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Description

The invention relates to a one-piece snap hinge of plastic material having the features set forth in the preamble of claim 1.

Snap hinges of this type are known from the publication DE-A-1 808 875. According to the latter the two hinge parts are connected together by a film hinge in which the geometrical main axis falls. The intermediate elements have the form of a bending spring which in the snap operation exerts forces on the two hinge parts in such a manner that they are pressed out of an instable equilibrium position either into the open position or into the closed position. The resilient intermediate elements are articulately connected with the aid of two further film hinges or thin spots to the hinge parts. The axes of all three film hinges extend parallel to each other.

A known field of use for snap hinges of this type are bottle-stoppers which are made in one piece with the hinges by injection moulding. Embodiments according to the aforementioned publication are admittedly applicable to stoppers but require a relatively large cutout in both hinge parts serving to accommodate the resilient intermediate element (16 therein). The resilient intermediate element must therefore be separated from both hinge parts by slots extending transversely of the axes.

The cutouts, which to accommodate the resilient intermediate element must have a considerable length, impair the strength of the snap hinge. It can be relatively easily broken in that the one hinge part is turned with respect to the other

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about an axis transversely of the main axis.

In a snap hinge stopper for bottles or the like the lower portion to be placed on the mouth is generally closed at the top by a head plate containing a casting or injection opening. The cutouts necessary for accommodating the resilient intermediate element in the cover and lower portion must have a considerable length. If the cutouts were omitted the film hinges coinciding with the main axis and connecting the two hinge parts articulately together would have to project relatively far to the outside at projections. This would firstly given an unsatisfactory esthetic impression and secondly make the screwing or knocking on impossible with conventional closing machines. Special machines would have to be used.

The cutout present in the lower part projects somewhat into the head plate. This however restricts the configuration possibilities for stoppers. It is not possible to make any stoppers which compared with the overall diameter have relatively large casting openings and associated parts.

Finally, snap hinges according to the the aforementioned publication, in particular when used for bottle stoppers, give a technical impression. As a result they frequently do not meet the esthetic requirements made of packages, for example by the cosmetic industry.

The known snap hinges cannot be employed as integrated hinges for deep drawn packages for the following reasons: the cutout would impair the strength of the passage. The punched-out waste would cause considerable disturbances in production. In some uses the cutout would form a troublesome hole in the package.

The publication US-A 3 135 456 deals with the problem of providing a hinge for round containers. It is proposed therein that one or two strips of flexible material be secured to the curved side faces of the lower part and cover of the container, the strip or strips having curved thin spots which define the intermediate element. In this case no film hinge falling in the geometric main axis is provided. The publication does not provide any teaching how the hinges shown could be designed so that a satisfactory snap action is obtained in which from a position of instable equilibrium the cover snaps with respect to the lower part either into the open position or into the closed position and remains therein.

The present invention is intended to provide a snap hinge which can be made in one piece from plastic and which accordingly can be part of a stopper, a deep-drawn package or other plastic article. The snap hinge is to be resistant to mechanical damage, including rotation of one of the hinge parts with respect to the other transversely of the geometrical main axis. An article equipped with the snap hinge, in particular a bottle stopper, is to give an esthetically satisfactory impression. In particular, no parts of appreciable size are to project outwardly so that bottle stoppers can be fitted to bottle mouths in standard closing machines without special means being necessary.

The areas which are available for the actual function of the parts connected by the hinge are to be not at all restricted or only slightly restricted by hinge parts. For example, in stoppers the entire head area of the lower part is to be available for a discharge opening.

All this is simultaneously achieved by a snap hinge according to claim 1 (hereinafter reference will be made to the wording of the claims). The term "geometrical" main axis

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is intended to mean that a film hinge need not be present over the entire length of this main axis.

The spring action necessary for the snap operation can be obtained by resilient formation of the intermediate element, the intermediate elements or other components of the snap hinge, for example one or both hinge parts. The important point is that the thin spots which connect the intermediate elements to the hinge parts do not extend parallel to each other but diverge so that the intermediate elements cover a planar or curved triangular area. The necessary stability and symmetry is achieved in that at least one such intermediate element is provided and a further articulate connection in the form of a film hinge falling in the geometrical main axis. Preferably, not only one but two or more intermediate elements are provided which are connected by thin spots to the hinge parts. For example on an elongated box several pairs of intermediate elements may be present. A film hinge between the pointed ends of two intermediate elements may have a very small length.

Two intermediate elements of the type referred to are also present when they merge into each other with their wide ends and form jointly a rombus. If a snap hinge is to be relatively long, for example disposed on an elongated box, more than two such intermediate elements may be provided, in particular several pairs of intermediate elements.

In a snap hinge according to the invention a cutout is no longer necessary in one or both hinge parts. On the other hand, the diverging thin spots can have a greater length than the film hinges of known snap hinge stoppers or fasteners. For both reasons the resistance to unintentional tensile loads and twistings is increased. The omission of the cutout gives the designer more freedom in his design. The snap

hinge provides an esthetically satisfactory impression. The intermediate elements may be formed and arranged so that when used in a stopper they do not project outwardly or do so only to a negligible extent.

Snap hinges according to the invention may be so constructed that a position of instable equilibrium (dead centre position) lies in the normal pivot path. Then, the spring action on either side of the instable equilibrium position ensures a snapping open or snapping to. The instable equilibrium position can however by constructional steps also be so arranged that the hinge parts only snap open or only snap to.

The use of the hinge according to the invention is not restricted to packaging means. A great many applications are conceivable, for example in the electroindustry, electronics, the automobile industry, the furniture industry, etc.

The hinge can also be made as independent component which is then subsequently attached to a certain product. Example: furniture door hinges.

Intermediate elements according to claim 6 in the form of widening grooves are particularly suitable for the production of bottle stoppers. The grooves may have different cross-sectional forms and depending on the form of the stopper when the latter is closed may point inwardly or outwardly, the possibility always being present of accommodating them constructively within the outer contour of the stopper.

According to claim 11 the intermediate elements may be constructed as tension elements which themselves need not have

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any spring action whilst at least one of the hinge parts is formed springily in the vicinity of the geometrical main axis. The desired snap action can also be obtained in this manner.

According to claim 13 the invention can be applied to the production of snap hinges for deep-drawn packages. To prevent the deep-drawn material - e.g. PVC or polystyrene - from breaking at the bending points the intermediate elements may have at least two deep-drawn grooves, each of which performs part of the deflection necessary in the snap operation.

If in accordance with claim 17 where the wide ends of two intermediate elements meet ribs are provided which extend transversely of the main axis then at least one bending groove is obtained there as well. This permits the two intermediate elements of the or each pair to perform a snap movement transversely of the main axis or facilitates said movement so that for for example when the package is closed the transversely extending ribs are snapped somewhat into the package and when the package is opened however snapped outwardly.

Examples of embodiment of the invention will be explained hereinafter with the aid of the drawings.

Figs. 1 to 3 show perspectively and in plan view of an opened stopper a first embodiment with intermediate elements which are bending springs and constructed as U-shaped grooves.

Figs. 4 and 5 show perspectively a second embodiment of a snap hinge with similarly formed bending elements which do not however move the hinge parts beyond the dead centre but

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can only be snapped open.

Figs. 6 and 7 show in axial cross-section a third embodiment of a snap hinge in which the intermediate elements are of a similar construction as in the first embodiment but point outwardly and not inwardly.

Figs. 8 to 12 show variants of the first to third embodiments.

Figs. 13 and 14 show the arrangement of two pairs of resilient intermediate elements in the form of V-shaped grooves on a box with a snap lid.

Figs. 15 to 18 show a fourth embodiment in which the intermediate elements are planar tension elements whilst the spring action is provided by the wall of one of the hinge parts.

Figs. 19 to 22 show a fifth embodiment, that is a deep-drawn package equipped with a snap hinge. Figs. 19 and 20 are perspective views in the closed and open positions whilst Fig. 22 is a plan view of the opened package and Fig. 21 a cross-section along the line XXI-XXI of Fig. 22.

First Embodiment

Figs. 1 to 3 show a snap hinge which is designated as a whole by 3 and which is injection moulded in one piece with a bottle stopper or cap, for example of polypropylene. The snap hinge comprises two hinge parts 1 and 2, of which the hinge part 1 is formed as lower part of a bottle stopper or cap for placing on a bottle neck whilst the hinge part 2 forms a cap for closing the lower part. The geometrical main axis is designated by 4. The lower part (1) has a wide

discharge opening 6 and the hinge part 2 an annular sealing lip 6a adapted thereto.

This hinge comprises two intermediate elements 5 which are formed as grooves of substantially U-shaped cross-section. The two intermediate elements taper in the direction of the main axis 4 to a very short film hinge 7 which lies in the main axis 4 and in a symmetry plane 12 disposed transversely thereof (Fig. 3).

The intermediate elements 5 are connected by thin spots 9 and 10 to the two hinge parts 1 and 2. Each of the thin spots 9, 10 is made continuous from the left wide end of the left intermediate element 5 (Fig. 2) up to the right wide end of the right intermediate element 5. Each describes a spatial curve which on the one hand describes substantially an arc seen from the side and on the other fall wholly or nearly in the cylindrical wall of the stopper.

The main hinge in the form of a film hinge 7 connecting the two hinge parts directly together has a negligibly small length. It merges smoothly into the two thin spots 9, 10. The intermediate elements 5 are constructed here as bending springs of U-shape cross-section. If the hinge parts are moved out of the position according to Fig. 1 into the position according to Fig. 2 the intermediate elements 5 are bent up somewhat until the hinge parts assume an instable equilibrium position (dead centre). From there the intermediate elements have a tendency to spring together again and press the hinge parts into the closure position.

In this embodiment the resilient intermediate elements 5 point when the stopper or closure means is open upwardly (Fig. 1) whilst when the stopper is closed they project into the interior thereof (Fig. 2). No parts project outwardly

and an esthetically satisfactory impression is obtained. Due to the length of the thin spots 9, 10 a mechanically stable structure is achieved which is difficult to damage even by twisting the one hinge part with respect to the other, in particular when the stopper is open.

Second Embodiment

Figs. 4 and 5 show a closure means or stopper having a snap hinge which only allows the cap to snap open. Whereas in the first embodiment the intermediate elements 5 are relaxed in the two end positions, in this case the intermediate elements 5.1 are relaxed only in the open position according to Fig. 4 whereas in the closure position according to Fig. 5 they are pressed together to a maximum extent. The cap is held by any desired detent means, for example discharge opening 6 and sealing lip 6a, in the closure position. After the release of the detent means it jumps automatically into a position which (possibly due to the long-time deformation (cold flow)) corresponds to an opening angle between 90° and 180° . In the hinge part 1, the lower part, depressions 14 are formed which serve to receive the compressed intermediate elements 5.1.

Third Embodiment

In the embodiment according to Figs. 6 and 7 the intermediate elements 5.3 are again constructed as bending springs but in the closure position do not arch as in Fig. 2 into the interior of an article but project outwardly and downwardly when the hinge parts (Fig. 7) are open. Otherwise, the function is the same as that described with reference to the first example of embodiment. Once again thin spots 9 and 10 are provided and a negligibly small real main axis at the point 7.

Variants of the first to third embodiments

The resilient intermediate elements may, as illustrated, be U-shaped and cross-section transversely of the geometrical main axis 4, but may also have other geometrical forms such as that of a triangle, rectangle or polygon. Fig. 8 shows an embodiment having intermediate elements 5.4 of rectangular cross-section. To achieve the desired opening and snap action and that the intermediate elements 5.4 when the hinge is closed disappear as far as possible completely in the two hinge parts, the height x within each section transversely of the main axis is preferably smaller than the width z . To obtain the form locking, the biasing (or closure tension) the condition $2x^2z$ should be fulfilled.

The thin spots 9 and 10 defining the intermediate elements may be concave (Fig. 9), convex (Fig. 10) or straight (Figs. 11 and 12). In addition, a great number of further combinations of paths is possible. In all the examples of embodiment hitherto described the pointed ends of the intermediate elements face each other. Between the pointed ends a straight piece of main hinge is provided in the form of a film hinge 16 as is particularly clearly apparent from Figs. 10 and 12. The thin spots 9 and 10 continue as main hinge and divide again at the opposite end into the two thin spots 9 and 10. The thin spots 9 and 10 can also continue in that they run closely adjacent each other and thereby form a main hinge or film hinge as illustrated in Figs. 2, 5 and 9.

In all the embodiments hitherto described one pair of intermediate elements is provided. Figs. 13 and 14 show snap hinges on a box which forms the hinge part 1, comprising a snap lid which forms the hinge part 2. Straight film hinges 16 form portions of a main hinge. At the outer ends of the hinge axis resilient intermediate elements 5.5 are provided which are made V-shaped in cross-section with respect to

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the geometrical main axis. The two outermost intermediate elements face outwardly with their wide ends and form jointly the one pair of intermediate elements. In the centre there is a further pair 17 which consists of two intermediate elements which face each other with their wide ends. These intermediate elements project when the box is open outwardly, i.e. correspond to the embodiment according to Figs. 6 and 7 and in the closed position are a snug fit in the rectangular form of the box (Fig. 13).

The two intermediate elements 5.5 of the pair 17 can be separated from each other by a slot 19 extending transversely of the geometrical main axis. This permits, in particular when stiff material is employed, the two centre intermediate elements to move apart when the box is opened.

The embodiment according to Figs. 13 and 14 may furthermore be modified so that either the two outer intermediate elements or the two intermediate elements disposed in the centre are dispensed with.

The intermediate elements need not necessarily be arranged in pairs. Arrangements with an odd number of intermediate elements along the geometrical main axis are also possible. Since an articulate connection in the form of a film hinge 16 is provided in the course of the main axis, the snap hinge can also be provided with only one intermediate element 5.5.

Finally, for particular uses along the geometrical main axis openings may be provided which are disposed either between the narrow or between the wide ends of the intermediate elements.

Fourth Embodiment

In the embodiment according to Figs. 15 to 18 the intermediate elements 5.6 are tension elements which are only slightly, if at all, tension elastic. When the stopper is opened the tensioned elements are flat and when the stopper is closed they bear smoothly on the cylindrical wall of the stopper, i.e. then have the form of a cylindrical shell. The folding action is produced here in that the wall of the hinge part 2, i.e. the lid, is flexurally elastic in the vicinity of the point 7, i.e. in the region 18. In the folding operation through an instable equilibrium position the wall in the region 18 can either be pressed radially inwardly or drawn radially outwardly in two regions, for example at 19, lying further outside in the peripheral direction. The region 7 between the two hinge parts may also be compressed or several of these effects may be superimposed on each other. In every case after passage through the instable equilibrium position an elastic springing back takes place.

In cases where the hinge member 1 is not covered by a head plate 20 but is hollow there, the wall of the hinge part 1 can also be employed to support the springing action.

As shown by Fig. 16 the thin spots 10.1 of the hinge part 2 in this case do not merge into each other and this applies equally to the thin spots 9.1 of the hinge part 1. On the contrary, the upper thin spot 9.1 in Fig. 16 merges in an arc into the thin spot 10.1. The same applies to the two lower thin spots.

Instead, in a modified embodiment the thin spots can cross each other so that the upper film hinge 9.1 in Fig. 16 merges rectilinearly into the lower film hinge 10.1 and vice versa accordingly.

Fifth Embodiment

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Figs. 19 to 22 illustrate a package deep-drawn from deep-draw sheet, in particular polystyrene. The deep-drawn sheet may have a considerable thickness whilst film hinges and thin spots must usually be substantially thinner. The embodiment shows one possibility of dividing the necessary thin spots and film hinges into a plurality of parallel or slightly inclined grooves. The package is deep-drawn in the position according to Figs. 20 and 22. Once again two hinge parts 1 and 2 are present which in the case form the halves of the deep-draw package. Intermediate elements 5.7 are provided which with their wide ends face each other and merge into each other without interruption.

The function of the thin spots 9.3 and 10.3 forming film hinges at their ends is taken on here by deep-drawn grooves whose walls are formed by ribs 25 and 26. The ribs 25 merge into the walls 35 of the hinge parts 1 and 2 and the ribs 26 into the intermediate elements 5.7.

The intermediate elements 5.7 preferably have just before their wide ends, i.e. near the hinge centre, a rib 28. A pair of such ribs serves on the one hand for transverse stiffening of the intermediate elements and on the other to form a transversely extending intermediate face or bending groove 30 which acts as deflection axis between the two intermediate elements. The grooves forming the thin spots 9.3 and 10.3 extend V-shaped to each other up to the narrow ends 32 of the intermediate elements.

When closing a deep-draw package from the position according to Fig. 20 into the position according to Fig. 19 the grooves forming the thin spots 9.3 and 10.3 and short film

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hinges at their ends 32 and the ribs 25 and 26 each perform part of the necessary bending. In this example of embodiment these grooves, seen in the direction of the arrow 34, assume in the closed state the form of a clover leaf.

The resilient snap action is obtained here by pivoting over the intermediate elements 5.7. Regions 36 of the container walls in the vicinity of the wide ends of the intermediate elements perform the spring function. In the open position according to Fig. 20 the two intermediate elements 5.7 jointly form a sort of roof area, the ridge of which points downwardly, i.e. towards the outside of the package. On movement into the closure position the two intermediate elements snap inwards. Once again a sort of roof face is formed whose ridge however now points inwardly. The intermediate face 30 forms a joint. The hinge function of the intermediate face 30 facilitates the snap action of the roof face.

Preferably, at least the walls 35 of the hinge parts are elastically flexible so that in the pivoting operation they provide part of the spring action.

The hinge parts 1 and 2 of the deep-draw package may have a flange 38 as shown only in Fig. 22.