Nov. 17, 1953

E. B. JACOBSON

2,659,621

LATCH MECHANISM

Filed Jan. 7, 1950

2 Sheets-Sheet 1

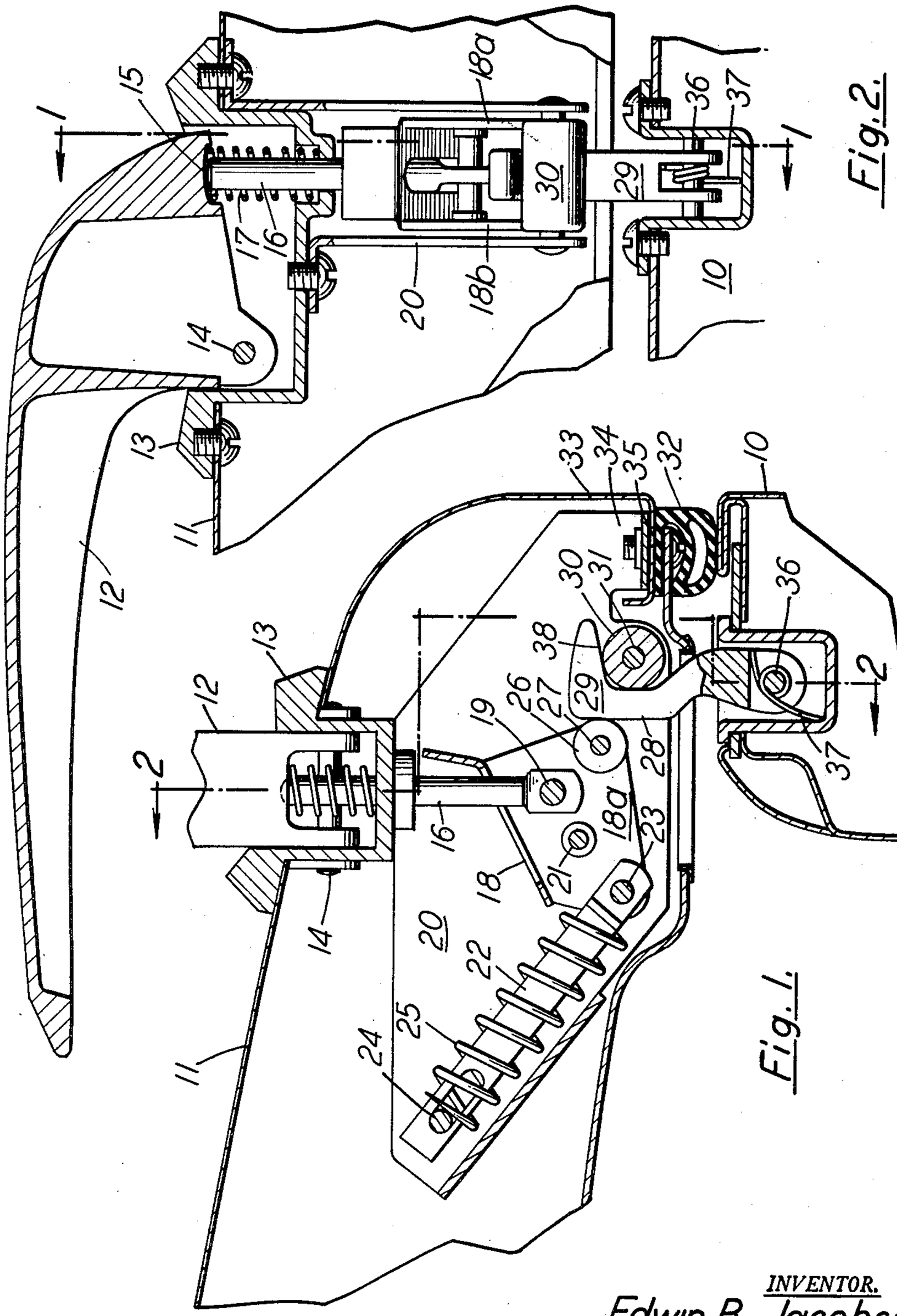

Fig. 2.

Fig. 1.

INVENTOR.
Edwin B. Jacobson
BY
Glenn B. Gibson
Attorney

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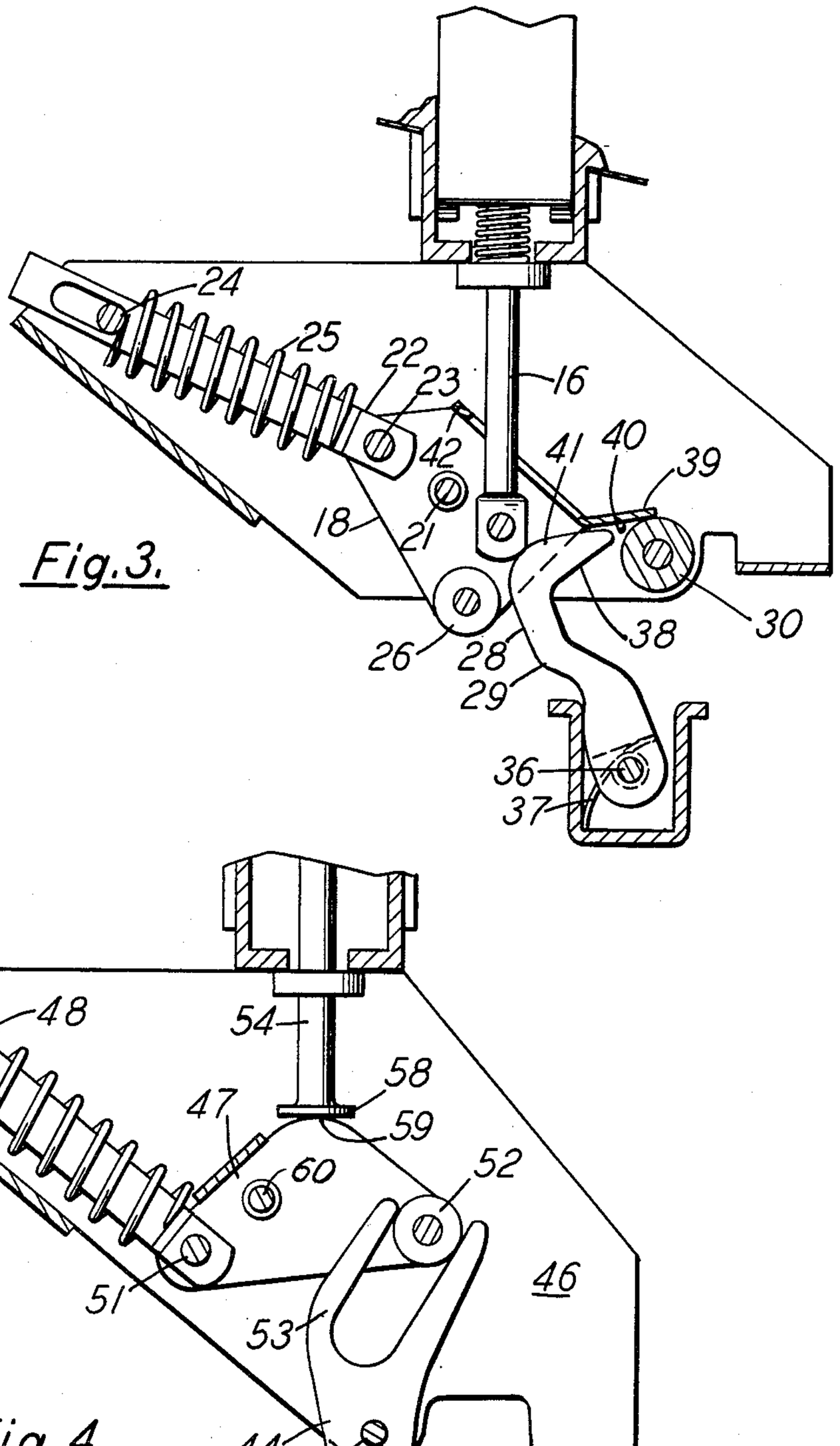

Fig. 3.

Fig. 4.

INVENTOR.
Edwin B. Jacobson
BY
Glenn B. Smith
Attorney

Patented Nov. 17, 1953

2,659,621

UNITED STATES PATENT OFFICE

2,659,621

LATCH MECHANISM

Edwin B. Jacobson, Grand Rapids, Mich., assignor to Crampton Manufacturing Company, a corporation of Michigan

Application January 7, 1950, Serial No. 137,453

5 Claims. (Cl. 292—240)

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The present invention provides a latch mechanism intended primarily for use with refrigerator doors and in other installations requiring that the door be closed and held in that position with considerable force. The requirement of a continuously maintained closing force results from the necessity of compressing a sealing gasket so that it may function properly. Devices designed to perform this general function are not new. The present invention presents an advance in the art by maintaining a particularly high sealing pressure which is relatively independent of the accumulation of tolerances in the manufacture of either the latch mechanism or the door, and also relatively independent of the deflection of these various parts under the forces involved.

Certain features of this invention also make possible a latch mechanism that assures complete actuation as the door is opened. In the case of several of the prior art devices, it is possible to open a refrigerator door by operating the handle in a particular manner which will result in the latch mechanism failing to open to a sufficient degree to cause the engagement of a trigger mechanism, thereby permitting the bolt to return to the locking position as the door swings open. The subsequent closing of the door is rendered somewhat difficult in this situation, and this possibility is removed when the escape of the door from the keeper guarantees that the actuating mechanism of the latch be operated sufficiently to assure that the full "open" position has been reached.

The mechanical advantage involved in the preferred form of the present latch mechanism results from the combined action of a toggle system with two independent cam actions. One of these cam actions involves the transmission of force from the toggle mechanism to the movable keeper, and the other results from the interaction between the keeper and a roller having its axis fixed with respect to the door.

The use as a holding point of a roller that is fixed with respect to the door permits the positioning of this roller at a point adjacent the edge of the door. Structurally, this results in the transmission of the closing forces to the door at a point where the surrounding structure is most capable of resisting such forces with a minimum of deflection. It will be obvious that if the closing force were transmitted to the door at a point on the generally flat portion of the door, a considerable deflection of that surface would occur under load producing the well known "oil can" effect. With the fixed holding point positioned near the edge of the door, however, the curved portion operates in the nature of the web

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of a beam and movement of the components under load is reduced to an absolute minimum.

While the preferred form of the invention involves a movable keeper member and a cooperating member fixed with respect to the door, a modified form of the present invention having somewhat fewer of the desirable features of the preferred form is provided in which a fixed keeper mounted upon the body of the refrigerator is used. In the modified form of the invention, the principal feature retained is the general independence of the moving member of the biasing or positioning system. A swinging bolt is pivoted to a point adjacent the edge of the door, and forces are applied to swing the bolt about the pivot point to urge it into engagement with the keeper. The pivot point of the bolt is not associated with the moving parts of the biasing or positioning mechanism.

The various features of the present invention will be discussed in detail by an analysis of the particular embodiments illustrated in the accompanying drawings. In these drawings:

Fig. 1 is a section taken upon a horizontal plane of a mechanism embodying the preferred form of the present invention, with the component in the "closed" position.

Fig. 2 is a section taken on the (vertical) plane 2—2 of Figure 1.

Fig. 3 is a section taken on a horizontal plane of the mechanism shown in Figure 1 with the components in the "open" position.

Fig. 4 is a section taken on a horizontal plane of a modified form of the present invention.

Referring to Figures 1, 2, and 3, a refrigerator is indicated at 10 having a door 11. A handle 12 is pivotally mounted in an escutcheon 13 for limited rotation about the axis of the pin 14. A pull upon the handle 12 induces rotation about the pin 14, and causes the actuating surface 15 associated with the handle to move the pin 15 inwardly with respect to the door. A return spring 17 is associated with the pin 16, and serves to position the handle as shown regardless of the position of the interior latch mechanism.

The pin 16 extends inwardly to a pivotal connection with the actuating member 18 at the pin 19. The actuating member 18 is pivotally mounted within the frame 20 upon the pin 21. A rod 22 is pivotally connected to the positioning member 18 at the pin 23, and slideably engages the pin 24 which is fixed with respect to the frame 20. A compression spring 25 transmits force between the pin 24 and the pin 23 generating a toggle action involving the positioning member 18. A roller 26 is mounted upon a shaft 27 carried by the positioning member 18, and this roller cooperates

with the back portion 28 of the swinging keeper 29 to position the same with respect to the fixed roller 30 carried by the shaft 31 fixed with respect to the frame 20. It will be noted that the shaft 31 transmits the entire locking force holding the door 11 in engagement with the body 10 of the refrigerator, and compressing the gasket 32 sufficiently to effect the necessary seal. The position of the shaft 31 is in close proximity to the edge 33 of the door, and it will be noted that structurally the portion 33 of the door acts as the web of a beam and is the most rigid portion of the door with regard to the forces generated by the locking mechanism. The frame 20 has the extension 34 securely attached to the flange 35 associated with the door section 33 so that the stress is adequately transferred between the various components involved.

The swinging keeper 29 is pivotally mounted upon the body 10 of the refrigerator upon the pin 36, and is biased in a counter-clockwise direction as seen in Figure 1 by the action of the spring 37. This biasing action urges the keeper to the unlocked position, and positions the keeper as shown in Figure 3 until the toggle mechanism operates to force it into engagement with the fixed roller 30. In the preferred form of the invention the inner surface 38 of the swinging keeper 29 cooperates with the roller 30 with a cam action causing the clockwise motion of the keeper 29 to urge the door 11 towards the body 10 of the refrigerator.

The actuating of the handle 12 of the mechanism a sufficient amount to open the door of the refrigerator causes the mechanism to assume the position shown in Figure 3. In order to open the door of the refrigerator, the roller 26 must move a sufficient distance away from the roller 30 to permit the withdrawal of the keeper 29. The proportions of the mechanism are such that the separation of these two rollers of that amount assures that the toggle involving the spring 25, the rod 22, and the positioning member 18 shall be tripped over the line of centers between the pins 21 and 24. When this position has been reached (as shown in Figure 3) the system is entirely stable, further rotation being prevented by the engagement of the projection 39 with the fixed roller 30. As the door is swung shut, the first contact of the latch mechanism with the swinging keeper 29 involves the engagement of the under surface 40 of the projection 39 with the outer end 41 of the keeper 29. As the door continues in its closing movement after the contact has been established, a counter-clockwise rotation of the positioning member 18 begins until the pin 23 passes over the line of centers between the pins 21 and 24. As soon as this line of centers has been passed, the spring 25 induces a rotation of the positioning member 18 in a counter-clockwise direction bringing the roller 26 to bear against the back portion 28 of the keeper 29. The engagement of the roller 26 and the keeper 29 urges the keeper in a clockwise direction against the action of the spring 37 and forces the cam surface 38 into secure engagement with the fixed roller 30. When the fully closed position of the mechanism has been reached, the relative position of the roller 26, the pin 21, and the back portion 28 of the keeper 29 results in a very high mechanical advantage. Due to the cosine relationship existing, a considerable rotation of the positioning member 18 results in a relatively small movement of the roller in a direction toward the fixed roller

30. The overall mechanical advantage of the entire latching mechanism, therefore, includes the effect of the toggle system per se, the cam effect between the roller 26 and the back 28 of the toggle, and the second cam effect between the surface 38 of the keeper 29 and the fixed roller 30.

The positioning member 18 is formed as a substantially U-shaped structure having the parallel side plates 18*a* and 18*b*. The connecting portion 42 and the projection 39 unite the sides 18*a* and 18*b*, and an opening is provided between the connecting portion 42 and the projection 39 sufficient to permit the rocking movement of the member 18 without interference with the actuating rod 16. It will be noted that the roller 26 can be moved considerably through misalignment or the accumulation of tolerances, particularly in a direction normal to the plane of the door, without substantially disturbing the action of the mechanism. Since the development of holding force by the mechanism is largely determined by the relative position of the roller 26 and the fixed roller 30, it also follows that misalignment of the entire mechanism with respect to the pivot point 36 of the keeper 29 has a relatively small bearing upon the force generated by the mechanism.

Referring to Figure 4, a modified form of the present invention is shown. In this modification, a fixed keeper 43 is used, and a swinging bolt 44 is mounted upon the shaft 45 carried by the frame 46. A positioning member 47 has essentially the same function as the positioning member 18 of the mechanism illustrated in Figures 1 to 3. A spring 48 cooperating with a rod 49 pivotally connected to the pins 50 and 51 generates the toggle action which positions the roller 52. The roller 52 is slideably received within a fork 53 of the bolt 44. Inward movement of the rod 54 in response to actuation of the handle of the device causes a clockwise rotation of the positioning member 47 about the shaft 60, resulting in the movement of the roller 52. This movement causes the roller to slide within the fork 53 and to rotate the bolt 44 in counter-clockwise direction and disengage the roller 55 from the cam surface 56 of the keeper. This disengagement is accompanied by the rotation of the positioning member 47 to a point such that the pin 51 passes across the line of centers between the shaft 60 and the pin 50. The closing of the door causes the roller 55 to impinge upon the auxiliary cam surface 57. The cooperation between the surface 57 and the roller 55 generates a tendency to rotate the bolt 44 in a clockwise direction about the pin 45 and provides the necessary force to rotate the positioning member 47 enough to bring the pin 51 across the line of centers of the shaft 60 and pin 50 in the direction such that the spring 48 will urge the mechanism to the position shown in Figure 4. As in the mechanism shown in Figures 1 to 3, the relative position of the surfaces of the fork 53, the roller 52, and the shaft 60 results in a cam action having a high mechanical advantage. The contact of the actuating rod 54 with the positioning member 47 is established by the sliding engagement of the enlarged end 58 with the curved section 59.

The particular embodiments which have been illustrated in the accompanying drawings and discussed herein are for illustrative purposes only and are not to be taken as a limitation upon the scope of the appended claims. In these claims, it

is the intent of the inventor to claim the entire invention to the extent to which he is entitled in view of the prior art.

1. A latch mechanism for a container door comprising: first engaging means, said first engaging means being mounted on said container; second engaging means, said second engaging means being mounted on said door, said first and second engaging means being adapted for relative lateral movement with respect to the plane of said door to and from engaged position; and biasing means mounted on said door, said biasing means being operative to urge said first and second engaging means into engaged position, said biasing means including a toggle system having crank means pivotally mounted on said door, spring means bearing at the opposite ends thereof on a point fixed with respect to said door and on a point on said crank remote from the axis of said crank, respectively, said spring means applying force substantially directed at the axis of said crank, stop means limiting the movement of said crank at a position wherein the said point on said crank is disposed at one side of a plane joining said fixed point and the axis of said crank, and said crank having a contacting member disposed to contact said engaging means when said door is adjacent closed position as said crank rotates from said stop to urge said engaging means into and maintain engagement.

2. A latch mechanism for a container door comprising: keeper means mounted on said container and having an engaging portion adapted for lateral movement with respect to the plane of said door; means forming a holding surface mounted on said door; and biasing means mounted on said door and disposed to urge said engaging portion into and maintain engagement with said holding surface when said door is adjacent closed position; and manually operated means for releasing said biasing means.

3. A latch mechanism for a container door comprising: keeper means mounted on said container and having an engaging portion adapted for lateral movement with respect to the plane of said door; means forming a holding surface mounted on said door; and biasing means mounted on said door, said biasing means being operative to contact said engaging portion when said door is adjacent closed position and urge said engaging portion into engagement with said holding surface, said biasing means including a toggle system having crank means pivotally mounted on said door, spring means bearing at the opposite ends thereof on a point fixed with respect to said door and on a point on said crank remote from the axis of said crank, respectively, said spring means applying force substantially directed toward the axis of said crank, stop means limiting the movement of said crank at a position wherein the said point on said crank is disposed at one side of a plane joining said fixed point and the axis of said crank, and said crank having a contacting member disposed to contact said engaging portion when said door is adjacent closed position as said crank rotates from said stop to urge said engaging portion into and maintain engagement with said holding surface.

4. A latch mechanism for a container door comprising: keeper means mounted on said container and having an engaging portion adapted for lateral movement with respect to the plane of said door; means forming a holding surface

mounted on said door; and biasing means mounted on said door, said biasing means being operative to contact said engaging portion when said door is adjacent closed position and urge said engaging portion into engagement with said holding surface, said biasing means including a toggle system having crank means pivotally mounted on said door, spring means bearing at the opposite ends thereof on a point fixed with respect to said door and on a point on said crank remote from the axis of said crank, respectively, said spring means applying force substantially directed toward the axis of said crank, stop means limiting the movement of said crank at a position wherein the said point on said crank is disposed at one side of a plane joining said fixed point and the axis of said crank, said crank having a contacting member disposed to contact said engaging portion when said door is adjacent closed position as said crank rotates from said stop to urge said engaging portion into and maintain engagement with said holding surface, trigger means adapted to move said crank away from said stop means on closing of said door, and manually operated release means adapted to move said crank toward said stop means.

5. A latch mechanism for a container door comprising: keeper means mounted on said container and having an engaging portion adapted for lateral movement with respect to the plane of said door; means forming a holding surface mounted on said door; biasing means urging said engaging portion away from engagement with said holding surface; stop means establishing a disengaged position of said engaging portion; and biasing means mounted on said door, said biasing means being operative to contact said engaging portion when said door is adjacent closed position and urge said engaging portion into engagement with said holding surface, said biasing means including a toggle system having crank means pivotally mounted on said door, spring means bearing at the opposite ends thereof on a point fixed with respect to said door and on a point on said crank remote from the axis of said crank, respectively, said spring means applying force substantially directed toward the axis of said crank, stop means limiting the movement of said crank at a position wherein the said point on said crank is disposed at one side of a plane joining said fixed point and the axis of said crank, said crank having a contacting member disposed to contact said engaging portion when said door is adjacent closed position as said crank rotates from said stop to urge said engaging portion into and maintain engagement with said holding surface, trigger means adapted to move said crank away from said stop means on closing of said door, and manually operated release means adapted to move said crank toward said stop means.

EDWIN B. JACOBSON.

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