April 7, 1959 E. B. JACOBSON 2,881,021

LATCH MECHANISM

Filed June 22, 1955 3 Sheets-Sheet 1

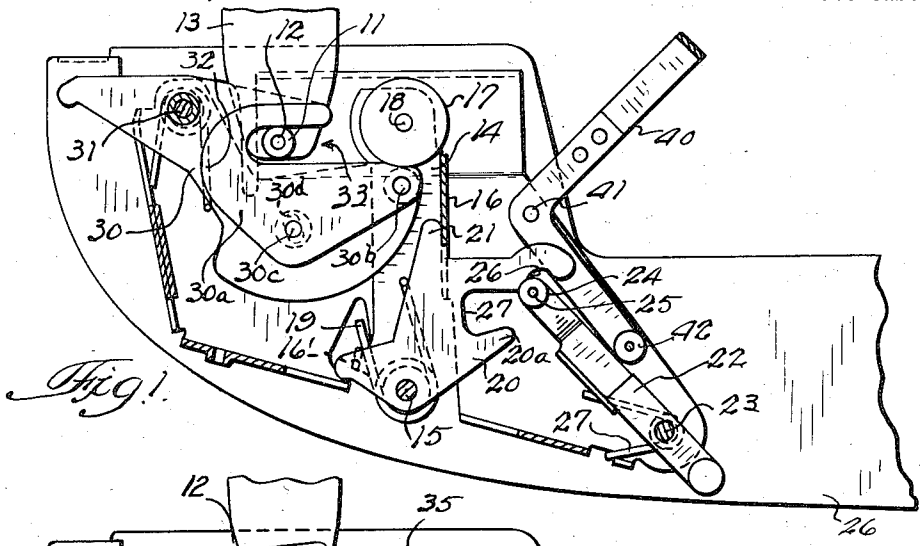


Fig. 1.

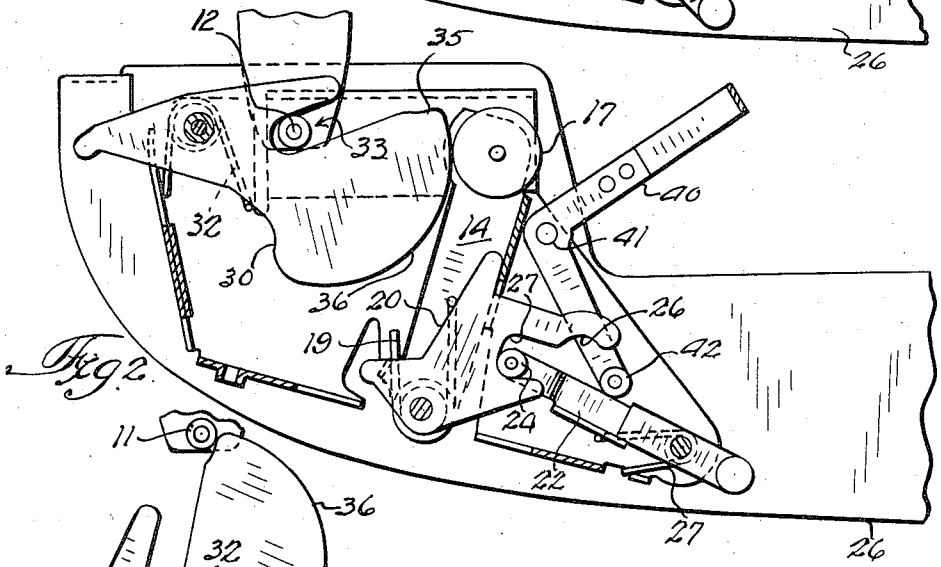


Fig. 2.

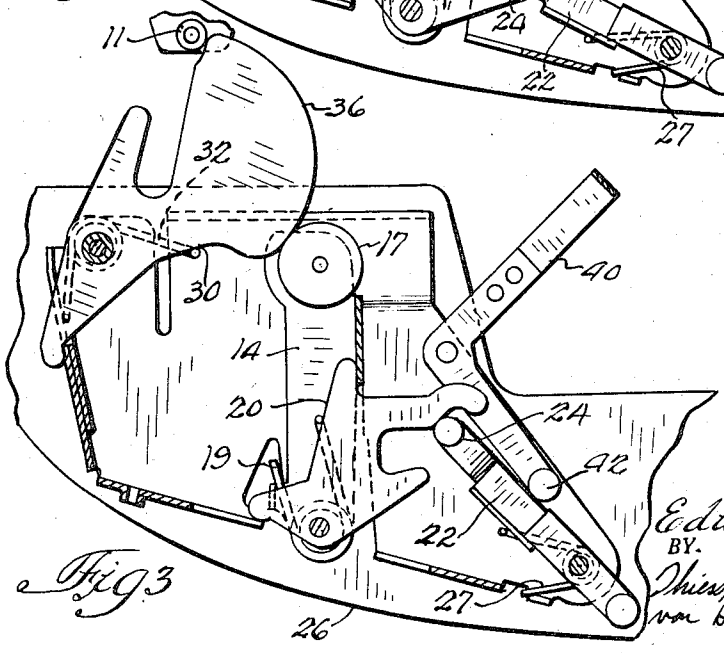


Fig. 3

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Filed June 22, 1955 3 Sheets-Sheet 2

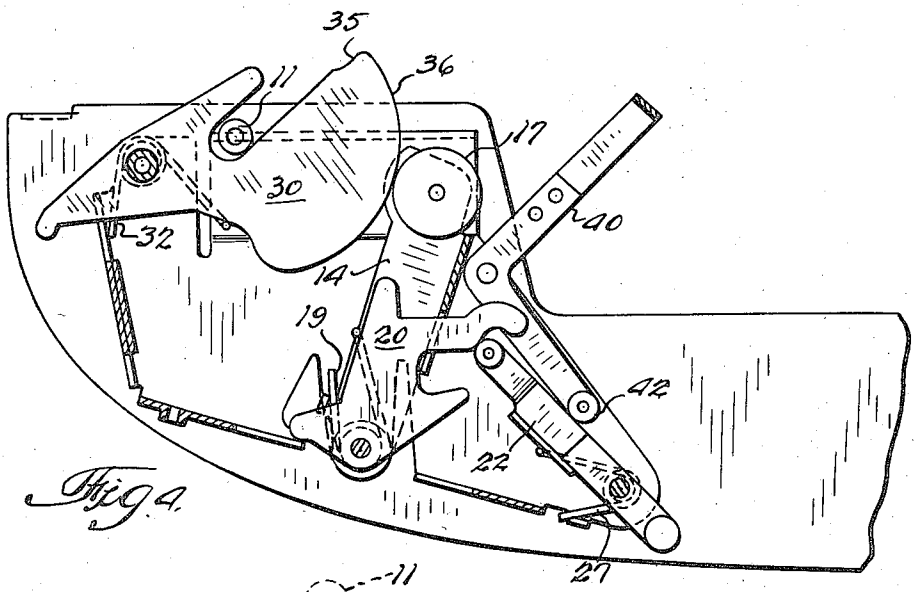


Fig. 4.

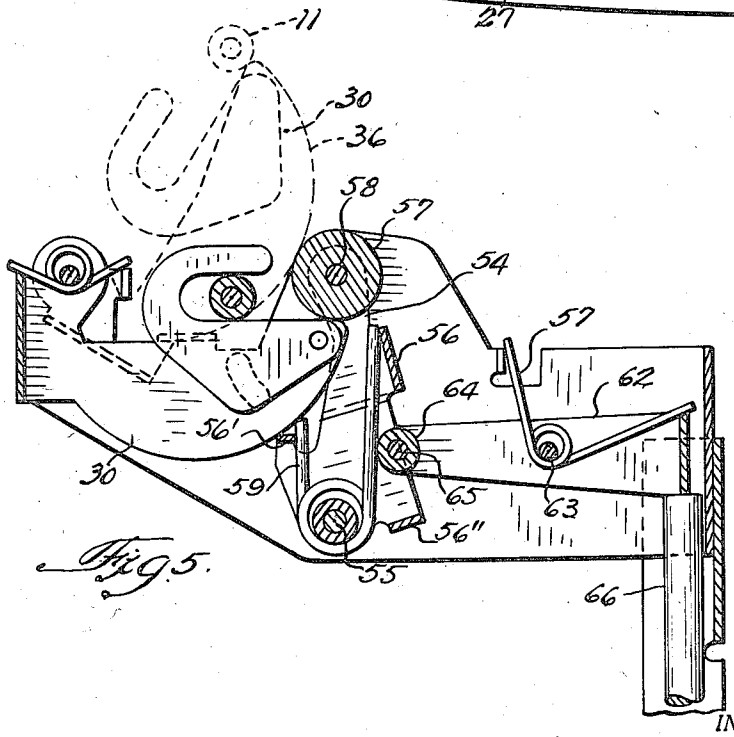


Fig. 5.

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LATCH MECHANISM

Filed June 22, 1955 3 Sheets-Sheet 3

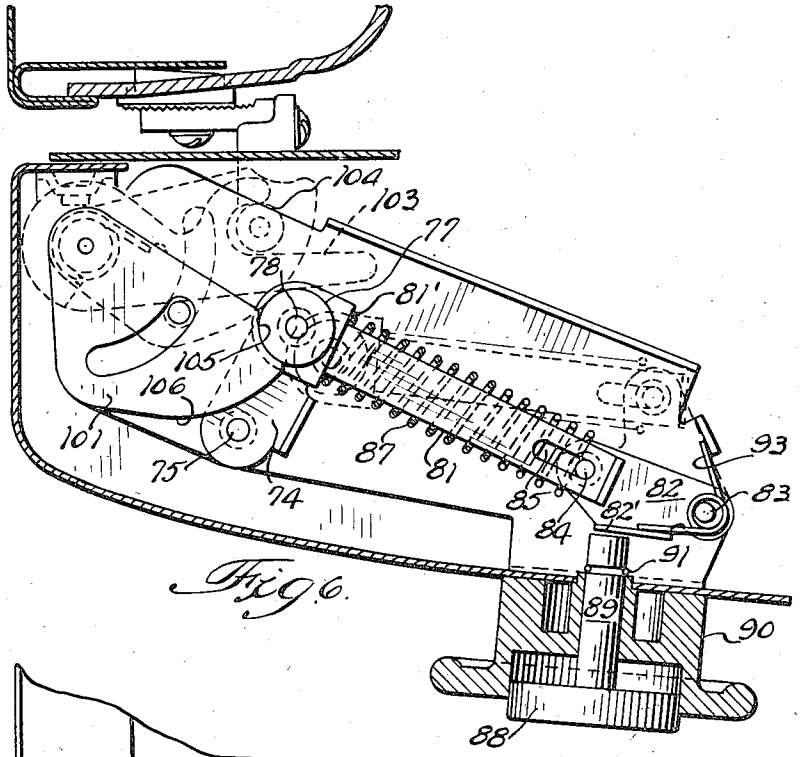
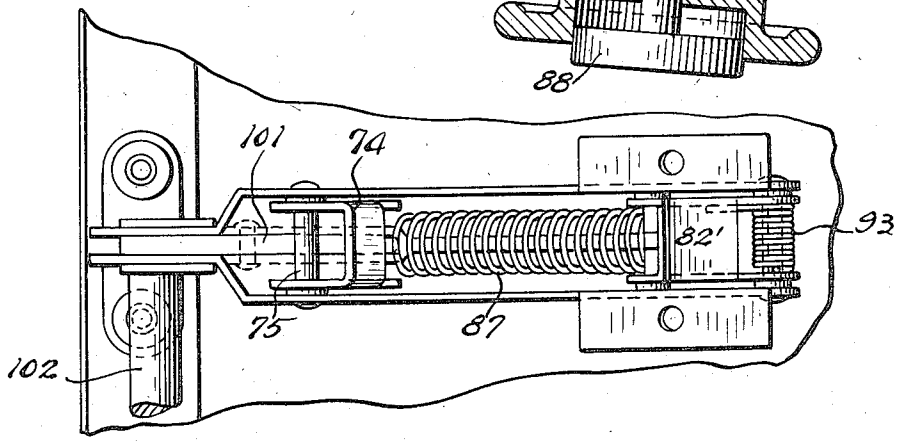


Fig. 6.



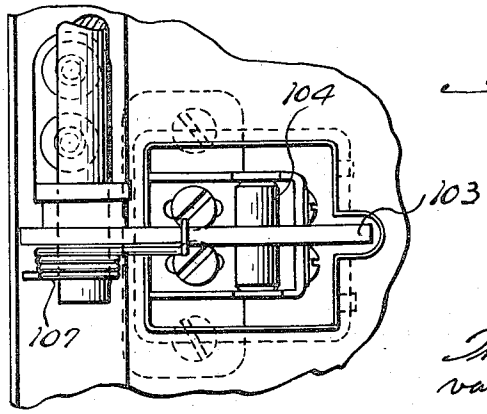


Fig. 7.

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United States Patent Office

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LATCH MECHANISM

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Application June 22, 1955, Serial No. 517,166

11 Claims. (Cl. 292—229)

This invention relates to an improved latch mechanism of the type which imparts a substantial closing force to the door or other closure with which it is associated. It is an object of the invention to provide an improved latch mechanism of that character.

Latch mechanisms employed on refrigerator doors and in various other applications are conventionally designed to provide a substantial door closing force after the door has closely approached its closed position. In the case of refrigerator doors, this closing force exerted by the latch mechanism serves to compress the sealing gasket in order to provide a tight seal without reliance upon the operator slamming or pressing the door closed with sufficient force that the operator himself adequately compresses the gasket.

Latch mechanisms of this class are of two basic types. In one form the main latch spring which exerts the desired gasket-compressing force is energized during the opening of the door and is held or cocked in its energized position until it is tripped by the closing of the door. The other basic type is one in which the latch bolt is retracted upon opening the door without energization of the main latch spring, the latch bolt being returned to its normal or closed position while the door is open. During the subsequent closing of the door, the latch bolt is forced from its normal position to its retracted position against the action of the main latch spring. The main spring being thus energized is able to provide the desired gasket-compressing force during the last portion of closing movement of the door.

The present invention is concerned with this second basic type of latch mechanism. With this type of latch mechanism, it is conventional to provide an elongated, gradually sloping keeper. During the last inch or two of closing movement of the door, the bolt rides over the gradually sloping keeper and is thus gradually moved toward its retracted position so that the main spring becomes energized. An elongated gradually sloping keeper is employed in order to spread the work of energizing the main spring over a substantial length of movement of the door such that the average force required is reasonably small. If a short keeper with a relatively sharply inclined surface were employed, the total work required to energize the spring would be the same, but this work would be spread over a shorter length of movement of the door and hence an objectionably large force would be required to close the door. The larger force required with a short, steeply inclined keeper is objectionable because of the jarring effect accompanying the closing of the door. However, the elongated keeper is also objectionable because of its substantial protrusion beyond the frame of the door opening.

In accordance with one embodiment of the present invention an additional member is arranged to operate intermediate the keeper and the latch element which most nearly corresponds to the conventional bolt member, which latter element would ordinarily directly contact and engage with the keeper. The proposed intermediate member extends a substantial distance toward the keeper when the door is open, whereby, upon closing of the door, it may engage the keeper while the door still has an inch or two of closing movement. Further, this intermediate member and the bolt member have associated therewith a pair of cam elements whereby movement of the intermediate member by the keeper during the last inch or two of closing movement of the door provides a gradual camming of the bolt member toward its retracted position. By this means the main latch spring, operating on the bolt member, is energized gradually without the necessity of employing an elongated keeper. The intermediate member is, in fact, a supplementary latch member added to what may otherwise be a conventional latch mechanism and which eliminates the necessity of an elongated keeper.

This same intermediate member may also be provided in two parts, adjustable with respect to each other, whereby adjustment of the over-all mechanism to provide efficient cooperation of the latch and the keeper is provided for in this intermediate member, thus eliminating the necessity of an adjustably positioned keeper.

Still further, a latch mechanism constructed in accordance with the present invention is particularly adapted for operation from the interior of the cabinet with which the latch mechanism is associated. A safety release may thereby be provided, reducing the danger of suffocation in the event that a child is trapped in the cabinet.

Accordingly, it is another object of the invention to provide a latch mechanism of the type in which the main latch spring is energized during the closing of the door with which the latch mechanism is associated, such latch mechanism having the specific improvement which provides for gradual energization of the main latch spring without the necessity of an elongated keeper.

It is another object of the invention to provide a latch mechanism of the type in which the main latch spring is energized during the closing of the door with which the latch mechanism is associated, such latch mechanism having the specific improvement comprising an intermediate member arranged between the latch bolt and the keeper, which intermediate member provides for gradual energization of the main latch spring without the necessity of an elongated keeper.

It is another object of the invention to provide an improved latch mechanism in which the latch member which engages the keeper is adjustable toward and away from the keeper whereby effective adjustment of the relative position of the keeper and the latch mechanism is obtained with a fixed or stationary keeper.

It is another object of the invention to provide an improved latch mechanism having one or more of the characteristics defined above and which is provided with means for releasing the latch mechanism from within the cabinet with which the latch mechanism is associated.

It is still another object of the invention to provide an improved latch mechanism having one or more of the characteristics described above while being efficient, rugged and economical to manufacture.

This invention, together with further objects and advantages thereof, will best be understood by reference to the following description taken in connection with the accompanying drawings and its scope will be pointed out in the appended claims.

In the drawings in which like parts are designated by like reference numerals,

Figure 1 is a plan view, partially broken away, of a latch mechanism illustrating one embodiment of the invention, the latch mechanism being shown in its latched position;

Fig. 2 is a view similar to Fig. 1 but showing the latch

mechanism released and the associated door partially open;

Fig. 3 is a similar view showing the latch mechanism in the position it normally occupies after the door has been fully opened and showing the latch mechanism proper making initial engagement with the keeper during closing movement of the door;

Fig. 4 is a view similar to Fig. 3 but showing the latch mechanism in the position occupied as the door more closely approaches its closed position;

Fig. 5 is a plan view, partially broken away, of a latch mechanism illustrating another embodiment of the invention;

Fig. 6 is a similar view of another embodiment of the invention incorporating a remote control feature, and

Fig. 7 is an elevational view of the latch mechanism of Fig. 6.

As previously indicated, this invention relates to the class of latch mechanism in which the main spring of the latch mechanism is energized during the closing of the door with which it is associated, such that the energy of this spring is available during the last fraction of an inch of closing movement to drive the door forcibly closed. In such a latch mechanism the latch bolt may be released without the necessity of energizing the spring, and the latch bolt returns to its normal position while the door is open. Accordingly, the latch mechanism is very easily opened and may, for example, be readily operated by a push button. The only time that the main spring is energized is during the closing of the door when the required force may be applied by the operator pushing directly on the door. Such a latch mechanism is disclosed and claimed in application Serial No. 466,471, entitled Latch Mechanism, filed November 3, 1954 by Lloyd L. Anderson and assigned to the same assignee as the present invention, now abandoned. In said application an elongated keeper is provided with a gradually sloping surface whereby the work required to energize the spring is distributed over a substantial length of movement. This reduces the average force required to energize the spring. However, a greatly elongated keeper has the disadvantage that anyone obtaining access to the interior of the cabinet may catch his clothing on the keeper. The keepers employed with the latch mechanism shown in the drawings may be very short and, in fact, are shown to be of the type consisting primarily of a roller or pin which cooperates with a slot or hook on the latch mechanism proper. At the same time the latch mechanisms illustrated in the drawings incorporate structure which permits the same gradual energization of the main latch spring whereby there is eliminated the jarring effect which would result from energization of the main latch spring over a relatively short length of movement of the door.

The embodiment of the invention illustrated in Figs. 1–4 includes a keeper in the form of a roller **11** rotatable about a pin **12**, the pin being rigidly supported between a pair of plates **13**.

The latch mechanism proper includes a member **14** which corresponds to what would be the bolt member in a conventional latch mechanism. This bolt member **14** is pivoted about a fixed pin **15**. The main body of the bolt member is preferably a channel construction comprising spaced-apart plates and interconnecting web portions **16**. Arranged between the plates of the bolt member is a roller **17** rotatably mounted on a pin **18**.

Around the pivot pin **15** there is arranged a coil spring **19** which is relatively heavy and comprises the main latch spring. The left-hand end of this spring bears against a web portion **16'** of the latch bolt **14** while the right-hand end of the spring **19** bears against a member **20** which extends between the walls of the bolt **14** and which also pivots about the pin **15**. It will be seen that if the member **20** is supported in any given position such as that shown in Fig. 1, the spring **19**, bearing against the web portion **16'**, urges the latch bolt **14** in a counterclockwise direction with respect to the member **20**. Such relative counterclockwise movement of the bolt **14** is limited by engagement of a projection **21** on the member **20** with the web portion **16** of the bolt member. When this projection **21** is in engagement with the web portion **16**, further counterclockwise movement of the bolt member **14** with respect to the member **20** is prevented.

An elongated arm **22** is arranged to the right of the member **20** and is pivotally mounted on a fixed pin **23**. At the upper or left-hand end of the arm **22** is a roller **24** rotatably mounted on a pin **25**. The roller **24** may engage a cam surface **26** on the member **20** as illustrated in Figs. 1, 3 and 4 and if pivoted in a counterclockwise direction, it may engage a recessed cam surface **27** of the member **20**.

It will be apparent that when the roller **24** is in engagement with the cam surface **26**, the member **20** is restrained from clockwise movement. Under these circumstances any clockwise movement of the bolt member **14** is necessarily accompanied by energization of the main spring **19**, as will be apparent by comparing Figs. 1 and 4. On the other hand, when the roller **24** is in position to engage the recessed cam surface **27**, the member **20** may pivot in a clockwise direction to the position illustrated in Fig. 2. Accordingly, corresponding clockwise movement of the latch bolt **14** to its position of Fig. 2 may be accomplished with no energization of the main spring **19**. This may be seen by comparison of Figs. 1 and 2.

It is intended that the arm **22** be operated by a suitable push button or lever arranged or extending through the outer surface of the door **26** on which the latch mechanism proper is mounted. Such control apparatus, of any desired type, is arranged to pivot the arm **22** in a counterclockwise direction against the action of a relatively light spring **27** which urges the arm **22** in a clockwise direction.

The apparatus as so far described is shown in Fig. 1 in its closed or latched position. When the control apparatus moves the arm **22** to the position of Fig. 2, the latch bolt **14**, along with the member **20**, is free to pivot in a clockwise direction to a retracted or released position. Relatively little force is required to thus release the latch mechanism. After the door has been opened and the push button or other control device has been released, the light spring **27** pivots the arm **22** in a clockwise direction so that its roller **24** again engages the cam surface **26** of the member **20**. This operation is easily performed by the relatively light spring **27** since there is nothing to prevent the latch bolt **14** and the member **20** from pivoting in a counterclockwise direction back to the closed or latched position.

When the door **26** is slammed shut, the latch bolt roller **17** could, if desired, ride over a suitable inclined surface, such as the sloping surface of a keeper, and cause clockwise pivotal movement of the latch bolt **14**. In such a case, since the roller **24** is again in engagement with the cam surface **26**, the member **20** would be restrained from clockwise pivotal movement, and accordingly such clockwise pivotal movement of the latch bolt **14** would necessarily be accompanied by energization of the main spring **19** as illustrated in Fig. 4. When the door **26** closely approached its fully closed position, the main spring **19** would be energized such that it might drive the latch bolt roller **17** forcibly to the left to produce the desired door-closing force.

In view of the above, it is apparent that the latch mechanism proper as thus far described is a complete and operable mechanism. It is capable of efficient and effective operation with a conventional hook-shaped keeper. Preferably such a keeper would have a long, gradually sloping surface over which the bolt roller **17** may roll during closing movement of the door in order that the work required to energize the main spring **19** may be spread over a substantial length of movement of

the door. As indicated above, such an elongated keeper is objectionable for aesthetic and practical reasons. In accordance with the embodiments of the invention illustrated in the drawings, the latch mechanism proper as described above may be made to cooperate with a simple pin or roller type of keeper through the use of an additional latch member which operates intermediate the bolt roller 17 and the keeper roller 11.

The intermediate or keeper-engaging member 30 illustrated in Figs. 1–4 is pivotally mounted on a pin 31 and is biased by a relatively light spring 32 in a counterclockwise direction. The keeper-engaging member 30 is provided with a slot 33 for receiving the keeper roller 11. In Figs. 2, 3 and 4, the slot 33 is formed in an integral keeper-engaging member 30. However, in Fig. 1, an additional, optional feature is disclosed in which the keeper-engaging portion of the keeper-engaging member 30 actually forms an independent element 30*a* which is adjustable with respect to the main body of the keeper-engaging member 30. More particularly, it is adjustable with respect to certain cam surfaces subsequently to be described. The element 30*a* is pivotally connected by a pin 30*b* to the main body of the keeper-engaging member 30 and is further connected thereto by a screw 30*c* which threadedly engages member 30*a* and passes through a slot 30*d* in the member 30. With this construction, illustrated in Fig. 1 only, the screw 30*c* may be loosened and the element 30*a* pivoted about the pivot pin 30*b* to adjust its position with respect to the main body of the keeper-engaging member 30, after which the screw 30*c* may be tightened to maintain the desired adjusted relative position.

The keeper-engaging member 30, whether it is an integral member as in Figs. 2, 3 and 4, or a two-element adjustable member as illustrated in Fig. 1, has arranged thereon a pair of cam surfaces, best seen in Figs. 2 and 4. Arranged on the upper edge of the keeper-engaging member 30, as viewed in Fig. 2, is a cam surface 35 which is engaged by the bolt roller 17 when the latch mechanism is in latched position as illustrated in Fig. 1. The second, elongated cam surface 36 is engaged by the bolt roller 17 when the door is being closed, as illustrated in Fig. 4. The cam surface 36 leads, of course, into the cam surface 35, whereby the bolt roller 17 may ride along the cam surface 36 and directly onto the cam surface 35.

Operation of the complete latch mechanism illustrated in Figs. 1–4 may best be described starting with Fig. 1, where the latch mechanism is shown in latched position. The latch is released by operation of suitable control means to pivot the arm 22 in a counterclockwise direction. This moves the roller 24 off the cam surface 26 and into the recessed cam surface 27 of the member 20, all as previously described. This permits movement of the latch bolt 14 and the member 20 in a clockwise direction. Furthermore, engagement of the roller 24 with a projection 20*a* on the member 20 encourages such clockwise movement of the member 20 and hence of the latch bolt 14. This movement draws the bolt roller 17 off the cam surface 35 of the keeper-engaging member 30 as seen in Fig. 2.

Any force now acting to open the door will draw the door open, the keeper-engaging member 30 freely pivoting in a counterclockwise direction to release the keeper roller 11. It should be noted that the spring 32 acting on the keeper-engaging member 30 encourages such pivotal movement of the keeper-engaging member and hence encourages opening of the door.

With the door fully opened, the push button or other control device may be released, whereupon the arm 22 returns to its normal position under the influence of the light spring 27. Since the keeper-engaging member 30 has been pivoted in a counterclockwise direction to the position of Fig. 3, wherein it is out of the way of the latch bolt roller 17, the latch bolt 14 and the member 20 are free to move in a counterclockwise direction, under the influence of the light spring 27, to their positions of Fig. 3.

The door 26 is shown in Fig. 3 nearing its closed position. With an inch or two of closing movement still remaining, the tip of the keeper-engaging member 30 engages the keeper roller 11. As the door closes further, the keeper roller 11 rolls down the side of the keeper-engaging member 30 and forces the latter to pivot in a clockwise direction. This in turn causes the cam surface 36 to wedge the bolt roller 17 to the right, all as illustrated in Fig. 4. Since the arm 22 is now in engagement with the cam surface 26 on the member 20, the latter member is restrained from clockwise movement, whereby this clockwise movement of the latch bolt 14 is necessarily accompanied by stressing of the main latch bolt 19.

This operation continues until the bolt roller 17 passes off the cam surface 36 and onto the cam surface 35. The main latch spring 19 is then able to drive the bolt member 14 in a counterclockwise direction and force the bolt roller 17 along the cam surface 35. The shape of the cam surface 35 is such that a wedging action is obtained, whereby the main spring 19 operates with a great mechanical advantage in forcing the keeper-engaging member 30 a short distance in a clockwise direction. This pulls the keeper roller 11 farther in toward the latch mechanism proper, whereby the door is pulled more tightly closed to compress any sealing gasket that may be arranged between the door and the door frame of the cabinet.

By virtue of the fact that the keeper-engaging member 30 projects a substantial distance toward the keeper when the door is open (see Fig. 3) and is forcibly pivoted in a clockwise direction by the keeper during some two inches of travel of the door, the keeper-engaging member 30 is able to transmit a main spring energizing force to the bolt member over a substantial length of movement of the door. This is accomplished specifically by the elongated cam surface 36. The embodiment of the invention illustrated in Figs. 1–4, therefore, provides for gradual energization of the main latch spring over a substantial length of movement of the associated door without the necessity of a greatly elongated keeper.

In this same embodiment of the invention, means are provided for releasing the latch mechanism from within the cabinet to which the latch is applied. A lever in the form of a bell crank 40 is pivotally mounted on a pin 41 which is secured to the frame of the latch mechanism. One end of the bell crank extends through an opening in the interior wall of the door 26 and is thereby exposed for operation from within the cabinet. The other end of the bell crank 40 has a roller 42 arranged thereon which is in such a position as to bear against the lever or arm 22.

It will readily be seen that an outward thrust on the bell crank will cause rotation in a clockwise direction, whereby the roller 42 pivots the arm 22 in a counterclockwise direction, this moves the roller 24 off the cam surface 26 such that the entire latch mechanism is released. This safety release for operation from within the cabinet is particularly well adapted to the latch mechanism disclosed in Figs. 1–4 by virtue of the fact that it is a latch mechanism which opens or releases very easily; that is, without the energization of the main latch spring.

The embodiment of the invention disclosed in Fig. 5 differs from the above-described embodiment primarily in the construction of the latch mechanism proper. More particularly, the differences lie between the control or operating means and that element of the latch mechanism which corresponds to the conventional latch bolt.

In Fig. 5 there may be seen an element 54 corresponding to the element 14 of Fig. 1. As in the case of the embodiment illustrated in Figs. 1–4, this member 54 could serve as a latch bolt and cooperate with a conventional hook-shaped keeper. The bolt member 54 at one

end thereof pivots about a pin 55 and has a roller 57 mounted on a pin 58 at its other end. A spring 59 extends around the pivot pin 55 and bears outwardly against web members 56 and 56' of the bolt member 54. As long as the ends of the spring 59 bear against these web members, the spring exerts no net force urging the latch bolt 54 to pivot in one direction or the other.

To the right of the bolt member is an arm 62 which pivots about a pin 63, and a roller 64 is mounted at one end of the arm on a pin 65. A light-weight spring 57 operates, as may be clearly seen in Fig. 5, to pivot the arm 62 in a clockwise direction.

When the arm 62 is in the position illustrated in Fig. 5, it will be seen that the roller 64 bears against the right-hand arm of the spring 59. Accordingly, clockwise movement of the bolt member 54 will cause the right-hand arm of the spring 59 to break contact with the web member 56. The spring 59 will then exert a very substantial counterclockwise torque to the bolt member. On the other hand, if the arm 62 is rotated a short distance in a counterclockwise direction, for example by pressure of a plunger 66 thereagainst, the roller 64 is removed from its position of Fig. 5 and is no longer in position to support the main latch spring 59. Under these circumstances the bolt member 54 may pivot in a clockwise direction without energization of the main spring 59, since the two ends of the latter remain in contact with the web members 56 and 56' and exert equal and opposite torques to the latch bolt.

To release this latch mechanism, the plunger 66 or similar control means is operated to cause counterclockwise movement of the arm 62 such that the main latch spring 59 is no longer supported thereby. The latch bolt 54 is then free to pivot in a clockwise direction to release the keeper-engaging member 30. Note further that as the arm 62 rotates in a counterclockwise direction, the roller 64 engages a web portion 56'' of the latch bolt and thereby urges the latch bolt in a clockwise direction.

As in the case of the embodiment illustrated in Figs. 1–4, after the door is opened and the control means 66 are released, the relatively light spring 57 urges the arm 62 back to its position of Fig. 5. This in turn pivots the freely moving latch bolt 54 back to its position of Fig. 5. At this time the keeper-engaging member 30 is in the position illustrated by the dotted lines in Fig. 5 and is therefore removed from the path of the bolt roller 57.

When the door is pushed shut, the keeper-engaging member 30 engages the keeper roller 11 while there is still several inches of closing movement remaining. Further closing movement of the door with which this latch mechanism is associated forces the keeper-engaging member 30 to pivot in a clockwise direction such that the cam surface 36 bears against the latch bolt roller 57 and forces the latch bolt to pivot in a clockwise direction. Since the arm 62 and its roller 64 have returned to the position of Fig. 5, this clockwise movement of the latch bolt 54 is necessarily accompanied by energization of the main latch spring 59. Accordingly, when the latch bolt roller 57 passes off the cam surface 36 and onto the cam surface 35, the main spring moves the roller 57 forcibly to the left along the cam surface 35 and wedges the door shut.

In general the embodiment of the invention illustrated in Fig. 5 differs from the embodiment of the invention illustrated in Figs. 1–4 by elimination of the member 20, the arm 62 of Fig. 5 bearing directly against the main spring 59.

The embodiment of the invention illustrated in Figs. 6 and 7 illustrates the invention as applied to a remote control latch mechanism. Furthermore, the latch mechanism proper is of a different type than that illustrated in the previously described embodiments of the invention.

In Fig. 6 there may be seen a member 74 which corresponds to the latch bolt or bolt member in a more conventional latch mechanism. As in the case of the previously described embodiments, this bolt member could, if desired, be made to cooperate with a conventional hook-shaped keeper.

The bolt member is pivotable about a fixed pin 75 at one end thereof and carries at its other end a roller 77 which turns about a pin 78. A toggle linkage is arranged to the right of the latch bolt, this comprising primarily links 81 and 82. The left-hand end of the link 81 is pivotally connected to the latch bolt 74 by the pin 78. The link 82 is pivotable about a fixed pin 83 at its right-hand end, and the two links are interconnected by a pin 84 which is secured to the link 82 and extends through a slot 85 in the link 81. A relatively heavy spring 87 is arranged around the link 81 and bears against the pin 84 at one end thereof and against a shoulder 81' at the left-hand end of the link 81.

When the links 81 and 82 are in the position illustrated in Fig. 6, the latch bolt 74 may pivot in a clockwise direction, the pin 84 moving relatively along the slot 85. Such movement, however, is accompanied by energization of the main spring 87, the spring being compressed between the pin 84 and the shoulder 81'.

Suitable control apparatus is illustrated in Fig. 6. This includes a push button 88, a stem or shaft 89 and a guide 90. When the push button 88 is pressed inwardly, the shaft 89 bears against a web portion 82' on the link 82 such that the toggle linkage may be collapsed upwardly. Relatively little force is required to collapse the linkage as is well recognized in the art. Collapsing of the linkage moves the toggle links to the position illustrated by the dotted lines in Fig. 6 and draws the free end of the latch bolt 74 to the right in Fig. 6. This motion is, of course, accomplished without energization of the main spring 87 since the distance between the shoulder 81' and the pin 84 remains constant, the pin 84 remaining at the right-hand end of the slot 85. A ring 91 is arranged in an annular recess in the shaft 89 and bears against the inner surface of the guide 90 to limit outward movement of the shaft 89. This limits outward movement of the shaft 89 and prevents outward buckling of the toggle links 81 and 82.

The apparatus as thus far described, like corresponding apparatus in the previously described embodiments, might, if desired, be employed as a completely operative latch mechanism for cooperation with a hook-shaped keeper as is explained immediately below. This apparatus when positioned as shown by the solid lines in Fig. 6 is in its latched position. The mechanism is released by pressure against the push button 88, this causing collapsing of the toggle links which, in turn, pivots the latch bolt 74 in a clockwise direction. After the door is opened and the push button is released, a light-weight spring 93 moves the link 82 and hence the link 81 back to the position shown in solid lines in Fig. 6. All of this operation is effected without energization of the main spring 87 with the exception of a very slight compression of this spring in moving the toggle links past their dead center position during the latch-releasing operation.

When the door is again moved toward closed position, a conventional hook-shaped keeper might engage the latch bolt roller 77, the sloping surface of the keeper forcing the roller to the right as the door closes. Since the toggle links 81 and 82 are now toggled, the resulting clockwise movement of the latch bolt 74 would cause compression of the main spring 87 between the now-fixed pin 84 and the inwardly moving shoulder 81'. When the roller 77 passes over the hook of the keeper, the main spring 87 would force the latch bolt roller to the left, wedging the door shut.

As in the case of the previously described embodiments of the invention, apparatus is arranged between the bolt member 74 and the keeper, and in the case of the embodiment presently being described, this apparatus in-

cludes an extension which permits control of the latch mechanism at a point remote from the keeper.

A cam member **101** is secured to a rotatable shaft **102**, seen best in Fig. 7. This shaft extends from the vicinity of the latch mechanism proper through any reasonable distance to the vicinity of the keeper. At the lower end of the shaft **102**, as viewed in Fig. 7, is a keeper-engaging element **103** which is also shown in dotted lines in Fig. 6. The keeper-engaging member **103** has a slot for receiving the roller or pin **104** which constitutes the keeper. The cam member **101** has a pair of cam surfaces **105** and **106** thereon similar to the cam surfaces **35** and **36** of Figs. 1–5.

When the latch mechanism is in the position illustrated by the solid lines in Fig. 6, the latch bolt roller **77** bears against the cam surface **105** and wedges the cam element **101** in a clockwise direction. At the same time the shaft **102** and the keeper-engaging member **103** are urged in a clockwise direction. It will be seen by reference to Fig. 6 that this draws the keeper roller **104** inwardly of the latch and thereby draws the door tightly closed. When the latch mechanism proper is released as described above, the latch bolt roller **77** is withdrawn from the cam member **101**, whereby the cam member and the keeper-engaging member **103** are free to rotate in a counterclockwise direction to release the keeper **104**. Such counterclockwise movement is in fact encouraged by a light-weight spring **107** shown at the bottom of the shaft in Fig. 7. The door is thereby permitted to open.

After the door is opened and the push button **88** is released, the toggle links **81** and **82** return to their normal position shown in solid lines in Fig. 6. Since the cam member **101**, along with the keeper-engaging member **103**, have been rotated in a counterclockwise direction, the cam member **101** is removed from the path of the latch bolt roller **77** whereby the toggle links can freely return to their normal positions. When the door is pushed shut, the keeper-engaging member **103** re-engages the keeper while there is still substantial door-closing movement remaining. Further closing of the door causes clockwise movement of the keeper-engaging member **103** and hence of the cam member **101**. The cam surface **106** is thereby made to bear against the latch bolt roller **77** and force it gradually to the right. Since the toggle links **81** and **82** are again toggled, such movement of the latch bolt roller is necessarily accompanied by energization of the main spring **87**.

When the door is almost fully closed, the latch bolt roller **77** passes off the cam surface **106** and onto the cam surface **105** whereupon the main latch spring **87** forces the latch bolt roller **77** along the cam surface **105** and wedges the door tightly shut.

In each of the embodiments of the invention disclosed in the drawings and described above, means are provided for permitting gradual energization of the main latch spring over a substantial length of closing movement of the associated door or other closure without the necessity of employing an elongated keeper with a gradually sloping surface. It should be noted that in the particular embodiments described, this is accomplished by interposing a supplemental latch member between the keeper and a latch element which corresponds to the latch bolt of a more conventional latch mechanism.

It has been shown, furthermore, that a latch mechanism constructed in accordance with the invention is readily provided with a safety release operable from within the cabinet with which the latch mechanism is associated.

Still further, it has been shown that these illustrated embodiments of the invention are particularly adapted to a novel form of adjustment whereby inward and outward adjustment of the latch mechanism and the keeper with respect to each other is accomplished within the latch mechanism proper, whereby the keeper may be fixedly mounted at least with respect to this direction of movement.

While particular embodiments of the invention have been shown, it will be understood, of course, that the invention is not limited thereto since many modifications may be made, and it is, therefore, contemplated to cover by the appended claims any such modifications as fall within the true spirit and scope of the invention.

The invention having thus been described, what is claimed and desired to be secured by Letters Patent is:

1. A latch mechanism cooperable with a keeper to releasably hold a closure in closed position, said latch mechanism comprising a bolt member movable between a normal position and a retracted position, spring means engageable with said bolt member and normally urging said bolt member toward said normal position, means for supporting said spring means, said supporting means being movable between an active position, in which it supports said spring means whereby said spring means may urge said bolt member toward said normal position, and a neutral position, in which said spring means is unsupported thereby and said bolt member is free to move to said retracted position without energizing said spring means, and a keeper-engaging member engageable with said bolt member and said keeper, said keeper-engaging member being movable between a keeper-interlocking position and a released position, one of said members having arranged thereon a cam follower, the other of said members having arranged thereon a first cam surface engageable by said cam follower when said keeper-engaging member is closely adjacent said interlocking position and along which said cam follower may move as said bolt member moves from its retracted position toward its normal position under the influence of said spring means to urge said keeper-engaging member toward its full interlocking position, said keeper-engaging member when in its released position extending toward said keeper whereby said keeper-engaging member may initially engage said keeper when said closure is partially open and be moved thereby toward said keeper-interlocking position as said closure is closed, said other member having a second, elongated, cam surface engageable by said cam follower during such movement of said keeper-engaging member and along which said cam follower may move to force said bolt member from its normal position to its retracted position against the action of said spring means.

2. A latch mechanism cooperable with a keeper to releasably hold a closure in closed position, said latch mechanism comprising a bolt member movable between a normal position and a retracted position, spring means engageable with said bolt member and normally urging said bolt member toward said normal position, means for supporting said spring means, said supporting means being movable between an active position, in which it supports said spring means whereby said spring means may urge said bolt member toward said normal position, and a neutral position, in which said spring means is unsupported thereby and said bolt member is free to move to said retracted position without energizing said spring means, and a keeper-engaging member engageable with said bolt member and said keeper, said keeper-engaging member being movable between a keeper-interlocking position and a released position, one of said members having arranged thereon a cam follower, the other of said members having arranged thereon a first cam surface engageable by said cam follower when said keeper-engaging member is closely adjacent said interlocking position and along which said cam follower may move as said bolt member moves from its retracted position toward its normal position under the influence of said spring means to urge said keeper-engaging member toward its full interlocking position, said keeper-engaging member when in its released position extending toward said keeper whereby said keeper-engaging member may initially engage said keeper when said closure is partially open and be moved thereby

toward said keeper-interlocking position as said closure is closed, said other member having a second, elongated, cam surface engageable by said cam follower during such movement of said keeper-engaging member and along which said cam follower may move to force said bolt member from its normal position to its retracted position against the action of said spring means, said first and second cam surfaces extending into each other whereby said cam follower may move from said second cam surface onto said first cam surface as said keeper-engaging member approaches its keeper-interlocking position.

3. A latch mechanism cooperable with a keeper to releasably hold a closure in closed position, said latch mechanism comprising a bolt member movable between a normal position and a retracted position, spring means engageable with said bolt member and normally urging said bolt member toward said normal position, means for supporting said spring means, said supporting means being movable between an active position, in which it supports said spring means whereby said spring means may urge said bolt member toward said normal position, and a neutral position, in which said spring means is unsupported thereby and said bolt member is free to move to said retracted position without energizing said spring means, and a keeper-engaging member engageable with said bolt member and said keeper, said keeper-engaging member being movable between a keeper-interlocking position and a released position, one of said members having arranged thereon a cam follower, the other of said members having arranged thereon a first cam surface engageable by said cam follower when said keeper-engaging member is closely adjacent said interlocking position and along which said cam follower may move as said bolt member moves from its retracted position toward its normal position under the influence of said spring means to urge said keeper-engaging member toward its full interlocking position, said keeper-engaging member when in its released position extending toward said keeper whereby said keeper-engaging member may initially engage said keeper when said closure is partially open and be moved thereby toward said keeper-interlocking position as said closure is closed, said other member having a second, elongated, cam surface engageable by said cam follower during such movement of said keeper-engaging member and along which said cam follower may move to force said bolt member from its normal position to its retracted position against the action of said spring means, said keeper engaging member being composed of two elements movable with respect to each other whereby the keeper-interlocking portion of said member may be adjustably positioned toward and away from said keeper with respect to the cam element arranged thereon.

4. A latch mechanism cooperable with a keeper to releasably hold a closure in closed position, said latch mechanism comprising a bolt member movable between a normal position and a retracted position, spring means engageable with said bolt member and normally urging said bolt member toward said normal position, a member for supporting said spring means, said supporting member being movable between an active position, in which it supports said spring means whereby said spring means may urge said bolt member toward said normal position, and a neutral position, in which said spring means is unsupported thereby and said bolt member is free to move to said retracted position without energizing said spring means, and a cam member engageable with said bolt member and said keeper, said cam member being movable between a keeper-interlocking position and a released position, said cam member having a first cam surface engageable by said bolt member when said cam member is closely adjacent said interlocking position and along which said bolt member may move from its retracted position toward its normal position under the influence of said spring means to urge said cam member toward its full interlocking position, said cam member when in its released position extending toward said keeper whereby said cam member may initially engage said keeper when said closure is partially open and be moved thereby toward said keeper-interlocking position as said closure is closed, said cam member having a second, elongated, cam surface engageable by said bolt member during such movement toward interlocking position to move said bolt member from its normal position to its retracted position against the action of said spring means.

5. A latch mechanism cooperable with a keeper to releasably hold a closure in closed position, said latch mechanism comprising a bolt member movable between a normal position and a retracted position, spring means engageable with said bolt member and normally urging said bolt member toward said normal position, a member for supporting said spring means, said supporting member being movable between an active position, in which it supports said spring means whereby said spring means may urge said bolt member toward said normal position, and a neutral position, in which said spring means is unsupported thereby and said bolt member is free to move to said retracted position without energizing said means, and a cam member engageable with said bolt member and said keeper, said cam member being movable between a keeper-interlocking position and a released position, said cam member having a first cam surface engageable by said bolt member when said cam member is closely adjacent said interlocking position and along which said bolt member may move from its retracted position toward its normal position under the influence of said spring means to urge said cam member toward its full interlocking position, said cam member when in its released position extending toward said keeper whereby said cam member may initially engage said keeper when said closure is partially open and be moved thereby toward said keeper-interlocking position as said closure is closed, said cam member having a second, elongated, cam surface engageable with said bolt member during such movement toward interlocking position to move said bolt member from its normal position to its retracted position against the action of said spring means, said cam surfaces extending into each other whereby said bolt member may move from said second cam surface onto said first cam surface as said cam member approaches said keeper-interlocking position.

6. A latch mechanism cooperable with a keeper to releasably hold a closure in closed position, said latch mechanism comprising a bolt member movable between a normal position and a retracted position, spring means engageable with said bolt member and normally urging said bolt member toward said normal position, a member for supporting said spring means, said supporting member being movable between an active position, in which it supports said spring means whereby said spring means may urge said bolt member toward said normal position, and a neutral position, in which said spring means is unsupported thereby and said bolt member is free to move to said retracted position without energizing said spring means, and a cam member engageable with said bolt member and said keeper, said cam member being movable between a keeper interlocking position and a released position, said cam member having a first cam surface engageable by said bolt member when said cam member is closely adjacent said interlocking position and along which said bolt member may move from its retracted position toward its normal position under the influence of said spring means to urge said cam member toward its full interlocking position, said cam member when in its released position extending toward said keeper whereby said cam member may initially engage said keeper when said closure is partially open and be moved thereby toward said keeper-interlocking position as said closure is closed, said cam member having a second, elongated cam surface engageable with said bolt member during

such movement toward interlocking position to move said bolt member from its normal position to its retracted position against the action of said spring means, said cam member being composed of two elements movable with respect to each other whereby the keeper interlocking portion of said cam member may be adjustably positioned toward and away from said keeper with respect to said first-mentioned cam surface.

7. A latch mechanism cooperable with a keeper to releasably hold a closure in closed position with respect to a cabinet, said latch mechanism comprising a bolt member movable between a normal position and a retracted position, spring means engageable with said bolt member and normally urging said bolt member toward said normal position, a member for supporting said spring means, said supporting member being movable between an active position, in which it supports said spring means whereby said spring means may urge said bolt member toward said normal position, and a neutral position, in which said spring means is unsupported thereby and said bolt member is free to move to said retracted position without energizing said spring means, a cam member engageable with said bolt member and said keeper, said cam member being movable between a keeper interlocking position and a released position, said cam member having a first cam surface engageable by said bolt member when said cam member is closely adjacent said interlocking position and along which said bolt member may move from its retracted position toward its normal position under the influence of said spring means to urge said cam member toward its full interlocking position, said cam member when in its released position extending toward said keeper whereby said cam member may initially engage said keeper when said closure is partially open and be moved thereby toward said keeper-interlocking position as said closure is closed, said cam member having a second, elongated, cam surface engageable with said bolt member during such movement toward interlocking position to move said bolt member from its normal position to its retracted position against the action of said spring means, and a control member arranged on said closure and operable from within said cabinet for moving said supporting member to said neutral position.

8. A latch mechanism cooperable with a keeper to releasably hold a closure in closed position, said latch mechanism comprising a bolt member pivotable between a normal position and a retracted position, spring means engageable with said bolt member and normally urging said bolt member to pivot toward said normal position, a member for supporting said spring means, said supporting member being pivotable between an active position, in which it bears against and supports said spring means whereby said spring means may urge said bolt member toward said normal position, and a neutral position, in which said spring means is unsupported thereby and said bolt member is free to pivot to said retracted position without energizing said spring means, a cam member engageable with said bolt member and said keeper, said cam member being pivotable between a keeper interlocking position and a released position, said cam member having a first cam surface engageable by said bolt member when said cam member is closely adjacent said interlocking position and along which said bolt member may move from its retracted position toward its normal position under the influence of said spring means to urge said cam member toward its full interlocking position, said cam member when in its released position extending toward said keeper whereby said cam member may initially engage said keeper when said closure is partially open and be pivoted thereby toward said keeper-interlocking position as said closure is closed, said cam member having a second, elongated, cam surface engageable with said bolt member during such movement toward interlocking position to pivot said bolt member from its normal position to its retracted position against the action of said spring means, and control means for pivoting said supporting member to said neutral position whereby said bolt member may readily move to its retracted position and said cam member may move to its released position.

9. A latch mechanism cooperable with a keeper to releasably hold a closure in closed position, said latch mechanism comprising a bolt member pivotable between a normal position and a retracted position, spring means engageable with said bolt member and normally urging said bolt member to pivot toward said normal position, toggle links for supporting said spring means, said toggle links when toggled supporting said spring means whereby said spring means may urge said bolt member toward said normal position, said toggle links when untoggled leaving said spring means unsupported whereby said bolt member is free to pivot to said retracted position without energizing said spring means, a cam member engageable with said bolt member and said keeper, said cam member being pivotable between a keeper interlocking position and a released position, said cam member having a first cam surface engageable by said bolt member when said cam member is closely adjacent said interlocking position and along which said bolt member may move from its retracted position toward its normal position under the influence of said spring means to urge said cam member toward its full interlocking position, said cam member when in its released position extending toward said keeper whereby said cam member may initially engage said keeper when said closure is partially open and be moved thereby toward said keeper-interlocking position as said closure is closed, said cam member having a second, elongated, cam surface engageable with said bolt member during such movement toward interlocking position to pivot said bolt member from its normal position to its retracted position against the action of said spring means, and control means for untoggling said toggle links whereby said bolt member may readily move to its retracted position and said cam member may move to its released position.

10. A latch mechanism cooperable with a keeper to releasably hold a closure in closed position, said latch mechanism comprising a bolt member movable between a normal position and a retracted position, spring means engageable with said bolt member and normally urging said bolt member toward said normal position, a member for supporting said spring means, said supporting member being movable between an active position, in which it supports said spring means whereby said spring means may urge said bolt member toward said normal position and a neutral position, in which said spring means is unsupported thereby and said bolt member is free to move to said retracted position without energizing said spring means, and a cam member engageable with said bolt member and said keeper, said cam member being movable between a keeper-interlocking position and a released position, said cam member having a first cam surface engageable by said bolt member when said cam member is closely adjacent said interlocking position and along which said bolt member may move from its retracted position toward its normal position under the influence of said spring means to urge said cam member toward its full interlocking position, said cam member when in its released position extending toward said keeper whereby said cam member may initially engage said keeper when said closure is partially open and be moved thereby toward said keeper-interlocking position as said closure is closed, said cam member having a second, elongated, cam surface extending into said first cam surface and being shaped such that the distance from the pivotal axis of said cam member increases as said first cam surface is approached, said second cam surface engageable with said bolt member during such movement toward interlocking position to move said bolt member from its normal position to its retracted position against the action of said spring means.

11. A latch mechanism cooperable with a keeper to releasably hold a closure in closed position, said latch mechanism comprising a bolt member movable between a normal position and a retracted position, spring means engageable with said bolt member and normally urging said bolt member toward said normal position, a member for supporting said spring means, said supporting member being movable between an active position, in which it supports said spring means whereby said spring means may urge said bolt member toward said normal position and a neutral position, in which said spring means is unsupported thereby and said bolt member is free to move to said retracted position without energizing said spring means, and a cam member engageable with said bolt member and said keeper, said cam member being movable between a keeper-interlocking position and a released position, said cam member having a first cam surface engageable by said bolt member when said cam member is closely adjacent said interlocking position and along which said bolt member may move from its retracted position toward its normal position under the influence of said spring means to urge said cam member toward its full interlocking position, said cam member when in its released position extending toward said keeper whereby said cam member may initially engage said keeper when said closure is partially open and be moved thereby toward said keeper-interlocking position as said closure is closed, said cam member having a second, elongated, cam surface extending into said first cam surface and being shaped such that the distance from the pivotal axis of said cam member increases as said first cam surface is approached, said second cam surface engageable with said bolt member during such movement toward interlocking position to move said bolt member from its normal position to its retracted position against the action of said spring means, said first cam surface forming an obtuse angle with said second cam surface whereby the movement of said bolt member along said first cam surface under the influence of said spring means will cause said cam member to forcefully move to its keeper-interlocking position.

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