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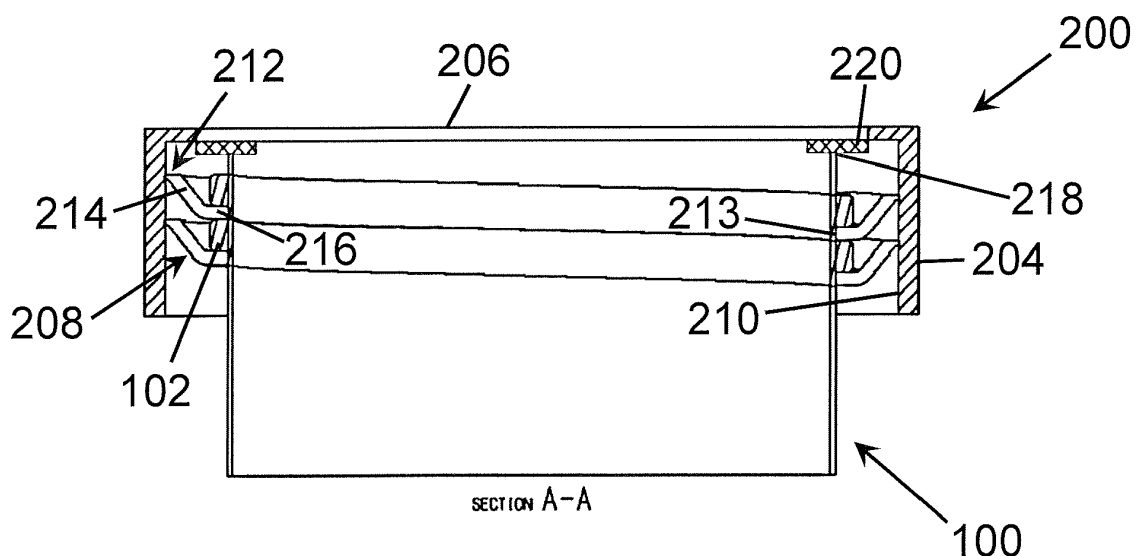
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(54) SCREW CAP HAVING A SELF-ADAPTING FEMALE THREAD

(57) This invention relates to a screw cap for sealing containers with threaded necks. The screw cap (200) comprises an outer body, comprising a cylindrical outer wall (204) closed at one end by a circular lid (206) and an interior neck seal (220) adjacent to the circular lid (206), and a female thread (208) extending around an inner surface (210) of the cylindrical outer wall (204), the female thread (208) comprising a main portion having

substantially uniform thickness, and an attachment portion (212) having a thickness which is less than the thickness of the main portion, wherein the female thread (208) is attached to the inner surface (210) of the cylindrical outer wall (204) in the region of the attachment portion (212), and wherein the attachment portion (212) is configured to permit deflection of the female thread (208).

**Fig. 2b****EP 3 287 386 A1**

Description

Technical field

[0001] This invention relates to screw caps for sealing plastic containers.

Background

[0002] Plastic jug bottles are used for the transportation of a variety of liquids, both hazardous and non-hazardous. Such bottles are available in a range of capacities, typically from 1 litre to 20 litres.

[0003] Plastic jug bottles are typically sealed by screw caps. A female thread inside the cap engages with a male thread around the neck of the bottle to tighten the cap onto the bottle neck. The mouth of the bottle presses against a layer of sealing material or a neck seal within the cap as it is tightened, sealing the contents of the bottle. A close fit between the male and female threads helps to ensure the cap can be sufficiently tightened to create a secure seal and prevent leaking. A tight seal is particularly important for bottles containing hazardous products.

[0004] The diameters of the bottle neck and the male thread of standard plastic jug bottles can vary by up to 5% of their nominal diameters between different manufacturers. This variation in dimensions can have a detrimental effect on the engagement of the male thread of the bottle with the female thread of the cap, preventing the cap from tightening properly and compromising the integrity of the seal when closed. Bottles from one manufacturer therefore have to be matched with caps from a designated manufacturer to ensure proper engagement of the threads.

[0005] The present invention seeks to provide a solution for allowing one cap of nominal size to fit a variety of container necks.

Summary of invention

[0006] According to the present invention, there is provided a screw cap for sealing a container with a threaded neck, the screw cap comprising: an outer body, comprising a cylindrical outer wall closed at one end by a circular lid and an interior neck seal; and a female thread extending around an inner surface of the cylindrical outer wall. The female thread comprises a main portion having a substantially uniform thickness and an attachment portion having a thickness which is less than the thickness of the main portion. The female thread is attached to the inner surface of the cylindrical outer wall in the region of the attachment portion, and the attachment portion is configured to permit deflection of the female thread.

[0007] The attachment portion is located adjacent to the inner surface of the outer cylindrical wall. The reduced thickness of the attachment portion allows the thread to deflect when a force is applied to it, for example when

the cap is screwed onto a bottle neck. Deflection of the female thread as it interconnects with the male thread of the bottle neck advantageously permits the end portion to align with and fully engage between the ridges of the male thread, without requiring accurate matching of the cap to the dimensions of the neck bottle, ensuring a tight seal when the cap is completely closed.

[0008] The term "thickness" is intended to have its usual meaning in this context, i.e. the thickness of the main portion is the minimum distance between the lower surface and the upper surface of the main portion at any given point. Similarly, the thickness of the attachment portion is the minimum distance between the lower surface and the upper surface of the attachment portion. It will be understood, however, that although the thickness of the main portion is substantially uniform along its length, the free end of the female thread may have a slightly reduced thickness due, for example, to rounding of the corners.

[0009] It will also be understood that the total length of the female thread is the distance to which the female thread extends away from the outer wall of the cap, measured in a direction perpendicular to the outer wall. The length of the attachment portion is the distance between the outer wall and the main portion of the female thread, i.e. the point at which the thickness of the female thread is no longer reduced.

[0010] The screw cap may be formed of a moulded polymer material. The moulded polymer material may comprise one or more of the following: high density polyethylene (HDPE), low density polyethylene (LDPE), polyacetal, polyamide, or any suitable rigid polymer. In an embodiment, the moulded polymer material is HDPE, nylon, or a combination thereof. The moulded polymer material may be selected based on a number of characteristics, such as: elasticity, which permits the thread to deflect while in engagement with the bottle neck but return to its original configuration when removed from engagement; rigidity and durability, to prevent deformation or breakage; and compatibility with the contents of the container which the cap is intended to seal. The skilled person will understand that the moulded polymer material is not limited to these examples, and that any material suitable for moulding and having the necessary durability may be used.

[0011] The moulded polymer material may be selected to work in conjunction with the attachment portion, to permit deflection of the thread while also preventing breakage of this portion, which might otherwise be weakened due to its reduced thickness. The attachment portion may be subjected to a significant amount of strain when the cap is screwed onto the bottle neck, due to a combination of deflection and rotational force. The polymer must therefore be resilient and durable to withstand this strain, but also flexible enough to allow the thread to deflect and perform its function. For example, HDPE or polyamide may exhibit suitable resilience and flexibility for this purpose.

[0012] The outer body of the cap, the female thread and the neck seal may each be formed of a different material, where necessary to achieve the desired physical characteristics of each component. For example, the outer body may be formed of a more rigid material, whereas the female thread may be formed of a more flexible material.

In an embodiment, the neck seal is formed from a softer material than the outer body. In an embodiment, the neck seal consists of a thin layer of material, such as a polytetrafluoroethylene (PTFE) liner. The neck seal may be formed from a material that is resistant to corrosion and oxidation, or is specifically resistant to the chemicals which are intended to be contained within the bottle.

[0013] The attachment portion of the female thread has a thickness that is less than the thickness of the main portion. The thickness of the attachment portion may be between 90% and 50%, between 80% and 60% or between 75% and 67% of the thickness of the main portion. The length of the attachment portion may be more than 5% and no more than 33%, or more than 5% and no more than 20%, of the total length of the female thread. In an embodiment, the length of the attachment portion is between 10% and 15% of the total length of the female thread.

[0014] In an embodiment, the main portion comprises an inclined region, which extends from the attachment portion in a direction away from the lid of the outer body, i.e. in a downward direction when the cap is upright with the lid at the top. The inclined region may extend from the attachment portion at an inclination angle of between 10° and 65°, between 20° and 55° or between 30° and 45°.

[0015] In an embodiment, the main portion further comprises an end portion, which extends from the inclined region at an angle such that the end portion is parallel to the lid of the outer body. The length of the end portion (i.e. the distance between the inclined region and the free end of the female thread) may be between 10% and 40%, or preferably between 25% and 33% of the total length of the female thread.

[0016] When the cap is screwed onto a bottle neck, in use, the end portion remains substantially horizontal and is therefore able to fit between the ridges of the male thread and engage correctly despite any deflection of the female thread. This ensures that the cap can be screwed on tightly to create a reliable seal.

Brief description of the drawings

[0017]

Figure 1 is a side perspective view of a typical jug bottle neck.

Figure 2a is an external side view of a screw cap according to an embodiment of the present invention, in engagement with a bottle neck.

Figure 2b is a schematic cross-sectional view through section A-A of Figure 2a.

Figure 3 is a schematic cross-sectional representation of the thread area of a screw cap according to an embodiment of the present invention, in engagement with a bottle neck.

Figure 4 is a detail of a cross-section of the thread area of the screw cap of Figure 3, showing exemplary dimensions.

Detailed description

[0018] Figure 1 shows a typical jug bottle neck 100 of diameter E. The neck has a male thread 102 of diameter T. Diameters E and T can vary by up to 5% of their nominal dimensions depending on the manufacturer.

[0019] Figure 2a shows a screw cap 200 according to an embodiment of the present invention, in engagement with a bottle neck 100 such as the one shown in Figure 1.

[0020] Figure 2b shows a cross-sectional view through section A-A of Figure 2a. The screw cap 200 comprises an outer body, which comprises a cylindrical outer wall 204 closed at one end by a circular top or lid 206, and a female thread 208 extending around an inner surface 210 of the cylindrical outer wall 204. The female thread 208 is shown in engagement with the male thread 102 of the bottle neck 100.

[0021] The female thread 208 comprises an attachment portion 212 and is attached to the inner surface 210 in the region of the attachment portion 212. The female thread 208 further comprises a main portion, which consists of an inclined region 214, extending downwardly from the attachment portion 212 (i.e. away from the lid of the cap 206), and an end portion 216, extending from the inclined region 214 to the free end 213 of the female thread 208. The end portion 216 extends from the inclined region 214 at an angle, so that it is approximately parallel with the lid of the cap 206.

[0022] The attachment portion 212 has a reduced thickness compared with the main portion, which allows the female thread 208 to deflect as it interconnects with the male thread 102 of the bottle neck 100. This in turn allows the end portion 216 to align with and fully engage between the ridges of the male thread 102, without requiring accurate matching of the cap to the dimensions of E and T (see Figure 1), ensuring a secure seal when the cap 200 is completely closed.

[0023] The cap 200 comprises a neck seal 220, in the form of a liner around the lid 206. In use, the cap 200 is fully tightened so that the mouth of the bottle 218 is completely sealed against the neck seal 220.

[0024] Figure 3 shows a cross-sectional representation of the screw cap 200 according to an embodiment of the present invention, zoomed in on the threads 208, 102. The attachment portion 212 has a reduced thickness relative to the rest of the female thread 208 and acts like

a hinge, allowing the thread 208 to deflect when in engagement with the male thread 102. The thickness of the narrow region is approximately 70% of the thickness of the rest of the female thread 208.

[0025] Figure 4 shows a detail of the cross-section of the female thread of the screw cap 200, with typical dimensions in millimetres for an example thread. It will be appreciated that these dimensions are shown for illustrative purposes only. Screw caps of different sizes, formed of different materials, or suitable for different applications, may have dimensions that vary considerably from those shown. As shown, the thread 208 extends at an angle from the inner surface of the outer wall 204 to a distance (total length, C) of 6.0 mm. The main portion 214 has a substantially uniform thickness (A) of 1.25 mm. The attachment portion 212 has a thickness (B) of 0.87mm (a reduction in thickness of about 30% compared to the main portion) and extends to a length (D) of 0.8 mm (about 13% of the total length of the female thread). The end portion 216 has a length (E) of 1.8 mm (about 30% of the total length of the female thread). Also as shown, 0.5 mm radius fillets are provided where the thread 214 joins the inner surface of the outer wall 204, as well as other radiuses on the outer form of the thread 208.

Claims

1. A screw cap for sealing a container with a threaded neck, the screw cap comprising:

an outer body, comprising:

a cylindrical outer wall closed at one end by a circular lid, and
an interior neck seal adjacent to the circular lid; and

a female thread extending around an inner surface of the cylindrical outer wall, the female thread comprising:

a main portion having substantially uniform thickness, and
an attachment portion having a thickness which is less than the thickness of the main portion;

wherein the female thread is attached to the inner surface of the cylindrical outer wall in the region of the attachment portion, and wherein the attachment portion is configured to permit deflection of the female thread.

2. A screw cap according to claim 1, formed of a moulded polymer material.

3. A screw cap according to claim 2, wherein the moulded polymer material is selected from one or more of the group consisting of: HDPE, LDPE, polyamide or polyacetal.

4. A screw cap according to any one of the preceding claims, wherein the thickness of the attachment portion is between 90% and 50%, between 80% and 60%, or more preferably between 75% and 67% of the thickness of the main portion.

5. A screw cap according to any one of the preceding claims, wherein the attachment portion has a length that is more than 5% and no more than 33%, more than 5% and no more than 20 %, or between 10% and 15% of a total length of the female thread.

6. A screw cap according to any one of the preceding claims, wherein the main portion comprises an inclined region that extends from the attachment portion in a direction away from the lid of the outer body.

7. A screw cap according to claim 6, wherein the inclined region extends from the attachment portion at an angle of between 10° and 65°, between 20° and 55° or between 30° and 45°.

8. A screw cap according to claim 6 or claim 7, wherein the main portion further comprises an end portion which extends from the inclined region at an angle, such that the end portion is substantially parallel to the lid of the outer body.

9. A screw cap according to claim 8, wherein the end portion has a length that is between 10% and 40%, or between 25% and 33% of the total length of the female thread.

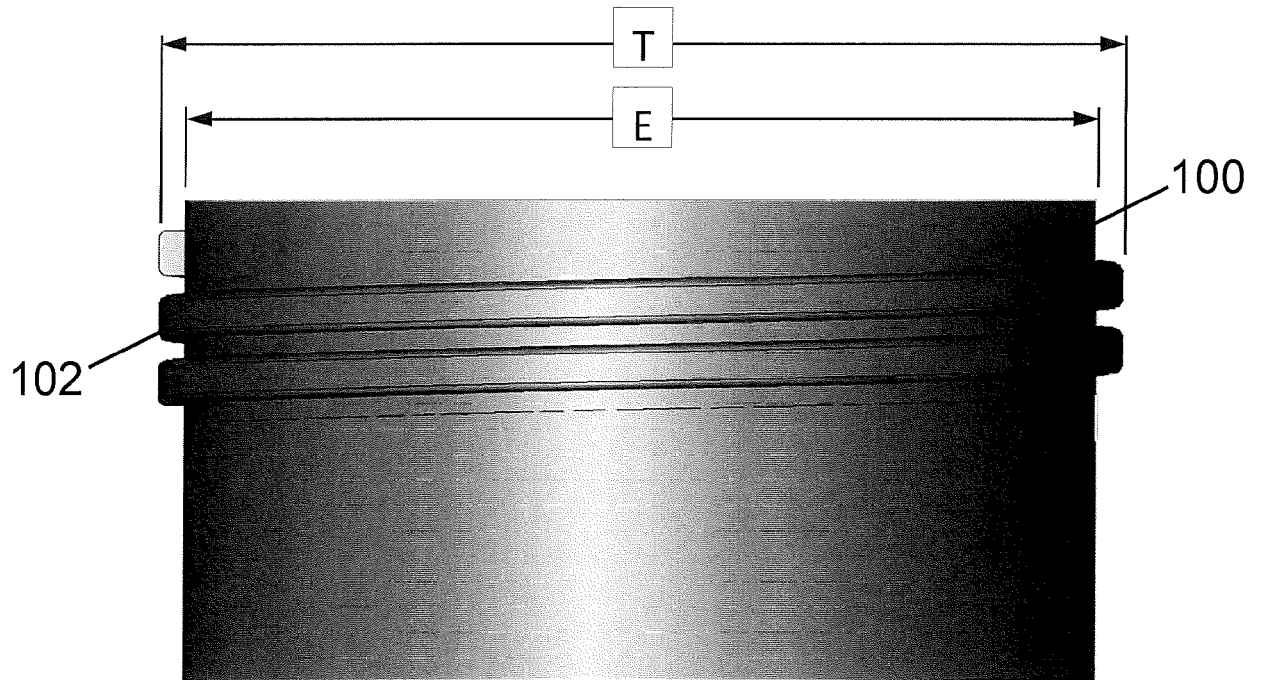


Fig. 1

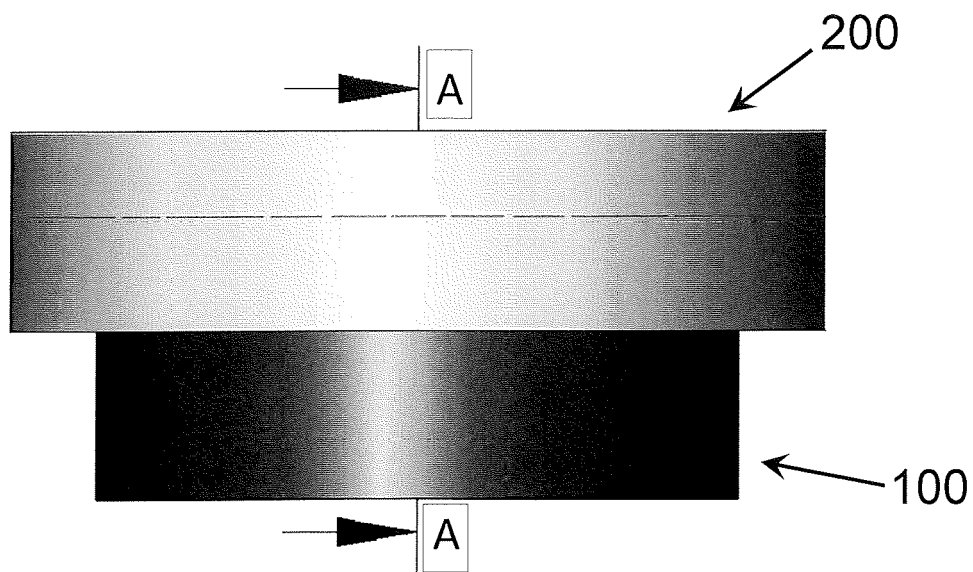


Fig. 2a

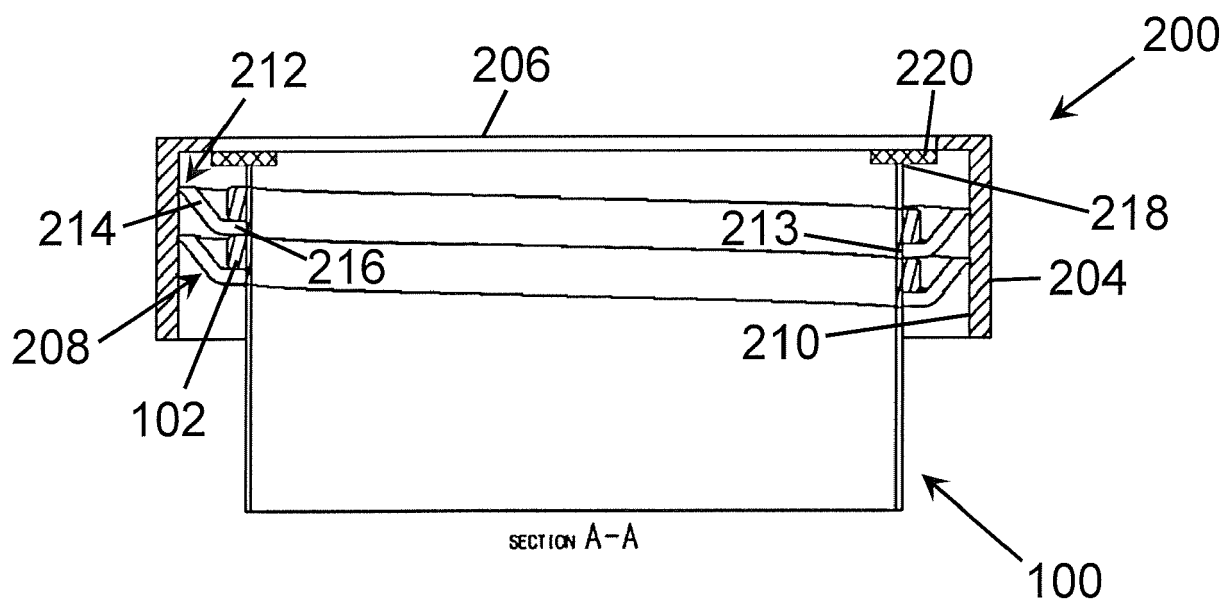


Fig. 2b

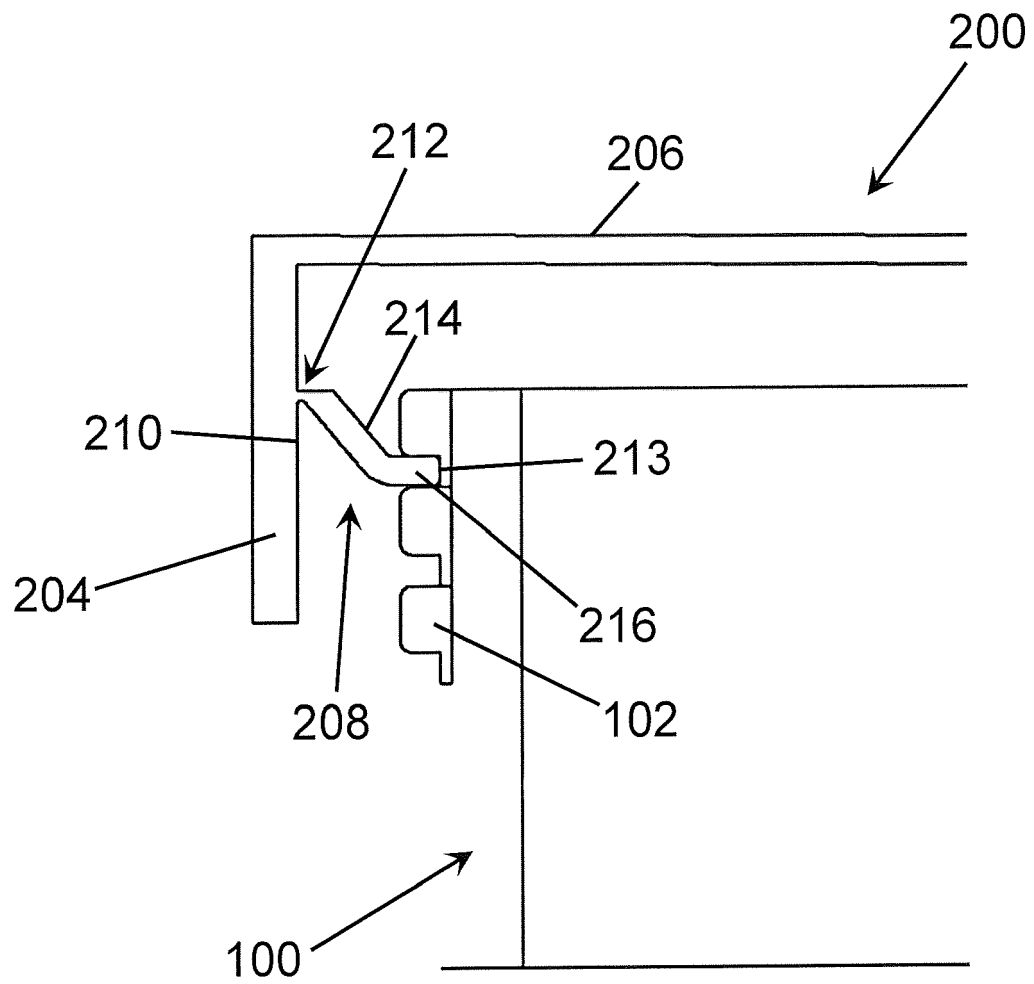


Fig. 3

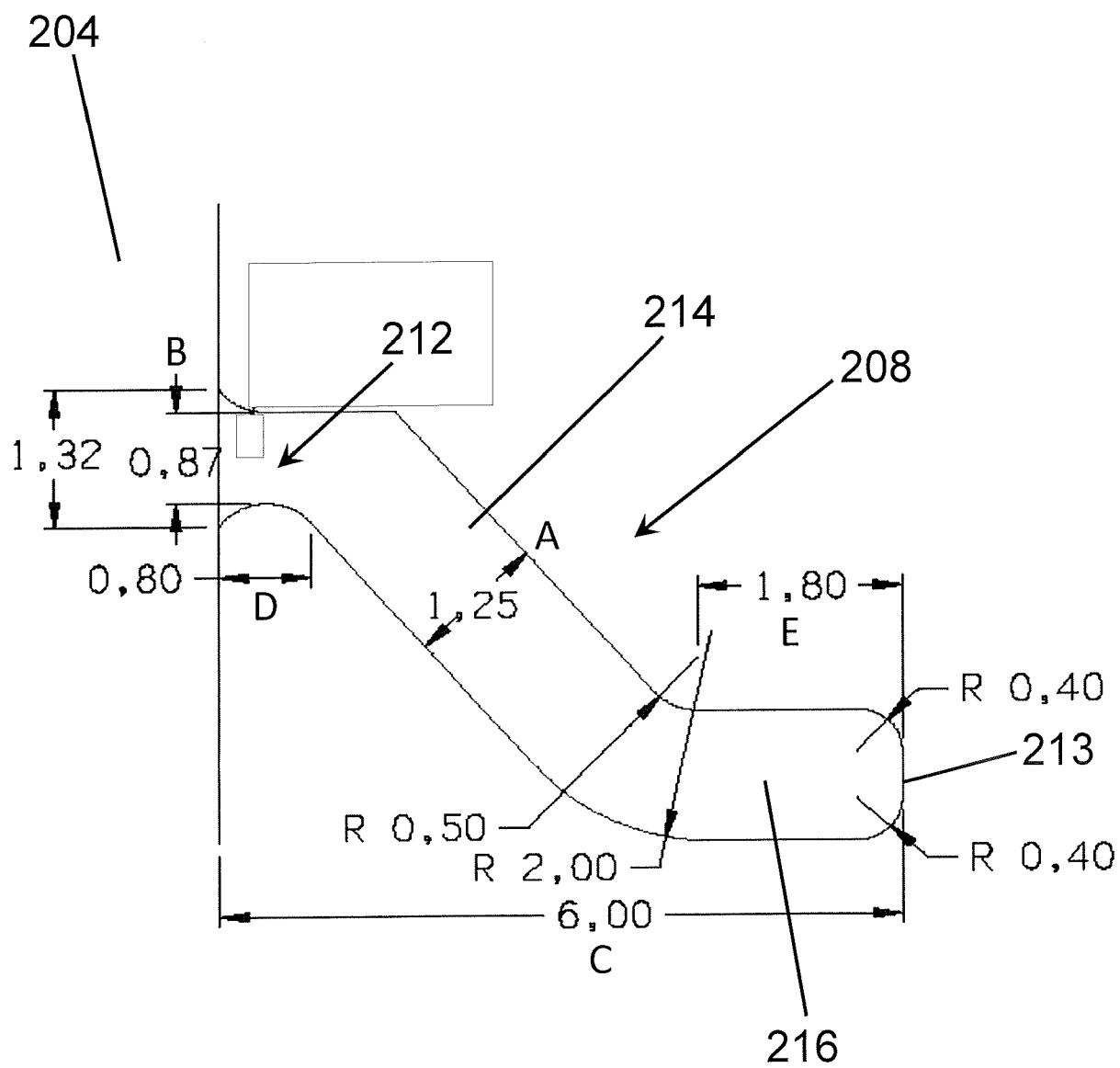


Fig. 4



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 Application Number
EP 17 18 7214

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A	US 2015/158621 A1 (LEE JEONG-MIN [KR] ET AL) 11 June 2015 (2015-06-11) * Female cap thread having thin attachment portion (to inner cap skirt wall) and thickened distal portion of non-uniform thickness; paragraph [0034] - paragraph [0036]; figures 13,15 *	1-9	
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Place of search The Hague		Date of completion of the search 5 December 2017	Examiner Dederichs, August
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
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