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(54) METAL CAN BEING A PRESSURE TIGHT METAL PACKAGING AND METHOD FOR PRODUCING THEREOF

DRUCKFESTE METALLVERPACKUNG BESTEHEND AUS EINER METALLDOSE UND VERFAHREN ZU IHRER HERSTELLUNG

BOITE METALLIQUE CONSTITUANT UN EMBALLAGE METALLIQUE ETANCHE A LA PRESSION ET PROCEDE DE REALISATION D' UNE TELLE BOITE

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Description

[0001] The invention relates to a metal can, being a pressure tight metal packaging and to a method for producing such a metal can according to the preambles of claims 1 and 11 respectively (see for example EP-A-0 667 193).

[0002] It is common practice in a metal can that the thickness of the side wall in its wall-to-closure transition portions is greater than the thickness in the main side wall portion.

[0003] There is a constant strive to down gauge the metal sheet from which metal cans are manufactured in general and the steel sheet use therefor in particular, in order to save material and to reduce "dead" weight in the distribution chain. However, customers of can makers, such as the fillers of the cans, are reluctant to reduce the wall thickness of aerosol cans because of the suspected lower vacuum performance of such a down gauged can. A lower vacuum performance increases the risk of collapsed cans during filling in case of dented cans.

[0004] A metal can with improved vacuum performance is known. American patent US 3,951,296 discloses a wall-ironed container having a plurality of reinforcing ribs being spaced from the ends of the side walls and from each other, in order to achieve increased resistance against buckling of the side wall and having improved resistance against vacuum. In axial cross section, the ribs are trapezium shaped, with a central surface parallel to the inside surface of the side walls having an axial length of 2,36 mm, and both wedging surfaces inclined at an angle of 24° from the inside surface of the side walls to the central surface of the reinforcing ribs. The ribs protrude inwards over a distance of 167 µm. The known ribs are formed in the side wall by means of ironing the side wall in an ironing ring against a punch in which grooves have been formed spaced from one another along the longitudinal axis of the punch. In an ironing operation, the side wall is passed through the ironing ring by which the side wall is reduced in thickness and elongated.

[0005] The known can has satisfactory vacuum performance, but it is difficult to fabricate in a plural-ring ironing process. As the side wall elongates under the action of a second ironing ring, the reinforcing ribs move out of the respective grooves in which they were formed. Their destruction has to be prevented.

[0006] According to the present invention, it is an objective to provide a novel can concept wherein considerable material and weight savings, in the order of 5 % and even more, can be achieved without unacceptably affecting the performance, notably the vacuum performance.

[0007] According to the invention a metal can with the features of claim 1 is provided.

[0008] For the purpose of the application, the annular portion is considered to comprise also an annular portion in which substantial regions along the circumference have a side wall thickness that is greater than the side wall thickness in the main side wall portion outside the annular portion.

[0009] Surprisingly the vacuum performance can be greatly enhanced by supporting the can wall only locally along its circumference by providing only one supporting annular portion, for instance a reinforcement rib, which forms part of the wall and is thus integrated therein. A side wall with only one reinforcement rib can be advantageously fabricated using multiple ironing steps in a plural-ring ironing process, since a formed rib will not be destructed by following ironing steps.

[0010] It is remarked that a semi-product is known from European patent EP B 0 122 651, which semi-product comprises a can side wall which has a greater wall thickness in one annular centre portion than in the other portions of the side wall. To obtain two end products, this semi-product is first cut transversely across the annular centre region, before it is provided with a closure to form a metal can having a side wall with a greater wall thickness adjacent the closures than at other regions. In the end-products, the greater wall thickness is localised in the wall-to-closure transition portions of the can walls, for the formation of a flanged connection with the closure. The thus obtained cans do not have a circumferential rib in the main side wall portion of their walls.

[0011] In an embodiment of the invention, the annular portion is intersected along essentially the entire circumference by a cross sectional plane through the metal can, located halfway between the first wall-to-closure transition portion and the second wall-to-closure transition portion. Such a located rib provides the best vacuum performance of the metal can.

[0012] In a suitable embodiment, the annular portion is a circumferential rib protruding inwardly from the inside surface of the side wall into the packaging. This has the advantage that the outside surface of the packaging is undisturbed.

[0013] According to the invention, the side wall thickness in the annular portion is not more than 40 µm thicker than the side wall thickness in the remainder of the main side wall portion. When the annular portion extends more than 40 µm from the main side wall of the packaging, it becomes problematic to strip the side wall from a wall ironing tool. For instance, stripping from a wall ironing punch becomes problematic in the case the annular portion protrudes into the packaging by more than 40 µm.

[0014] By preference, the side wall thickness is not more than 30 µm thicker than the side wall thickness in the remainder of the main side wall portion. Herewith the stripping problems are limited to a more acceptable level.

[0015] More by preference, the side wall thickness is not more than 20 µm thicker than the side wall thickness in the remainder of the main side wall portion. The stripping behaviour of a side wall with an inward protrusion of 20 µm has been found to be approximately equal to that of a straight wall can.

[0016] In an embodiment of the invention, the annular portion comprises, when seen in a longitudinal section of the metal can, a portion wherein the side wall thickness is constant over an axial distance. This provides a further advantage in fabrication, in that such a metal can side wall is better stripped from a wall ironing tool, for instance a wall ironing punch.

[0017] Additionally, in the case that the first end closure is integral to the side wall, the thickness of the side wall in the annular portion of the main side wall portion, when seen in a longitudinal section of the metal can and measured at increasing distances from the first end closure, first gradually increases from the thickness of the side wall outside the annular portion to a maximum thickness of the side wall inside the annular portion over a section with an axial length D_1, and then decreases from the maximum thickness to the thickness in the remainder of the main side wall portion outside the annular portion over a section with an axial length D_2, which length is shorter than D_1. This is done with regard to the stripping direction of the metal can side wall, and further improves the stripping behaviour from the wall ironing punch.

[0018] In an embodiment wherein the first end closure is integral to the side wall, it is advantageous that, when seen in a longitudinal section of the metal can, the thickness of the side wall in a section of the annular portion of the main side wall portion, measured at increasing distances from the first end closure, gradually increases from the thickness of the side wall outside the annular portion to a maximum thickness of the side wall inside the annular portion, in which section the surface of the side wall inside the packaging is wedged with respect to the corresponding surface of the side wall on the outside of the packaging at an angle between 0.01 and 5°. The lower limit of the range of angles is related to the available space between the annular portion and a wall-to-closure transition portion. The upper limit marks an angle above which it becomes increasingly problematic to strip the side wall from a wall ironing tool.

[0019] By preference, this surface is wedged at an angle between 0.01 and 1°. Herewith, stripping problems are even better avoided.

[0020] More by preference, this surface is wedged at an angle between 0.01 and 0.25°. Herewith stripping behaviour can be approximately equal to that of a straight wall can.

[0021] Further, a can wall according to the invention may be manufactured by conventional drawing and wall ironing processes.

[0022] The invention is also embodied in a method of forming a metal can wall according to the invention, as defined in claim 11.

[0023] The invention will be illustrated in the following in more detail, also using the drawings wherein:

Fig. 1 shows a longitudinal section partly in perspective of a can body showing an inwardly protruding thicker wall portion;
Fig. 2 shows a longitudinal section through the centre line of a can body showing an inwardly protruding thicker wall portion indicating dimension symbols;
Fig. 3 shows the actual dimensions of several cans tested;
Fig. 4 shows the relation between applied vacuum and collapsing force for different can types;
Fig. 5 shows the dimensions of a carbide punch used in the method according to the invention;
Fig. 6 shows the dimensions of a steel punch used in the method according to the invention.

[0024] For investigations three types of cans were produced on a commercially available bodymaker:

- A first type of a known can concept with a straight wall with a wall thickness of 0.15 mm.
- A second type of a can according to the invention with a wall thickness of 0.15 mm and a mid wall step of 0.02mm x 40mm, i.e. with H1 = 44 mm, H2 = 52 mm, H3 = 92 mm, H4 = 96 mm and X1 = 0.170 mm, see Fig. 2;
- A third type of a can according to the invention with a wall thickness of 0.15 mm and a mid wall step of 0.03mm x 20mm, i.e. with H1 = 50 mm, H2 = 62 mm, H3 = 82 mm, H4 = 88 mm and X1 = 0.180 mm, see Fig. 2.
- A fourth type of can commercially available in the market having a straight wall with a wall thickness of 0.167 mm was used as a reference.

[0025] For the test cans and the reference cans T57 packaging steel grade was used. This is a regular material commercially supplied to the market to manufacture such cans.

[0026] Five hundred trial cups were made in two stages: The first draw was done on a separate cupping press.

[0027] The second draw was carried out on a separate cupping press to the final diameter of 45 mm.

[0028] For a can of the first type a punch was used with diameter 44.917 mm. This punch was reground afterwards for a can of the second type with a step of 0.02 mm x 40 mm while changing the nominal diameter to 44.913 mm.

[0029] A new tool steel punch was manufactured for a can of the third type with a step of 0.03 mm x 20 mm.

[0030] The cans of the second type and the third type were provided with an inwardly protruding thicker wall portion. This has the advantage that the outside surface of the packaging is undisturbed.

[0031] The transition zone length in front and at the end of the punch step was chosen to be different. This is done with regard to the stripping direction of the cans.

Table 1 shows the used ironing dies:

	➢ 1st die [mm]	➢ 2nd die [mm]	➢ 3rd die [mm]	➢ 4th die [mm]
0.15 cans	45.56	45.33	45.20	45.21
0.15 "step" cans	45.54	45.32	45.22	45.21

[0032] All cans were wall ironed on one and the same body maker.

[0033] The stripping behaviour of the test cans of the second type with X1 = 0.170 mm was approximately equal to that of the straight wall cans. Some stripping problems occurred with cans of the third type with a X1 = 0.180 mm. The reason for this is the difference in step size and the use of a tool steel punch, which gives a higher friction.

[0034] A profile of the wall thickness of the different can types was made with a thickness scanner. The wall thickness profile of the cans with a step was also measured after the third die in order to check the effect of moving the thick wall by reducing the can in the fourth die, see Fig. 3 and table 2.

Table 2 Measured thickness

	Thickness thick wall [μm]	Thickness thin wall [μm]
0.17 reference cans	167	167
0.15 reference cans	152	152
0.15, step 0.02 cans 3rd die	188	167
0.15, step 0.03 cans 3rd die	205	175
0.15, step 0.02 cans	172	150
0.15, step 0.03 cans	183	155

[0035] From figure 3 and table 2 it can be concluded that the wall thickness between the different can types is approximately equal. The thickness of the step is 22 and 28 microns respectively. There is no measurable material displacement in the step, caused by the fourth die operation.

[0036] Each type of can was tested on vacuum performance using a force-gauge. A force perpendicular to the centre line of the can, hereafter called the T-bar force, was applied on the wall of the can in the middle of the can height, i.e. where the test can according to the invention had a local annular wall portion with a greater thickness . The can was depressurised to different vacuum levels. For each vacuum level, ten cans were tested by increasing the T-bar force. In Fig. 5 the results are summarised.

[0037] Each point in Fig. 5 represents an average of 10 measurements. Some cans from a can of the second and third type were tested by applying the force at a quarter of the can height, where the wall was thin.

[0038] From the results it is concluded that the vacuum performance of the second can type according to the invention is approximately equal to the performance of the reference can. That means that a local wall thickness increase according to the invention does increase the vacuum performance. Further, it is clear that the length of the thick wall also plays a role in increasing the vacuum performance.

[0039] According to the invention it is now feasible to down gauge packaging steel for aerosol type cans without losing vacuum performance by providing the can wall with supporting means such as a supporting thicker portion along its circumference as dislosed herein.

Claims

1. Metal can, being a pressure tight metal packaging, comprising an ironed side wall stretching essentially along an axial direction and a circumferential direction, and a first end closure adjoining the side wall in a first wall-to-closure transition portion, and a second end closure adjoining the side wall in a second wall-to-closure transition portion, which side wall comprises a main side wall portion stretching from the first wall-to-closure transition portion to the second wall-to-closure transition portion, wherein the main side wall portion is provided with means of increased side wall thickness supporting the side wall essentially along the circumference of the can, consisting of one annular portion of wall ironed metal in which the thickness of the side wall is greater than the side wall thickness in the main side wall portion outside the annular portion, **characterised in that** the one annular portion comprises wall ironed metal that has been reduced in thickness by more than 39.4 %, and the side waD thickness in the annular portion is less than 40 µm thicker than the side wall thickness in the remainder of the main side wall portion.

2. Metal can according to claim 1, **characterised in that** the one annular portion comprises wall ironed metal that has been reduced in thickness by more than 41.6 %, preferably by more than 45.1 %.

3. Metal can according to claim 1 or 2, **characterised in that** the main side wall portion outside the annular portion comprises wall ironed metal that has been reduced in thickness by more than 50.6 %.

4. Metal can according to claim 1, 2, or 3, **characterised in that** the main side wall portion comprises steel, preferably packaging steel.

5. Metal can according to Claim 1, **characterised in that** the annular portion is intersected along essentially the entire circumference by a cross sectional plane through the metal can, located halfway between the first wall-to-closure transition portion and the second wall-to-closure transition portion.

6. Metal can according to Claim 1 or 5, **characterized in that** the annular portion is a circumferential rib protruding inwardly from the inside surface of the side wall into the packaging.

7. Metal can according to any one of the preceding claims, **characterised in that** the side wall thickness in the annular portion is not more than 28 µm thicker than, by preference not more than 22 µm thicker, than the side wall thickness in the remainder of the main side wall portion.

8. Metal can according to any one of the preceding claims, **characterised in that**, when seen in a longitudinal section of the metal can, the annular portion comprises a portion wherein the side wall thickness is constant over an axial distance.

9. Metal can according to any one of the preceding claims, **characterised in that**, when seen in a longitudinal section of the metal can, the thickness of the side wall in the annular portion of the main side wall portion, measured at increasing distances from the first end closure, first gradually increases from the thickness of the side wall outside the annular portion to a maximum thickness of the side wall inside the annular portion over a section with an axial length D_1, and then decreases from the maximum thickness to the thickness in the remainder of the main side wall portion outside the annular portion over a section with an axial length D_2, which length is shorter than D_1, and wherein the first end closure is integral to the side wall.

10. Metal can according to any one of the preceding claims, **characterised in that**, the first end closure is integral to the side wall, and, when seen in a longitudinal section of the metal can, the thickness of the side wall in a section of the annular portion of the main side wall portion, measured at increasing distances from the first end closure, gradually increases from the thickness of the side wall outside the annular portion to a maximum thickness of the side wall inside the annular portion, in which section the surface of the side wall inside the packaging is wedged with respect to the corresponding surface of the side wall on the outside of the packaging at an angle between 0.01 and 5°, by preference at an angle between 0.01 and 1°, more by preference at an angle between 0.01 and

0.25°.

11. Method of producing a metal can, being a pressure tight metal packaging, comprising an ironed side wall stretching essentially along an axial direction and a circumferential direction, and a first end closure adjoining the side wall in a first wall-to-closure transition portion, and a second end closure adjoining the side wall in a second wall-to-closure transition portion, which side wall comprises a main side wall portion stretching from the first wall-to-closure transition portion to the second wall-to-closure transition portion, wherein the main side wall portion is provided with means of increased side wall thickness supporting the side wall essentially along the circumference of the can, consisting of one annular portion of wall ironed metal in which the thickness of the side wall is greater than the side wall thickness in the main side wall portion outside the annular portion, the method comprising the steps of (i) producing cups in at least one drawing operation, (ii) reducing the side wall thickness using at least one ironing die and a punch having a forming contour in longitudinal cross section comprising an essentially straight section provided with a recess, the recess being provided for forming the annular portion, **characterised in that** the recess has a depth of less than 40 μm and thickness of the main side wall portion where the recess is located is reduced from at least 313.5 μm to less than 190 μm.

Patentansprüche

1. Metalldose, die eine druckfeste Metallverpackung ist, mit einer abgestreckten Seitenwand, die sich im wesentlichen entlang einer axialen Richtung und einer Umfangsrichtung erstreckt, und einem ersten Endverschluß angrenzend an die Seitenwand in einem ersten Wand-zu-Verschluß-Übergangsabschnitt, und einem zweiten Endverschluß angrenzend an die Seitenwand in einem zweiten Wand-zu-Verschluß-Übergangsabschnitt, wobei die Seitenwand einen Hauptseitenwandabschnitt aufweist, der sich von dem ersten Wand-zu-Verschluß-Übergangsabschnitt zu dem zweiten Wand-zu-Verschluß-Übergangsabschnitt erstreckt, wobei der Hauptseitenwandabschnitt mit Mitteln erhöhter Seitenwanddicke versehen ist, die die Seitenwand im wesentlichen entlang des Umfangs der Dose stützen, bestehend aus einem ringförmigen Abschnitt aus wandabgestrecktem Metall, bei welchem die Dicke der Seitenwand größer als die Seitenwanddicke in dem Hauptseitenwandabschnitt außerhalb des ringförmigen Abschnitts ist, **dadurch gekennzeichnet, daß** der eine ringförmige Abschnitt wandabgestrecktes Metall aufweist, das um mehr als 39, 4 % in der Dicke reduziert wurde, und die Seitenwanddicke in dem ringförmigen Abschnitt weniger als 40 μm dicker als die Seitenwanddicke in dem restlichen Hauptseitenwandabschnitt ist.

2. Metalldose nach Anspruch 1, **dadurch gekennzeichnet, daß** der eine ringförmige Abschnitt wandabgestrecktes Metall aufweist, das in der Dicke um mehr als 41,6 %, bevorzugt um mehr als 45,1 % reduziert wurde.

3. Metalldose nach Anspruch 1 oder 2, **dadurch gekennzeichnet, daß** der Hauptseitenwandabschnitt außerhalb des ringförmigen Abschnitts wandabgestrecktes Metall aufweist, das in der Dicke um mehr als 50,6 % reduziert wurde.

4. Metalldose nach Anspruch 1 oder 2, **dadurch gekennzeichnet, daß** der Hauptseitenwandabschnitt Stahl, bevorzugt Verpackungsstahl aufweist.

5. Metalldose nach Anspruch 1, **dadurch gekennzeichnet, daß** der ringförmige Abschnitt im wesentlichen entlang des gesamten Umfangs von einer Querschnittsebene durch die Metalldose geschnitten wird, die in der Mitte zwischen dem ersten Wand-zu-Verschluß-Übergangsabschnitt und dem zweiten Wand-zu-Verschluß-Übergangsabschnitt liegt.

6. Metalldose nach Anspruch 1 oder 5, **dadurch gekennzeichnet, daß** der ringförmige Abschnitt eine Umfangsrippe ist, die von der Innenfläche der Seitenwand nach innen in die Verpackung ragt.

7. Metalldose nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, daß** die Seitenwanddicke in dem ringförmigen Abschnitt nicht mehr als 28 μm, bevorzugt nicht mehr als 22 μm dicker als die Seitenwanddicke in dem restlichen Hauptseitenwandabschnitt ist.

8. Metalldose nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, daß** der ringförmige Abschnitt aus der Sicht in einem Längsschnitt der Metalldose einen Abschnitt aufweist, bei welchem die Seitenwanddicke über eine axiale Strecke konstant ist.

9. Metalldose nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, daß** die Dicke der Seitenwand in dem ringförmigen Abschnitt des Hauptseitenwandabschnitts aus der Sicht in einem Längsschnitt der Metalldose und gemessen in zunehmenden Abständen von dem ersten Endverschluß zunächst allmählich von der Dicke der Seitenwand außerhalb des ringförmigen Abschnitts bis zu einer maximalen Dicke der Seitenwand innerhalb des ringförmigen Abschnitts über einen Schnitt mit einer axialen Länge D_1 zunimmt und dann von der maximalen Dicke zu der Dicke in dem restlichen Hauptseitenwandabschnitt außerhalb des ringförmigen Abschnitts über einen Schnitt mit einer axialen Länge D_2 abnimmt, die kürzer als D_1 ist, und wobei der erste Endverschluß mit der Seitenwand einstückig ist.

10. Metalldose nach einem der vorhergehenden Ansprüche; **dadurch gekennzeichnet, daß** der erste Endverschluß mit der Seitenwand einstückig ist und die Dicke der Seitenwand aus der Sicht in einem Längsschnitt der Metalldose in einem Schnitt des ringförmigen Abschnitts des Hauptseitenwandabschnitts, gemessen in zunehmenden Abständen von dem ersten Endverschluß, allmählich von der Dicke der Seitenwand außerhalb des ringförmigen Abschnitts bis zu einer maximalen Dicke der Seitenwand innerhalb des ringförmigen Abschnitts zunimmt, wobei in diesem Schnitt die Oberfläche der Seitenwand innerhalb der Verpackung bezüglich der entsprechenden Oberfläche der Seitenwand an der Außenseite der Verpackung in einem Winkel zwischen 0,01 und 5° verkeilt ist, bevorzugt in einem Winkel zwischen 0,01 und 1°, bevorzugter in einem Winkel zwischen 0,01 und 0,25°.

11. Verfahren zur Herstellung einer Metalldose, die eine druckfeste Metallverpackung ist, mit einer abgestreckten Seitenwand, die sich im wesentlichen entlang einer axialen Richtung und einer Umfangsrichtung erstreckt, und einem ersten Endverschluß angrenzend an die Seitenwand in einem ersten Wand-zu-Verschluß-Übergangsabschnitt, und einem zweiten Endverschluß angrenzend an die Seitenwand in einem zweiten Wand-zu-Verschluß-Übergangsabschnitt, wobei die Seitenwand einen Hauptseitenwandabschnitt aufweist, der sich von dem ersten Wand-zu-Verschluß-Übergangsabschnitt zu dem zweiten Wand-zu-Verschluß-Übergangsabschnitt erstreckt, wobei der Hauptseitenwandabschnitt mit Mitteln erhöhter Seitenwanddicke versehen ist, die die Seitenwand im wesentlichen entlang des Umfangs der Dose stützen, bestehend aus einem ringförmigen Abschnitt aus wandabgestrecktem Metall, bei welchem die Dicke der Seitenwand größer als die Seitenwanddicke in dem Hauptseitenwandabschnitt außerhalb des ringförmigen Abschnitts ist, wobei das Verfahren die Schritte aufweist, daß (i) Näpfe in wenigstens einer Zugoperation hergestellt werden, (ii) die Seitenwanddicke unter Verwendung wenigstens eines Abstreckstempels und eines Prägestempels reduziert wird, der einen Formumriß im Längsquerschnitt mit einem im wesentlichen geraden Schnitt hat, der mit einer Ausnehmung versehen ist, wobei die Ausnehmung zum Bilden des ringförmigen Abschnitts vorgesehen ist, **dadurch gekennzeichnet, daß** die Ausnehmung eine Tiefe von weniger als 40 µm hat und die Dicke des Hauptseitenwandabschnitts, wo die Ausnehmung angeordnet ist, von wenigstens 313,5 µm auf weniger als 190 µm reduziert ist.

Revendications

1. Une boîte métallique constituant un emballage métallique étanche à la pression, comprenant une paroi latérale matricée s'étendant essentiellement le long d'une direction axiale et d'une direction périphérique et une première fermeture d'extrémité adjacente à la paroi latérale dans une première partie de transition paroi-fermeture et une deuxième fermeture d'extrémité adjacente à la paroi latérale dans une deuxième partie de transition paroi-fermeture dont la paroi latérale comprend une partie principale de paroi latérale s'étendant de la première partie de transition paroi-fermeture à la deuxième partie de transition paroi-fermeture dont la partie principale de la paroi latérale est dotée d'un moyen augmentant l'épaisseur de la paroi latérale soutenant la paroi latérale essentiellement le long de la circonférence de la boîte, comprenant une partie annulaire d'une paroi métallique matricée dans laquelle l'épaisseur de la paroi latérale est supérieure à l'épaisseur de la paroi latérale dans la partie principale de la paroi latérale en dehors de la partie annulaire, **caractérisée en ce que** la partie annulaire comprend une paroi métallique matricée qui a été réduite en épaisseur de plus de 39,4 % et **en ce que** l'épaisseur de la paroi latérale dans la partie annulaire est moins de 40 µm plus épaisse que l'épaisseur de la paroi latérale dans le reste de la partie principale de la paroi latérale.

2. Une boîte métallique selon la revendication 1 **caractérisée en ce que** la partie annulaire comprend une paroi métallique matricée qui a été réduite en épaisseur de plus de 41,6 %, de préférence de plus de 45,1 %.

3. Une boîte métallique selon la revendication 1 ou 2 **caractérisée en ce que** la partie principale de la paroi latérale en dehors de la partie annulaire comprend une paroi métallique matricée qui a été réduite en épaisseur de plus de 50,6 %.

4. Une boîte métallique selon la revendication 1, 2 ou 3 **caractérisée en ce que** la partie principale de la paroi latérale est composée d'acier, de préférence un acier d'emballage.

5. Une boîte métallique selon la revendication 1 **caractérisée en ce que** la partie annulaire est coupée essentiellement le long de toute la circonférence par un plan de coupe transversale à travers la boîte métallique, situé à mi-chemin entre la première partie de transition paroi-fermeture et la deuxième partie de transition paroi-fermeture.

6. Une boîte métallique selon la revendication 1 ou 5 **caractérisée en ce que** la partie annulaire est une nervure périphérique s'étendant à l'intérieur depuis la surface intérieure de la paroi latérale dans l'emballage.

7. Une boîte métallique selon l'une des revendications précédentes **caractérisée en ce que** l'épaisseur de la paroi latérale de la partie annulaire n'est pas plus épaisse de 28 μm, de préférence pas plus épaisse de 22 μm, que l'épaisseur de la paroi latérale dans le reste de la partie principale de la paroi latérale.

8. Une boîte métallique selon l'une des revendications précédentes **caractérisée en ce que**, vue dans une coupe longitudinale de la boîte métallique, la partie annulaire comprend une partie dans laquelle l'épaisseur de la paroi latérale est constante sur une distance axiale.

9. Une boîte métallique selon l'une des revendications précédentes **caractérisée en ce que**, vue dans une coupe longitudinale de la boîte métallique, l'épaisseur de la paroi latérale dans la partie annulaire de la partie principale de la paroi latérale, mesurée à des distances croissantes à partir de la première fermeture d'extrémité, augmente d'abord progressivement depuis l'épaisseur de la paroi latérale en dehors de la partie annulaire vers une épaisseur maximum de la paroi latérale à l'intérieur de la partie annulaire sur une section avec une longueur D_1 et diminue ensuite depuis l'épaisseur maximum vers l'épaisseur dans le reste de la partie principale de la paroi latérale en dehors de la partie annulaire sur une section avec une longueur axiale D_2 dont la longueur est plus courte que D_1 et dans laquelle la première fermeture d'extrémité fait partie intégrante de la paroi latérale.

10. Une boîte métallique selon l'une des revendications précédentes **caractérisée en ce que** la première fermeture d'extrémité fait partie intégrante de la paroi latérale, et, vue dans une coupe longitudinale de la boîte métallique, l'épaisseur de la paroi latérale dans une section de la partie annulaire de la partie principale de la paroi latérale, mesurée à des distances croissantes depuis la première fermeture d'extrémité, augmente progressivement de l'épaisseur de la paroi latérale en dehors de la partie annulaire vers une épaisseur maximum de la paroi latérale à l'intérieur de la partie annulaire, section dans laquelle la surface de la paroi latérale à l'intérieur de l'emballage est calée par rapport à la surface correspondante de la paroi intérieure sur l'extérieur de l'emballage à un angle variant entre 0,01° et 5°, de préférence à un angle variant entre 0,01° et 1°, d'une façon encore plus préférée à un angle variant entre 0,01° et 0,25°.

11. Méthode de production d'une boîte métallique constituant un emballage métallique résistant à la pression, comprenant une paroi latérale matricée s'étendant essentiellement le long d'une direction axiale et d'une direction périphérique et une première fermeture d'extrémité adjacente à la paroi latérale dans une première partie de transition paroi-fermeture et une deuxième fermeture d'extrémité adjacente à la paroi latérale dans une deuxième partie de transition paroi-fermeture dont la paroi latérale comprend une partie principale de la paroi latérale s'étendant de la première partie de transition paroi-fermeture à la deuxième, dans laquelle la partie principale de la paroi latérale est dotée d'un moyen d'accroissement de l'épaisseur de paroi latérale soutenant essentiellement la paroi latérale le long de la circonférence de la boîte, comprenant une partie annulaire de paroi métallique matricée dans laquelle l'épaisseur de la paroi latérale est supérieure à l'épaisseur de la paroi latérale dans la partie principale de la paroi latérale en dehors de la partie annulaire, la méthode comprenant les étapes (i) de production des coupelles dans au moins une opération d'étirage, (ii) de réduction de l'épaisseur de paroi latérale en utilisant au moins une matrice de matriçage et un poinçon ayant un contour de formage dans la section longitudinale comprenant essentiellement une partie droite munie d'une cavité, la cavité étant prévue pour former la partie annulaire, **caractérisée en ce que** la cavité a une profondeur inférieure à 40 μm et l'épaisseur de la partie principale de paroi latérale où la cavité est située, est réduite d'au moins 313,5 μm à moins de 190 μm.

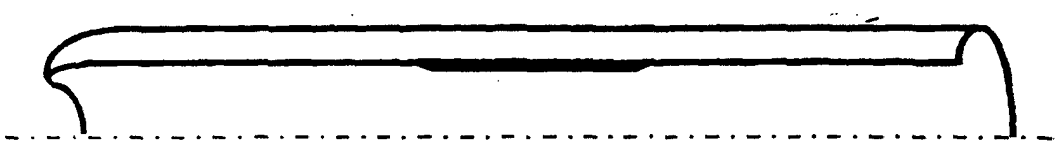

Fig. 1

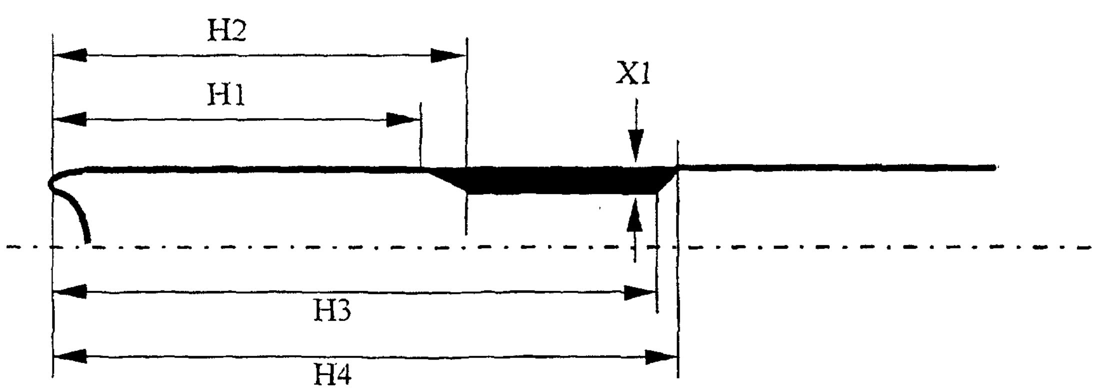

Fig. 2

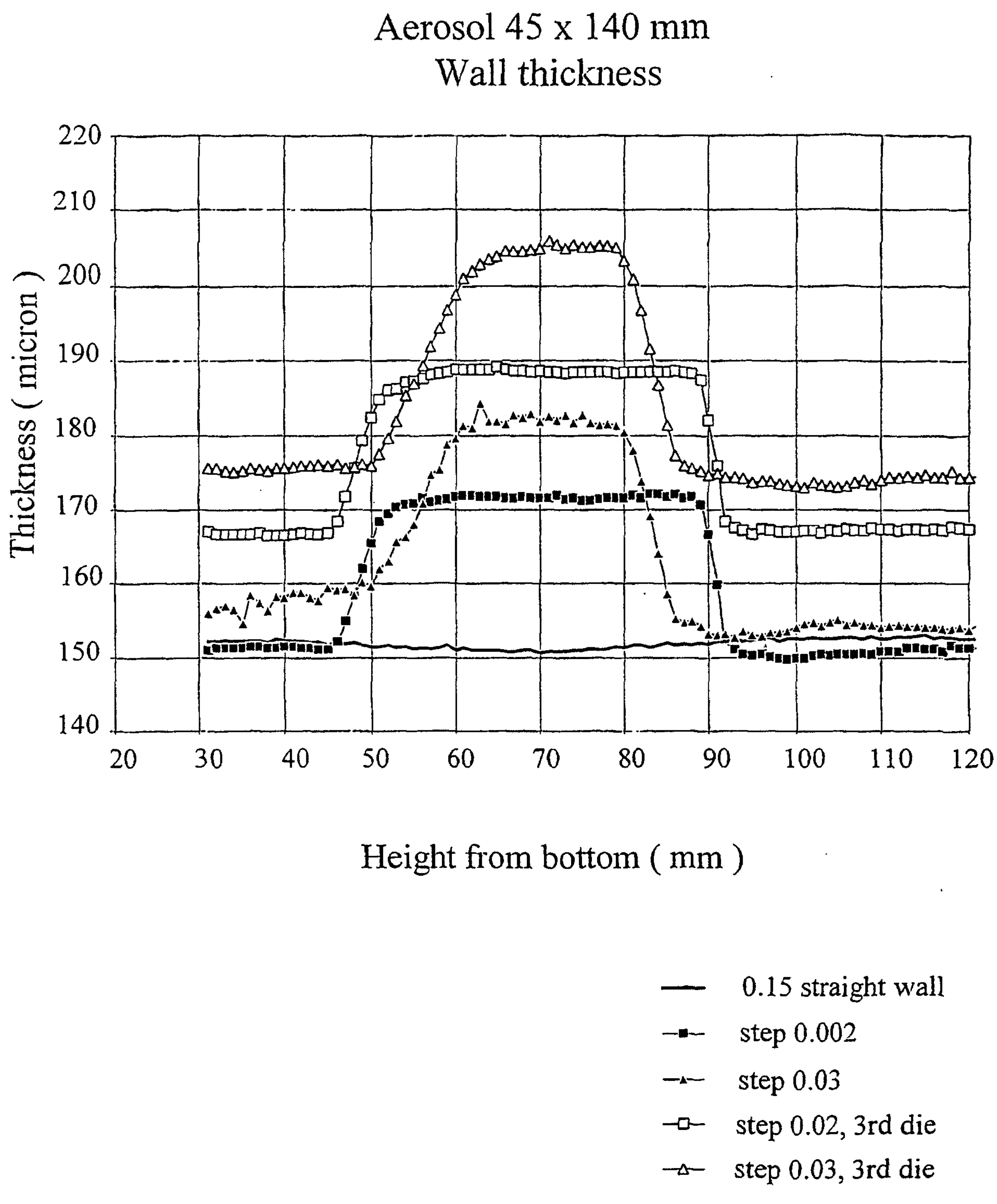
Aerosol 45 x 140 mm
Wall thickness
Thickness (micron)
220
210
200
190
180
170
160
150
140
20
30
40
50
60
70
80
90
100
110
120
Height from bottom (mm)
0.15 straight wall
step 0.002
step 0.03
step 0.02, 3rd die
step 0.03, 3rd die

Fig. 3

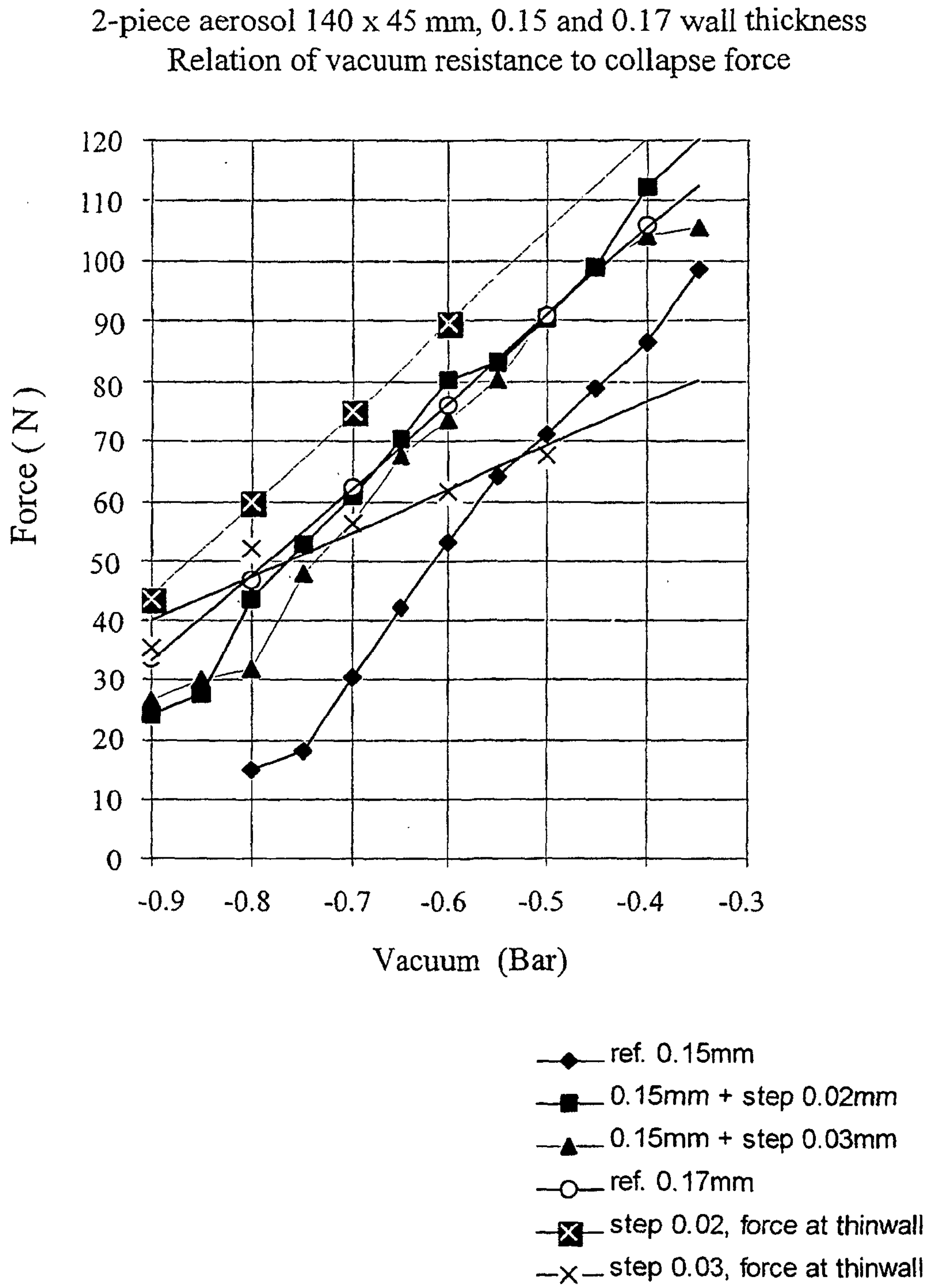
2-piece aerosol 140 x 45 mm, 0.15 and 0.17 wall thickness
Relation of vacuum resistance to collapse force
Force (N)
120
110
100
90
80
70
60
50
40
30
20
10
0
-0.9
-0.8
-0.7
-0.6
-0.5
-0.4
-0.3
Vacuum (Bar)
ref. 0.15mm
0.15mm + step 0.02mm
0.15mm + step 0.03mm
ref. 0.17mm
step 0.02, force at thinwall
step 0.03, force at thinwall

Fig. 4

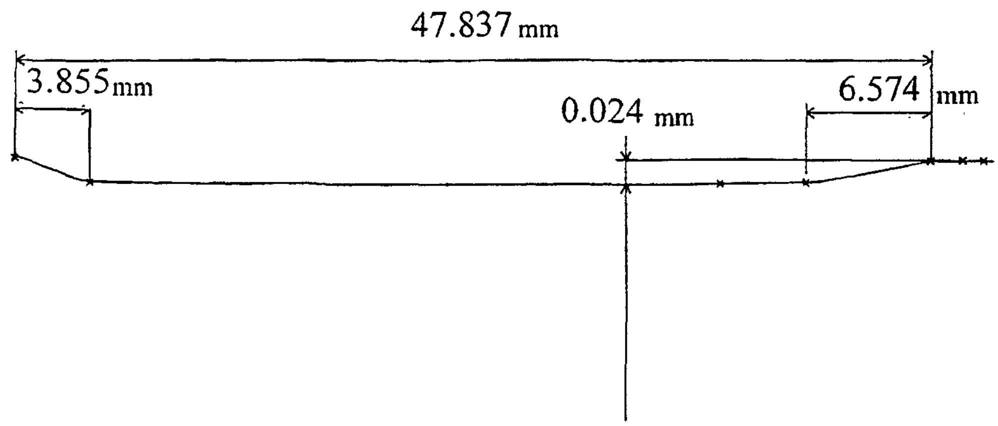
47.837 mm
3.855mm
0.024 mm
6.574 mm

Fig. 5

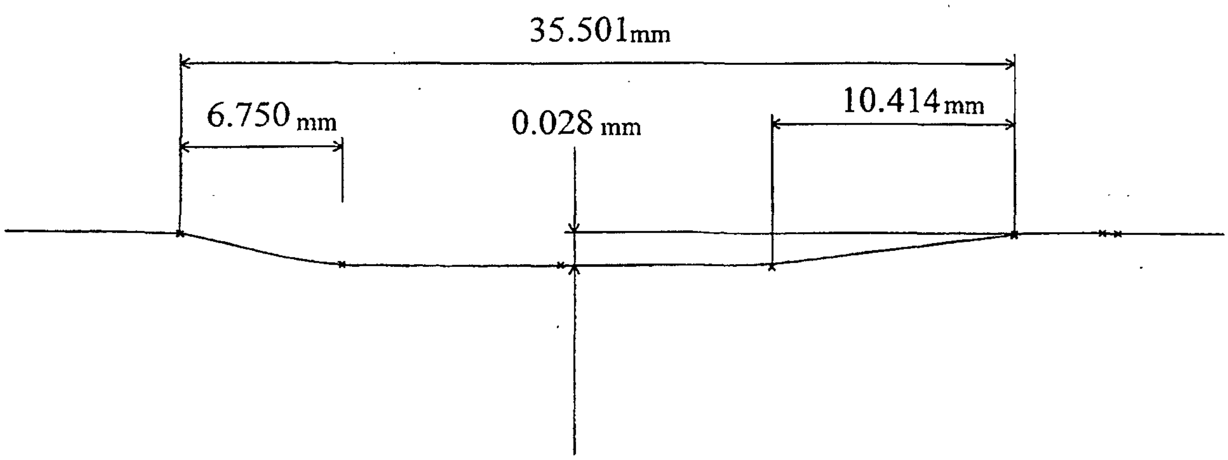
35.501mm
6.750 mm
0.028 mm
10.414mm

Fig. 6