Jan. 6, 1959 A. J. VAN NOORD 2,867,465

LATCH CONTROL MECHANISM

Filed March 16, 1956 2 Sheets-Sheet 1

Fig. 1.

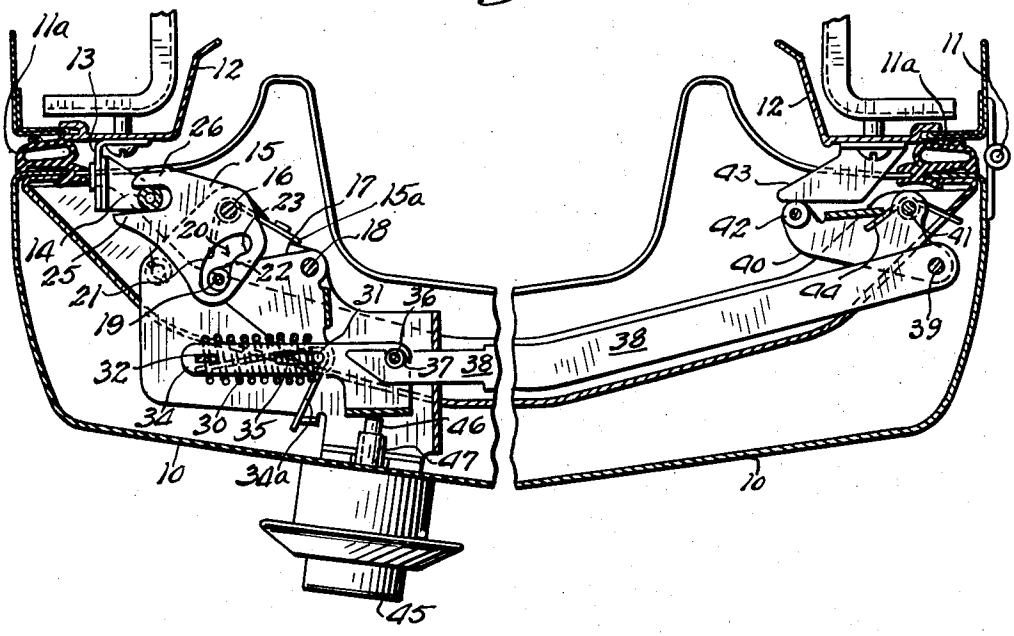
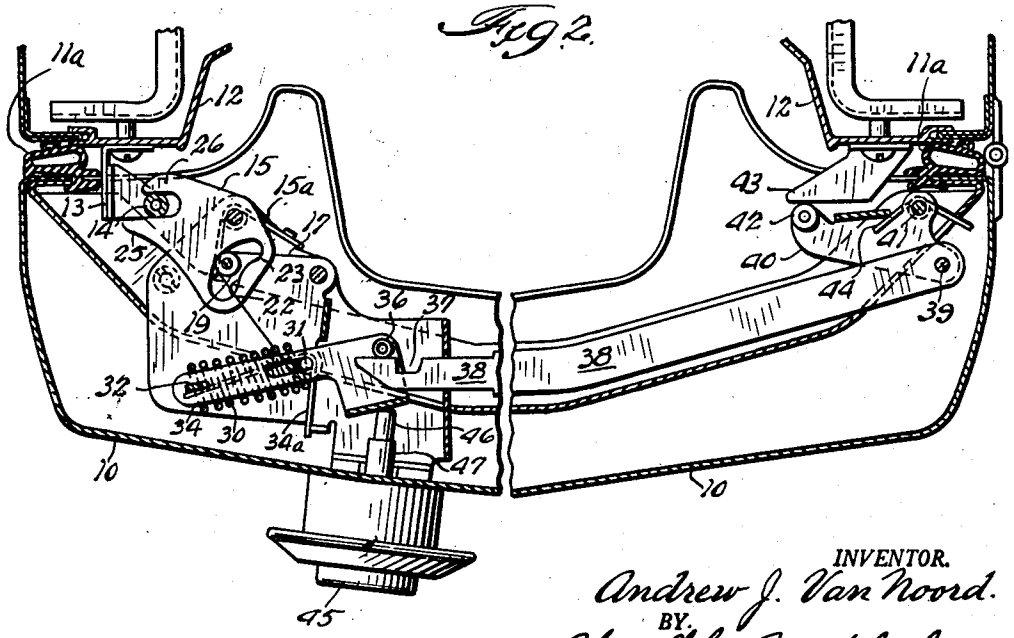


Fig. 2.



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Fig. 4.

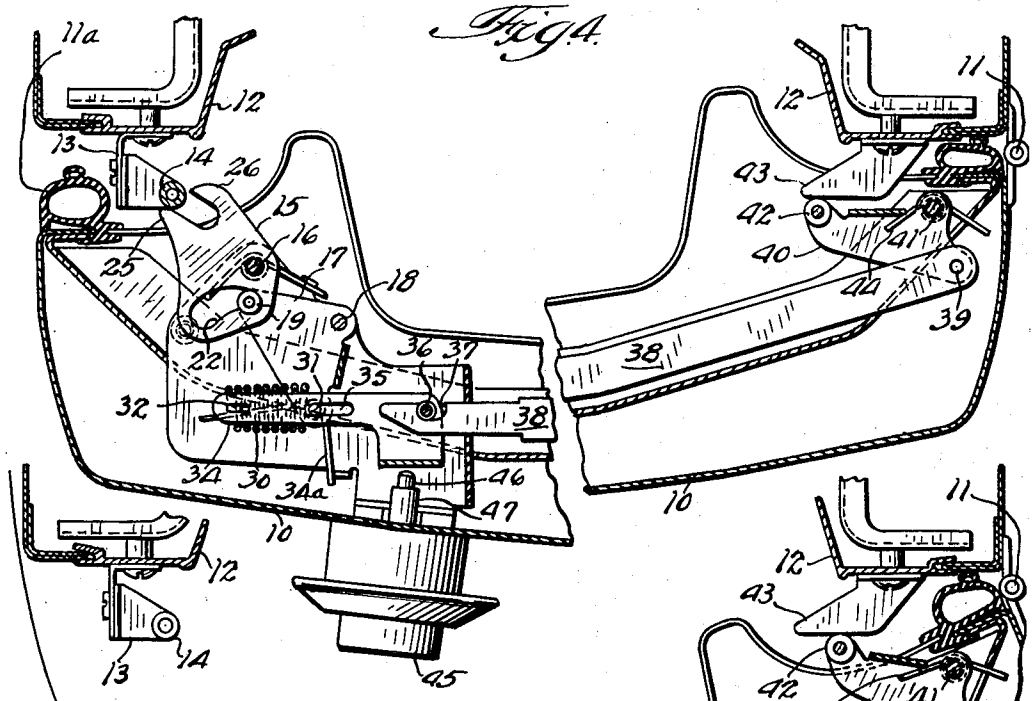
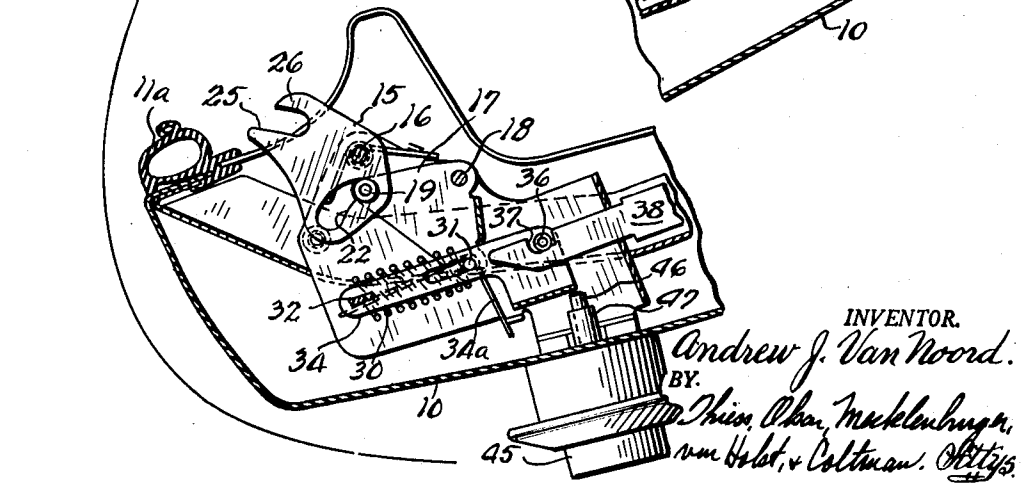


Fig. 3.



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United States Patent Office 2,867,465 Patented Jan. 6, 1959

2,867,465

LATCH CONTROL MECHANISM

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Application March 16, 1956, Serial No. 572,134

9 Claims. (Cl. 292—216)

This invention relates to latch control apparatus and particularly to apparatus which permits easy opening of a cocking latch mechanism. It is an object of the invention to provide improved apparatus of such character.

In various applications of latch mechanism, for example in household refrigerators, it is desirable that the latch mechanism be capable of drawing the associated door tightly shut. In the case of application to a household refrigerator, this action assures adequate compression of the sealing gasket without reliance upon the operator's closing the door with sufficient force to compress the gasket. This forceful closing of the door by the latch mechanism over the last fraction of an inch of closing movement of the door is conventionally accomplished by utilizing energy stored in a powerful main latch spring.

The required energy is most commonly stored in the main latch spring during the release of the latch mechanism. In such case an elongated handle is generally provided in order that the operator may more readily energize the spring during the latch releasing operation. Provision is necessarily made for cocking such a latch mechanism in released position such that energy may remain stored in the main latch spring until the latch bolt is tripped as the door closely approaches its closed position. The main latch spring then forcefully drives the latch bolt to its latching position and draws the door tightly shut. Such a latch mechanism is disclosed and claimed in United States Patent No. 2,802,684, entitled "Latch Mechanism," filed July 27, 1953, by Edwin B. Jacobson issued August 13, 1957 and assigned to the same assignee as the present application.

In other known forms of latch mechanism, the necessary energy is stored in the main latch spring when the door is pushed shut. Such a latch mechanism is disclosed in application Serial No. 517,166, entitled "Latch Mechanism," filed June 22, 1955 by Edwin B. Jacobson and assigned to the same assignee as the present application. In such apparatus the latch is released with relatively little expenditure of energy and, in particular, without energizing the main latch spring. When the door again approaches its closed position, the latch bolt contacts the keeper and is moved relative to the door in such a manner as to energize the main latch spring. When the door more closely approaches its closed position, the energy stored in the main latch spring is released to drive the latch bolt forcefully into its latching position whereby the door is drawn tightly shut.

The present invention combines certain advantageous features of both these types of apparatus. It is a cocking latch mechanism whereby energy may be stored in the main latch spring while the door is still open to an extent that no part of the latch mechanism is in contact with the keeper. At the same time, the latch mechanism is of the easy opening type in which the main latch spring is not energized by the release of the latch

mechanism. Accordingly, the latch mechanism may be released by light pressure on a simple push button rather than by substantial force applied to an elongated handle. Energy for drawing the door tightly shut is supplied to the main latch spring by the closing movement of the door as it swings through a substantial arc. A latch mechanism constructed in accordance with the invention, therefore, avoids the disadvantage of the first type of mechanism discussed above in that it is an easy opening latch mechanism and avoids the jarring effect which necessarily occurs where energy is supplied to the main latch spring during the last two or three inches of closing movement of the door.

Accordingly, it is another object of the invention to provide improved control apparatus for a latch mechanism which permits easy opening of the latch mechanism and which supplies the necessary energy to the main latch spring while the door pivots through a substantial arc of closing movement.

It is another object of the invention to provide improved control apparatus for a latch mechanism which supplies energy to the main latch spring over a wide arc of closing movement of the associated door through engagement with the associated cabinet at a point adjacent the hinged edge of the door.

It is another object of the invention to provide improved control apparatus for a latch mechanism having various of the characteristics specified above, while being efficient, reliable 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 conenction 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 of a latch control apparatus and associated latch mechanism illustrating one embodiment of the invention, the apparatus being shown in latched position;

Fig. 2 is a similar view showing the same apparatus released for opening of the associated door;

Fig. 3 is a similar view showing the same apparatus with the door opened through a substantial arc, and

Fig. 4 is a similar view showing the same apparatus with the associated door closely approaching its closed position.

The latch mechanism proper, to which the present invention is applied, may be of known form, and in the drawings it is shown to be similar to a latch mechanism disclosed and claimed in Patent No. 2,802,684, referred to above.

In the illustrated embodiment of the invention, a door **10** is shown hingedly mounted at **11** on a cabinet **12**. A keeper **13** having a keeper roller **14** is arranged on the cabinet at the side opposite the hinged edge of the door.

The latch mechanism proper includes a bolt member **15** pivotally mounted by a pin **16**. A bolt actuator **17** is pivotally mounted through a pin **18** and is operatively connected to the latch bolt **15** by cam means including a cam follower **19** and a cam surface **20** which forms in part a slot **21** in the latch bolt **15**. The bolt actuator is preferably of double wall construction with interconnecting web portions, as is common in the art.

The cam surface **20** includes a cam portion **22** which is engageable by the cam follower **19** when the latch bolt **15** is in latching position. It also includes a cam surface **23** which is engageable with the cam follower when the latch bolt is in cocked position. Since the cam surface **23** is substantially circumferential about the pivotal axis of the latch bolt, pressure of the cam fol-

lower 19 thereagainst as a result of torque applied to the bolt actuator 17 will have little or no tendency to pivot the latch bolt about its axis. Under these circumstances, the latch mechanism is cocked.

When the door 10 closely approaches its closed position, an arm 25 formed on the latch bolt 15 strikes the keeper roller 14 whereby further closing movement of the door pivots the latch bolt in a counterclockwise direction. Such movement of the latch bolt causes the cam follower 19 to roll off the cam portion 23 and onto the cam portion 22. The latter cam portion is substantially aligned with the pivotal axis of the latch bolt as shown. Accordingly torque applied to the bolt actuator 17 will drive the cam follower 19 along the cam portion 22 and wedge the latch bolt 15 forcefully in a counterclockwise direction.

During this latter movement a second arm 26 on the latch bolt engages the rearward or inner side of the keeper roller 14 with the result that the door 10 is drawn forcefully closed. Such closing movement under the influence of the latch mechanism may be employed to compress a sealing gasket 11*a* between the door and the cabinet.

When the door 10 and the latch mechanism are in the position shown in Fig. 1, a main latch spring 30 bears against a pin 31 which is secured to the bolt actuator 17. The opposite end of the spring 30 is confined by a pin or key 32 which is secured to a spring bar 34 extending within the spring 30.

The spring bar 34 is guided by the previously mentioned pin 31, a slot 35 being provided in the spring bar to receive this pin. At the right-hand end of the spring bar 34 is a roller 36 which is received within a slot 37 in an elongated link 38.

The link 38 extends substantially across the door 10 where it is pivotally connected through a pin 39 to a bell crank 40. The bell crank is arranged to pivot about a pin 41 and has a roller 42 arranged to engage a bracket 43 which extends outwardly of the cabinet 11 and into the space between the double-walled door 10. A spring 44 arranged about the pin 41 urges the bell crank in a clockwise direction, as shown, and thereby maintains the roller 42 in contact with the bracket 43, and urges the door open after the latch has been tripped for the door-opening cycle.

With the control apparatus in the position illustrated in Fig. 1, the link 38 is drawn to the right by the bell crank 40 and pulls on the spring bar 34 through the roller 36. This compresses the spring 30 such that it bears against the pin 31 and urges the bolt actuator 17 forcefully in a counterclockwise direction. As described above, this urges the cam follower 19 downwardly along the cam portion 22 such that the latch bolt 15 is wedged in counterclockwise direction and maintains the door 10 tightly closed.

The latch mechanism may be released by relatively light pressure against a simple push button 45 which is connected to or integral with a push pin 46 slidably mounted in a sleeve 47. When pressure is applied to the push button 45, the push pin 46 bears against the right-hand end of the spring bar 34 and causes it to pivot in a counterclockwise direction about the pin 31. This removes the roller 36 on the spring bar 34 from the slot 37 in the link 38, with the result that the spring bar is no longer drawn to the right. No force is then applied to the bolt actuator 17 by the spring 30, since the spring and spring bar assembly floats freely on the bolt actuator pin 31.

As the door 10 opens, the latch bolt 15 necessarily pivots in a clockwise direction by virtue of its engagement with the keeper roller 14. A relatively light weight spring 15*a* moves the latch bolt 15 to the limit of its clockwise rotation wherein the cam follower 19 engages the right-hand end of the slot 21 in the latch bolt. The latch bolt and the bolt actuator are then in cocked position, with the spring and spring bar assembly floating freely on the bolt actuator.

As the door moves farther open, as in Fig. 3, the pivot pin 41 of the bell crank 40 is carried outwardly away from the cabinet 12 while the bell crank roller 42 remains in contact with the bracket 43 under the influence of the spring 44. Accordingly, the bell crank 40 rotates in a clockwise direction with respect to the door 10. This causes the pin 39 and hence the link 38 to move to the left with respect to the door. As is shown in Fig. 3, this movement of the link 38 is ultimately sufficient to bring the slot 37 in the link 38 opposite the roller 36 on the spring bar 34.

A relatively light spring 34*a* is wound about the pin 31 and engages the bar 32 at one end and a fixed portion of the latch housing at its other end. This spring urges the spring bar 34 lightly in a clockwise direction about the pin 31. Accordingly, when the link 38 has been so moved to the left, the spring bar roller 36 falls into the slot 37 in the link.

When the door is again moved toward its closed position, the bell crank 40 is caused to pivot in a counterclockwise direction with respect to the door 10 whereby the link 38 is again drawn to the right. The roller 36 on the spring bar 34 engages the wall forming the left-hand side of the slot 37 in the link 38 with the result that the spring bar is drawn to the right along with the link. The right-hand end of the spring 30 is thereby brought to bear resiliently against the pin 31. This urges the bolt actuator 17 forcibly in a counterclockwise direction, but since the cam follower 19 is in contact with the cam portion 23, pivotal movement of the bolt actuator and of the latch bolt is prevented, the latch mechanism being in cocked position. Accordingly, closing movement of the door compresses the spring 30 as is indicated in Fig. 4 by the fact that the pin 31 is relatively displaced toward the left-hand end of the slot 35.

When the door closely approaches its closed position, the arm 25 of the latch bolt strikes the keeper roller 14 as seen in Fig. 4. Slight additional closing movement causes rotation of the latch bolt in a counterclockwise direction, with the result that the cam follower 19 passes off the cam portion 23 and onto the cam portion 22. The latch is then uncocked, whereby the spring 30 may expand and drive the bolt actuator in a counterclockwise direction. The cam follower 19 rolls downwardly along the cam portion 22 and moves the latch bolt in a counterclockwise direction with a powerful wedging action. The arm 26 of the latch bolt bears against the rearward or inner side of the keeper roller 14 and draws the door tightly shut to compress the gasket 11*a*.

It will now be seen that the latch apparatus disclosed in the drawings and described above includes an easy opening latch mechanism. Pressure against the push button 45 to release the latch mechanism does not entail energization of the main latch spring 30 since the effect of the push button operation is merely to disconnect the spring bar 34 from the link 38 such that the spring and spring bar assembly floats freely on the bolt actuator and thereby exerts no force thereagainst.

It will also be seen that the energization of the main latch spring occurs over a wide arc of closing movement of the door. This results in a gradual energization of the main spring whereby only a light force need be exerted by the operator at any time. Further, this arrangement eliminates the jarring effect which necessarily accompanies energization of the main latch spring over a very short arc of closing movement of the door as is the case in latch mechanisms wherein energization of the main latch spring occurs only after some portion of the latch mechanism proper engages the associated keeper.

This latch mechanism, while having the advantages described above, also has the ability to draw the associated door tightly shut during the last fraction of an inch of its closing movement, whereby a sealing gasket as-

sociated with the door and cabinet may be properly compressed without reliance upon the operator closing the door with sufficient force to accomplish such gasket compression.

When the latch apparatus is released by operation of the push button, the spring *40a* acting through the bell crank **40** serves to urge the door open. This is particularly desirable in applications of easy opening latch mechanisms operated by push buttons since no pulling force is applied to the door by the operator.

An important feature of this illustrated embodiment of the invention is that the link **38** is caused to move laterally with respect to the door as the door opens and closes. This feature permits ready re-engagement of the link **38** and the spring bar **34** upon opening the door after they have been disconnected under stress. It will, of course, be understood that the latch mechanism proper and the main spring means may be arranged such that directions of movement of the spring means may be reversed. In such case the link **38** may readily be connected to the bell crank **40** at such a point that the link is moved toward the free edge of the door when the door closes and toward the hinged edge when the door opens. Alternatively, a simple, first-class lever may be employed to reverse the effective movement.

Attention is directed to the fact that the link is connected to the bell crank at such a point that the link is moved a greater distance than were the link connected to an arm fixed to the cabinet at a point outwardly of the pivotal axis of the door. This is a preferred embodiment of the invention, but the invention is not limited to such an arrangement.

While the present description sets forth a preferred embodiment of the invention, numerous changes may be made in the construction without deviating from the spirit of the invention, and it is therefore desired that the present embodiment be considered in all respects as illustrative and not restrictive, reference being had to the appended claims rather than to the foregoing description to indicate the scope of the invention.

I claim:

1. For use with a cabinet, a door hinged to said cabinet along one edge and a keeper mounted on said cabinet, the novel combination of a latch mechanism mounted on said door and adapted to engage said keeper and draw the door tightly closed with respect to the cabinet and a cooperating door-mounted control apparatus for said latch mechanism, said latch mechanism including a bolt movable between a latched and an unlatched position, a main spring adapted to urge said latch bolt into its latched position and main spring support means movable relative to said bolt in one direction to energize said main spring and in the opposite direction to de-energze said main spring, said control apparatus including a link extending across said door and having a portion thereof adapted to releasably engage said main spring support means, spring means for urging the latching engagement of said main spring support means and said link, means connected to said link and engaging said cabinet adjacent the hinged edge thereof and effective to move said link toward said hinged edge as said door closes and away from said hinged edge as said door opens, said link being effective to move said main spring support means in said one direction to energize said main spring when said link moves toward said hinged edge, and manually operable means for disconnecting said link and said main spring support means against the action of said spring means to de-energize said main spring and to release said latch mechanism.

2. For use with a cabinet, a door hinged to said cabinet along one edge and a keeper mounted on said cabinet, the novel combination of a latch mechanism mounted on said door and adapted to engage said keeper and draw the door tightly closed with respect to the cabinet, and a cooperating door-mounted control apparatus for said latch mechanism; said latch mechanism including a bolt movable between a latched and an unlatched position, a main spring adapted to urge said bolt into its latched position, and main spring support means movable relative to said bolt in one direction to energize said main spring and in the opposite direction to de-energize said main spring, said control apparatus including a link extending across said door and having a portion thereof adapted to releasably engage said main spring support means, spring means for urging the latching engagement of said main spring support means and said link, means connected to said link and resiliently engaging said cabinet adjacent the hinged edge thereof and effective to move said link toward said hinged edge as said door closes and away from said hinged edge as said door opens, said link being effective to move said main spring support means in said one direction to energize said main spring when said link moves toward said hinged edge, and manually operable means for disconnecting said link and said main spring support means against the action of said spring means to deenergize said main spring and to release said latch mechanism.

3. The structure of claim 2 in which the means connected to said link includes a member pivotally mounted on said door adjacent the hinged edge thereof, which member is spring biased toward engagement with said cabinet, whereby said member pivots with respect to said door as said door opens and closes.

4. The structure of claim 2 in which said spring means is effective to move said main spring support means and said link into engagement when said door is partially open and said link is moved away from said hinged edge.

5. For use with a cabinet, a door hinged to said cabinet along one edge and a keeper mounted on said cabinet, the novel combination of a latch mechanism mounted on said door and adapted to engage said keeper and draw the door tightly closed with respect to the cabinet, and a cooperating door-mounted control apparatus for said latch mechanism; said latch mechanism including a bolt movable between a latched and unlatched position, a helical main spring adapted to urge said latch bolt into its latched position and an elongate bar adapted to support said main spring, said bar having a latching formation disposed adjacent one end thereof and being axially movable in one direction to energize said main spring and in the opposite direction to de-energize said main spring, said control apparatus including a link extending across said door and having a latching formation disposed adjacent one end thereof which is adapted to releasably engage the latching formation on said bar, spring means urging the latching engagement of said bar and said link, means connected to said link engaging said cabinet adjacent the hinged edge thereof and effective to move said link and said engaged bar in said one direction as said door closes whereby said main spring is energized, and manually operable means for disconnecting said link and said bar against the action of said spring means, thereby de-energizing said main spring and releasing said latch mechanism.

6. For use with a cabinet, a door hinged to said cabinet along one edge and a keeper mounted on said cabinet, the novel combination of a latch mechanism mounted on said door and adapted to engage said keeper and draw the door tightly closed with respect to the cabinet, and a cooperating door-mounted control apparatus for said latch mechanism; said latch mechanism including a latch bolt movable between a latched and an unlatched position, a bolt actuator, cam means operatively connecting said latch bolt and said bolt actuator, a main spring urging said bolt actuator and said latch bolt toward a latched position and main spring support means movable relative to said bolt and said bolt actuator in one direction to energize said main spring and in the opposite direction to de-energize said main spring, said control apparatus including an elongate link extending across said

door and having a formation thereon adapted to releasably and latchingly engage said main spring support means, spring means for urging the latching engagement of said main spring support means and said link, a member pivotally connected to said door and resiliently urged toward engagement with said cabinet adjacent the free edge thereof, said member being pivotally connected to said link at a point spaced from its pivotal axis whereby said link is moved toward said hinged edge as said door closes and away from said hinged edge as said door opens, said link being effective to move said main spring support means, when engaged therewith, in said one direction to energize said main spring when said link moves toward said hinged edge and manually operable means for disconnecting said link and said main spring support means against the action of said spring means thereby de-energizing said main spring and permitting said bolt to move to its unlatched position.

7. For use with a cabinet structure, a door structure hinged to said cabinet structure along one edge and a keeper mounted on one of said structures, the novel combination of a latch mechanism and a cooperating control apparatus therefor, said combination being mounted on the other of said structures and said latch mechanism being adapted to engage said keeper and draw the door structure tightly closed with respect to the cabinet structure, said latch mechanism including a bolt movable between a latched and an unlatched position, a main spring adapted to urge said bolt into its latched position, and main spring support means movable relative to said bolt in one direction to energize said main spring and in the opposite direction to de-energize said main spring, said control apparatus including means engaging said one structure adjacent the hinged edge thereof and adapted to operatively and releasably engage said main spring support means and to effect movement thereof in said one direction when said door structure is being closed, spring means for urging the latching engagement of said control apparatus and said main spring support means, and manually operable means for disconnecting said control apparatus and said main spring support means against the action of said spring means to de-energize said main spring and to release said latch mechanism.

8. For use with a cabinet structure, a door structure hinged to said cabinet structure along one edge and a keeper mounted on one of the structures, the combination of a latch mechanism adapted to latchingly engage the keeper to draw the associated door structure tightly closed and a control apparatus for said latch mechanism, said combination being mounted on the other of said structures, said latch mechanism including a bolt movable between a latched and an unlatched position, a main spring adapted to urge said latch bolt into at least one of its positions, and a main spring support means movable in one direction to energize said main spring and in the opposite direction to de-energize said main spring, said control apparatus including a movable link extending across the other of said structures and adapted to releasably engage said main spring support means, spring means urging the latching engagement of said main spring support means and said link, means operatively connected to said link and engaging said one structure adjacent the hinged edge thereof and effective to move said link and said main spring support means engaged therewith in said one direction when said door structure is being closed thereby energizing said main spring, and manually operable means for disconnecting said link and said main spring support means againts the action of said spring means to release said latch mechanism.

9. For use with a cabinet structure, a door structure hinged to said cabinet structure along one edge and a keeper mounted on one of said structures, the novel combination of a latch mechanism and a cooperating control apparatus therefor mounted on the other of said structures, said latch mechanism being adapted to engage said keeper and draw the door structure tightly closed with respect to the cabinet structure, said latch mechanism including a bolt movable between a latched and unlatched position, an elongate spring bar, a portion of which is adapted to support said main spring, said spring bar being axially movable in one direction to energize said main spring and in the opposite direction to de-energize said main spring, said control apparatus including a link extending across the other of said structures and having a formation thereon adapted to releasably engage said spring bar and means engaging said one structure adjacent the hinged edge thereof and operatively connected to said link to effect movement of said link and said main spring support means in a direction to energize said main spring when said door structure is being closed, spring means urging the latching engagement of said spring bar and said link and manually operable means for disconnecting said link and said main spring support means against the action of said spring means to de-energize said main spring and to release said latch mechanism.

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