SPRING HINGE STRUCTURES

Assignees: Howard E. Crawford, Dearborn; Robert C. Haake, Holly, both of, Mich.; part interest to each

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Primary Examiner—Paul R. Gilliam
Assistant Examiner—Kenneth J. Dorner
Attorney, Agent, or Firm—Hauke, Gifford, Patalidis & Dumont

ABSTRACT

Spring hinges wherein a unitary plate is separated into adjacent portions by a thin flexible section to permit hinge motion of the plate portions along a bend line which is interrupted by a U-shaped cut-out tab formed integrally with one plate portion and separated from the other plate portion, the tab having cylindrical and flat surface portions, and the other plate portion carrying a resilient or spring-loaded element abutting the tab surfaces so that when engaged on the cylindrical portion no bias of the plate portions is effected, but when engaging the flat tab surface portion the plate portions will be biased toward selective relative positions.

16 Claims, 12 Drawing Figures
SPRING HINGE STRUCTURES

BACKGROUND OF THE INVENTION

A. Field of the Invention
My invention relates to spring-biased hinges as are used on cupboard doors and the like.

B. Description of the Prior Art
Well-known spring hinges of the type which the present invention can replace are such as those disclosed in U.S. Pat. Nos. 3,205,332, 3,255,484, 3,344,462, 3,381,332, 3,381,333, 3,391,420, 3,397,422, 3,521,319, 3,531,823, 3,550,186, 3,550,187, 3,568,241, 3,600,743, 3,613,151, 3,623,185 and 3,629,899. Such hinges, however, are costly due to the many parts requiring manufacture, as well as presenting many problems in their fabrication and assembly.

Simplified one-part spring hinges, for example as disclosed in U.S. Pat. Nos. 3,561,039 and 3,562,852 and involving resilient materials have been devised, but these have a generally constant spring rate applying continuous counter-pressure when deformed from their normal configurations, so that they cannot be used for many purposes as can those hinges of the first noted group of patents which have cam-spring combinations for holding the hinge parts in different selected positions. Finally, in unitary hinges fabricated to embody "over-center" positioning capabilities, such as in U.S. Pat. Nos. 3,628,215 and 3,629,901, such hinges being made of high flex life resilient plastics such as polypropylene, it is seen that they are under constant bias toward one side or the other of the "center" position, and thus are of relatively limited usage because they lack the versatility and positive positioning features needed in many hinge applications.

SUMMARY OF THE INVENTION
My invention involves the cam-spring principle involved in the more costly type of spring hinges while making use of low cost plastics in which the hinge proper is made in a single part, thus overcoming the high cost problem while retaining the desired versatility, as well as the positive positioning aspects, of the hinges of the first group of patents listed in the foregoing paragraph.

Basically, the present hinge is formed as a unitary plate, of high flex life plastic such as polypropylene or the like, separated into adjacent portions by a thin flexible joining section extending along a bend line but interrupted by at least one partially cut-out tab formed integrally with one plate portion and separated from the other plate portion, the tab and the other plate portion having a resilient spring means counter to bias the plate portions toward selected relative angular positions.

The positions are selected in preferred modifications by forming the tab as a substantially cylindrical element with at least one flat, and engaging the tab with a spring element retained adjacent thereto so when the hinge is moved toward engagement of the flat and spring, the spring will tend to bias the hinge portions toward a position wherein the flat and spring are fully engaged, but otherwise non-biased hinge motion is possible when the spring engages the cylindrical and hence constant radius surfaces.

Plural tabs and spring elements may be used to multiply the biasing pressure, and plural flats may be used on a single tab to provide multiple positioning characteristics.

The present concept is readily embodied in heavy door hinges, piano hinges and the like, and a modification using a varying radius tab can be used to function as a door closer.

DESCRIPTION OF DRAWINGS
A more complete understanding of my invention may be obtained upon referring to the accompanying drawings illustrating various embodiments of the invention in which like reference characters refer to like parts throughout the several views and in which:

FIG. 1 is a fragmentary perspective exploded view of a support and door structure or the like with a hinge of the present invention;

FIG. 2 is a fragmentary perspective view of the support, door structure and hinge assembled and in another position;

FIG. 3 is an elevational plan view of the hinge of FIGS. 1 and 2;

FIG. 4 is a transverse cross-sectional view through the center of the hinge of FIGS. 1-3 in its cam action position;

FIG. 5 is an elevational plan view illustrating a hinge embodying another modification of the invention;

FIG. 6 is an elevational end view of the hinge of FIG. 5;

FIG. 7 is a fragmentary cross-sectional view taken substantially on the line 7-7 of FIG. 5;

FIG. 8 is a fragmentary cross-sectional view similar to that of FIG. 7 but illustrating another hinge modification;

FIG. 9 is a fragmentary cross-sectional view similar to that of FIG. 7 but illustrating yet another hinge modification;

FIG. 10 is a fragmentary elevational view illustrating a further hinge modification; and FIGS. 11 and 12 are fragmentary cross-sectional views similar to that of FIG. 7 but illustrating yet further hinge modifications.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

FIGS. 1-4 illustrate an integral hinge plate member 10 formed of a portion 12 adapted to be secured by any means such as screws 14 to the edge of a cupboard door opening, door jamb or the like support 16, and a portion 18 adapted to be secured by any means such as a screw 20 to a recess provided in a door 22.

The hinge 10 is formed of a "long flex life" plastic material such as polypropylene or the like, the portions 12 and 18 being separated by a thin flexible joining section 24 extending along a bend line for relative hinge motion of the portions 12 and 18 substantially about the axis A of the bend line.

The flexible bend line section 24 is interrupted by a partially cut-out tab 26 formed integrally with the portion 18 and separated from the portion 12 on three edges as shown. The tab 26 is formed as a partial cylinder extending along the axis A with a flat 28 provided along one side.

The portion 12, having a U-shaped recess 30 substantially complementary with the three edges of the tab 26, has an extended housing 32 provided with bores 34 for containment of a pair of compression springs 36 (FIG. 4) in which are seated cam elements 38 resi-
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iently urged by the springs 36 against the adjacent surface of the tab 26.

In use, the hinge may flex between a position such as that of FIG. 2 in which the cam elements 38 engage on a constant radius surface of the tab 26 and thus apply no hinging bias pressure thereon, and a position approaching that of FIG. 4 in which the cam elements 38 edge off of the radius surface to apply a hinging bias which forces the hinge portions to relative positions of FIG. 4 in which the cam elements 38 are fully engaged on the flat 28 and resiliently hold the hinge portions 12 and 18 in such positions.

It will be apparent that in FIGS. 1–4 the support 16 may as well be a door and the door 22 may as well be a support, with the same effect. It will be seen also that the present hinge is well suited to use as "hidden" hinges.

Another type of hinge 40 is illustrated in FIGS. 5–7 as comprising a pair of substantially normally coplanar adjacent portions 42 and 44 integrally connected by a thin flexible section 46 extending along a bend line for relative hinge motion substantially about the axis A.

The section 46 is interrupted by a partially cut-out tab 48 formed integrally with the portion 44 and separated from the portion 42, the tab being formed as a partial cylinder extending along the axis A with a flat 50 extending in a plane substantially normal to the plane of the portion 44.

The portion 42, having a U-shaped recess 52 substantially complementary with the tab 48, supports a leaf spring element 54 as shown for engagement with the tab 48 so that, when the portions 42 and 44 are moved to the phantom line position shown in FIGS. 6 and 7, the spring element 54 engages a constant tab radius and exerts no hinging bias, but when moved toward the coplanar position the spring element 54 edges off the cylindrical surface and biases the portions 42 and 44 to the full line position illustrated with the spring element 54 fully engaged on the flat 50.

FIG. 8 illustrates another embodiment similar to that of FIGS. 5–7 but in which a flat 501 is provided on the tab 48 substantially parallel to the plane of the portion 44 such that in the full-line coplanar position shown no hinging bias is exerted, but when the portions 42 and 44 are moved toward the phantom line position illustrated the spring element 54 edges off the radius and urges the portions 42 and 44 to the phantom line position at a 90° angle.

In the modification of FIG. 9, the tab 48 is shown as provided with two flats 502 and 503 functioning to provide opposite biased positions of the hinge as indicated by the two phantom line positions.

FIG. 10 illustrates a piano hinge 60 modification comprising portions 62 and 64 integrally connected by a thin flexible section 66 extending along a longitudinal bend line for relative hinge motion about the axis A, the section 64 being interrupted by a plurality of partially cut-out tabs 68, 70 and 72, the tabs 68 and 72 being similar to the tab 47 of FIG. 7 and the tab 70 being similar to the tab 48 of FIG. 8, respectively having flats 74 and 74.

The portion 62 has a plurality of recesses 76 provided with leaf springs 78 and 80 as previously described. The springs 78 thus will operate to bias the portions 62 and 64 toward the coplanar position shown while the spring 80 will operate to bias the portions 62 and 64 toward a 90° relative position. Note that any number of tabs and springs may be used in a single hinge, and that some tabs may be formed integral with different hinge portions.

FIG. 11 illustrates yet another modification similar to that of FIGS. 5–7 but in which a tab 80 is formed as shown with a pair of flats 82 and 84 with a decreasing radius surface therebetween, such that, when the leaf spring element 54 is moved out of the phantom line position 423 it will exert a small but gradual hinging bias toward the phantom line position 422, thereby enabling use as a door closer with positive end holding positions.

FIG. 12 illustrates yet a further modification in which a tab 86 is formed of an entire series of flats 88, 881, 882, 883 and 884 so that the portions 42 and 44 will always be biased toward one or the other of a number of holding positions as indicated by the full line and multiple phantom line illustrations.

It will be noted that tabs shaped in different ways will effect different results. For example, smaller flats on the tabs will provide a smaller hinging bias motion. Combinations of flats in desired planes other than those shown are possible. Steeper or shallower variable radius gradients than that of FIG. 11 may be used to effect more or less closing bias.

Further, other biasing elements than the springs shown and described herein may be used.

Instead of flats on a tab, concave depressions may be used for more positive holding engagement with a complementary convex-shaped spring element. In fact, many and varied coacting elements on the hinge portions may readily be provided to obtain unlimited results depending on the uses to which the hinge may be put.

The concept herein described may of course be used with hinges of different sizes and other shapes than those shown, depending on load factors, decorative needs, and the like.

Having shown and described a number of preferred embodiments of my invention, it will be apparent to one skilled in the art to which the invention pertains that various other changes and modifications may be made therein without departing from the scope of the invention or the spirit of the appended claims.

I claim:

1. A spring hinge comprising a unitary plate separated into adjacent portions by a thin flexible joining section extending along a selected bend line for relative hinge motion of said plate portions around the axis of said bend line, said flexible joining section being interrupted by at least one partially cut-out tab formed integrally with one plate portion and severed from the other plate portion and extending across said bend line, said hinge having means cooperatively engaging said tab and said other plate portion to bias said plate portions toward a selected angular relationship.

2. The hinge of claim 1 wherein said means includes a resilient spring element carried by said other plate portion for camming engagement with said tab.

3. The hinge of claim 2 wherein said tab is formed with a flat portion effecting when engaged with said spring element a bias of said tab and its integral plate portion to a selected angular position with respect to the other plate portion.

4. The hinge of claim 2 wherein said tab is formed with a portion substantially cylindrical around the axis of said bend line to effect no bias when engaged with
said spring element and a flat portion effecting a bias of said tab and its integral plate portion to a selected angular position with respect to the other plate portion when said spring and said flat portions are engaged.

5. The hinge of claim 2 wherein said tab is formed with multiple flat portions each effecting when engaged with said spring element a bias of said tab and its integral plate portion to a selected angular position with respect to the other plate portion.

6. The hinge of claim 2 wherein said tab is formed with a portion substantially cylindrical around the axis of said bend line to effect no bias when engaged with said spring element and multiple flat portions each effecting when engaged with said spring element a bias of said tab and its integral plate portion to a selected angular position with respect to the other plate portion.

7. The hinge of claim 1 wherein said flexible section is formed to permit hinge motion of one plate portion to both sides of a common plane with the other plate portion.

8. The hinge of claim 3 wherein said tab flat portion is disposed in a plane angularly intersecting the plane of said one plate portion.

9. The hinge of claim 3 wherein said tab flat portion is disposed in a plane extending normal to the plane of said one plate portion.

10. The hinge of claim 3 wherein said tab flat portion is disposed in a plane extending parallel to the plane of said one plate portion.

11. The hinge of claim 1 wherein said bend line is interrupted by multiple spaced apart partially cut-out tabs each formed integrally with one of the plate portions and separated from the other of the plate portions, each tab and its related other plate portion having means cooperatively engaging to urge said plate portions toward a selected angular relationship.

12. The hinge of claim 11 wherein one tab and the means engaging therewith are formed to urge said plate portions toward one selected angular relationship and another tab and the means engaging therewith are formed to urge said plate portions toward a different selected angular relationship.

13. The hinge of claim 5 wherein one flat portion is formed to effect a bias of one plate portion toward a position angled to one side of the other plate portion and another flat portion is formed to effect a bias of said one plate portion toward a position angled to the other side of said other plate portion.

14. The hinge of claim 1 wherein said means urges said plate portions toward planes extending normal to each other.

15. The hinge of claim 1 wherein said means urges said plate portions toward planes common with each other.

16. The hinge of claim 2 wherein said tab is formed with a portion having a varied cam radius around the axis of said bend line to effect a variable bias when engaged with said spring element.

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