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[54] **UNITARY HINGE AND SPRING MEMBER**
7 Claims, 13 Drawing Figs.

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E05f 1/12
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180; 220/31 SR

[56]

References Cited

UNITED STATES PATENTS

3,391,845	7/1968	Bessett	229/2.5
3,145,895	8/1964	Reifers	229/2.5
3,398,875	8/1968	Snow et al.	229/2.5
3,289,877	12/1966	Wolf	16/150

FOREIGN PATENTS

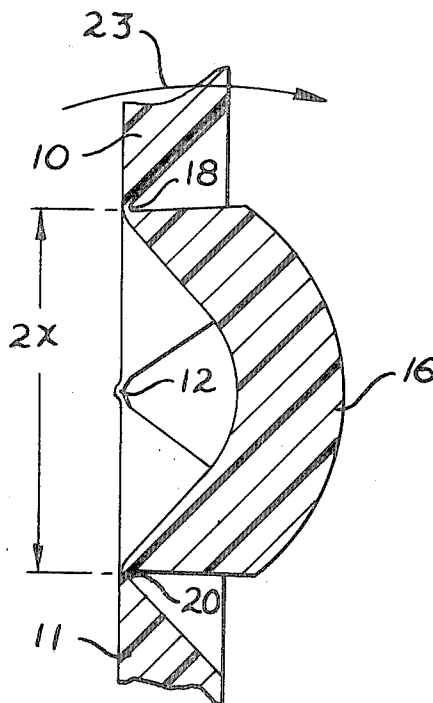
1,056,999	2/1967	Great Britain	16/150
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ABSTRACT: A combined hinge and spring device which may be molded of a plastic material in a single unit for use and application in a variety of products employing a spring hinge.



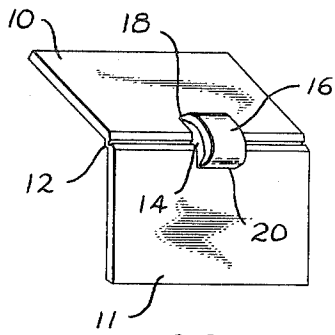


Fig. 1

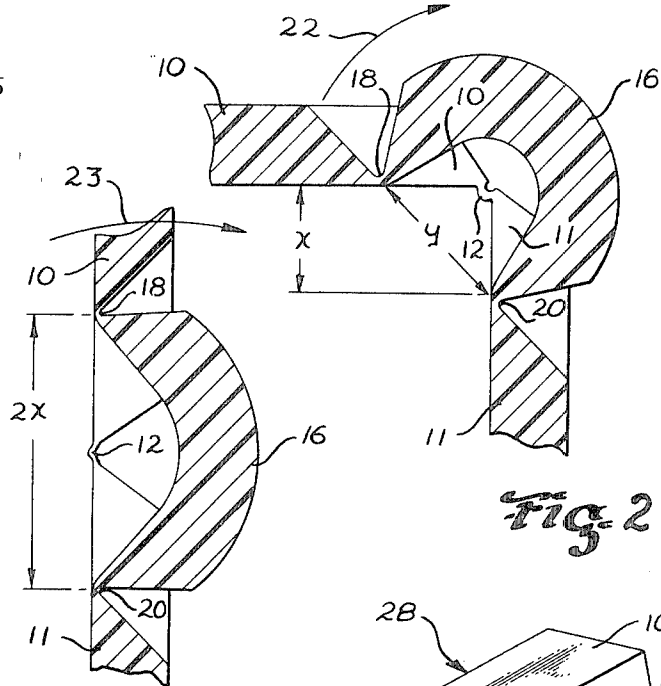


Fig. 2

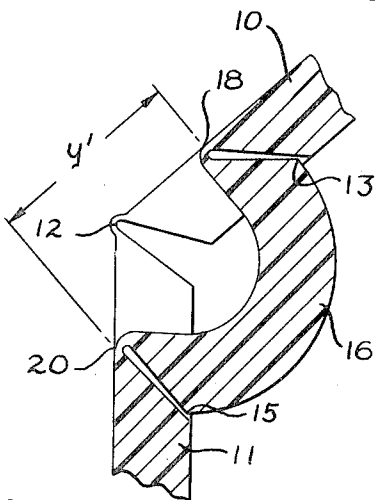


Fig. 3

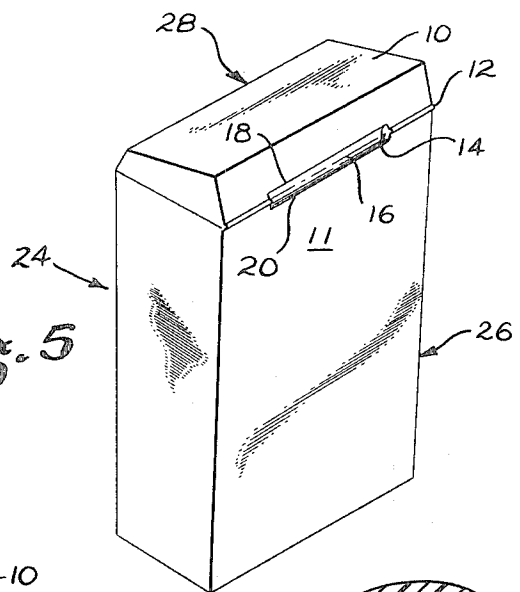


Fig. 4

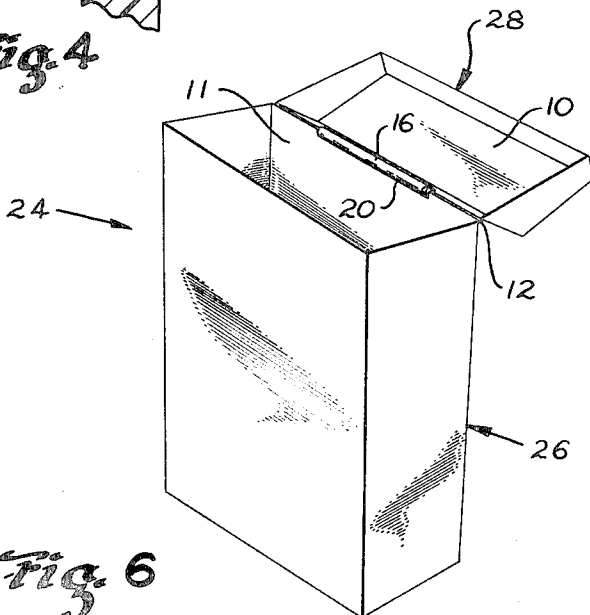


Fig. 6

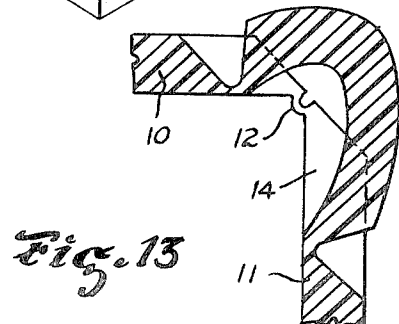
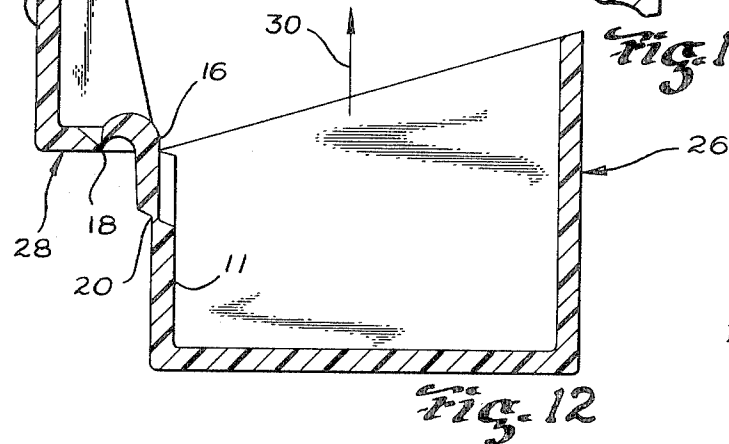
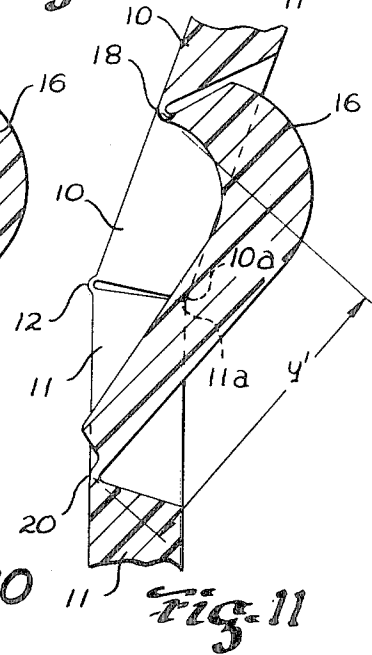
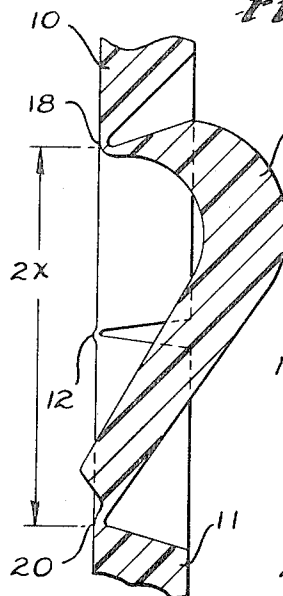
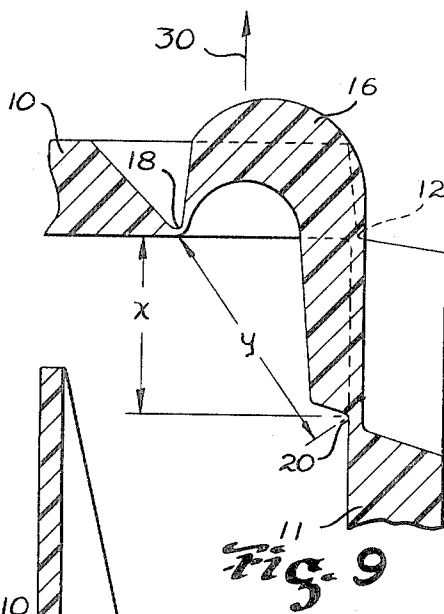
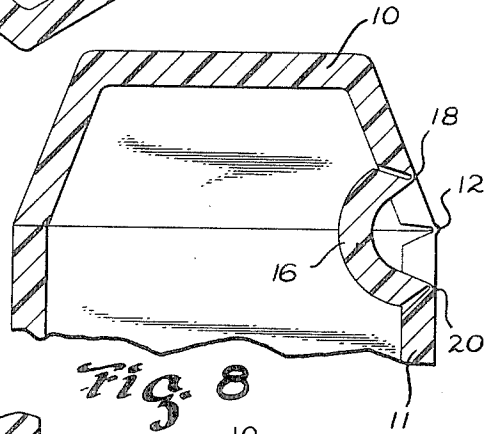
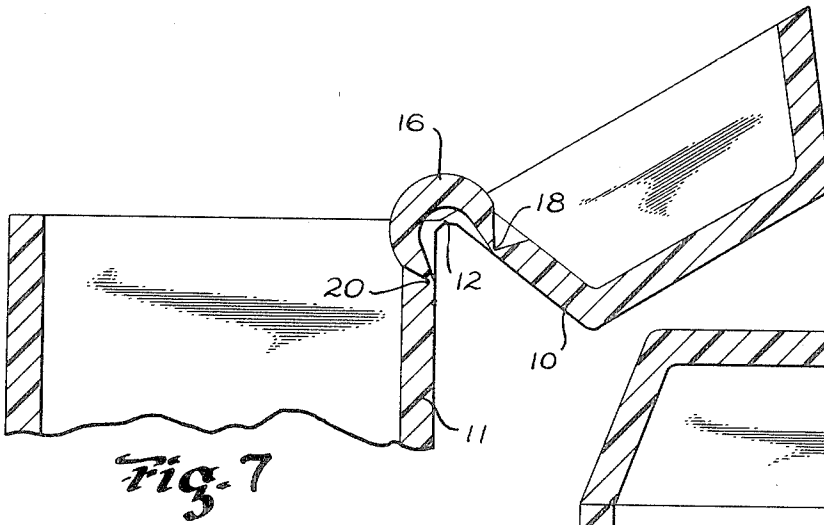


Fig. 13

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UNITARY HINGE AND SPRING MEMBER

BACKGROUND OF THE INVENTION

1. Field of the Invention

A hinge and spring device which is integrally formed with the product in the manufacturing process.

2. Description of the Prior Art

In the prior art hinges and spring clips as found for example in U.S. Pat. No. 2,735,609, a method of manufacturing the structure involves first constructing a box and then fixing to the box in the manufacturing process a hinge and a C-clip or C-shaped spring. In order to efficiently accomplish this process the C-spring member of this type of box has to be large enough to be handled and results in a structure which, in addition to being expensive to manufacture, is also unsightly and of little aesthetic values. Many of the boxes to be used for articles of jewelry and decorative containers must be lined in order to cover over the unsightly hinge and spring clip. In a container as found for example in U.S. Pat. No. 2,464,524 the method of manufacturing the box involves heating up the up-standing wall portions to soften the box and then bending the softened wall portions into engagement with leaf sections of the hinge and spring clip and thereby hinge the container together. Needless to say, this method is costly since it involves a two step process and also results in a structure of poor aesthetic value due to the unsightly appearance of the exposed hinge and softened wall portion. In the hinge as found for example in U.S. Pat. No. 3,289,887 the clamping unit itself, although molded unitarily with the hinge and box, has as its components a connecting arm and a resilient spring member. The connecting arm constitutes the major portion of the clamping unit resulting in an oversized and unattractive hinge. In contrast to such prior art examples, an embodiment of the present invention overcomes the disadvantages of the prior art spring hinges by having a unitary hinge and spring member all molded integrally as one piece without the necessity of a separate connecting arm. The result is a hinge that may be barely detectable in either an open or a closed position. By use of this invention, a unitary spring hinge is produced which can be molded of plastic material integrally with the rest of the total device to form a product of high aesthetic value. It may thus advantageously be used in decorative containers or boxes without the necessity of such being lined or otherwise treated to conceal the spring elements. It is also suitable for use as a spring hinge for eyeglass frames and may indeed also be produced as a spring hinge for attachment by screws, cement or the like in cabinets, chests and similar articles of furniture.

SUMMARY

This invention relates to a design for a unitary hinge and spring device which may be molded of a plastic material such as polypropylene. In the manufacturing process, in one operation, the two hinge plates are formed integrally with the product, the plates themselves being connected to each other by a thin web of plastic material to form a first bending line. Formed integrally with these two plates at the edge of an aperture formed in the adjoining edges of each plate member and bisecting the thin web of plastic material forming the first bending line is a resilient spring member having a cross-sectional shape of a C and having its ends joined to the plates and serving as an "over-the-center" or toggle spring to provide the energy to retain the hinge in either of two alternate end positions of travel.

It is an object of this invention to provide a product with a hinge and spring member which may be formed together in one operation thus reducing the manufacturing cost.

A further object of this invention is to provide a unitary spring hinge structure which will be of high aesthetic value and suitable for use in decorative containers without the necessity of their being lined or otherwise covered to conceal the hinge and spring member and with a neat appearance when viewed from the outside.

A further object of this invention is to provide a hinged product having a hinge and spring member that may be molded so as to be barely visible in the finished product.

A further object of one embodiment of the invention is to provide a spring hinge which may be integrally molded as a part of a container without the necessity of utilizing cam operated moving parts in the molding equipment.

DESCRIPTION OF THE DRAWINGS

FIG. 1 is an isometric view of the spring hinge of one embodiment of this invention.

FIG. 2 is a fragmentary cross-sectional view of a modified form of a spring hinge in one rest position.

FIG. 3 is a cross-sectional view of said hinge in a position of maximum stress.

FIG. 4 is a cross-sectional view of said hinge in an opposite rest position from that of FIG. 2.

FIG. 5 is a three-dimensional view of the spring hinge of this invention as applied to a box, such as a cigarette box, in a closed position.

FIG. 6 is a view similar to FIG. 5 but showing said hinge in an open position.

FIG. 7 is an enlarged fragmentary cross-sectional view of the spring hinge as found in FIGS. 5 and 6, showing said hinge in an open position.

FIG. 8 is a view similar to FIG. 7 but showing said hinge in a closed position.

FIG. 9 is a fragmentary cross-sectional view of another embodiment of the spring hinge of this invention in a rest position.

FIG. 10 is a cross-sectional view similar to FIG. 9 but in a position of maximum stress.

FIG. 11 is a cross-sectional view of the hinge similar to FIGS. 9 and 10 but in an opposite rest position from that shown in FIG. 9.

FIG. 12 is a cross-sectional view of another embodiment of this invention in a container or box.

FIG. 13 is a cross-sectional view of still another embodiment of the invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

In the drawings in each figure, similar numerals are used to indicate similar parts although the shapes of these parts may be somewhat different from embodiment-to-embodiment. As is shown in FIG. 1, the hinge of this invention consists of two plate members 10 and 11 hingedly molded and held together by a thin layer of plastic material forming first bending line 12 sometimes called a "living hinge". Formed partially in each plate member when said plate members abut is aperture 14. Molded integrally to each respective plate member at the edges of aperture 14 parallel to first bending line 12 is an arcuate spring member 16, formed generally in the shape of a C. However, as is shown in FIGS. 9-12, the shape of spring member 16 may be somewhat varied from the shape of a C and be within the scope of this invention. In a typical embodiment of this invention, said plate members are integrally formed as part of the wall of the product and reference to the plate members as such is done merely for ease in describing the present invention, since the plate members need not protrude from either the inside or outside wall of the product or container, as is best shown in FIGS. 5 and 6. As plate members 10 and 11 adjoin each other at the hinged area, said plate members are abruptly thinned or angled to form a thin layer of plastic material which operates to form first bending line 12 so that each plate member may pivot with respect to each other. The exact angle of thinning is somewhat empirical and is controlled to a great extent by the particular use desired of the spring hinge in the product. As is clearly shown in FIG. 11, the edges of plate members 10 and 11 may be constructed so that end shoulders 10a and 11a contact each other and serve as a stopping means. Aperture 14 formed in plate members 10 and 11 may be symmetrically oriented with respect to bending line

12. However, an embodiment, shown in FIG. 13, is possible wherein said aperture is oriented more in one plate member than the other. In this case the length of aperture 14 from first bending line 12 would extend further into one plate 10 than it would into the other plate 11, for example. The dimensions and requirements of the aperture are determined by the requirements of a particular product in which the spring hinge is to be employed. As will become apparent to those skilled in the art, the orientation of the aperture influences the total distance travelled by said plate members from one rest position to another, since said spring member arcuately bridges said aperture. As plate members 10 and 11 adjoin spring member 16, they are thinned or angled to form second and third bending lines 18 and 20, in each respective plate member. Bending lines 18 and 20 are formed in a similar manner to first bending line 12 and said bending lines provide the means for said spring member to pivot along with said plate members. Plate members 10 and 11 and spring member 16 may also be thinned or angled so as to serve as a stopping means as is best shown in FIG. 4. Resilient spring member 16 functions both as a spring means and a connecting link between each plate member and is designed so that it has a resistance to elongation. When in operation, as the plate members are pivoted from one rest position, such as in FIG. 2, to another, as shown in FIG. 4, spring member 16 will have to be stretched and since the plastic material employed in this invention is elastic, said spring member tends to return to its original shape. The elastic property of said spring member has been found to be most pronounced when its intermediate portion is thicker than the end portions adjoining each plate member. However, embodiments are possible which employ a spring member of uniform thickness.

In FIG. 2 the plate members and hinge are in what can be arbitrarily referred to as a first rest position. A first distance between second bending line 18 and third bending line 20 is represented in FIG. 2 by the arrow lettered "y." If plate member 10 is moved in a direction of arrow 22, the result would be an increase in the distance between second bending line 18 and third bending line 20. The resilient spring member 16 is so designed that a force will have to be exerted to overcome the elastic energy of tension within resilient member 16. As movement of plate member 10 is continued to the position indicated in FIG. 3, the distance between second bending line 18 and third bending line 20 reaches a maximum and the spring hinge is at a theoretical unstable equilibrium point, so that in theory, resilient member 16 neither resists nor assists further movement of the plate members. The maximum distance between second bending line 18 and third bending line 20, which is represented by the arrow y in FIG. 2, is increased in FIG. 3 and is represented by arrow 2x, x being the distance between either second bending line 18 or third bending line 20 and first bending line 12. In the embodiment shown in FIGS. 2-4, the distance between second bending line 18 and first bending line 12 and the distance between the third bending line 20 and first bending line 12 are equal because aperture 14 is symmetrically oriented in each plate member. However, the invention is not intended to be limited to such a design, since an embodiment is possible wherein the distances between said second and third bending lines and said first bending lines are not equal. However, said plate members cannot be molded in a straight line since said spring member would then resist any pivotal movement of said plate members. When positioned in the mold in the molding process the spring hinge must occupy the position that is to be one of the rest positions in the molded product. Further movement of plate member 10 in the direction of arrow 23 (FIG. 3) results in a decrease in the distance between second bending line 18 and third bending line 20. The energy of the spring member 16 tends to return said bending lines to a second distance represented in FIG. 4 by the arrow y'. That is the shortest distance possible between said bending lines with the embodiment. As is shown in FIG. 4 the energy of spring member 16 is arrested by end shoulders 13, 15 of said spring member coming in contact with plate members 10, 11, respectively.

FIGS. 5 and 6 show an embodiment of the spring hinge in a container or box such as a cigarette box indicated by numeral 24, having a body 26 and a cover 28. As is shown in the drawing, the entire unit forms a handsome and attractive container in which spring member 16 blends in with the rest of the total device producing a streamlined effect in either the open or closed position.

FIGS. 7 and 8 illustrate the principle of operation of the embodiment as found in FIGS. 5 and 6 to be identical to that previously explained with reference to FIGS. 2-4. The cigarette box as shown in FIG. 7 is in an open position. In order to close cover 28 of the cigarette box, spring member 16 will have to be stretched and in its travel will pass through the theoretical unstable equilibrium position until it finally comes to an alternate position of rest. As is shown in FIG. 8, body 26 of box 24 serves as a stopping means by making contact with cover 28 and thereby arresting the motion of said hinge prior to its reaching the rest position. In this embodiment it is preferred that the hinge be so designed that cover 28 is stopped by said cover coming in contact with body 26 with some energy of tension remaining in spring member 16 so as to produce a clamping action and thereby eliminate the necessity of molding a snap, catch or other clamping means into the edge of the box opposite the hinge. FIGS. 9-12 show another embodiment of this invention. This embodiment contains no undercut. The phrase "undercut" refers to a process in which a "side action motion" is required to remove the part from the mold in the ejection molding process. The reference point in determining the upper part of the mold is the direction of ejection represented by arrow 30 (FIGS. 9 and 12). The hinge is so designed to eliminate production costs and the necessity of cams within the ejection mold to remove interfering properties in the mold which would prevent removal of the product from the mold. Elimination of undercutting within the mold is achieved by a design wherein resilient spring member 16 is integrally joined to plate member 11 by offsetting said spring member from the planes of the walls of said plate member so that the total amount of plastic material forming said spring member only extends within the planes of the walls of said plate member by a distance equal to or less than the thickness of the thin web of plastic material forming the third bending line. It is to be understood that the above description applies to the formation of third bending line 20 but could apply also to the formation of second bending line 18. In the embodiment shown in FIG. 12 the problem of undercutting need not be considered when forming second bending line 18. However, since the term "upper part of the mold" is relative to the ejection direction, the above teaching is intended to be applied to eliminating undercutting in order to remove that part of the spring hinge occupying the lower part of the mold. This design produces a streamlined interior without indentations or incisions forming said third bending line. There are then no obstacles or obstructions to prevent the molded hinge from being ejected in the direction of arrow 30. The container as shown in FIG. 12 is in the position it will actually occupy in the mold, the upper part of the mold being indicated by arrow 30. The principle of operation (FIGS. 9-12) is identical to that previously described with reference to FIGS. 2-4. In FIG. 9, second bending line 18 and third bending line 20 are closer with respect to each other than in FIG. 10. FIG. 10 shows said spring member in a position of maximum elongation or theoretical unstable equilibrium. In FIG. 11, the distance between second bending line 18 and third bending line 20 is decreased from that shown in FIG. 10. The elastic energy of the spring member tends to bring the plate members together so that said second and third bending lines are as close as the construction of the hinge allows once past the theoretical unstable equilibrium position. The spring hinge in FIG. 11 is in a rest position, due to the stopping action of plate members 10 and 11 contacting each other.

In a typical embodiment of this invention, the spring hinge is generally molded of polypropylene, but any other material having the desired properties of moldability and flexibility in thin sections without breakdown are contemplated and within the scope of this invention.

As will be apparent to those skilled in the art, other uses and applications not shown are within the scope and spirit of this invention. For example, an embodiment may be employed as a spring hinge for eyeglass frames and any number of products which employ a spring hinge.

I claim:

1. A unitary spring toggled hinge molded of a resilient material which is flexible in thin sections, said hinge comprising:

two substantially thick and rigid plate portions interconnected by linelike relatively thin and flexible sections of said material, said sections being aligned with each other along a main bending line of said hinge and spaced apart by an aperture through said hinge, said aperture extending laterally of said main bending line partially into each plate portion;

an arcuate toggle spring formed of a relatively rigid but resilient substantial thickness of said molded material, said spring extending arcuately away from and over said main bending line spanning said aperture and having each of its opposite ends connected to a respective one of said plate portions by additional thin linelike flexible sections of said molded material which form second and third bending lines of said hinge at respective opposite ends of said aperture, said second and third bending lines being parallel to said main bending line but respectively offset

therefrom in said extensions of said aperture whereby said arcuate spring serves to resiliently urge said plate portions in either of two permissible directions of bending along said main bending line away from an aligned relationship with each other and thereafter to resiliently retain said plate portions in one of said nonaligned relationships.

2. A unitary hinge as set forth in claim 1 wherein said hinge is molded of polypropylene.

3. A unitary hinge as set forth in claim 1 wherein said plate portions are integrally molded in a container, said container having a body and a cover where said body and cover comprise said plate portions.

4. A unitary hinge as set forth in claim 1 wherein said aperture is centrally oriented with respect to each plate portion.

5. A unitary hinge as set forth in claim 1 wherein said aperture is extended a greater distance into one of said plate portions than the other.

6. A unitary hinge as set forth in claim 1 wherein one of said second and third bending lines of said spring section is offset from main bending line a greater distance than the other of said second and third bending lines.

7. The hinge as set forth in claim 6 wherein said one offset bending line is disposed along a wall of a container.

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