DESCRIPTION

The present invention relates to an integral over centre spring action hinge for connecting a generally arcuate cap periphery to the periphery of a correspondingly arcuate body portion.

The invention has been developed primarily for use in moulded flip top closures of the kind used in flowable material dispensing packages such as shampoo bottles and will be described hereinafter with reference to this application. However, it will be appreciated that the invention is not limited to this particular field of use.

A known integral spring action hinge used in some such closure designs, comprises two spaced apart hinge portions that are formed on generally radially outwardly extending protuberances, so as to be offset from the peripheral edges of the cap and body. Also included is a centrally located flexible connecting member that extends from cut outs in the body and cap, across the mating peripheral edges. In use the cap is flipped open to rotate about an axis defined by the hinge portions, the offset flexible connecting member stretching at a central unstable equilibrium point to bias the cap toward either the open or closed position.

Hinge structures of this kind have several disadvantages. Firstly, as described above, the hinge portions must be offset from the general extent of the flexible connecting member in the generally open and generally closed position to effect the biasing spring

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action. In order to achieve this required offset the spaced hinges need to be supported on large protuberances that extend significantly beyond the peripheral edges of the closure. Not only are such large protuberances unsightly, more importantly they cause assembly problems, in that they are not easily transported by rolling and are difficult to secure with automatic rotating capping machinery. Secondly, the cut outs which accommodate the flexible connecting portion are generally aesthetically unappealing and furthermore are prone to collecting grime.

One solution to these problems has been the provision of an integral hinge that is generally shaped as a bow tie, the cap and body being connected at the periphery around the knot of the tie and along the upper and lower diverging edges of the wings of the bow. The wings form the resilient connecting members that provide the biasing spring action.

Hinges of this design overcome the problems of the prior art by providing an unobtrusively low profile that can be readily moulded integrally with the body and cap. However, these hinges tend to have a spring action that, whilst being very positive, can be fairly heavy to operate.

It is an object of the present invention to provide an alternative integral over centre spring action hinge which similarly overcomes or at least ameliorates one or more of the disadvantages of the

first discussed prior art and which preferably provides a lighter easier to use spring action.

Accordingly, this invention consists in an integral over centre spring action hinge for axially connecting a generally arcuate cap periphery to the periphery of a correspondingly arcuate body portion, said hinge comprising:

a flexible interconnection between the cap and body that extends adjacent the respective peripheral edges, said flexible interconnection defining a main geometric axis about which the hinge folds; and

at least one resilient connecting member that extends between the cap and the body, the connecting member being secured to protuberances provided on each of said cap and body along flexing lines that extend parallel to the main geometric axis, said flexing lines also being transversely displaced from the main geometric axis to provide an over centre spring action.

Preferably, the hinge includes two resilient connecting members, one disposed each side of the flexible interconnection. The connecting members are preferably formed with a reduced section adjacent the midpoint between the cap and body. This has been found to provide a significant improvement in performance of the hinge. It is believed that the reduced section provides for elastic deformation during the opening and closing of the cap which provides a positive over-centre action without overloading the flexible

interconnection. Larger diameter closures require a thicker section of connecting element and a transversely wider connecting element than smaller diameter closures.

Desirably, the flexible interconnection comprises a reduced section deformable connecting web of material that is preferably formed integrally between the cap and body. In a preferred form, the flexible interconnection comprises a reduced section web that extends parallel to a tangent to the arcuate cap and body peripheries at the point of connection. Preferably, the generally linearly extending web is supported on integrally formed formations provided on the cap and body.

In one preferred form, the cap and body are generally circular in cross-section and ideally none of the protuberances and formations extend beyond the circumferential peripheries by much more than approximately 6% of the radius of curvature of the respective body and cap.

Desirably, the protuberances are contoured to provide a substantially continuous surface when the hinge is in the closed position.

In a preferred form, the connecting members extend generally parallel to the axis of the body and cap. Desirably, the protuberances supporting the connecting members have a generally triangular portion connected with an end of the connecting member along

the flexing line and side shields that extend to cover any gap between the connecting member and the body and cap. Desirably, the side of each connecting member nearest the central flexible interconnection is closely adjacent the peripheral surface of the cap and body when in the closed position, such that side shields are required only on one side of each connecting member.

A preferred embodiment of the invention will now be described, by way of example only, with reference to the accompanying drawings in which:

Figure 1 is a schematic front view of a closed cap and body closure incorporating a first embodiment integral over centre spring action hinge according to the invention;

Figure 2 is a schematic side view of the closed closure shown in Figure 1;

Figure 3 is a schematic rear view of the closed closure shown in Figure 1;

Figure 4 is a schematic side view of the closure of Figure 1 illustrated in the fully open position;

Figure 5 is a schematic plan view of the closure illustrated in the fully open position;

Figure 6 is a schematic plan view of the closure illustrated in the fully closed position;

Figure 7 is a schematic enlarged fragmented view of the hinge shown in the fully open position; and

Figure 8 is a schematic enlarged fragmented part sectioned view of the hinge taken on line 8-8 of in

Figure 7.

Referring to the drawings, the closure 1 comprises a body portion 2 to which is secured a cap 3 by means of an integrally formed over centre spring action hinge shown generally at 4. The body portion 2 includes a raised dispensing aperture 5 designed to snap connect with a sealing plug 6 provided on the cap 3. The body 2 also includes a thumb depression 7 opposite the hinge 4 for flipping open the cap 3. The hinge 4 is disposed to connect a generally arcuate portion of the preferably circular cap periphery 8 to the correspondingly arcuate periphery 9 of the body portion 2.

The hinge 4 comprises a centrally located flexible interconnection 10 that extends adjacent and approximately tangential to the mating peripheral edges 8 and 9.

The interconnection 10 comprises a linearly extending connecting web 11 of reduced section, supported on integrally formed generally wedge shaped formations 12. The interconnection 10, or more particularly the web 11, defines a main geometric axis 13 about which the hinge 4 folds.

In the embodiment illustrated, the hinge 4 also comprises two spaced resilient connecting members 14 that extend across the peripheral edges 8 and 9, one connecting member 14 being disposed on each side of the flexible interconnection 10.

The connecting members 14 are secured at opposing ends to protuberances 15 provided on the cap and body, along flexing lines 16 about which the connecting members can bend. The flexing lines 16 extend in a direction parallel to the main geometric axis 13. The flexing lines are also offset from the main axis as shown in Figure 6, to provide the required over centre spring action.

The protuberances 15 are desirably contoured to provide a substantially continuous surface when the hinge is in the closed position as shown in Figure 1. This is achieved in the illustrated embodiment by providing protuberances 15 having generally a triangular shaped portion 17 that is secured with an end of each connecting member along the flexing lines 16, and angled side shields 18 that extend along the outermost sides 19 of the connecting members 14 remote the flexible interconnection 10. The innermost sides 20 of the connecting members 14 adjacent the connection 10 extend generally parallel to the axis of the body 2 and cap 3 and are closely adjacent the peripheral surfaces in the closed position.

The closures with the integrally formed hinge 4 are injection moulded in suitable plastics materials in the fully opened position as shown in Figures 4 and 5, the hinge being formed as shown in detail in Figures 7 and 8. It can be seen that the connecting elements are originally formed as an arcuate band, having a central

portion 21 of decreased cross-sectional thickness compared to the thickness adjacent the flexing lines 16.

Referring in particular to Figures 2 and 6, it can be seen that the hinge according to the invention is of relatively low profile relative to the circumferential periphery of the body 2 and cap 3. In this regard, the protuberances 15 and formations 12 extend beyond the circumferential edges by no more than about 6% of the radius of curvature of the respective body and cap. This low profile in combination with the contouring of the protuberances, enables the closures to roll freely and to be rotated automatically without interference. These features are extremely important when it is considered that closures of this kind are generally secured to the containers for which they are designed by means of automatic machinery.

The separately formed connecting members 14 of the hinge 4 illustrated, each being connected only at its ends, provides a spring that deforms only in the direction intended, that is along its length, to provide an efficient positive biasing action that is also surprisingly light.

Although the invention has been described with reference to a specific example, it will be appreciated by those skilled in the art that the invention may be embodied in many other forms.

* C L M S *

THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:-

1. An integral over centre spring action hinge for axially connecting a generally arcuate cap periphery to the periphery of a correspondingly arcuate body portion, said hinge comprising:

a flexible interconnection between the cap and body that extends adjacent the respective peripheral edges, said flexible interconnection defining a main geometric axis about which the hinge folds; and

at least one resilient connecting member that extends between the cap and the body, the connecting member being secured to protuberances provided on each of said cap and body along flexing lines that extend parallel to the main geometric axis, said flexing lines also being transversely displaced from the main geometric axis to provide an over centre spring action.

2. An integral over centre spring action hinge as claimed in claim 1 wherein said hinge includes two resilient connecting members, one disposed on each said of the flexible interconnection.

3. An integral over centre spring action hinge as claimed in claim 2 wherein said connecting elements have a reduced section adjacent the midpoint between said cap and body to provide for elastic deformation of the connecting elements during opening and closing.

4. An integral over centre spring action hinge as claimed in any one of claims 1 to 3 wherein said flexible interconnection is provided by an integrally formed connecting web.

5. An integral over centre spring action hinge as claimed in claim 4 wherein said web extends parallel to a tangent to the peripheral edges of said body and said cap at the point of connection.

6. An integral over centre spring action hinge as claimed in claims 1 to 5 wherein said flexing lines are provided by an integrally formed web of material of reduced thickness to said connecting elements.

7. An integral over centre spring action hinge as claimed in claims 1 to 6 wherein said protuberances extend outwardly from said peripheral edges by less than about 6% of the radius of curvature of said arcuate body or cap.

8. An integral over centre spring action hinge as claimed in claims 1 to 7 wherein said connecting elements are formed as an arcuate band with said cap in an open position.

9. An integral over centre spring action hinge substantially as herein described with reference to the accompanying drawings.