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P. J. GRAHAM

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SNAP ACTION HINGE FOR BOX COVERS

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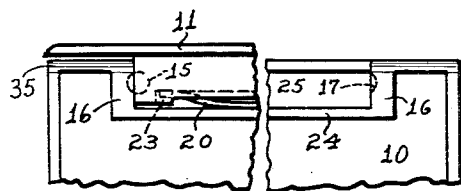


Fig. 4.

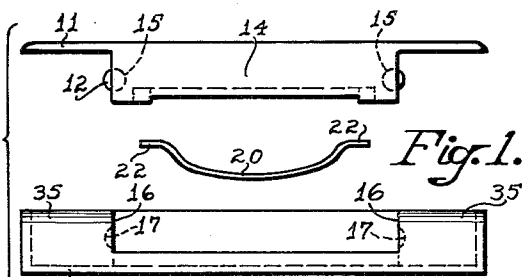


Fig. 1.

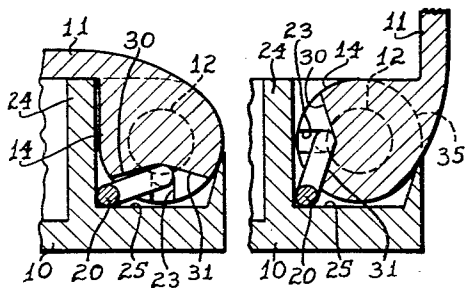


Fig. 5. Fig. 6.

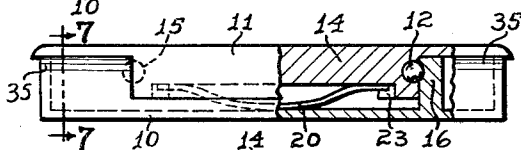


Fig. 2.

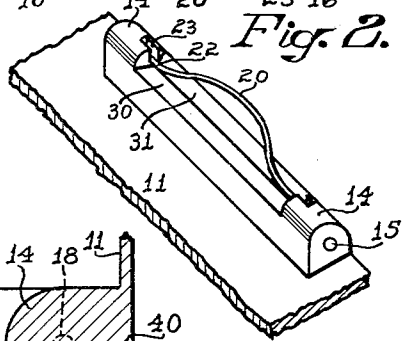


Fig. 3.

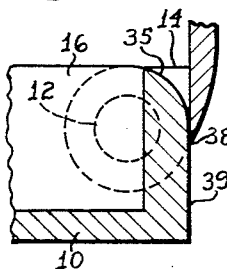


Fig. 7.

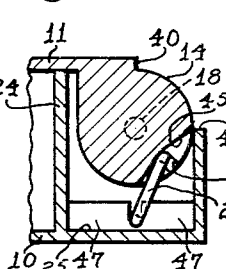


Fig. 9.

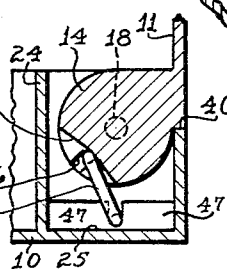


Fig. 10.

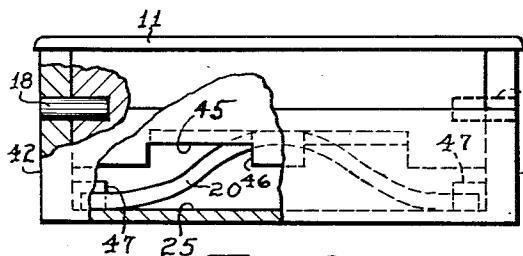


Fig. 8.

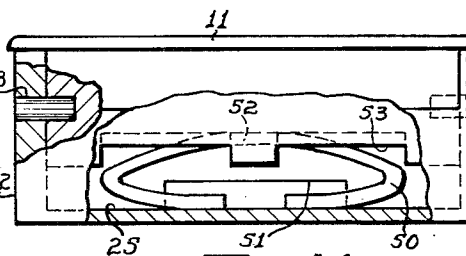


Fig. 11.

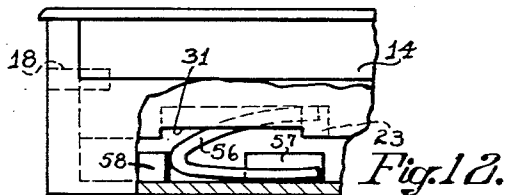


Fig. 12.

Inventor
Philip J. Graham
By Clayton L. Jenkins
Attorney

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SNAP ACTION HINGE FOR BOX COVERS

Philip J. Graham, Worcester, Mass., assignor to Trig Corporation, Worcester, Mass., a corporation of Massachusetts

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1 Claim. (Cl. 220—31)

This invention relates to a snap action hinge structure for receptacle closures and more particularly to a hinge for a moulded plastic box.

Various types of covered receptacles have been made of moulded plastic, and problems have been inherent in the provision of hinge connections between the moulded parts. The cover may be provided with a knuckle which is pivotally mounted by means of pins or balls between spaced lugs formed as a part of the receptacle. Such a construction is shown in my prior pending application Serial No. 20,637, filed April 13, 1948, now abandoned. In that box, the cover is freely movable and is not biased to a closed or an open position. Various hinge constructions have provided a snap action for the cover, but they involve constructional problems or are not wholly satisfactory in their use, or are not especially adapted for moulded plastic parts.

The primary object of this invention is to provide a hinge structure which is especially adapted for moulded plastic boxes in which the cover is pivotally secured to the receptacle and is urged either to a closed or to an open position by a resilient device which may be readily assembled but is substantially wholly concealed and does not interfere with the use of the box.

A further object of the invention is to provide a structure of this general type wherein the box parts may be readily moulded of plastic material and both the hinge and the resilient operating device may be economically made and assembled. Further objects will be apparent in the following disclosure.

In accordance with this invention, the cover of a moulded plastic receptacle is secured substantially permanently in place on a pivotal hinge engaging a knuckle on one part and a lug on the other, which permits the free movement of the cover between open and closed positions. The cover is, however, biased to either one of these positions by means of a rocking toggle including a resilient toggle arm which permits the toggle to cross dead center and snap the cover to an open or a closed position. The toggle preferably comprises a bowed or substantially U-shaped resilient member which pivotally engages the cover or its knuckle in an eccentric position relative to the hinge axis and which rockingly bears against a fixed bearing on the receptacle, the toggle arms being so positioned that when the cover is moved the resilient toggle arm swings across a dead center and resiliently urges or biases the cover towards and holds it in an open or a closed position.

Referring to the drawings, illustrating various embodiments of the invention;

Fig. 1 is an exploded view of the receptacle, cover and spring toggle member in positions ready for assembly;

Fig. 2 is a vertical rear elevation, partly in section;

Fig. 3 is an isometric view of the under side of the cover, partly broken away;

Fig. 4 is a fragmentary top plan view, partly broken away to show the relations of the parts when the cover is open;

Fig. 5 is a fragmentary sectional detail showing the toggle position when the cover is closed;

Fig. 6 is a similar detail, with the cover open;

Fig. 7 is a fragmentary sectional detail taken on the line 7—7 of Fig. 2, but with the cover open;

Fig. 8 is a rear elevation, partly in section, of a modification, showing the spring wire in a reverse arrangement;

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Figs. 9 and 10 are vertical central sections through the toggle of Fig. 8, showing the cover in closed and open positions respectively;

Fig. 11 is a vertical rear elevation, partly broken away, showing a further modification having a double U shape of toggle spring; and

Fig. 12 is a similar fragmentary detail of another form of U-shaped toggle spring bowed laterally.

In the embodiment of the invention illustrated in Figs. 1 to 7, I have shown a receptacle 10 made of suitable moulded plastic having a cover 11 secured thereto by means of pivot balls 12 mounted in hinge bearing recesses. One of the moulded plastic parts, and preferably the cover, is provided with a knuckle 14 having axially aligned, part-spherical recesses 15 premoulded in the opposite parallel ends thereof and into which steel balls 12 of the same radius as the recesses are fitted in a projecting relationship. The other box part, and preferably the receptacle, has a hinge lug carrying the pivot. These are shown as wall or lug portions 16, between the inner parallel walls of which the knuckle interfits. These lugs 16 are provided with similar axially aligned, part-spherical recesses 17 for the hinge pivots 12. The inner faces of the lugs are spaced apart by a distance just slightly greater than the length of the knuckle 14, so that when the pivotal spheres 12 are mounted in the recesses 15 of the knuckle and are sprung into the pivot bearings 17, as is permitted by the flexibility of the walls 16 and associated parts of the box, the balls 12 will secure the parts together substantially permanently. Various procedures, as set forth in my said prior application, may be employed for making and assembling the parts. Also, if desired, a cylindrical pin 18 (Fig. 8) may be substituted for the hinge balls, and in this case each pin may be driven into position through a cylindrical hole in the end wall portion of the receptacle and a similar end bearing recess in the knuckle 14.

In order that the cover may be held resiliently in a closed or open position, I form a toggle of the knuckle and a resilient arm 20 which is pivotally connected to the knuckle 14 and is so mounted in a fixed bearing on the receptacle that the resilient arm 20 may rock or swing across a dead center plane to hold the cover as required. The arm 20 may be made of steel spring wire or of other suitable material and shape. The wire 20 may be variously shaped to serve as a resilient lever arm. It is shown as a substantially U-shaped wire having two axially aligned ends 22 connected by an intermediate bowed portion held under compression during use.

The wire ends 22 are mounted in the recesses 23 (Fig. 3) in spaced portions of the knuckle 14 and so arranged that these constitute the central pivot of the toggle that oscillates through an arc as the cover is moved. Each recess 23 is at right angles to the inner face of the cover and medial of the knuckle, and it is so arranged that the ends of the wire may be sprung into position. The knuckle 14 is shown as mounted in a closely fitting external recess formed by a longitudinal wall 24 connecting the lateral lug walls 16 and the bottom 25, which are so dimensioned as to provide only room for the knuckle and the wire 20 without material waste of space.

The bottom medial portion of the rocking toggle wire 20 is held in a fixed bearing on the receptacle located below the knuckle. This may be formed by the right-angled corner between the vertical wall 24 and the bottom 25 (Figs. 4 and 5). That corner bearing for the center portion of the wire toggle arm is so positioned relative to the slots 23 that the toggle arm 20 may rock through substantially 45° on each side of a plane passing through the hinge axis of the centers of the balls 12 and the corner angle of wall 24 and the bottom 25. The angular position of the wire arm 20 is such that the wire remains in its bearing corner. When the cover 11 is moved from its closed position shown in Fig. 5 to the open position of Fig. 6, the pivot slot or recess 23 and the ends 22 of the toggle wire will rock through an equal angular distance about the fixed pivot of the toggle wire on each side of the dead center plane.

The steel spring wire toggle 20 may be so shaped and of such a length, as illustrated, that the axially aligned piv-

otal ends 22 of the wire are resiliently urged into the slots 23 and will not fall out during assembly. The knuckle 14 is cut away between the slots 23, or between the straight portions 22 of the wire, to provide two walls 30 and 31 which make such an angle that the intermediate bowed part of the wire arm 20 may rock through the required distance without interference. That is, these surfaces 30 and 31 constitute the bottom of a recess as shown in the inverted view of Fig. 3, and when the aligned ends 22 pivot in the slots 23, the medial bent portion of the wire 20 may rock through the limiting angle defined by the walls 30 and 31. The surface 31 forms a limit stop when the cover is opened, since the cover cannot move beyond the vertical position of Fig. 6 after the wire contacts with that surface. The other surface 30 permits the cover to close fully by the time the wire contacts it.

Supplementing the use of the shoulder 31 as a limit stop, the cover and associated receptacle parts may be so shaped that the cover may move only to a limiting open position, such as the vertical, before it strikes an obstruction. As shown in Fig. 7, the receptacle is provided with a rounded part-cylindrical surface 35 over which the under side of the cover 11 rides as the cover is opened. The limiting position of the cover is when the cover edge 38 strikes the back wall 39 of the box. If desired, and as shown in Figs. 9 and 10, the cover may be provided with a shoulder 40 adapted to strike against the top face 41 of the box and rest thereon when the cover is vertical.

In assembly, the spring wire is sprung into the slots 23 of the cover. The length of the wire and the width of the central bowed portion are such that, when assembled, the wire is held under compression in the slots 23 and between the bottoms of the slots and the box corner formed by the walls 24 and 25. The closeness of the walls 24 and 25 to the knuckle insures that the wire cannot move out of position.

As shown in Figs. 8 to 10 inclusive, the spring member 20 may be reversed relative to the arrangement of Fig. 1. The cover knuckle 14 may fit between the end walls 42 of the box; and the pivots are formed of pins 18 inserted in drilled or pre-cast holes in the knuckle and box parts, as is indicated. The under side of the knuckle is shaped to form two spaced projecting parallel-sided lugs having a slot 46 therebetween which pivotally supports the middle straight part of the wire. The knuckle is cut away at each side of these lugs to provide sloping faces 45, similar to the surfaces 30 and 31 shown in Fig. 3, which permit the downwardly projecting sides of the wire bow to rock as required. The ends of the toggle wire 20 are supported in slots between two pairs of lugs 47 projecting upwardly from the box bottom 25 and located near the box ends, or they may be located in the box corner. The knuckle slot lies in a radial line passing through the fixed bearing when the arm is on dead center. Also, the angle between the spring toggle arm and a line from the center of the wire in the slot 46 to the axis of the pivots 18 (Figs. 9 and 10) is greater than 90°, so that in moving the cover through 90° the wire will not spring out of the slot 46 but will always crowd into it. In these constructions, the wire ends form one effective bearing portion of the toggle arm and the medial bowed section of the wire forms the other effective bearing portion.

The modification of Fig. 11 shows that the toggle arm may be substantially an elliptical or other shape of spring which is arranged to rock about a lower fixed pivot bearing. In this construction, the spring 50 is made of a single piece of wire bent to a double U shape, with its ends located at one of the pivot bearings. It is supported between a pair of lugs 51 on the bottom of the box similar to the construction of Fig. 9, or in the corner as shown in Fig. 5, for example. The top central, straight portion of the spring arm is secured within a slotted recess 52, and the outer bent portions of the wire are permitted to rock within the limits prescribed by the sloping faces 53 shaped like the surfaces 30 and 31 of Fig. 3.

The toggle arm may be shaped as a single wire or leaf spring bent into an S or other form to provide suppleness. As shown in Fig. 12, a single spring toggle member 56 is preferably bent to provide a substantially U shape which is bowed laterally. The cover knuckle 14 is shaped as half of the construction of Fig. 3, in which there is only one slot 23 and the sloping surfaces 30 and 31 are made only long enough to provide for rocking the bowed part of the arm 56 which fits into the recessed part of the knuckle. The lower end of the arm 56 may lie in the box corner or be held between a pair of lugs 57 provided for the purpose. An end shoulder 58 may be used if needed to keep the spring 56 from moving endwise. Each of the toggle arms illustrated has a substantially U shape, but other suitable shapes may be employed.

Various modifications of the structure may be made, provided each has a toggle snap action for urging the cover past a dead center towards either a closed or an open position, and the resiliency needed for the purpose may be variously obtained, as will now be understood. Also, it is immaterial which of the hinge parts is considered as the knuckle. The spring wire 20 is appropriately pivoted on whatever lug projects downwardly from the cover and carries the pin 18 or a hinge ball 12. That cover lug may be considered as the knuckle. Hence, the above disclosure is to be interpreted as setting forth the principles of the invention and several embodiments and not as imposing limitations on the appended claims.

Subject matter relative to the ball hinge disclosed herein is claimed in said pending application and my pending application Serial No. 104,968, filed July 15, 1949, now Patent No. 2,624,907.

I claim:

A molded plastic resin box having two parts forming a receptacle and a cover, one of which has spaced lugs and the other a knuckle, the lugs and knuckle having substantially contiguous rotatively interfitting parallel plane faces and being respectively integral with said box parts, the contiguous faces of the lugs and knuckle having a pair of opposed aligned pivot bearings at each side of the knuckle, a spherical metal pivot mounted in each of the opposed bearings and forming the sole hinge for the cover, said box parts being made of a resilient resin which normally holds the pivots in position and is distortable to permit the lugs to be spread apart for assembly of the pivots, the receptacle walls forming an inner space and an external rearwardly and upwardly opening bearing recess separate from said space and located beneath the knuckle, said knuckle having an open bearing slot eccentric to the hinge axis and opposed to and facing said external recess, a resilient substantially U-shaped wire having two axially spaced bearing portions respectively mounted in the knuckle slot and in said external recess and being so located that the wire swings as a toggle under compression across a dead center as the cover is moved, and a shoulder on the receptacle which engages and limits the opening movement of the cover, said parts being so arranged that the wire may be mounted in its associated knuckle slot and external recess and the hinge pivots forcibly assembled by distortion of the receptacle.

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