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(54) **Pressurised metal container preform and a method of making same**

(57) The invention relates to a pressurised metal container (11,17,24) preform (3), such as for an aerosol container (17) or beverage container (24), comprising a container body (12,18,25) unitary with a bottom (13,19,26), which container (11,17,24) has been made by ironing, wherein the ironing ratio is in the range of about 64% to 77%, and wherein the thickness of the bottom made of aluminum is in the range of about 0.50mm to 1.2mm, or the bottom made of steel is in the range of 0.30mm to 0.70mm, to a container (11,17,24) comprising such preform (3) and to methods for making same.

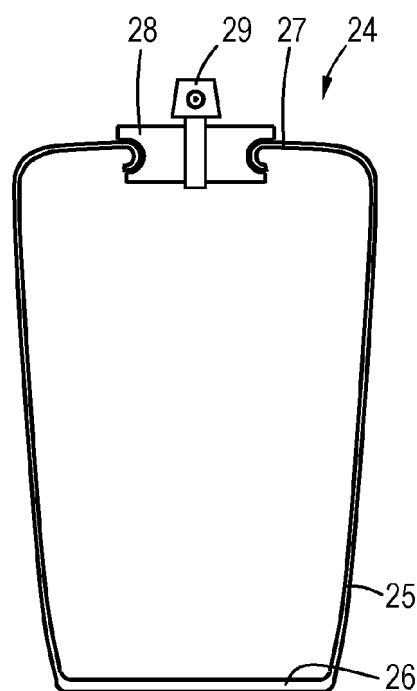


Fig.4

Description

[0001] The present invention relates to a pressurised metal container preform, to a pressurised metal container and to a method for making such pressurised metal container and its related preform.

[0002] Pressurised metal containers are used for containing various types of products. Such products may be beverages, whipped cream, shaving cream, hair dressing lacquer, aerosols, fragrances and perfumes. The intended use determines generally the pressure in the pressurised container. Such pressure may be constantly present as from closing by the filler up to the end of the use of the container by the end user. The use or the opening of the container may be such that the content is released constantly and/or stepwise via a valve. The pressure may only be temporarily present in the container, such as the result of a heating procedure to which the container is subjected. For instance, for pasteurising or sterilising the content, after such heating procedure the pressure generally returns approximately to the initial filling pressure or below.

[0003] For beverage containers and containers for food or hygienic products the internal pressure is generally around 8bars. For pressurised aerosol containers the pressure is generally in the range of around 10bar to around 30bar (or even higher).

[0004] For all the mentioned types of container it is an essential requirement that the container, the closed container, and the container during use maintains its container integrity and in particular its desired shape. Thus, the container preform and the container should be form stable during their life time. This implies in view of the intended use that the container preform and the container should have a particular wall thickness. A thickness that will guarantee the shape stability of the empty preform during its making process, transport, handling, filling and closing the container with the closure. In relation to the filled container, it is required that the container is not only substantially from stable during handling and transport, but in particular after last use by the end user and during intended use of the container content.

[0005] The shape stability is directly related to the thickness of the container body wall. This container body wall is the wall upstanding from the bottom. The strength of in particular the container body is depended on the metal of which the container has been made. Although stiffening or strengthening structure may contribute the strength of the container. Practically, the pressurised container may be made from steel or aluminum. The choice of either metallic material may be depended on the intended use and internal pressures to be withstood, but also on the ultimate shape of the container and of container structures such as an end curl, a necked portion, and stiffening structures. Another aspect is the price of the metal from which the container is made. That aerosol container may be made of aluminum or steel.

[0006] Accordingly, for a particular purpose a steel container is thinner than an aluminum container. This means that for such steel container less steel in volume is required for making the container than when such container would have been made of aluminum. However, steel and aluminum differ in other properties such as toughness and formability. This means that for particular containers and container bodies the metal to be used is either steel or aluminum. But by using particular alloys and tempers of steel and aluminum there is sometimes in overlap in properties making both metals interchangeable.

[0007] Finally, the choice of metal for the container or container body is dictated by the content of the container. Thus, for particular products only steel or aluminum containers or bodies may be used. Depilatory creams, hair mousse, and body sprays will be preferably packed into aluminum containers.

[0008] The containers of the invention relate to containers comprising a container body and bottom which are unitary. They form a so called mono-block. Such containers are made by drawing and ironing. Thereto, a disc or blank is cut from a sheet of metal having a particular thickness or gauge. The disc is then transferred into an apparatus comprising a punch forcing the disc through a drawing die to make a cup. Then, the produced cup is usually transferred to another apparatus to redraw and iron the cup in one operation... The redraw of the cup will result in a reduction in diameter and the ironing process will result in a thinning and elongation of the wall ultimately forming the container body wall. The bottom of the monoblock may be subjected to a forming operation, such as providing the bottom with a concave shape. Such a drawing and ironing process is for instance described in US5,394,727.

[0009] The drawing and ironing process (such as the DWI process) has as an effect that the bottom has substantially the same thickness or gauge as the original disc, blank or sheet of metal. The ratio of the thickness of the wall of the container body wall over the thickness or gauge of the sheet of metal is called the ironing ratio

$$\text{Ironing ratio (IR)} = 100 \cdot \frac{\text{initial thickness} - \text{final thickness}}{\text{initial thickness}}.$$

[0010] This ironing ratio is in essential equal to the extent of which the original sheet of metal after forming the initial cup has been radially decreased in diameter and longitudinally elongated. In other words, the ironing ratio is an indication of the amount of metal material of the metal sheet (or metal stock) is required for making the container body by drawing

and ironing. The higher the ironing ratio the less material is required for making the container body for a specific container height.

[0011] Presently, there is an increased tendency in using less metal for making a container or container preform. Because this will reduce costs for making the container and will also reduce the amount of metal to be recycled. Still such reduction in metal use may not negatively affect the properties of the container preform and container in their making, transport, filling, handling and use.

[0012] Generally it is considered that the ironing ratio for steel and aluminum drawn and ironed containers could not be higher than about maximally 50 to 60%. However, extensive and long lasting research by the inventors has resulted in experimental evidence that steel and aluminum with a respective metal gauge may be subjected to a drawing and ironing process such that the container and container preform can be made from steel or aluminum with a gauge at a higher ironing ratio.

[0013] Accordingly, the present invention relates to a pressurised metal container preform, such as for an aerosol container or beverage container, comprising a container body unitary with a bottom, which container preform has been made by drawing ironing, wherein the ironing ratio is in the range of about 64% to about 77%, and wherein the thickness of the bottom made of aluminum is in the range of about 0.50mm to about 1.2mm, or the bottom made of steel is in the range of about 0.30mm to about 0.70mm.

[0014] Thus, the invention is based on the insight that aluminum and steel container be drawn and ironed at an ironing ratio when starting with aluminum with a gauge in the range of 0.50mm to 1.2mm. As discussed such gauge is substantially identical to the bottom of the container or container as the bottom is generally not affected by the drawing and ironing procedure. Similarly, such higher ironing ratio may also be obtained with steel having a gauge of 0.30mm to 0.70mm. Due to the increase of the ironing ratio the amount of aluminum or steel is reduced for making a container and container having substantially the same properties as a container or container preform made at a lower ironing ratio. For in particular aluminum such ironing at a higher ironing ratio became preferably feasible when applying the aluminum cup to a drawing process generally used for steel cup drawing and ironing.

[0015] Although the ironing ratio may be selected at any ratio within the range of 64% to 77%, such as 65%, 66%, 67%, 68%, 69%, 70%, 71%, 72%, 73%, 74%, 75% 76% and 77%, it is preferred that such selection is within a range of such ironing ratio values. Practically, it was experimentally determined that practical results could be obtained when the ironing ratio is in the range of about 66% to 70%. Such ratio provides container preforms and containers having optimal or even best properties.

[0016] For aluminum container preforms and containers, the optimal results are obtained when preferably the thickness of the bottom made of aluminum is in the range of about 0.57mm to about 1.0mm. Better results are obtained when more preferably the thickness of the aluminum bottom is in the range of about 0.6mm to about 0.7mm.

[0017] Although aluminum alloys of any type may be used, it turned out that desired and good results may be obtained when preferably the aluminum is of the 3000 series, preferably 3104, or 3004.

[0018] For steel container preforms and containers, the optimal results are obtained when preferably the thickness of the bottom made of steel is in the range of about 0.35mm to about 0.60mm. Better results are obtained when more preferably the thickness of the steel bottom is in the range of about 0.45mm to about 0.55mm.

[0019] Although steel of any type may be used, it turned out that desired and good results may be obtained when preferably the steel is a temper from the range TS200 to TS550, preferably the range from TS210 to TS350. For particular, uses it may be desired that the container body is provided with a necked portion. The inventors have found that the preform (and container) may be provided when desired with a necked body portion. Such necking of the container body free end may be done with traditional operations using a series of necking dies. It has in this respect been established by the inventors that although drawn and ironed with the higher ironing ratio of the invention, the preform container still be necked substantially without problems such as kinking, cracking and jamming in the necking dies. For instance, 16 to 20 necking steps would be required to neck a 45mm diameter to 25.4mm and 32 to 40 necking steps to reduce a 65mm diameter to 25.4mm.. At this point it is noted that the reduction is the number of necking dies to be used in the necking operation may also be acquired at an ironing ratio which is lower than the ironing ratio of the present invention and still obtain an aluminum or steel container preform or container with good properties (although not with the benefit of using less aluminum or steel).

[0020] Another aspect of the invention relates to a pressurised container comprising preform according to the invention as described herein and a closure connected to the container body. The closure may be of any type as is required for the intended use of the container. For a container for beverages it may be a closure provided with a pull tab, an easy opening panel, or a twisted cap. For an aerosol container the closure may be a clamped on closure provided with a valve to be actuated for releasing the content. For a correct connection to the open end of the container body, the closure may be connected by adhesive or solder, or by a mechanical connection such as by snapping and/or seaming, clamping and screwing. Dependent on the type of closure the container may be filled before application of the closure or via the closure. For a proper connection it may be desired to trim the open end of the container body using a known trimming operation and/or to provide the open end with an inwardly or outwardly directed curl. Such additional operations may

be applied irrespective whether the container body is provided before or thereafter with a necked wall portion.

[0021] Finally, if desired or required the inner surface of the container preform or container may be provided with a coating the product or use so desires. Examples of such inner coatings are lacquers, and plastic neutralising layers.

[0022] A further aspect of the invention relates to a method of making a container preform for a pressurised metal container, such as an aerosol container or beverage container, having a container comprising a container body unitary with a bottom, comprising the steps of:

- i. forming a cup from a metal sheet, wherein the thickness of the sheet is in the range of about 0.50mm to 1.2mm when made of aluminum, or in the range of 0.30mm to 0.70mm when made of steel; and
- ii. drawing and ironing the wall of the cup with an ironing ratio in the range of about 64% to 77%.

[0023] In such method it is preferred as indicated hereinbefore that preferably the ironing ratio is in the range of about 66% to about 70%.

[0024] When the cup is made of aluminum then it is preferred that the cup thickness is in the range of about 0.57mm to about 1.0mm, and more preferably in the range of about 0.6mm to about 0.7mm.

[0025] When the cup is made of steel then it is preferred that the cup thickness is in the range of about 0.35mm to about 0.60mm, more preferably in the range of about 0.45mm to about 0.55mm.

[0026] Similarly, when desired for a particular use of the container the optional additional step of necking the container body is included.

[0027] A further aspect of the invention relates to a pressurised metal container preform obtainable with the method according to the invention.

[0028] Still a further aspect of the invention relates to method of making a pressurised metal container, such as an aerosol container or beverage container, comprising the step of providing a preform according to the invention with a closure, preferably a twisted cap or a clamped closure.

[0029] Mentioned and other features of the container, container preform and their method of making according to the invention will be further illustrated by several embodiments which are given for information purposes only and are not intended to limit the invention to any extent. In relation to these embodiments reference will be made to the annexed figures of which:

figure 1 shows schematically the process of making container preform and container of the invention;
figures 2-4 show in cross section other embodiments of the container of the invention.

[0030] Figure 1A shows a disc 1 made of aluminum. The gauge of the disc is about 0.65mm. The disc 1 is then drawn to a cup 2 as shown in figure 1B. The drawing process used may suitable drawing (and ironing process) such as described in US5,394,727, although the described reverse drawing is not necessarily used. Particularly suitable drawing and ironing processes are those that are essentially designed for drawing and ironing steel to monoblocks.

[0031] The aluminum cup or monoblock 2 is then subjected ironing using one or more ironing rings for producing the container preform 3 having a diameter of about 40mm, (figure 1C). The preform 3 has a bottom 4 which has substantially same thickness as the gauge of the disc 1, that is for example about 0.65mm. The ironing ratio is for this example about 68%. This means that the thickness of the container body wall 5 is about 0.208mm [].

[0032] The preform 3 is subsequently provided at the container body open end 7 with a outwardly directed curl 6 (figure 1D to be redesigned outwardly). On this curl 6 is mounted a closure 8 clamped snappingly with a groove 9 on the curl 6. The container 10 can be used for containing a product with a pressure of about 17bar. The closure may be pinched for releasing the content.

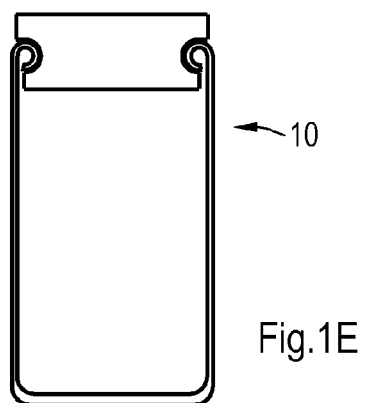
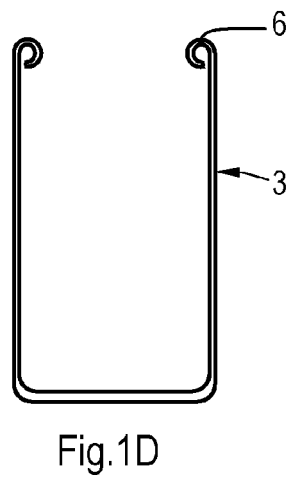
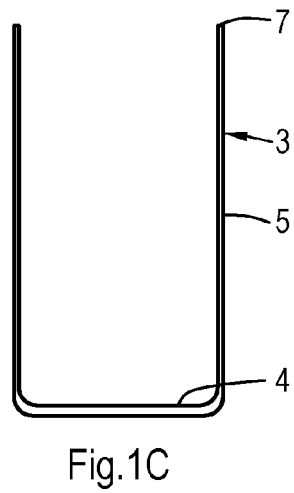
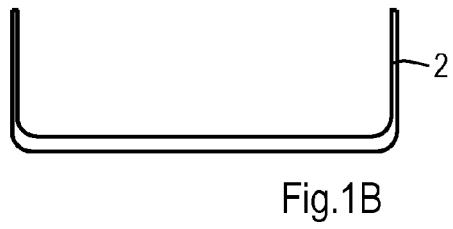
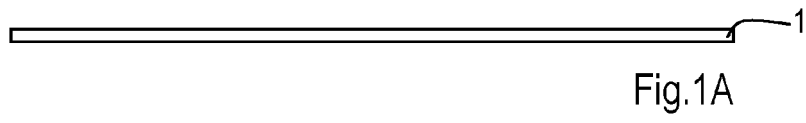
[0033] Figure 2 shows a container 11 according to the invention. The container 11 comprises a container body 12 unitary with a bottom 13. The bottom has a thickness of about 0.60mm corresponding substantially to the gauge of the metal disc from which the container body 12 has been made by drawing and ironing with a ironing ratio of about 70%. The container body 12 has a container body wall thickness of about 0.18mm. The container body is provided with a necked portion 14. The necked portion 14 has been formed by necking using for instance 16 necking dies. The container body has a diameter of about 45mm and a necked and curled opening of about 25mm. The necked portion 14 is provided with a screw path structure 15 onto which is screwed a screw cap 16. The internal pressure of the beverage filled container 11 is about 1.7bar.

[0034] Figure 3 shows an aerosol container 17 according to the invention. The aerosol container 17 comprises a container body 18 unitary with a concave bottom 19. The thickness of the bottom is about 0.60mm and has been formed by drawing and ironing to an ironing ratio of about 70%. The container body has a container body wall thickness of about 0.18mm. The container body has a necked portion 20 having an outwardly curled curl 21. On the curl 21 is mounted a closure 22 provided with a valve 23. The diameter of the container body 18 is about 45mm and the diameter of the necked portion is about 20mm. The internal pressure of the contained aerosol is about 18bar.

[0035] Finally, figure 4 shows a container 24 according to the invention made of aluminum. The container 24 comprises a container body 25 having a shape slightly diverging from a bottom 26. The bottom 26 has a thickness of about 0.59mm. The container body is formed by drawing and ironing at an ironing ratio of about 64%. The container body wall thickness is about 0.212mm. After ironing the container body may have subjected to a forming process with any kind of expansion method: hydraulic, pneumatic, mechanical. The container body 25 is provided with an inwardly curled part 27 onto which is snapped a closure 28 provided with valve to be opened by pressing. The gaseous aerosol product has a pressure of about 12bar.

Claims

1. Pressurised metal container preform, such as for an aerosol container or beverage container, comprising a container body unitary with a bottom, which container has been made by drawing and ironing, wherein the ironing ratio is in the range of about 64% to about 77%, and wherein the thickness of the bottom made of aluminum is in the range of about 0.50mm to about 1.2mm, or the bottom made of steel is in the range of about 0.30mm to about 0.70mm.
2. Preform according to claim 1, wherein the ironing ratio is in the range of about 66% to about 70%.
3. Preform according to claim 1 or 2, wherein the thickness of the bottom made of aluminum is in the range of about 0.57mm to about 1.0mm, preferably in the range of about 0.6mm to about 0.7mm.
4. Preform according to any of the claims 1-3, wherein the aluminum is of the 3000 series, preferably 3104, or 3004.
5. Preform according to claim 1 or 2, wherein the thickness of the bottom made of steel is in the range of about 0.35mm to about 0.60mm, preferably in the range of about 0.45mm to about 0.55mm.
6. Preform according to claim 1, 2, or 5, wherein the steel is a temper from the range TS200 to TS550, preferably the range from TS210 to TS350.
7. Preform according to claim 1, 2, 5, or 6, wherein the steel is tin coated.
8. Preform according to any of the claims 1-7, wherein the container body is provided with a necked body portion.
9. Pressurised container comprising a container preform according to any of the claims 1-8, and a closure connected to the container body, and preferably the closure is a twisted cap or a clamped closure.
10. Method of making a container preform for a pressurised metal container, such as an aerosol container or beverage container, having a container comprising a container body unitary with a bottom, comprising the steps of:
 - i. forming a cup from a metal sheet, wherein the thickness of the sheet is in the range of about 0.50mm to about 1.2mm when made of aluminum, or in the range of about 0.30mm to about 0.70mm when made of steel; and
 - ii. drawing and ironing the wall of the cup with an ironing ratio in the range of about 64% to about 77%.
11. Method as claimed in claim 10, wherein the ironing ratio is in the range of about 66% to about 70%.
12. Method as claimed in claim 10 or 11, wherein the cup is made of aluminum and the cup thickness is in the range of about 0.57mm to about 1.0mm, preferably in the range of about 0.6mm to about 0.7mm.
13. Method as claimed in claim 10 or 11, wherein the cup is made of steel and the cup thickness is in the range of about 0.35mm to about 0.60mm, preferably in the range of about 0.45mm to about 0.55mm.
14. Method as claimed in any of the claims 10-13, comprising the step of necking the container body.
15. A pressurised metal container preform obtainable with the method according to any of the claims 10-14.
16. Method of making a pressurised metal container, such as an aerosol container or beverage container, comprising the step of providing a container preform according to any of the claims 1-8 or 15, with a closure, preferably a twisted cap or a clamped closure.



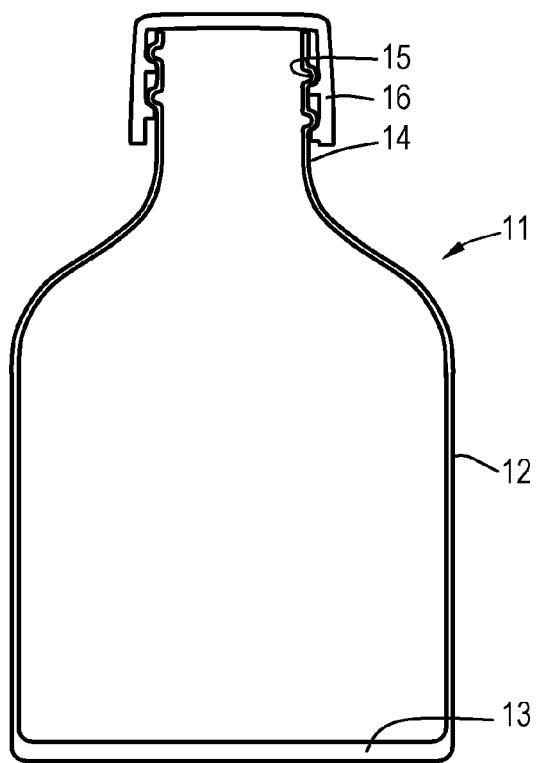


Fig.2

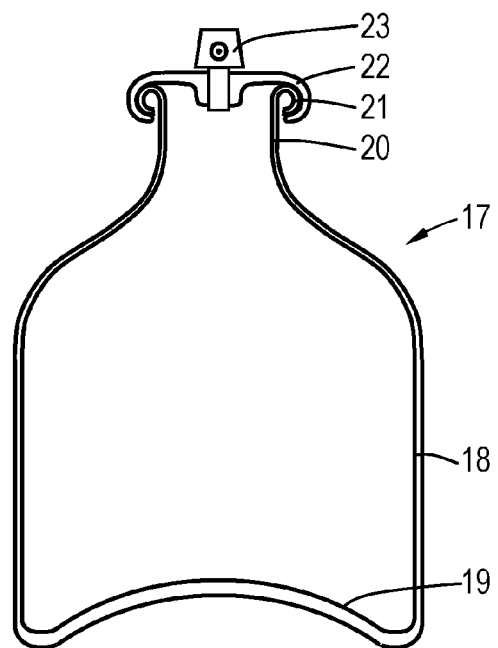


Fig.3

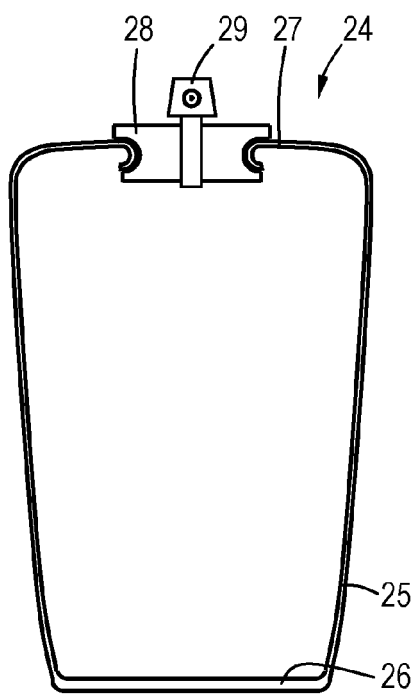


Fig.4

**PARTIAL EUROPEAN SEARCH REPORT**

Application Number

under Rule 62a and/or 63 of the European Patent Convention.
This report shall be considered, for the purposes of
subsequent proceedings, as the European search report

EP 11 15 0767

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A	figures 1,3,4 *	3,4,12	

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Y	* abstract; example 2 *	7-9,14	
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Y	* page 4, line 24 - line 27; figures *	7-9,14	
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Y	* abstract; figures 1,2,6; examples 1,2 *	8,9,14	
A		3,4,12	

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			TECHNICAL FIELDS SEARCHED (IPC)
			B21D B65D
INCOMPLETE SEARCH			
The Search Division considers that the present application, or one or more of its claims, does/do not comply with the EPC so that only a partial search (R.62a, 63) has been carried out.			
Claims searched completely :			
Claims searched incompletely :			
Claims not searched :			
Reason for the limitation of the search: see sheet C			
Place of search Munich		Date of completion of the search 12 July 2011	Examiner Cano Palmero, A
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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PARTIAL EUROPEAN SEARCH REPORT

Application Number
EP 11 15 0767

DOCUMENTS CONSIDERED TO BE RELEVANT			CLASSIFICATION OF THE APPLICATION (IPC)
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	
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**INCOMPLETE SEARCH
SHEET C**

Application Number
EP 11 15 0767

Claim(s) completely searchable:
1-14

Claim(s) not searched:
15, 16

Reason for the limitation of the search:

Rule 62a(1) EPC.

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

EP 11 15 0767

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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12-07-2011

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