A closure assembly comprising a closure spout adapted to be fitted to the neck of a container and a closure cap. The closure spout comprises a dispensing opening. The closure cap comprises an upper wall and a skirt depending therefrom, adapted to be fitted to the closure spout to close the container, especially for use on pressurized containers such as carbonated beverage containers. At least one substantially continuous second retaining arrangement on said closure spout has one or more elongate second retaining segments. The lower second retaining surface has no pitch or at least a relatively lower pitch in a first region, a relatively higher pitch in a second region displaced from the first region in an unscrewing direction, and no pitch or at least a relatively lower pitch in a third region displaced from said second region in an unscrewing direction.
CLOSURE ASSEMBLY FOR A CONTAINER


[0002] The present invention relates to a closure assembly according to the preamble of the independent claims. The assembly comprises a closure spout and a closure cap. The closure spout is adapted to be fitted to the neck of a container and comprises a dispensing opening. The closure cap comprises an upper wall and a skirt depending therefrom, adapted to be fitted to the closure spout to close the container, especially for use on pressurized containers such as carbonated beverage containers.

[0003] In recent times, the use of so-called sport caps has increased. Sport caps differ from the more traditional so-called single caps in that they are adapted to provide a dispensing outlet for directly drinking from. Generally, they have two areas of sealing: i) between the closure and the container neck (similarly to single caps); and ii) between two or more parts of the closure. The two or more parts of the closure may include, for example, a spout with an outlet or dispensing opening adapted to be used for directly drinking from. Such sport caps permit people to have their beverages in an “on the go drinking” and especially an athlete, particularly a cyclist, to drink during sports activity.

[0004] There is a desire to provide sport caps also for carbonated beverages, which need demanding closures due to the internal pressure in the container. The internal pressure may become especially high in the case of sport caps, since a container being moved during a sports activity leads to an augmented degassing of the contained beverage.

[0005] Currently commercially mass-produced carbonated beverage containers use threads on the container and on the single-cap closure of the continuous, helical type. The threads comprise a single, substantially continuous thread portion on the container neck with a low thread pitch angle, typically less than 50°. The low pitch angle is needed in order to ensure that the closure does not unscrew spontaneously under pressure from inside the container. The low pitch of the helical threads also means that the closure typically needs to be rotated through more than 360° to disengage it completely from the container neck. Whilst this can be laborious, especially for weaker users such as elderly people or children, it also permits some gas venting to take place while the closure is being unscrewed, and thereby reduces the risk that the closure will blow off uncontrollably once unscrewing of the closure from the container neck has commenced. This gas venting is usually assisted by the provision of axial gas venting notches extending longitudinally through the helical threads.

[0006] EP0668358 proposes a neck and a single-cap closure which are constructed and arranged to provide a vent for venting gas from the container neck at least when the closure is in an intermediate position. The closure comprises means for blocking or restricting rotation beyond the intermediate position when there is an axial pressure in a direction emerging from the container neck. These means are part of the screw thread as well of the container neck as of the closure. Thus, the proposed solution can only be implemented for specifically adapted containers.

[0007] The arrangements described above generally are not suitable for use with standard container filling apparatuses using, for example, standard (PCO neck finish) PET bottles and standard profile closure caps which are screwed onto the bottles and removed therefore by unscrewing and breaking a tamper evident ring.

[0008] It is the aim of the present invention to provide a solution which avoids the disadvantages of the prior art, which in particular provides a sport cap also suitable for carbonated beverages and for which a modification to industry-standard bottles is not necessarily required.

[0009] Accordingly, the invention provides a closure assembly comprising a closure spout adapted to be fitted to the neck of a container and a closure cap adapted to be fitted to the closure spout to close the container. The closure spout comprises a dispensing opening.

[0010] Preferably the closure spout has a narrow cylindrical neck with a smooth and slightly rounded lip to permit drinking directly from the container.

[0011] The closure cap comprises an upper wall and a skirt depending therefrom.

[0012] The closure cap has a first retaining arrangement comprising one or more elongate first retaining segments. Each first retaining segment has upper and lower first retaining surfaces.

[0013] In this context “upper” means directed away from the container when the assembly is applied to the container and, “lower” means directed towards the container when the assembly is applied to the container.

[0014] The closure spout has at least one substantially continuous second retaining arrangement comprising one or more elongate second retaining segments. Each second retaining segment also has upper and lower second retaining surfaces.

[0015] The lower second retaining surface has no pitch or at least a relatively lower pitch in a first region, a relatively higher pitch in a second region placed from the first region in an unscrewing direction and no pitch or at least a relatively lower pitch in a third region placed from said second region in an unscrewing direction.

[0016] As a matter of course, the present invention shall be understood as also implying a closure assembly wherein the first retaining arrangement is on the closure spout and a substantially continuous second retaining arrangement is on the closure cap.

[0017] Since the pitch of the second retaining surface is different in three different regions there is a different axial interaction between the first and the second retaining elements in the different regions. A lower pitch provides for a stronger axial interaction which may prevent a sudden unintentional removing of the closure cap in case there is internal pressure. On the other hand, there is also a region with a higher pitch, the rotation angle for opening the cap is smaller as compared with a low pitch thread.

[0018] The closure cap may be removed in a controlled way, especially in a first opening phase, when for the first time gas may escape from the container and a third phase, just before the closure cap is completely unscrewed.

[0019] The closure spout may be adapted to fit to the container in any intended way, for example having a screw thread being suitable for standard container necks.

[0020] Preferably the second retaining arrangement comprises a lower stopping area adjacent to said first region which provides a stopping abutment surface. Correspondingly the
first retaining arrangement comprises a corresponding lower abutment surface on at least one of said first segments, which abuts against said lower stopping area to block or restrict rotation of said closure cap in the direction of screwing on (hereinafter screwing direction) to define or to support the fully secured position.

[0021] The contact between the lower abutment surface of the closure cap and the stopping abutment surface of the closure spout prevents the closure cap from being overtightened when applied to the closure spout. There is the risk that a cap which is overtightened may not be removed from the closure spout in a controlled manner. Over tightening also bears the risk of disengaging the retaining elements and thus the risk of a sudden blow off.

[0022] Additionally or alternatively the second retaining arrangement comprises an upper stopping area adjacent to said third region which provides a stopping abutment surface. Correspondingly the first retaining arrangement comprises a corresponding upper abutment surface on at least one of said first segments which abuts against the upper stopping area to block or restrict rotation of said closure cap in the screwing direction to define or to support the fully secured position. Such an upper area provides for an even better protection against overtightening.

[0023] The stopping abutment surface may be part of the lower second retaining surface, may pass into the lower second retaining surface or may be a separate surface. The stopping abutment surface preferably tends to a rotational direction, more preferably the stopping abutment surface normal is perpendicular to the main axis of the closure assembly.

[0024] In a preferred embodiment of the invention said lower second retaining surface further comprises a blocking step adjacent to said third region to provide a blocking abutment surface. The first retaining arrangement comprises a corresponding blocking abutment surface on at least one of said first segments which abuts against said blocking step to block or restrict rotation of said closure in an unscrewing direction at an intermediate position when said closure cap is under axial pressure in a direction emerging from the closure spout.

[0025] Preferably said closure spout and closure cap are constructed and arranged to provide a vent for venting gas from said container at least when said closure cap is in said intermediate position.

[0026] More preferably said closure spout and closure cap are constructed and arranged to enable said step and said first retaining segments to be moved out of engagement by axial displacement of the closure cap downwardly, i.e. towards the container, on said closure spout at said intermediate position.

[0027] Such an arrangement is therefore responsive not only to internal pressure acting on the closure cap, but also to external pressure applied by the person unscrewing the closure cap.

[0028] The greater the internal pressure is, the bigger is the force needed to press down and the more difficult it is to unscrew the closure cap. Thus the arrangement is a safety feature.

[0029] The closure cap will be held at the intermediate position until the internal pressure has reduced to a low level at which the closure cap may be easily pressed downwards.

[0030] Furthermore, should the closure begin to spin uncontrollably when it is first unscrewed, the arrangement will act to hold the closure at the intermediate position until the pressure is reduced.

[0031] Preferably at least a part of the lower surface and/or the stopping abutment surface in the first region of the second retaining segment forms a matching fit with at least a part of said upper surface and/or the corresponding abutment surface on one of said first retaining segments when the closure is fully secured on the closure spout.

[0032] Additionally or alternatively at least a part of the lower surface and/or the stopping abutment surface in said third region of the second retaining segment forms a matching fit with at least a part of the upper surface and/or the corresponding abutment surface on one of said first retaining segments when the closure cap is fully secured on the closure spout.

[0033] Preferably at least a part of the lower surface of the second retaining segment in the third region forms a matching fit with at least a part of the upper surface of the first segment surface when the closure cap is at said intermediate position and outwardly displaced on said closure spout.

[0034] The matching fit between parts of the first and second retaining arrangements provides for a reliable contact area, securing the closure cap in an axial direction and preferably also in a rotational direction.

[0035] In an embodiment of the invention at least one of the first retaining segments comprises a back off cam arranged on the upper first retaining surface which abuts against a blocking step of the second retaining arrangement to block or restrict rotation of said closure in an unscrewing direction on the basically fully secured position.

[0036] The back off cam provides for a resistance against simply starting to open the closure cap by turning it, especially in case there is an internal pressure.

[0037] In particular the back off cam may prevent a self-opening of the closure cap, for example during a transport of the container. An axial force from the inside of the container together with an accidental torque due to for example an external vibration would not be sufficient to open the closure cap.

[0038] The back off cam may be constructed and arranged so as to get over the restriction relatively easily when opening torque is applied by a user, especially in case the closure assembly comprises further safety features as described above.

[0039] Preferentially the first retaining arrangement is constructed and arranged such that when the closure cap is fully secured on the closure spout the first retaining arrangement contacts both the first and third regions of the second retaining arrangement to provide a holding force in the axial direction.

[0040] The first retaining arrangement may comprise retaining segments having an adequate rotational length to contact both the first and third regions of the second retaining arrangement. Alternatively the first retaining arrangement may comprise at least two axially displaced retaining segments whereof one contacts a first retaining region and a second one contacts a third retaining region in the fully secured position.

[0041] Since in the first and third regions of the second retaining arrangement the segments have no pitch or have at least a lower pitch than in the second region, the contact between the first retaining segments and the first and third regions of the second retaining arrangement, primarily provides for an axial holding force. The axial force is necessary to hold the closure cap at the closure spout, especially when an internal pressure arises due to degassing of the beverage.
Using both regions with no pitch increases the holding force.

In a preferred embodiment of the invention the first retaining arrangement comprises at least one retaining segment with both an upper abutment surface and a back off cam, preferably additionally an upper surface which provides for an axial force towards the second retaining arrangement when the closure cap is in the fully secured position, preferably with no pitch.

Preferably the upper abutment surface is displaced in the unscrewing direction from the back off cam. The back off cam is arranged on the upper retaining surface. The upper abutment surface may be formed as a continuation of the upper retaining surface, arranged at an angle to said upper retaining surface.

Thus one retaining segment may have multiple functionalities: it prevents unintended self-opening by the back off cam, it provides for a defined fully secured position by the upper abutment surface and it also provide for an axial holding force by a mainly horizontal upper retaining surface.

The closure spout is meant to remain fixed on the container when the closure assembly is opened and the closure cap is removed from the closure spout.

Moreover in order to allow a comfortable opening of the closure assembly the closure spout should be blocked from rotating with respect to the container. A torque applied to the closure assembly should only act on the closure cap.

Therefore the closure spout may be fixed to the container basically inseparably, for example by a snap fit, an adhesive or a welded bond.

Advantageously the closure spout is adapted to be screwed on a container. Preferably the closure spout comprises anti-rotational elements, which block or prevent rotation of said closure spout in the unscrewing direction, when the closure spout is fully secured on the container. Preferably rotational elements may be formed as ribs adapted for interaction with venting slots and/or thread ends in a screw thread of a standard container neck.

With this solution the closure assembly may be used for standard container necks.

Preferably the first region extends for 5°-40° about the circumference of the closure spout and/or the second region extends for 20°-90° about the circumference of the closure spout and/or the third region extends for 5°-40° about the circumference of the closure spout.

Favourably the pitch of the lower second retaining surface in the first region is in the range -5° to 10° and/or the pitch of the lower second retaining surface in the second region is in the range 5° to 25° and/or the pitch of the lower second retaining surface in the third region is in the range -5° to 10°.

Advantageously the pitch of the lower second retaining surface in the first region is equal or at least similar to the pitch of the lower second retaining surface in the third region.

Most preferably the lower second surface in the first region and in the third region has no pitch. This provides for an optimal axial holding force and additionally prevents spontaneous opening.

Preferably the second region is adjacent to the first region and/or to the third region of the lower second retaining surface. More preferably at least one second retaining segment comprises basically three sections, wherein the first section corresponds to the first region with no pitch or a lower pitch, the second section corresponds to the second region with a higher pitch and the third section corresponds to the third region with also no pitch or a lower pitch. There may additionally be a lower stopping area adjacent to the first region and an upper stopping area adjacent to the third region.

The closure assembly may further comprise means to form a seal between a the container neck and the closure assembly when the closure cap is fully engaged on the closure spout. Preferably there are two areas of sealing, that is on the one hand between the closure spout and the container neck and on the other hand between the closure spout and the closure cap.

A rim of the neck of the closure spout may abut sealingly against the inside of the closure cap, in particular against one or more sealing lips of the closure cap.

Additionally or alternatively other seals may be formed between the container neck and the closure spout as well as between the closure spout and the closure cap, such as elastomer layers, interference fit seals, O-ring seals or plug seals, the sealing means sealing against the inner, top or outer surface of the container neck or spout neck.

The closure assembly may further comprise a tamper-evident ring attached to the skirt portion of the closure cap. First unscrewing the closure cap causes the closure cap and the tamper-evident ring to at least partially separate.

The closure assembly may also comprise a tamper-evident ring attached to the closure spout. Removing the closure spout causes the closure spout and the tamper-evident ring at least partially to separate.

The closure assembly of this invention may comprise only single start retaining arrangements, or it may preferably comprise multi-start retaining arrangements.

Preferably at least one of said first and second retaining arrangements has at least two arrangement starts, more preferably four arrangement starts.

Favourably the arrangement starts are equally distanced around the circumference, such that the force for axially holding and rotationally restricting is equally distributed, which supports a reliable closing and a comfortable opening.

In an advantageous embodiment of the invention the first retaining arrangement comprises two groups of retaining segments, whereof the first group comprises at least one retaining segment with a lower abutment surface and/or a blocking abutment surface and the second group comprises at least one retaining segment with an upper abutment surface and/or a back off cam and/or a mainly horizontal upper surface.

The retaining segments of the first group and the second group typically are axially displaced from each other, in particular, the retaining segments of the first group (lower first retaining segments) are arranged on a first axial plane, which is lower than a second axial plane on which the retaining segments of the second group are arranged (upper first retaining segments).

In the fully secured position the lower first retaining segments engage with the first region of the lower surface of the second retaining arrangement and the upper first retaining segments engage with the third region of the lower surface of the second retaining arrangement.

Preferably the lower second surface in the first region has no pitch. Correspondingly the lower first retaining
segments also have an upper surface with no pitch and are basically arranged horizontally around the skirt of the closure cap.

[0068] Preferably the closure cap can be moved from a fully released to a fully engaged position on the closure spout by a single smooth rotation through 360° or less, preferably through 180° or less, most preferably through about 90° or less.

[0069] Furthermore the invention provides a container and a closure assembly as described above.

[0070] Further benefits and advantages of the present invention will be described in the description and with reference to the following drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0071] FIG. 1 is a perspective view of a first example of a closure spout;
[0072] FIG. 2 is a cross section view of a closure cap;
[0073] FIG. 3a is a perspective view of the closure spout shown in FIG. 1 in interaction with a first retaining arrangement in the fully closed position;
[0074] FIG. 3b is a perspective view of a second example of a closure spout in interaction with a first retaining arrangement in the fully closed position;
[0075] FIG. 4 is an enlarged fragmentary view of the closure spout shown in FIG. 1 in interaction with a first retaining segment in an intermediate degassing position;
[0076] FIG. 5 is an enlarged fragmentary view of the closure spout shown in FIG. 1 in interaction with a first retaining segment in an intermediate position after degassing;
[0077] FIG. 1 is a perspective view of a closure spout I. The closure spout comprises a dispensing opening 2 and a narrowed cylindrical neck 3 with a smooth and slightly rounded rim 4.

[0078] The closure spout 1 has a substantially continuous second retaining arrangement 5 comprising four elongate second retaining segments 6 evenly distributed around the circumference. Each second retaining segment 6 has an upper second retaining surface 7 and a lower second retaining surface 8.

[0079] The lower second retaining surface has no pitch in a first region 9, a relatively high pitch in a second region 10 displaced from the first region in an unscrewing direction and no pitch in a third region 11 displaced from said second region 10 in an unscrewing direction.

[0080] The second retaining arrangement 5 comprises a lower stopping area 12 adjacent to said first region 9 which provides a stopping abutment surface 13, the respective surface normal having a direction in a plane perpendicular to the axis (hereinafter referred to as horizontal).

[0081] The second retaining arrangement 5 further comprises an upper stopping area 14 adjacent to said third region 11 which provides a further stopping abutment surface 15, the surface 15 including an angle β with the axial direction 29.

[0082] The second retaining arrangement 5 further comprises a blocking step 16 adjacent to said third region 11 to provide a blocking abutment surface 17, the respective surface normal having a horizontal direction. The blocking step 16 also provides a lower retaining surface 8a.

[0083] FIG. 2 is a cross sectional view of a closure cap 100.

[0084] The closure cap 100 comprises an upper wall 101 and a skirt 102 depending therefrom. On the inside of the upper wall 101 the closure cap 100 comprises sealing means 103, formed by an outer seal 104, a top seal 105 and a plug seal 106.

[0085] A tamper-evident ring 107 is attached to the skirt portion 102 of the closure cap 100. A first unscrewing of the closure cap causes the closure cap and the tamper-evident ring to separate.

[0086] The closure cap 100 comprises a first retaining arrangement 18.

[0087] The first retaining arrangement 18 comprises upper first retaining segments 19 and lower first retaining segments 20.

[0088] The lower first retaining segments 20 are arranged basically horizontally in the same axial plane.

[0089] The axial distance between the lower first retaining segments 20 and the upper first retaining segments 19 depends upon the axial thickness of the second retaining segment 6. The distance is typically bigger than the axial thickness of the segment 6 at its upper horizontally running end and less than twice its axial thickness (see also FIG. 4). The distance typically may be between 1 to 3 mm.

[0090] The horizontal length of each lower first retaining segment 20 is between 80 and 120% of the length of the first region or it has typically an angular extension in the circumferential direction of between 15 and 30°. For a closure with a 30 mm diameter the horizontal length typically may be 3 to 7 mm. The maximal axial length is between 0.7 and 2.5 mm.

[0091] Each upper first retaining segment 19 has an upper first retaining surface 21a and a lower first retaining surface 22a, and each lower first retaining segment 20 has an upper first retaining surface 21b and a lower first retaining surface 22b.

[0092] The lower first retaining segments 20 comprise a lower abutment surface 23 with a mainly horizontally directed surface normal.

[0093] The upper first retaining segments 19 comprise an upper abutment surface 24. The upper abutment surface 24 includes an angle α, which is between 120° and 160°, with the upper first retaining surface 21a.

[0094] The lower first retaining segments 20 comprise a blocking abutment surface 25 with a mainly horizontally directed surface normal.

[0095] The upper first retaining segments 19 comprise a back off cam 26 arranged on the upper retaining surface 21a. The back off cam 26 has a rounded upper surface to provide for a relatively easy opening when a torque is applied by a user.

[0096] FIG. 3a is a perspective view of a closure spout I in interaction with a first retaining arrangement 18 in the fully closed position. The figure only schematically shows the first retaining arrangement of a closure cap 100 the rest of which is not fully shown in this figure.

[0097] The lower abutment surface 23 abuts against a lower stopping abutment surface 25 to block or restrict rotation of said closure cap in the screwing direction to define or to support the fully secured position.

[0098] The upper abutment surface 24 abuts against the upper stopping area 14 to block or restrict rotation of said closure cap 100 in the screwing direction also to define the fully secured position.

[0099] The back off cam 26 abuts against the blocking step 16 to block or restrict rotation of said closure 100 in an unscrewing direction at the fully secured position.
A part of the lower second retaining surface 8 and the stopping abutment surface 13 in the first region 9 of the second retaining segment 6 forms a matching fit 27 with at least a part of the upper surface 21a and the lower abutment surface 23 on the lower retaining segments when the closure cap 100 is fully secured on the closure spout 1.

The upper first retaining surface 21b is engaged with the lower surface 8a of the blocking step 16 to provide an additional axial holding force.

FIG. 36 is a perspective view of a second example of a closure spout 1a in interaction with a first retaining arrangement 18 in the fully closed position.

The closure spout 1a comprises a second blocking step 16a, wherein the back off cam 26 abuts against the blocking step 16a to block or restrict rotation of said closure 100 in an unscrewing direction at the fully secured position.

FIG. 4 is an enlarged fragmentary view of one of the second retaining segments 6 of the closure spout 1 in interaction with an upper first retaining segment 19 and a lower first retaining segment 20 in an intermediate degassing position.

The blocking abutment surface 25 of the lower first retaining segment 20 abuts against the blocking step 16 to block or restrict further rotation of said closure in an unscrewing direction at an intermediate position when said closure cap 100 is under axial pressure in a direction emerging from the closure spout 1.

A part of the lower surface of the second retaining segment 6 in the third region forms a matching fit 28 with at least a part of the upper surface of the lower first retaining segment 20 when the closure cap is at said intermediate position and outwardly displaced on said closure spout.

FIG. 5 is an enlarged fragmentary view of one of the second retaining segments 6 of the closure spout 1 in interaction with an upper first retaining segment 19 and a lower first retaining segment 20 in an intermediate position after degassing.

When the internal pressures relieve, the matching fit between the lower first retaining segment 20 and the second retaining segment 6 in the third region 11 releases, the closure cap 100 may be moved in axial direction 29 and in unscrewing direction 30 and the lower retaining segment 20 may pass the blocking step 16 of the second retaining segment 6.

The closure assemblies are typically made by injection or compression moulding from a plastic material such as polyethylene or polypropylene.

According to an example, a closure assembly comprises a closure spout adapted to be fitted to the neck of a container, the closure spout comprising a dispensing opening, and a closure cap comprising an upper wall and a skirt depending therefrom, adapted to be fitted to the closure spout for closing the container, a first retaining arrangement on said closure cap, said first retaining arrangement comprising at least one elongate first retaining segment, each first retaining segment having upper and lower first retaining surfaces; and at least one substantially continuous second retaining arrangement on said closure spout, said second retaining arrangement comprising at least one elongate second retaining segment, each second retaining segment having upper and lower second retaining surfaces, wherein the lower second retaining surface has no pitch or at least relatively lower pitch in a first region, relatively higher pitch in a second region displaced from the first region in an unscrewing direction, and no pitch or at least relatively lower pitch in a third region displaced from said second region in the unscrewing direction.

The second retaining arrangement can comprise a lower stopping area adjacent to said first region which provides a stopping abutment surface and the first retaining arrangement comprises a corresponding lower abutment surface on at least one of said first segments, which abuts against said lower stopping area to block or restrict rotation of said closure cap in an unscrewing direction to define the fully secured position and/or wherein the second retaining arrangement comprises an upper stopping area adjacent to said third region which provides a stopping abutment surface and the first retaining arrangement comprises a corresponding upper abutment surface on at least one of said first segments which abuts against the upper stopping area to block or restrict rotation of said closure cap in a screwing direction to define the fully secured position.

The lower second retaining surface can further comprise a blocking step adjacent to said third region to provide a blocking abutment surface and the first retaining arrangement comprises a corresponding blocking abutment surface on at least one of said first segments which abuts against said blocking step to block or restrict rotation of said closure in an unscrewing direction at an intermediate position when said closure cap is under axial pressure in a direction emerging from the closure spout.

In an example, at least a part of the lower surface and/or the stopping abutment surface in the first region of at least one second retaining segment forms a matching fit with at least a part of said upper surface and/or the corresponding abutment surface on one of said first retaining segments when the closure cap is fully secured on the closure spout and/or wherein at least a part of the lower surface and/or the stopping abutment surface in said third region of at least one of the second retaining segments forms a matching fit with at least a part of the upper surface and/or the corresponding abutment surface on one of said first retaining segments when the closure cap is fully secured on the closure spout.

At least a part of the lower surface of at least one of the second retaining segments in the third region can form a matching fit with at least a part of the upper surface on one of the first retaining segments when the closure cap is at an intermediate position and axially displaced in an upper direction on said closure spout.

The lower second retaining surface can further comprise a blocking step adjacent to said third region to provide a blocking abutment surface and at least one of the first retaining segments comprises a back off cam arranged on the upper retaining surface which abuts against said blocking step to block or restrict rotation of said closure cap in an unscrewing direction at the fully secured position, in particular when said closure cap is under axial pressure in a direction emerging from the closure spout.

The first retaining arrangement can be constructed and arranged such that when the closure cap is fully secured on the closure spout the first retaining arrangement contacts the first and third regions of at least one second retaining segment to provide a holding force in axial direction, in particular the first retaining arrangement comprises at least one lower first retaining segment engaging the first region of the lower second retaining surface of at least one second retaining segment and the first retaining arrangement comprises at least one upper first retaining segment engaging the
third region of the lower second retaining surface of at one least second retaining segment, wherein the lower first retaining segment and the upper first retaining segment are axially displaced.

[0117] The first retaining arrangement can comprise at least one integral retaining segment with an upper abutment surface and a back off cam, preferably additionally an upper surface which provides for an axial force towards the second retaining arrangement, preferably with no pitch.

[0118] The closure spout can be adapted to be screwed on a container and/or comprises anti-rotational elements, which block or prevent rotation of said closure spout in the screwing direction when the closure spout is fully secured on the container, in particular rotational elements adapted for interaction with venting slots in a screw thread of a standard container neck.

[0119] The first region can extend for 5°-40° about the circumference of the closure spout and/or the second region can extend for 10°-90° about the circumference of the closure spout and/or the third region can extend for 5°-40° about the circumference of the closure spout.

[0120] The pitch of the lower second retaining surface in the first region is in the range -5° to 10° and/or the pitch of the lower second retaining surface in the second region is in the range 5° to 25° and/or the pitch of the lower second retaining surface in the third region is in the range -5° to 10°.

[0121] According to an example, for a container closure assembly as described, at least one of said first and second retaining arrangements has at least two arrangement starts, preferably at least four arrangement starts.

[0122] The first retaining arrangement can comprise two groups of retaining segments, whereof the first group comprises at least one retaining segment with a lower abutment surface and/or a blocking abutment surface and the second group comprises at least one retaining segment with an upper abutment surface and/or a back off cam.

[0123] The closure cap can be moved from a fully released to a fully engaged position on the closure spout by a single smooth rotation through 360° or less, preferably through 180° or less, most preferably through about 90° or less.

[0124] According to an example, a closing assembly comprises a container and a closure assembly as described.

1-15. (canceled)

16. A closure assembly comprising:

- A closure spout adapted to be fitted to a neck of a container,
- The closure spout comprising a dispensing opening, and
- A closure cap comprising an upper wall and a skirt depending therefrom, adapted to be fitted to the closure spout for closing the container, a first retaining arrangement on said closure cap, said first retaining arrangement comprising at least one elongate first retaining segment, each first retaining segment having upper and lower first retaining surfaces; and at least one substantially continuous second retaining arrangement on said closure spout, said second retaining arrangement comprising at least one elongate second retaining segment, each second retaining segment having upper and lower second retaining surfaces, wherein the lower second retaining surface has no pitch in a first region, relatively higher pitch in a second region displaced from the first region in an unscrewing direction, and no pitch in a third region displaced from said second region in the unscrewing direction.

17. The closure assembly according to claim 16, wherein the second retaining arrangement comprises a lower stopping area adjacent to said first region which provides a stopping abutment surface and the first retaining arrangement comprises a corresponding lower abutment surface on at least one of said first retaining segments, which abuts against said lower stopping area to block or restrict rotation of said closure cap in a screwing direction to define a fully secured position and wherein the second retaining arrangement comprises an upper stopping area adjacent to said third region which provides a stopping abutment surface and the first retaining arrangement comprises a corresponding upper abutment surface on at least one of said first retaining segments which abuts against the upper stopping area to restrict rotation of said closure cap in the screwing direction to define the fully secured position.

18. The closure assembly according to claim 16, wherein said lower second retaining surface further comprises a blocking step adjacent to said third region to provide a blocking abutment surface and the first retaining arrangement comprises a corresponding blocking abutment surface on at least one of said first retaining segments which abuts against said blocking step to restrict rotation of said closure cap in the unscrewing direction at an intermediate position when said closure cap is under axial pressure in a direction emerging from the closure spout.

19. The closure assembly according to claim 17, wherein at least a part of the lower second retaining surface and the stopping abutment surface in the first region of at least one second retaining segment forms a matching fit with at least a part of the upper first retaining surface and the corresponding lower abutment surface on one of said first retaining segments when the closure cap is fully secured on the closure spout and wherein at least a part of the lower second retaining surface and the stopping abutment surface in said third region of at least one of the second retaining segments forms a matching fit with at least a part of the upper first retaining surface and the corresponding upper abutment surface on one of said first retaining segments when the closure cap is fully secured on the closure spout.

20. The closure assembly according to claim 18, wherein at least a part of the lower second retaining surface of at least one of the second retaining segments in the third region forms a matching fit with at least a part of the upper first retaining surface on one of the first retaining segments when the closure cap is at the intermediate position and axially displaced in an upper direction on said closure spout.

21. The closure assembly according to claim 16, wherein said lower second retaining surface further comprises a blocking step adjacent to said third region to provide a blocking abutment surface and at least one of the first retaining segments comprises a back off cam arranged on the upper first retaining surface which abuts against said blocking step to restrict rotation of said closure cap in the unscrewing direction at a fully secured position.

22. The closure assembly according to claim 21, wherein the back off cam is arranged on the upper first retaining surface which abuts against said blocking step to restrict rotation of said closure cap in the unscrewing direction at the fully secured position when said closure cap is under axial pressure in a direction emerging from the closure spout.

23. The closure assembly according to claim 16, wherein the first retaining arrangement is constructed and arranged such that when the closure cap is fully secured on the closure
spout the first retaining arrangement contacts the first and third regions of at least one second retaining segment to provide a holding force in an axial direction.

24. The closure assembly according to claim 23, wherein the first retaining arrangement comprises at least one lower first retaining segment engaging the first region of the lower second retaining surface of at least one second retaining segment and the first retaining arrangement comprises at least one upper first retaining segment engaging the third region of the lower second retaining surface of at least one second retaining segment, wherein the lower first retaining segment and the upper first retaining segment are axially displaced.

25. The closure assembly according to claim 16, wherein the first retaining arrangement comprises at least one integral retaining segment with an upper abutment surface and a back off cam.

26. The closure assembly according to claim 25, wherein the integral retaining segment further comprises an upper surface with no pitch which provides for an axial force towards the second retaining arrangement.

27. The closure assembly according to claim 16, wherein the closure spout is adapted to be screwed on the container and comprises anti-rotational elements, which restrict rotation of said closure spout in a screwing direction when the closure spout is fully secured on the container.

28. The closure assembly according to claim 27, wherein the anti-rotational elements are adapted for interaction with venting slots in a screw thread of a standard container neck.

29. The closure assembly according to claim 16, wherein the first region extends for 5°-40° about a circumference of the closure spout and the second region extends for 10°-90° about the circumference of the closure spout and the third region extends for 5°-40° about the circumference of the closure spout.

30. The closure assembly according to claim 16, wherein the pitch of the lower second retaining surface in the first region is in the range −5° to 10° and the pitch of the lower second retaining surface in the second region is in the range 5° to 25° and the pitch of the lower second retaining surface in the third region is in the range −5° to 10°.

31. The closure assembly according to claim 16, wherein at least one of said first and second retaining arrangements has at least two arrangement starts.

32. The closure assembly according to claim 16, wherein the first retaining arrangement comprises two groups of retaining segments, wherein the first group comprises at least one retaining segment with a lower abutment surface and a blocking abutment surface and the second group comprises at least one retaining segment with an upper abutment surface and a back off cam.

33. The closure assembly according to claim 16, wherein the closure cap can be moved from a fully released to a fully engaged position on the closure spout by a single smooth rotation through 360° or less.

34. The closure assembly according to claim 16, wherein the closure cap can be moved from a fully released to a fully engaged position on the closure spout by a single smooth rotation through 180° or less.

35. A closing assembly comprising a container and a closure assembly according to claim 16.