sides. When dome reversal starts from such an initiation point, even the stiff corners of the dome according to the invention cannot prevent complete dome reversal.

[0012] To avoid this, further cans were made using a punch with a punchnose of polygon shape and corresponding dome tooling. The dome tooling was adapted by adding a connection piece that fits exactly between punch nose and dome tooling. The use of a polygon dome tooling ensures that the inside nose angle is the same on every position around the circumference, so there is no initiation point for dome reversal.

[0013] The material used to manufacture the cans was 0.20 mm T57 CA (TP 709) skin pass reduction = 6%. Cut edge for the cups was 136 mm. Cans were made with a 2 ring set-up. As a reference two types of "conventional" cans with "normal" domes were made respectively with a bottom profile depicted in Fig. 6 and in Fig. 7 to compare them with cans according to the invention. The ageing cycle used for the material was a 20 min, 200 °C heat treatment. The results of the dome reversal tests are as listed in Tables 1 and 2.

[0014] Averages were determined by testing 10 cans, see Table 1 for the properties in non-aged condition and Table 2 for the same in aged condition.

[0015] Legenda of tables 1 and 2:

depth	depth of dome in mm
dome reversal	pressure in the can in bar at which dome reverses
avg	average
min	minimum value of the measured parameter in that column
max	maximum value of the measured parameter in that column
stdev	standard deviation of the values in that column
avg-3xstdev	average less three times standard deviation

[0016] The several dimenions of the cans are shown in Figures 6, 7, 8, 9 giving the measured contour of the dome.

[0017] As can be seen in the Tables 1 and 2 giving the results of measurements of dome depth and dome reversal,

the use of a polygon punchnose significantly increased buckle strength compared to the former tool set-up. The buckle strength is higher with a polygon shape, the ageing process even having a catalyzing effect on the buckle strength of the can according to the invention.

[0018] The invention is also elucidated by drawings wherein:

Fig. 1 shows photographic representations of a can bottom according to the invention with a dome made using both a polygon shaped punch nose and dome tooling (right) and with a dome made using a polygon punch nose and conventional dome tooling (left).

Fig. 2 shows in a schematical way a bottom view of a pentagonal bottom profile according to the invention.

Fig. 3 shows in a schematical way a bottom view of a decagonal bottom profile with an indication of section lines A-A and B-B.

Fig. 4 shows in a schematical way part of a longitudinal section through the bottom part of the can according to the invention according to section line B-B.

Fig. 5 shows in a schematical way part of a longitudinal section through the bottom part of the can according to the invention according to line A-A.

Fig. 6 shows the dimensions of a can bottom profile according to the invention in which the rim diameter is 48.23 mm and the depth of the dome is 8.58 mm.

Fig. 7 shows the dimensions of a can bottom profile according to the invention in which the rim diameter is 47.28 mm and the depth of the dome is 8.05 mm.

Fig. 8 shows the dimensions of a can bottom profile in cross section across the corners of the decagon according to the invention in which the rim diameter is 48.37 mm and the depth of the dome is 9.00 mm.

Fig. 9 shows the dimensions of the can bottom profile of Fig. 8 across the middle of the sides of the decagon.

Fig. 10 schematically shows the introduction of small ribs for local strengthening by hampering initiation of dome reversal.

[0019] It is clear that both the conventional cans are inferior to the polygon cans according to the invention. The buckle strength (in aged condition) of the can according to the invention is in the order of 1 bar above that of the polygon can.

[0020] Reducing the number of sides will even more increase the buckle strength, as compared to the 10 sided polygon as used.

[0021] The experiments show that the polygon dome performs well and that further improvements are achieved by:

- decreasing the gap between punchnose and domer in order to obtain an inside nose angle referred to as α_2 and α_1 in Figures 4 and 5 respectively, of e.g. 80.22° and 86.52° respectively, in order to further raise the buckle strength.
- The use of polygon shapes with less than ten sides which consequently leads to sharper angles of the corners, although there is a minimum of five sides in view of deformation problems.

property sample	conventional can 1		conventional can 2		invention can	
	depth	dome reversal	depth	dome reversal	depth	dome reversal
1	8.58	6.13	8.14	6.34	8.93	6.94
2	8.56	6.42	8.06	6.40	8.95	6.80
3	8.55	6.44	8.12	6.52	8.98	7.02
4	8.57	6.34	8.08	6.46	8.98	6.92
5	8.58	6.34	8.11	6.48	8.98	6.94
6	8.57	6.32	8.11	6.44	8.96	6.90
7	8.56	6.34	8.13	6.42	8.94	6.98
8	8.48	6.36	8.09	6.38	8.95	6.92
9	8.58	6.36	8.09	6.42	8.95	6.96
10	8.58	6.4	8.12	6.40	8.95	6.96
avg	8.56	6.35	8.11	6.43	8.96	6.93
min	8.48	6.13	8.06	6.34	8.93	6.80
max	8.58	6.44	8.14	6.52	8.98	7.02
stdev	0.03	0.09	0.02	0.05	0.02	0.06
avg-3xstdev	8.47	6.09	8.03	6.27	8.90	6.76

TABLE 1

property sample	conventional can 1		conventional can 2		invention can	
	depth	dome reversal	depth	dome reversal	depth	dome reversal
1	8.57	6.80	8.14	6.80	8.99	7.50
2	8.57	6.82	8.12	7.02	9.00	7.54
3	8.57	6.80	8.12	6.98	8.97	7.48
4	8.56	6.72	8.14	6.96	9.00	7.52
5	8.56	6.70	8.13	7.06	8.97	7.52
6	8.57	6.80	8.13	7.04	8.80	7.54
7	8.58	6.78	8.13	6.92	8.97	7.46
8	8.55	6.76	8.12	6.94	8.96	7.56
9	8.57	6.78	8.13	6.84	8.98	7.46
10	8.58	6.78	8.12	6.96	8.91	7.5
avg	8.57	6.77	8.13	6.95	8.96	7.51
min	8.55	6.70	8.12	6.80	8.80	7.46
max	8.58	6.82	8.14	7.06	9.00	7.56
stdev	0.01	0.04	0.01	0.08	0.06	0.03
avg-3xstdev	8.54	6.66	8.10	6.70	8.77	7.41

TABLE 2

Claims

1. Pressurised container including a generally cylindrical body having a side wall and a bottom wall, said bottom wall comprising a central inwardly extending outwardly concave dome shaped portion bottom profile **characterised in that** the dome shaped portion has a equilateral polygonal shape with five corners or more.
2. Pressurised container according to claim 1, **characterised in that** the dome shaped portion has a equilateral polygonal shape with ten corners or less.

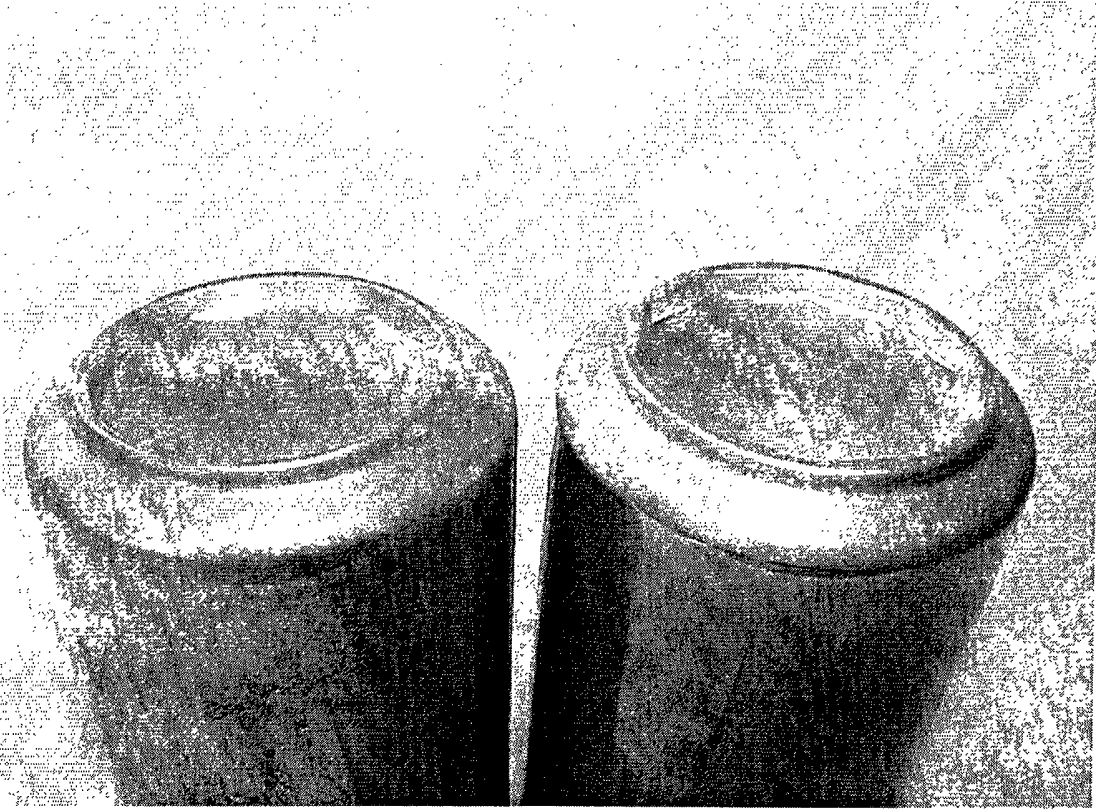


FIG. 1

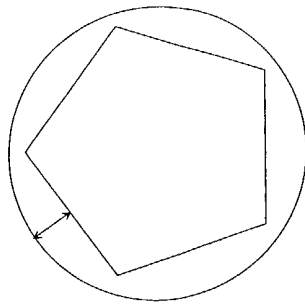


FIG. 2

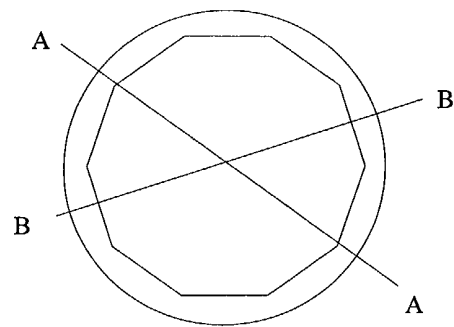


FIG. 3

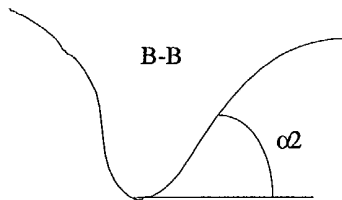


FIG. 4

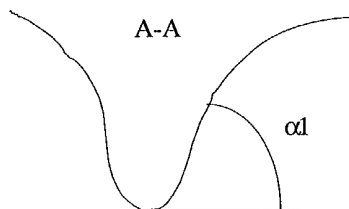


FIG. 5

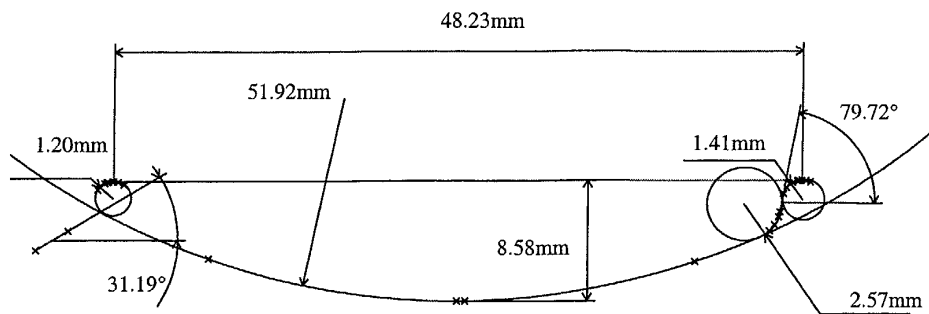


FIG. 6

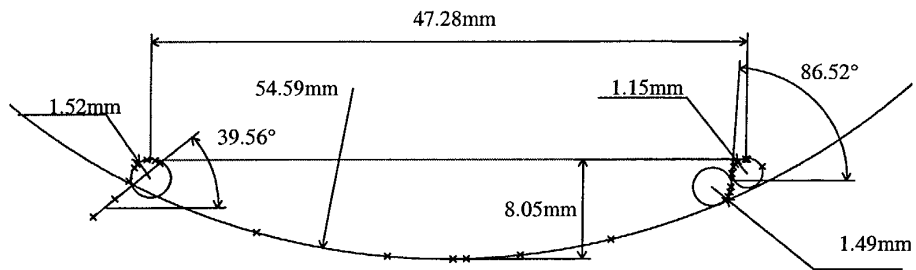


FIG. 7

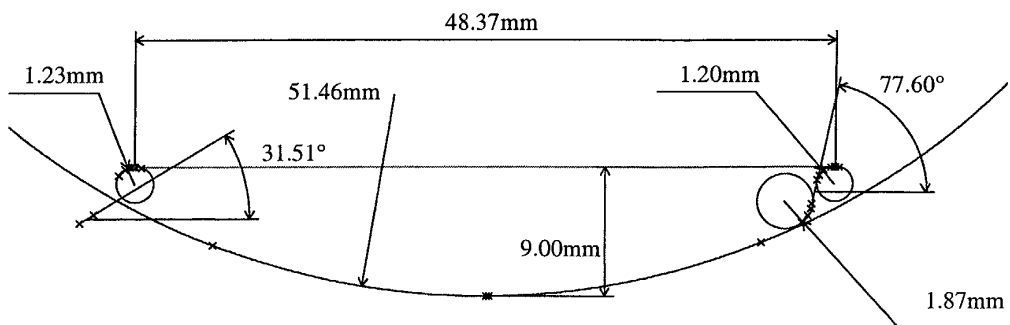


FIG. 8

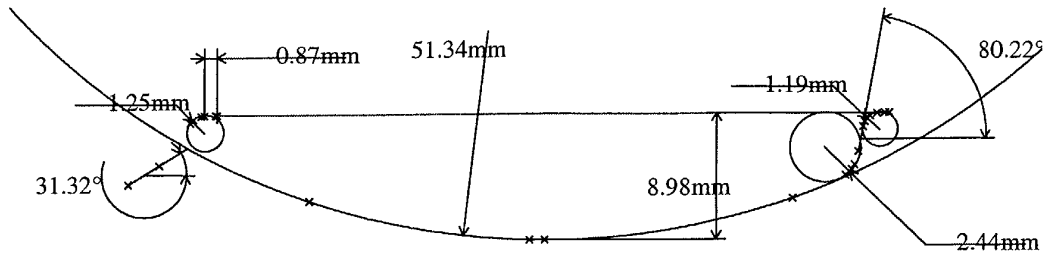


Fig.9

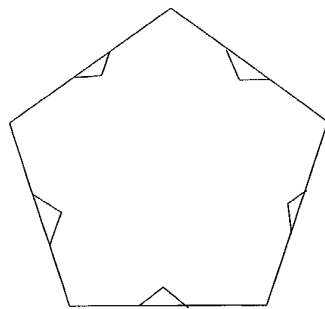


Fig. 10



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EUROPEAN SEARCH REPORT

Application Number
EP 02 07 5512

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
X	US 5 645 190 A (GOLDBERG) 8 July 1997 (1997-07-08) * column 8, line 18 - line 41; figures 8,9 *	1,2	B65D1/16
A	US 5 355 709 A (BAUDER) 18 October 1994 (1994-10-18) * the whole document *	1	
A	US 6 132 155 A (GOULIARD) 17 October 2000 (2000-10-17) * the whole document *	1	
The present search report has been drawn up for all claims			TECHNICAL FIELDS SEARCHED (Int.Cl.7)
			B65D
Place of search		Date of completion of the search	Examiner
THE HAGUE		23 July 2002	Newell, P
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 02 07 5512

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23-07-2002

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
US 5645190	A	08-07-1997	NONE	
US 5355709	A	18-10-1994	NONE	
US 6132155	A	17-10-2000	NONE	

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82