Oct. 12, 1948. G. E. CURTISS, JR 2,451,380

LATCH

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FIG. 1.

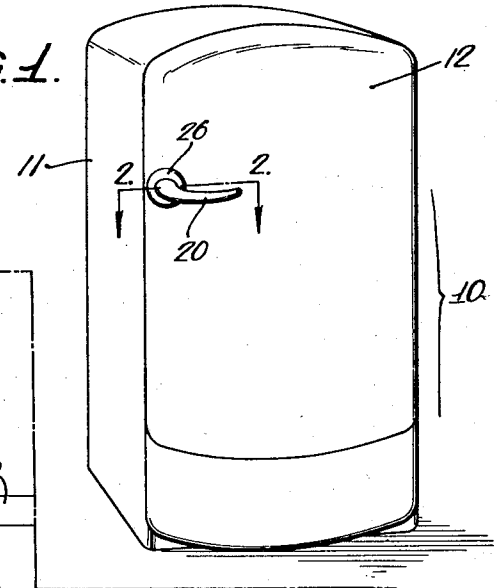


FIG. 2.

FIG. 6.

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FIG. 3.

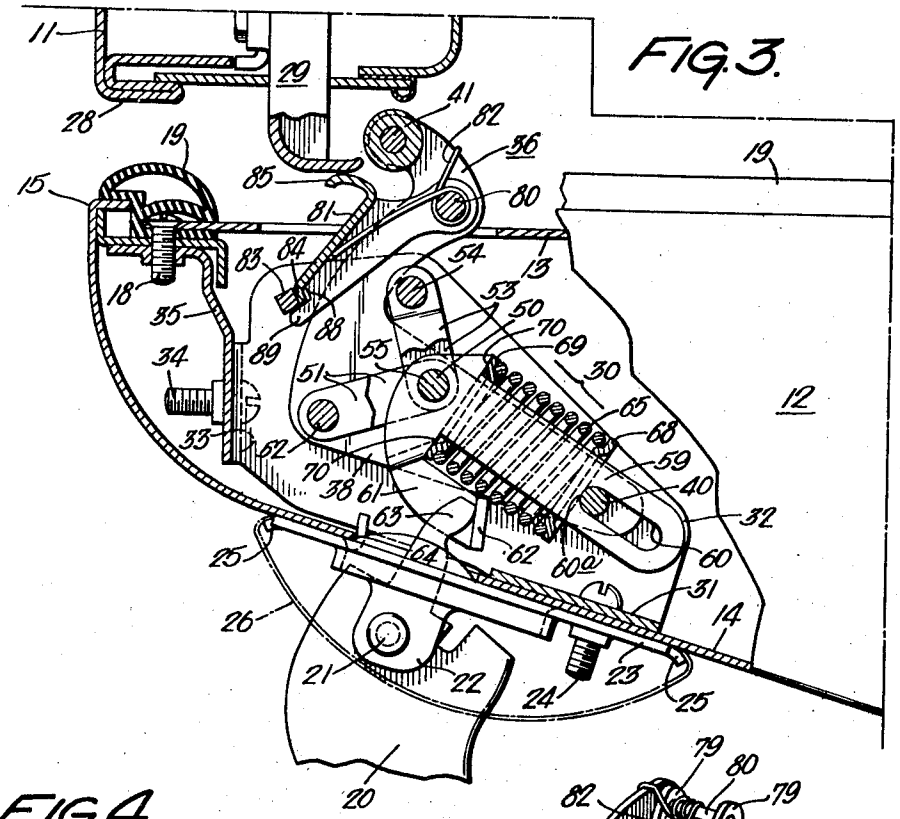


FIG. 4.

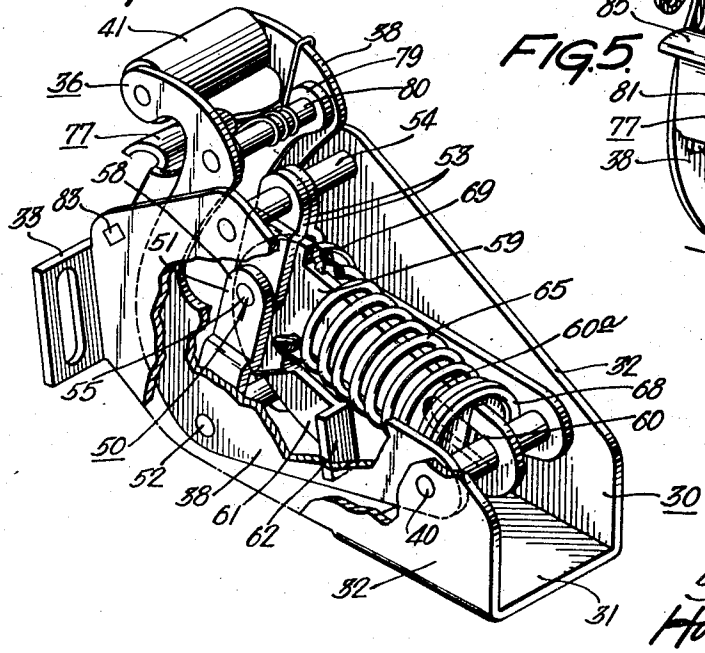
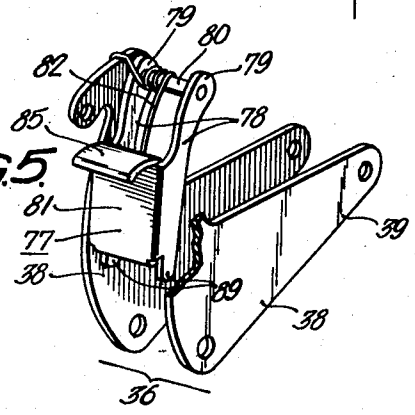


FIG. 5.



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UNITED STATES PATENT OFFICE

2,451,380

LATCH

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Application October 27, 1943, Serial No. 507,839

9 Claims. (Cl. 292—336)

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This invention relates to latches and more particularly to latches of the type adapted for use with refrigerator doors.

Proper latching of refrigerator doors to prevent leakage of cold air from the cooling compartments thereof has always received important consideration by refrigerating engineers since the operating efficiency of a refrigerator depends largely upon an airtight condition of the cabinet. When leakage does occur there is an increase in the frequency or duration of the operating cycle of the compressor and a consequent undesirable increase in operational expense.

Many latches already known in the refrigerator art purporting to provide a positive seal between the door and cabinet of a refrigerator have employed mechanisms such as spring pressed pivotally mounted latch bolts having either flat or hooked faces for engagement with correspondingly shaped strikes and usually having their pivotal mounting adjacent the latch strike when the door is in a closed position. Others have provided cam faces on either or both the bolt and the strike. Experience has shown these mechanisms to be sensitive to "re-bound," that is, when the refrigerator door is swung closed it often strikes the door jamb with sufficient force to "bounce" or "re-bound" to an open position. These known latch mechanisms offer little resistance to such re-bound forces, as the re-bound force need overcome only the spring pressure against the bolt. In latch mechanisms using cam face bolts and strikes, re-bound forces are offered little or no resistance in overcoming the spring pressure as the bolt is assisted in its reverse rotation by the cam action of its cam face against the strike. Re-bound is of course highly undesirable because the refrigerator door often has to be swung to a closed position more often than necessary thereby causing not only undue wear on the latch mechanism but a source of annoyance to the operator also. Many times the door does not re-bound sufficiently to be noticed and remains slightly ajar with a consequent loss of refrigeration. Some known latches have made use of toggle mechanisms of various types in conjunction with springs but the constructions thereof have been such that the tendency to re-bound has not been successfully overcome.

With these premises in mind, the present invention has for its principal object the provision of a latch mechanism designed to amplify the main source of latching power in such a manner that an unusually large "draw-in" of the door to its closed position is achieved and the maximum

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available force in the mechanism is applied to the bolt at the time when it is fully "home" and the door fully closed.

More particularly, it is an object of the invention to provide a latch mechanism having its main pivot point so located as to cause the latch bolt to approach the latch strike angularly from behind in an extended substantially straight-line path, or a substantially flat arc.

Another object of the invention is to provide a latch of the type described which operates absolutely to prevent any re-bound of the refrigerator door when it is swung to a closed position and which positively secures the door in closed position.

A further object of the invention is to provide a self-cocking latch which is adapted for use with various types of standard handles well known in the refrigerator industry.

A still further object of the invention is the provision of a latch of sturdy, compact, inexpensive, and simplified construction, which is adapted to be concealed within the door structure, and which requires a minimum of effort to operate.

These and other objects of the invention and the construction and advantages thereof are fully set forth in the following description and in the drawings, in which:

Figure 1 is a perspective view of a refrigerator embodying the invention;

Figure 2 is a sectional view on an enlarged scale taken in the horizontal plane indicated by the line 2—2 of Figure 1 and showing the mechanism in its latched position;

Figure 3 is a view similar to Figure 2 but showing the mechanism in its unlatched position;

Figure 4 is a perspective view of the mechanism detached from the door and with parts broken away;

Figure 5 is a perspective view of an element of the mechanism; and

Figure 6 is a reduced elevational view of a modification of the invention.

Referring now to the drawings, and more particularly to Figures 1 and 2 thereof, numeral 10 designates a domestic type refrigerator comprising a cabinet 11 and a door 12 having an inner panel 13 and an outer panel 14 joined about their peripheries at 15 as by screws 18 which serve also as a means for fastening a resilient sealing gasket 19 to the door at this juncture. A suitable door handle 20, preferably of standard design, is pivotally mounted upon a pin 21 which is journaled in lugs 22 of a substantially flat member 23 secured to the exterior of the outer panel 14 of the

door 12 by screws or the like 24 and provided with outwardly turned lugs 25 which serve to secure a round face plate 26 about the base of the handle 20. The resilient sealing gasket 19 on the door 12 is adapted to close against a door jamb 28 of the cabinet 11 and provide an airtight seal between the door and the cabinet when the door is closed. The door jamb 28 is equipped with an adjustably mounted keeper 29, having an external strike face for cooperation with a trigger mechanism to be later described.

As best illustrated in Figure 4 of the drawings, the latch comprises a substantially channel-shaped support or housing 30 comprising a bottom wall 31 and a pair of parallel side walls 32, 32 having at the forward ends thereof slotted ear portions 33 turned outwardly at right angles therefrom. As shown in Figure 2, screws 34 pass through these slotted ear portions 33 and are threaded into a member 35 which extends outwardly from the juncture 15 of the outer and inner door panels and is secured to the door at this juncture by the screw 18, thereby providing a fastening for the forward end of the housing 30 to the door 12. The right or rearward end of this housing 30 is fastened through its bottom wall 31 to the inside of the outer door panel 14 by the same screw 24 which secures the flat member 23 to the outside of said panel 14.

Between the parallel walls 32, 32 of the housing 30 is latch bolt 36 (see Figures 4 and 5) preferably comprising a pair of spaced substantially Z-shaped bolt arms 38, 38 each of which has its bottom end 39 journaled to said walls 32, 32 by a pivot pin 40 located toward the rear of said walls and at a point sufficiently offset to the right from the keeper 29, as viewed in Figures 2 and 3, to provide angularly rotational movement of the other end of the bolt 36 in a substantially straight line or flat arc to and from contact with the underside of said keeper 29. Rotatably carried by this other end of the Z-shaped bolt 36 is a self-lubricating cylinder or roller 41 which provides substantially frictionless engagement of said bolt 36 with the underside of the keeper 29.

As shown in Figures 2, 3 and 4 of the drawings, a toggle mechanism comprising a toggle joint 50 is provided within the housing 30 and arranged to rotate the bolt arms 38, 38 about the pivot pin 40 so that the roller 41 is moved into and out of engagement with the underside of the keeper 29. The toggle joint 50 preferably comprises a first pair of spaced links 51, 51 journaled on the aforesaid bolt arms 38, 38 by a pivot pin 52, and a second pair of links 53, 53 journaled on the housing walls 32, 32 by a pivot pin 54. As more clearly illustrated in Figure 2, this latter pivot pin 54 is located on an imaginary straight line connecting the pivotal mounting pin 40 of the bolt arms 38, 38 and the roller 41 carried thereby. By reason of this location of pin 54, the bolt arms are made substantially Z-shaped to provide the necessary clearance with respect to said pin 54 and to avoid striking the pin during pivotal movements of said arms 38, 38 to and from latching position. While pairs of links are preferred, it is to be understood that these first and second links of the toggle joint could just as well be single links.

The links 51, 51 and 53, 53 are pivotally jointed at their outer ends by a pivot pin 55 thereby forming the knuckle 58 of the toggle joint which is constrained in its movements to an arcuate path defined by the rotation of links 53, 53 about the pin 54. Also pivotally attached to the pin 55 at

the knuckle 58 and between links 51, 51 and 53, 53 is a rearwardly extending link 59 having its rearward end slotted as at 60 to receive therethrough the pivot pin 40 which serves to guidingly support the link 59 above the bottom wall 31 of the housing 30, the slot 60 restricting forward motion of the toggle knuckle 58 to an extended substantially straight line position when the latch is in its fully locked position and serving also to restrict rearward movement thereof to the desired retracted position.

Depending from the forward end of the link 59 and extending rearwardly of the knuckle 58 is an arm 61 having a portion 62 turned outwardly at right angles thereto and arranged for engagement with the end of a lever 63 on the door handle 20. This lever 63 extends inwardly through an opening 64 in the outer shell 14 of the door, and between the walls 32, 32 of the housing 30 to impinge against the left face of the outwardly turned portion 62 of arm 61. Surrounding the link 59 and carried thereby is a coil spring 65 having its ends enclosed by slotted washers 68 and 69 through which the link passes, the rearward end of the spring 65 being anchored against the pin 40 while the forward end thereof presses against a pair of abutments 70, 70 on the link 59 disposed closely adjacent the knuckle 58 of the toggle joint 50, and in effect impinges directly against the knuckle 58.

Although a true toggle joint has been described above, that is, a toggle having two joined links movable between extended and retracted positions and in which the movement to an extended position causes an increasing wedging force to be exerted, it will be evident that the same result may be achieved by other toggle arrangements coming within the scope of the instant invention, such as, for example, by eliminating the aforesaid links 53, 53 and properly guiding the ends of the links 51, 51 in the same path in which they are caused to travel when the links 53, 53 are associated therewith.

One modification, such as that just described, is illustrated in Figure 6 of the drawings, wherein the links 53, 53 have been removed and the pin 55 has been replaced by a longer pin 101 which has its ends 102 extending through arcuate slots 103, 103 in the side walls 32, 32 of the housing 30. These slots 103, 103 serve to constrain and guide movement of the pin 101 and its associated links 51, 51 in a path between extended and retracted terminal positions substantially similar to that taken by the knuckle 58 and the links 51, 51 in the preferred embodiment previously described. It is to be understood that by the term "extended position" is meant when the links 51, 51 have been moved to the left terminal position and the term "retracted position" when said links have been moved to the right terminal position as defined by the ends of the aforesaid slots 103, 103.

Referring again to Figures 2, 3 and 5 of the drawings, adjacent the roller 41 is a trigger mechanism 77 having side flanges 78, 78 extending upwardly to form a pair of arms 79, 79 which serve as bearings for pivotally supporting the said trigger mechanism 77 on a pivot pin 80 secured to the upper end portions of the bolt arms 38, 38 and slightly spaced from the roller 41. A flat face portion 81 of the trigger mechanism 77 is normally pressed by one end of a light spring 82, in a clockwise direction about its pivot 80 against a pin 83 (Figure 2) which preferably has a flat surface 84. This pin 83 is secured to the housing walls 32, 32 at the upper forward end

of said housing, and the main body of the spring 82 is wrapped around said pin 80 and has its other end extending upwardly and over one of the bolt arms 38 to provide an anchor for said spring 82. At approximately the mid-point of the trigger mechanism 77, at the upper edge of the flat face portion 81 thereof and adjacent the roller 41, is an outwardly turned portion 85 positioned so as to contact the strike face of the keeper 29 (Figure 3) when the door 12 is swung to a closed position. Provided on the opposite or lower edge of the trigger mechanism is an inwardly turned shoulder portion 88 arranged to move into engagement with the flat surface 84 of the pin 83 and thereby hold the latch in a cocked or ready position upon actuation of the toggle mechanism 50 by the handle 20 to open the door. A pair of lugs 89, formed by lower extensions of the side flanges 78, 78 of the trigger mechanism 77 adjacent the shoulder portion 88, is provided for properly aligning said trigger 77 on the flat face 84 of the pin 83.

In operation, and assuming the device to be in the latched position, as illustrated in Figure 2, and that it is desired to open the door, the door handle 20 is grasped and pivoted in a clockwise direction to actuate the lever 63 against the outwardly turned portion 62 of the depending arm 61 and move the link 59 to the right thus retracting the knuckle joint 58 of the toggle mechanism 50 and at the same time compressing the coil spring 65 against the pivot pin 40. This movement of the link 59 to the right is limited by the left end 60*a* of the slot 60 striking the pin 40 (Figure 3). Retraction of the knuckle joint 58 causes the links 51, 51 to draw the bolt arms 38, 38 upwardly and to rotate about the pivot pin 40 in a clockwise direction and move the roller 41 in a substantially flat arc angularly away from the keeper 29 until said roller will just clear the edge of said keeper upon movement of the door 12 to its open position. At the same time the flat face 81 of the trigger mechanism 77 rides against the pin 83 until the left end 60*a* of the slot 60 strikes the pin 40 at which time the trigger swings freely in a clockwise direction until the lugs 89 strike the pin 83 and properly align the trigger 77 with the pin 83 and the shoulder portion 88 on the flat surface 84 of the pin 83 where it is releasably held by the counterclockwise urge of the now loaded coil spring 65.

The latch is now in the cocked position ready to snap to a closed position upon contact of the portion 85 of the trigger with the strike face of the keeper 29. The latch mechanism remains in this cocked position until the door 12 is swung to a closed position, whereupon the outwardly turned portion 85 of the trigger mechanism 77 contacts the strike face of keeper 29 to disengage the trigger from the pin 83 and free the spring 65 to urge the toggle joint 50 to its extended or straight line position shown in Figure 2. At the instant of trigger disengagement, the bolt arms 38, 38 are rotationally urged in a counterclockwise direction by the straightening toggle joint thereby moving the roller 41 angularly from behind in a substantially flat arc to contact the underside of the keeper 29 and, with the ever-increasing force exerted by the straightening of the toggle joint, draw the door into its closed position.

It can be seen that a gentle pressure of the outwardly turned portion 85 of trigger mechanism 77 against the strike face of the keeper 29 is sufficient to overcome the light pressure exerted by the spring 82 and cause the shoulder 88 to move off the flat surface 84 of the pin 83 thus releasing the force of the spring 65 to impinge against the knuckle 58 of the toggle joint 50 and force the knuckle to its extended or straight line position, as illustrated in said Figure 2, thereby obviating the necessity of slamming the door to its closed position.

By reason of the novel arrangement of the spring 65 impinging against the knuckle 58 of the toggle joint 50, and the offset location of the pivot 40 of the bolt arms 38, 38 the toggle force tending to rotate said arms 38, 38 in a counterclockwise direction effects engagement of the roller 41 against the underside of the strike 29 immediately upon release of the trigger mechanism, to urge the door 12 in a closing direction, and delivers an increasingly amplified "draw-in" force on the mechanism as the toggle joint approaches its dead-center or extended straight-line position at which time the greatest force has been delivered and the door is secured in its fully closed position. The sealing strip 19 will thus be drawn against the jamb 28 in a slightly compressed and air-tight or leak-proof condition. The straight-line position of the toggle prevents any re-bounding of the door because the rebound force is directed against the fixed pivot pin 54 and thus restrained.

The operation of the modified embodiment, as illustrated in Figure 6 of the drawings, is similar to that of the preferred embodiment except that the links 51, 51 are guided in their movements to actuate the bolt arms 38, 38 into and out of engagement with the keeper 29 by the pin 101 and slots 103, 103.

It will be understood that a position of the toggle knuckle 58 slightly over dead center, to the left, as viewed in Figure 2, will achieve the same result as stated above. It should also be understood that the pivot pin 40 may be moved to the right or left without destroying the function of the bolt mounted thereon. Its present location, however, has been found to be the most desirable. To provide an adjustment of the pressure exerted against the sealing strip 19 when the door is closed against the jamb 28, the keeper 29 is provided with a slot 90 through which the bolt 91 is passed and threaded into a nut 92 for securing the strike to the jamb. Thus, by loosening the nut 92, the strike may be moved inwardly or outwardly to adjust its relative position with the jamb. Similarly, the door handle 20 is of standard design and it will be understood that any one of a number of various types of standard handles may be used for moving the link 59 to the right. Most of the latch parts may be made by simple stamping methods and the mechanism may be less expensively manufactured than latches having parts that must be accurately machined.

From the foregoing, it will be evident that the present invention provides a novel refrigerator door type of latch that has an unusually large "draw-in" capacity wherein an ordinarily decreasing spring force is utilized in such a manner that instead of its decreasing force being used to pivot the bolt against the strike to "draw-in" the door to its closed position, as is customary in prior latches, it is directly applied to the knuckle of a toggle joint wherein it is substantially and continuously amplified thereby, until the bolt has reached its fully home position and the door is "drawn-in" to a fully closed position. Further-

more, the invention provides a sturdy and compact latch mechanism that absolutely prevents the door of a refrigerator from bouncing or rebounding to an open or ajar position when it contacts the door jamb upon being swung to a closed position, and to positively hold the door in its closed position by so positioning the toggle joint that when the door is fully closed the toggle links are in an extended or straight line position and the re-bound force is directed therethrough to the fixed pivot pin and thereby restrained.

It is also evident that the present invention provides a latch which eliminates the necessity of slamming the refrigerator door as but slight force is required to un-cock the trigger mechanism to release the toggle actuating spring force. Moreover, the individual parts thereof are of inexpensive and simple design thus lending themselves well to mass production methods at comparatively low cost.

It will be understood further that the apparatus described and shown herein, including the configuration of the several parts thereof, is merely illustrative of the inventive principles involved, and that these principles may be applied to other physical embodiments within the scope of the claims without departing from the spirit of the invention.

I claim:

1. In a door latch, a movable latching member, a toggle having one of its links anchored and its other link pivotally connected to said latching member and movable between an extended substantially straight line position and a retracted terminal position to move said latching member into and out of latching position, and spring means impinging against the knuckle of said toggle for moving said member into extended position.

2. In a door latch, a movable latching member, a toggle having one of its links anchored and its other link pivotally connected to said member and movable between an extended substantially straight line position and a retracted terminal position to thereby move said member into and out of latching position, spring means impinging against the knuckle of said toggle for moving said member into its extended position, and manual means for moving said member out of said latching position.

3. A door latch comprising a support, an elongated latching member pivotally mounted at one of its ends to said support, a toggle having one of its links pivoted on said housing and its other link pivoted on said latching member at a point intermediate of the ends of said latching member, resilient means impinging against the knuckle of the toggle for urging said toggle into an extended substantially straight line position to rotate said latching member into latching position, means for retracting said toggle to rotate said member out of latching position, and means for limiting said extending and retracting movements.

4. A latch for a door arranged for cooperation with a strike mounted on a cabinet, comprising a latch bolt, a toggle having the outer end of one of its links anchored on the door and the outer end of its other link pivotally connected to said latch bolt, spring means impinging against the knuckle of said toggle for urging it into an extended straight-line position to move said bolt into engagement with said strike for drawing in said door to a tightly closed position, means for moving said toggle into a retracted position to disengage said bolt from said strike, and means for releasably holding said toggle in said retracted position.

5. A door latch comprising in combination a keeper having a strike face, a housing, a latch bolt pivotally mounted on said housing, a toggle movable between extended and retracted terminal positions and having one of its links arranged to react against said housing and its other link operatively associated with said latch bolt, spring means impinging against the knuckle of said toggle operable to move said toggle toward a straight-line position and pivot said bolt into engagement with said keeper upon initiation of said movement to draw said door into a closed position with increasing force as the toggle approaches said fully extended position, manual means for urging said toggle to said retracted position against the urge of said spring means and disengage said bolt from said keeper to allow said door to be opened, and trigger means to hold said toggle in its retracted position against the urge of said spring means, said trigger means being releasable upon contact with said strike face to release said spring means.

6. A door latch comprising in combination a keeper having a strike face, a substantially channel-shaped housing having side and bottom walls, a substantially Z-shaped latch bolt having the lower end thereof pivotally mounted on the walls of the housing at a point transversely offset from the keeper and the other end carrying a strike engaging means thereon, a toggle movable between extended and retracted positions and having one of its links pivotally anchored on said housing and its other link pivotally connected to said latch bolt intermediate the ends of said bolt, spring means impinging against the knuckle of the toggle operable to urge the toggle to said extended position and move the keeper engaging end of the bolt in a substantially flat arc about its pivotal mounting into engagement with the keeper upon initiation of said movement to subsequently draw-in the door to a closed position with a force which increases until the toggle reaches said fully extended position, manual means operable to urge the toggle to said retracted position and compress said spring means to disengage the bolt from the keeper and allow the door to be opened, and spring pressed trigger means to hold the toggle in said retracted position against the urge of the compressed spring means, said trigger means being adapted to release the spring means upon contact with the strike.

7. A latch structure comprising a support, a latch bolt pivotally mounted on said support for movements into and out of latching positions, a toggle having one of its links pivotally mounted on said support and its other link pivotally mounted on said latch bolt, a link having one end pivotally carried by the knuckle of said toggle and its other end having lost motion connection with the pivotal mounting of said bolt for permitting limited reciprocation of said arm during movements of the latch bolt to and from latching positions, a coil spring carried by said arm and having one of its ends anchored against said pivotal mounting of said bolt and its other end impinging against the knuckle of the toggle to thereby urge said toggle into an extended straight-line position to rotate said bolt into latching position, means for retracting said toggle to rotate said bolt out of latching position, and trigger means for releasably holding said toggle in its restracted position.

8. In a latch mechanism for latching a door with a fixed structure, a latch bolt movable in a plane substantially normal to and adapted to engage the bolt-retaining surface of a keeper mounted on said structure, a toggle associated with said bolt and arranged to operate by expansion to advance the bolt into interlocking engagement with said keeper with increasingly amplified force as the toggle approaches the fully expanded position, resilient means operatively connected with said toggle for urging the toggle into the expanded position, and means for retracting the toggle against the action of said resilient means to disengage the bolt from the keeper, said bolt, toggle and keeper being constructed and relatively arranged so that the bolt when advanced into said engagement will meet the said retaining surface of the keeper substantially before the bolt has moved into the fully advanced position whereby the said resilient means may be effective through the expanding toggle to draw the door securely to a tightly closed position against said structure.

9. In a latch mechanism for latching a door with a fixed structure, a latch bolt movable in a plane substantially normal to and adapted to engage the bolt-retaining surface of a keeper mounted on said structure, a toggle associated with said bolt and arranged to operate by expansion to advance the bolt into interlocking engagement with said keeper with increasingly amplified force as the toggle approaches the fully expanded position, resilient means operatively connected with said toggle for urging the toggle into the

expanded position, means for retracting the toggle against the action of said resilient means to disengage the bolt from the keeper, means for holding the toggle and bolt in retracted position independently of said retracting means, and means operative to release said holding means when during closing movement of the door the bolt and keeper have been brought to contiguous positions wherein the bolt may be projected by said resilient means into interlocking engagement with the keeper, said bolt, toggle and keeper being constructed and relatively arranged so that the bolt when projected into said engagement will meet the said retaining surface of the keeper substantially before the bolt has moved into fully projected position whereby the said resilient means may be effective through the expanding toggle to draw the door securely to a tightly closed position against said structure.

GEORGE E. CURTISS, JR.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,184,498	Wells	May 23, 1916
1,542,916	Skogerson	June 23, 1925
1,810,532	Rubin	June 16, 1931
1,880,585	Tibbetts	Oct. 4, 1932
1,937,978	Miller	Dec. 5, 1933
2,136,662	Anderson	Nov. 15, 1938
2,234,541	Parsons	Mar. 11, 1941

Disclaimer

2,451,380.—*George E. Curtiss, Jr.*, Penn Wynne, Pa. LATCH. Patent dated Oct. 12, 1948. Disclaimer filed Aug. 28, 1951, by the assignee, *Philco Corporation.*

Hereby enters this disclaimer to claims 1, 2, and 8 of said patent.

[*Official Gazette October 9, 1951.*]