US 20080047923A1

(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2008/0047923 A1**

Zoppas et al. (43) **Pub. Date: Feb. 28, 2008**

(54) **PLASTIC BOTTLE AND PROCESS FOR AFFIXING A SHRINKABLE LABEL THEREON**

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(21) Appl. No.: **11/629,587**

(22) PCT Filed: **Jun. 16, 2005**

(86) PCT No.: **PCT/EP05/52799**

§ 371(c)(1),
(2), (4) Date: **Dec. 14, 2006**

(30) **Foreign Application Priority Data**

Jun. 16, 2004 (IT) RM2004A000294

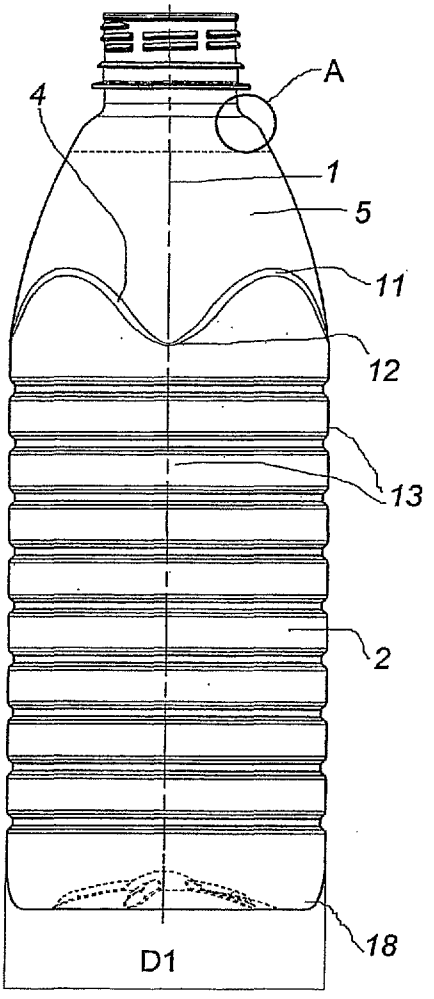
Publication Classification

(51) **Int. Cl.**
B65D 1/02 (2006.01)

(52) **U.S. Cl.** **215/371**

(57) **ABSTRACT**

Plastic bottle having a body (**2**) with a polygonal cross section, with three or four sides, and a tapered part (**5**) which extends between said body (**2**) and the neck (**7**) of the bottle having surface of revolution form or cross section similar to that of the body (**2**), but less accentuated. The bottle is particularly suitable to be covered with a heat-shrinkable plastic film.



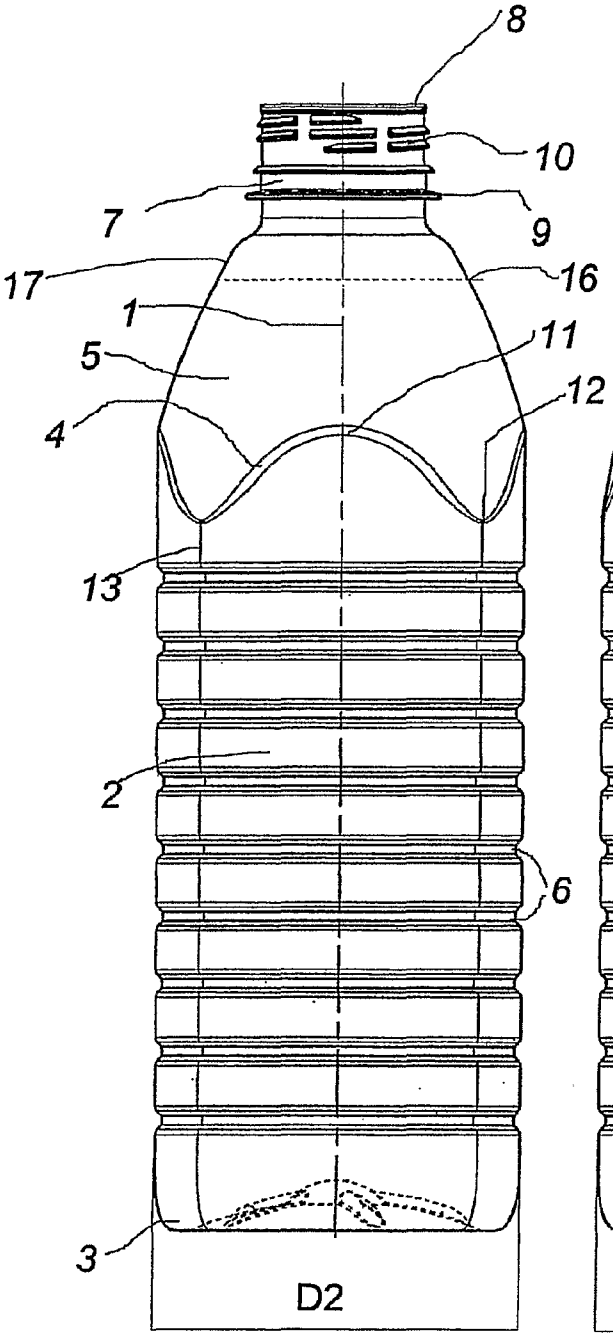


Fig. 1

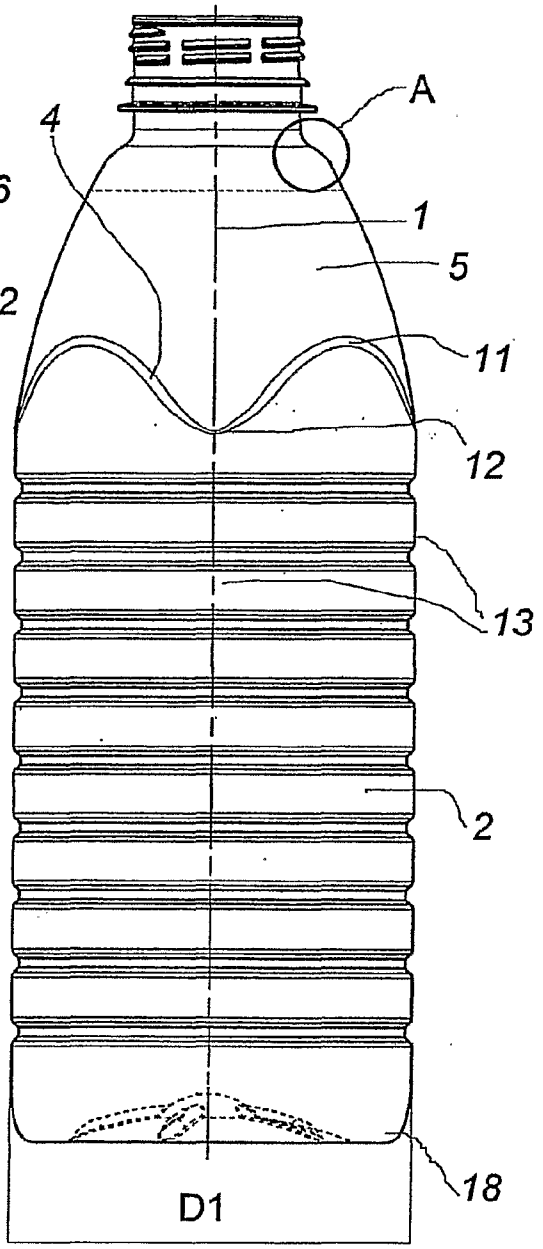


Fig. 2

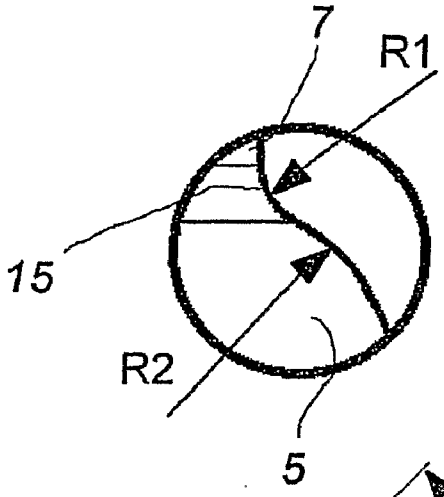


Fig. 3

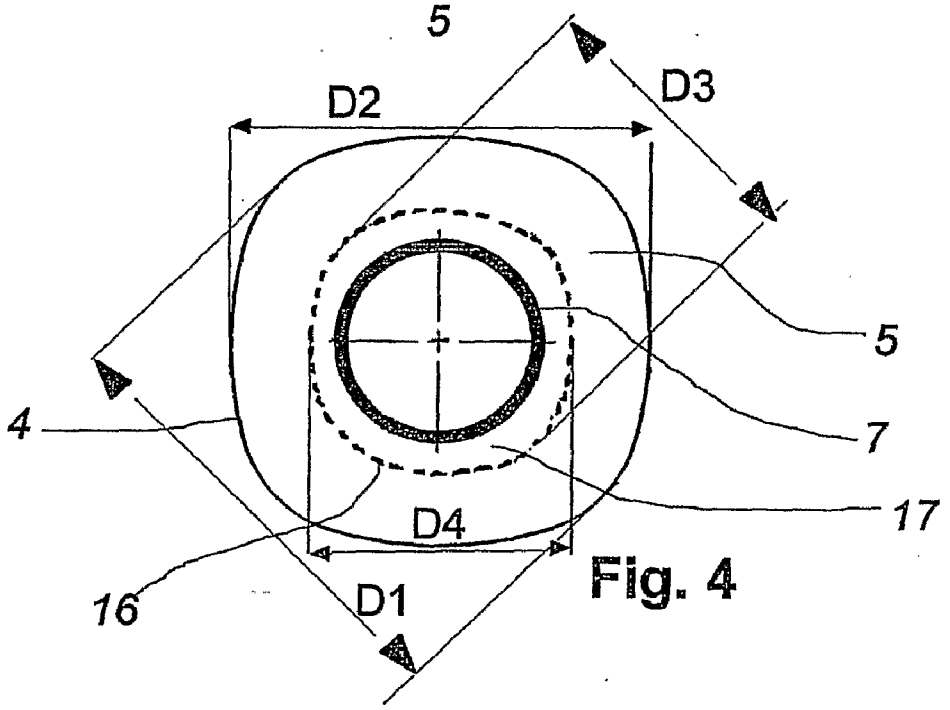


Fig. 4

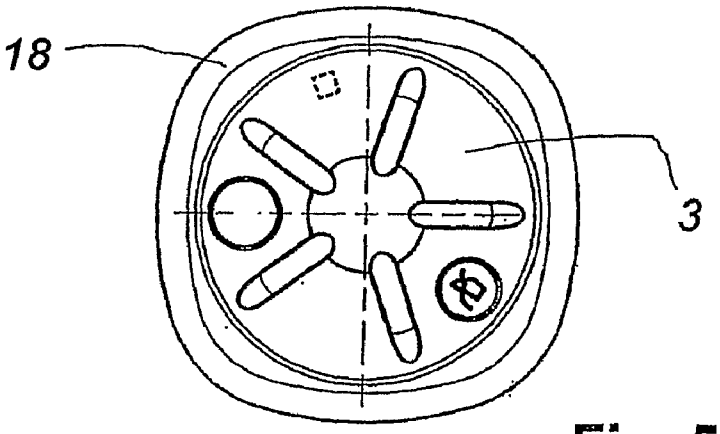


Fig. 5

PLASTIC BOTTLE AND PROCESS FOR AFFIXING A SHRINKABLE LABEL THEREON

FIELD OF THE INVENTION

[0001] The present invention relates to a plastic bottle, suitable to be covered with a sheet of shrinkable plastic material, and to a process to cover said bottle.

PRIOR ART

[0002] A problem occurring in the field of containers for foods, and more particularly in the plastic bottle field, is how to protect the content from external agents, as well as from the loss of components through the walls of the bottle, for example carbon dioxide in carbonated drinks. Among the external agents that cause worsening in the taste and nutritional properties of the content are oxygen and light, both ultraviolet and visible; for example, foods such as milk are particularly susceptible to the action of light, which even in just two days causes deterioration of the proteins which imparts a typical disagreeable flavour. Moreover, light, especially at wavelengths ranging from 200 to 800 nm, causes the destruction of some vitamins typical of these foods. For this reason bottles are commonly made of thermoplastic materials (such as PVC and PET) covered with a heat-shrinkable plastic film. The film provides adequate barrier properties for gases such as oxygen and carbon dioxide and against physical agents such as ultraviolet and visible light. For example, it is often considered necessary to screen light with a wavelength ranging from 200 to 800 nm in particular. Different types of film are used. These can be films with several layers, for example co-extruded, of different thermoplastic materials or of the same material treated in different ways, for example a layer of expanded material and one or two layers of non-expanded material. Often the outermost layer is printable: in fact, the covering can have the functions of a label.

[0003] The covering film is shaped like a sleeve, for example by extrusion thereof directly in this shape or by joining two sides of a film in an appropriate way, for example by gluing or heat-sealing. A cylinder of this film is suitably positioned around the bottle, for a height adequate for the covering to be obtained, for example by gluing the two edges of a film surrounding the body of the bottle. Usually, the bottle has a lower part, also called body, with a more or less constant section except for projections or grooves, and an upper part which tapers towards the neck of the bottle. The shrinkable film can also cover this part, providing the height of the film is adequate. Application of heat causes the film to shrink, adapting to the surface of the bottle, comprising the upper tapered part, if required. There are different ways of applying heat, for example hot air can be blown, for example at 250° C. for 5 seconds, while the bottle is made to rotate.

[0004] Some plastic bottles have a body with a section which is not round, for example a quadrilateral section, with rounded edges; this type of bottle is appreciated, as well as for aesthetic reasons, also due to the fact that more bottles can be stored in a smaller space compared to bottles with a round section, containing the same volume of liquid. In this case, the tapered part also usually has a similar section to the body and must be connected to the cylindrical neck of the bottle in a suitable way.

[0005] A problem with this type of bottle lies in the fact that the tapered part and the connection area are usually critical areas as regards adhesion of the shrinkable film. This is because, in the direction along the longitudinal axis of the bottle, usually an axis of symmetry, the length to be covered differs at the edges of the quadrilateral section with respect to the centre of the sides. This determines poor adhesion of the film in the part below the neck of the bottle, where shrinkage must be maximum, causing non-uniform thickness of the covering and the possible formation of creases.

[0006] Therefore, the object of the present invention is to identify forms of plastic bottles having a body with a section which is not round, for example triangular or quadrilateral, which allows good adhesion of the covering also on the tapered part and also extending in proximity to the cylindrical neck, that is, in the areas above the body of the bottle.

SUMMARY OF THE INVENTION

[0007] The problem set forth above has been solved, according to the present invention, by means of a plastic bottle having a longitudinal axis, a body with a cross section which is not round, an essentially cylindrical neck, a tapered part starting from said body and interposed between said body and said neck, wherein the boundary between said body and the tapered part has convexities facing in a longitudinal direction towards said neck in the points in which it is at a minimum distance from said longitudinal axis, and facing in the opposite direction in the points in which it is at a maximum distance from said longitudinal axis.

[0008] Preferably said body has an essentially parallelepiped form, therefore with a base of a form which is not round. It can be a parallelepiped with an essentially polygonal base, preferably quadrilateral, more preferably square and preferably with rounded edges.

[0009] According to a preferred aspect, the tapered part is a convex surface. It is preferably a surface of revolution about the longitudinal axis, or it can have a cross section similar in form to the cross section of the body, but less accentuated, at said boundary.

[0010] The invention therefore relates to a bottle, as described above, which allows perfect covering thereof with a heat-shrinkable film with uniform thickness and without the possible formation of creases in said film, and to a process to cover said bottle.

LIST OF FIGURES

[0011] FIG. **1** schematically represents a front view of a bottle according to the present invention.

[0012] FIG. **2** schematically represents a view rotated through 45° with respect to the longitudinal axis of the bottle in FIG. **1**.

[0013] FIG. **3** schematically represents a longitudinal sectional view of the detail in FIG. **2** enclosed in the circle A.

[0014] FIG. **4** schematically represents a plan view of a bottle, sectioned at the cylindrical neck below the finish, according to a different aspect of the invention.

[0015] FIG. **5** schematically represents a bottom view of a bottle according to the present invention.

DETAILED DESCRIPTION OF AN EMBODIMENT OF THE INVENTION

[0016] FIG. **1** shows a front view of a bottle according to the present invention. It has a longitudinal axis **1**, which, preferably, is essentially an axis of symmetry of the bottle; in the present description, unless otherwise specified, cross section is intended as a section according to a plane perpendicular to said axis **1**, while longitudinal section is a section according to a plane containing said axis **1**.

[0017] The bottle comprises a body **2**, as said with a cross section which is not round, in the case specified essentially squared (a certain convexity of the sides towards the outside is possible), with rounded edges. This can be appreciated by comparing FIG. **1** with FIG. **2**, where rotation through 45° makes it possible to observe the maximum width D**1** of the body **2**, while in FIG. **1** the minimum width D**2** is shown. The body **2** extends between a base **3**, which closes it at the bottom and has a form and characteristics which can be of a known type, and the tapered part **5** from which it is delimited by the boundary **4**, which can, for example, be a more or less rounded edge, a projection or a groove. The cross section of the body **2** is preferably essentially constant along the axis **1**. It is understood that in any case there may be narrowings or widenings due, for example, to grooves or projections, such as the grooves **6**, or other elements, such as contoured areas to facilitate grip, writing or decorative elements, which are commonly found on plastic bottles. The bottle has an essentially cylindrical neck **7**, at the end of which is an opening **8** to gain access to the content. There may be other structures such as the finish **9**, a more or less flanged shaped annular projection which is usually provided around the neck of many types of plastic bottle, the thread **10** to allow screwing of a cap, and any others deemed suitable.

[0018] The tapered part **5** starts from the boundary **4**, between the body **2** and the neck **7**. According to a preferred aspect, this tapered part **5** has the form of a surface of revolution. This determines the typical course of the boundary **4** between the tapered part and the body **2**, with the convexities **11** facing upward in a longitudinal direction, namely towards the end of the bottle with the neck **7**, where the wall of the bottle is at a minimum distance from the axis **1**, that is, in the case of a body **2** with a polygonal section, in the middle of the sides, and the convexities **12** facing downward, that is towards the base **3** of the bottle, where the wall of the bottle is at the maximum distance from the axis **1**, that is at the edges **13** of the body **2**. The convexities **12** can be shaped as a consequence of the radius of curvature of the edges **13** which are preferably rounded; they will tend to become cusps if the edges **13** are sharp.

[0019] According to another aspect of the invention it is possible that the tapered part **5** is not a surface of revolution or at least not for its entire extension. In this case, it can preferably have a cross section, at the area involved by the boundary **4**, similar to the cross section of the body **2**, for example essentially polygonal, in particular quadrilateral, with convex sides towards the outside and with rounded edges, although less accentuated, which means curvature of the sides, convex towards the outside, more marked and edges more rounded; this produces an intermediate form between the form of the cross section of the body **2** and a circular form. This again determines a course of the boundary **4** as described above, but less accentuated than in the case of a tapered part **5** having the form of a surface of revolution. The tapered part **5** can have an increasing inclination with respect to the axis **1** as it approaches the neck **7**, that is being essentially convex, naturally with the exception of grooves or other elements as already mentioned for the body **2**.

[0020] Advantageously, between the neck **7** and the tapered part **5**, is a concave and rounded connection area **15**, with a radius of curvature R**1**. Particularly advantageous results have been obtained with particular types of covering films for values of the radius of curvature R**1** that are greater than zero and less than or equal to 8 mm.

[0021] Preferably, a truncated cone shaped part **17** is produced in the variant of bottle in which the tapered part **5** has a form which is not a surface of revolution. The truncated cone shaped part **17** is interposed between the tapered part **5** and the neck **7**, or between the tapered part and the area **15**.

[0022] FIG. **4** represents a top view of a bottle with the tapered part **5** with a cross section similar to the section of the body **2**, as described above. The lower limit of the truncated cone shaped part **17** is indicated with the dashed line **16**. It is observed that it can also have a form similar to the cross section of the tapered part **5**, to allow connection. In particular, said lower limit will have a maximum width D**3** and a minimum width D**4**. Preferably, the following relation will be valid: $0.6 \leqq (D2-D4)/(D1-D3) \leqq 1$.

[0023] The truncated cone shaped part **17** is preferably inclined so that a plane tangent thereto forms with the axis **1** an angle α ranging from 30° to 90°. Moreover, with coverings suitable to withstand shrinkages from 20% to 60% of the diameter, values are preferred in which: $0.1 \leqq (D1-D3)/D1 \leqq 0.8$ and $0.1 \leqq (D2-D4)/D2 \leqq 0.8$. In the case in which the tapered part **5** is a surface of revolution, it is possible that D**3**=D**4**. This is also possible in the case in which a regular truncated cone shaped part, with a circumference as base, is present.

[0024] In an advantageous variant, the point of maximum inclination of the tapered part **5** is immediately below the neck **7**, or the area **15** if present, and is such that the plane tangent in that point, as shown in FIG. **3**, forms an angle α with the axis **1** ranging from 30° to 90°.

[0025] If the covering is to be applied up to the neck **7**, it is preferable, immediately below this point of maximum inclination, for the tapered part **5** to have a longitudinal section with a radius of curvature R**2** below 15 mm, to obtain, in a very restricted area below the neck **7**, a variation in the profile of the wall of the bottle from concave to convex, through a point of inflection coinciding with said point of maximum inclination, so as to essentially define an S-shape and therefore form a sort of "shoulder", which reduces the risk of the covering slipping, in consideration of the fact that there must be maximum shrinkage in this area.

[0026] With all the modalities described above the external form of the bottle is improved preventing the formation of creases and wrinkles in the covering in the area below the neck **7**.

[0027] The bottle can be produced in any thermoplastic material considered suitable, such as PVC, PET and the like, according to any known art, such as blow moulding.

[0028] The invention also relates to a bottle covered with a heat-shrinkable film. The covering can include the body **2** and preferably all or part of the tapered part **5**. The tapered part **5**, as described above, allows high-quality and uniform adhesion of the covering thereon, also for bottles the body of which is not circular, solving the problems indicated above. The presence of the truncated cone shaped part **17** and/or the "shoulder" formed by the accentuated curvature of radius R**2** below the neck **7**, moreover, has the advantage of providing fixing for the covering if it extends up to the neck **7**, preventing slipping or non-uniform tightness even in this critical area.

[0029] The covering can extend from the base **3** or in any case involve part of the rounded connection area **18** which joins the base **3** to the body **2**, providing improved fixing, as is usually the case.

[0030] The covering can be made of a known thermoplastic material. For example, it can be constituted by a film comprising several layers, one of which is expanded: plastic materials which can be used can be polyolefins, polystyrenes and the like, with additives and pigments to provide barrier properties against light and atmospheric agents. Purely by way of example, a film with three co-extruded layers can be used, wherein the intermediate layer is expanded polystyrene and the other layers are non-expanded polystyrene, the innermost of which is black and the outermost of which is printable. The film can, for example, have a thickness of around 120 μm, with the inner expanded layer having a thickness of around 100 μm. The film can be wound around the bottle and glued or sealed by two edges, to create a cylinder around the bottle, coaxial therewith for an adequate height. It is shrunk in a known way, for example using hot air. It is also possible to start with a cylinder of film pre-formed by extrusion.

[0031] Those skilled in the art can easily make the choice of materials to employ to produce the bottle and the covering, and also of the process conditions.

1. Plastic bottle having a longitudinal axis (**1**), a body (**2**), a cross section substantially polygonal with three of four sides, a neck (**7**) essentially cylindrical in form, a tapered part (**5**) connecting the body (**2**) to the neck (**7**), characterized in that a boundary (**4**) between said body (**2**) and the tapered part (**5**) has convexities (**11**) facing in a longitudinal direction towards said neck (**7**) in the points in which it is at a minimum distance from said longitudinal axis (**1**), and convexities (**12**) facing in the opposite direction in the points in which it is at a maximum distance from said longitudinal axis (**1**), and in that below the neck (**7**) said tapered part (**5**) has a portion with convex curvature with radius of curvature R**2** below 15 mm.

2. Bottle as claimed in claim 1, wherein said body (**2**) has rounded edges (**13**).

3. Bottle as claimed in any of the previous claims, wherein said tapered part (**5**) has the form of a surface of revolution, at said boundary (**4**).

4. Bottle as claimed in claim 1 or 2, wherein said tapered part (**5**) has a cross section, at said boundary (**4**), with a form corresponding to the cross section of said body (**2**), but less accentuated.

5. Bottle as claimed in any of the previous claims wherein said tapered part (**5**) is ogival.

6. Bottle as claimed in claim 5, wherein said tapered part (**5**) comprises a truncated cone shaped part (**17**) in proximity to said neck (**7**).

7. Bottle as claimed in claim 6, wherein said truncated cone shaped part (**17**) is inclined so that a plane tangent thereto forms with said longitudinal axis (**1**) an angle ranging from 30° to 90°.

8. Bottle as claimed in claim 6 or 7, wherein said truncated cone shaped part (**17**) has a maximum width D**3** and a minimum width D**4** in which $0.6 \leqq (D2-D4)/(D1-D3) \leqq 1$, where D**1** is the maximum width and D**2** the minimum width of said body (**2**).

9. Bottle as claimed in any of claims 1 to 5, wherein the maximum inclination of the ogival part (**5**) is such that a plane tangent in the point of maximum inclination forms with said longitudinal axis (**1**) an angle ranging from 30° to 90°.

10. Bottle as claimed in any of the previous claims wherein immediately below the neck (**7**) said tapered part (**5**) has a portion (**15**) with concave curvature with radius of curvature R**1** greater than zero and less than or equal to 8 mm.

11. Bottle as claimed in any of the previous claims wherein a covering with a heat-shrinkable film is provided.

12. Bottle as claimed in claim 11, wherein said covering with said film includes at least a portion of said tapered part (**5**).

13. Bottle as claimed in claim 12, wherein it is covered with said film up to the neck (**7**).

14. Process to cover a plastic bottle comprising the steps of:

positioning a heat-shrinkable film around a bottle as claimed in any of claims 1 to 10;

causing shrinkage of the film by applying heat, so that it adheres to the bottle.

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