March 5, 1935. F. J. SULLIVAN 1,992,972

DOOR OPERATING MECHANISM

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Fig. 1.

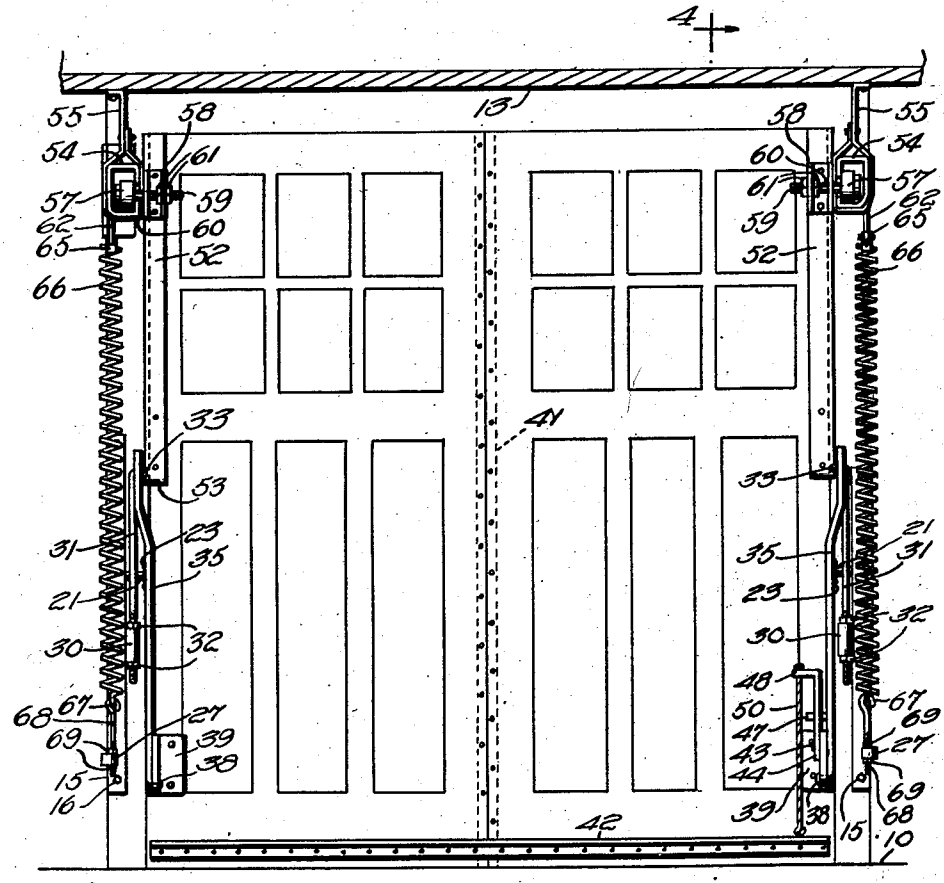


Fig. 2.

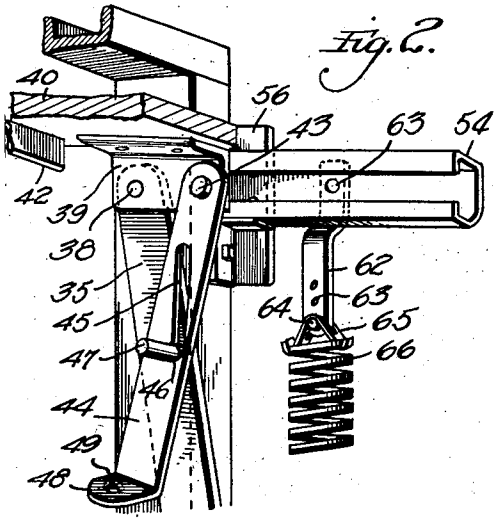
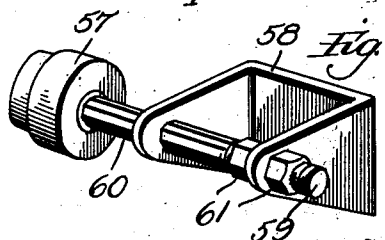


Fig. 3.



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Fig. 4.

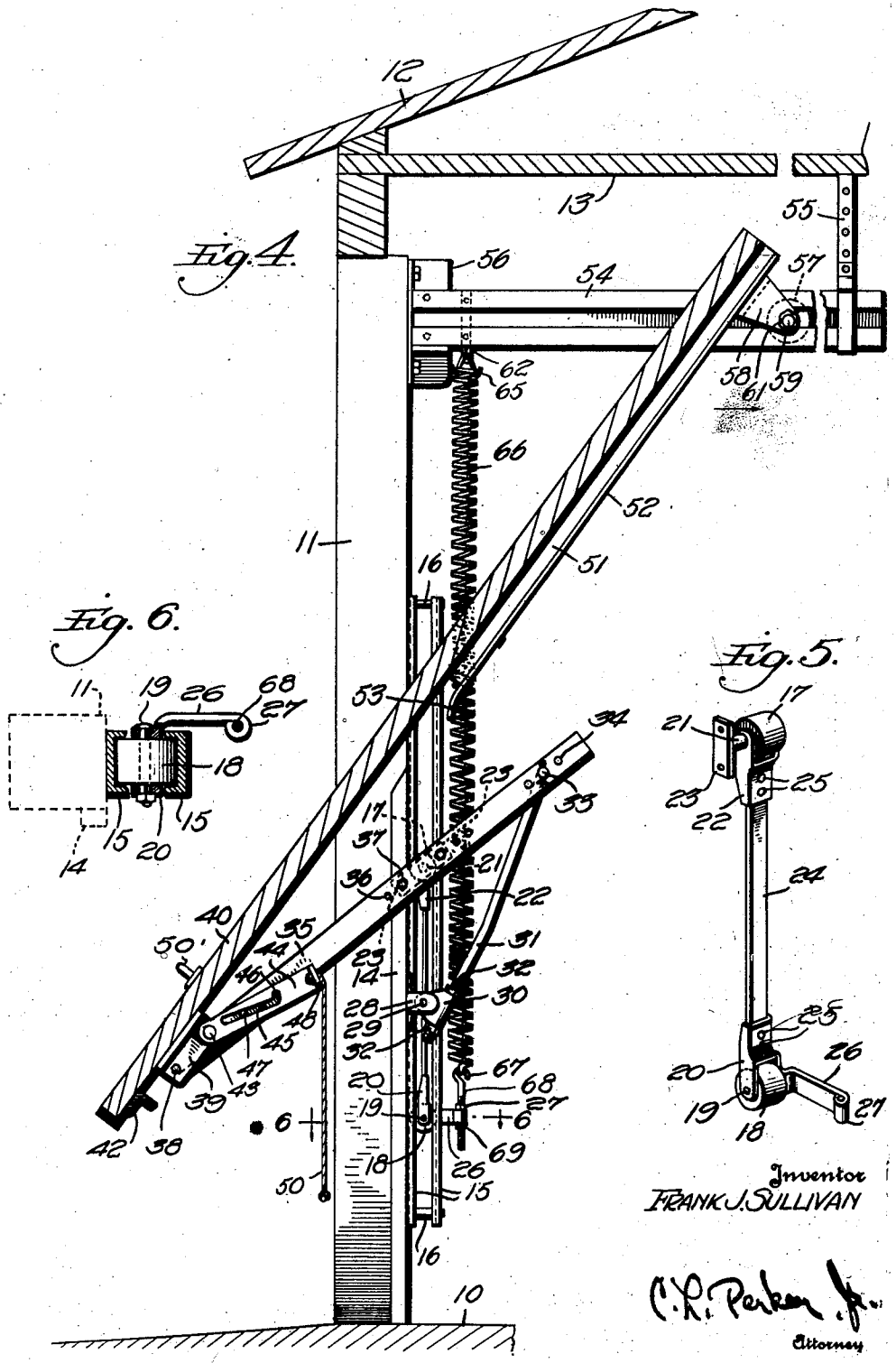


Fig. 6.

Fig. 5.

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1,992,972

DOOR OPERATING MECHANISM

Frank J. Sullivan, Oshkosh, Wis.

Application June 19, 1931, Serial No. 545,546

14 Claims. (Cl. 20—19)

This invention relates to door operating mechanisms and more particularly to a mechanism for operating garage doors and the like, and is an improvement over the construction shown in my copending application Serial No. 493,616, filed November 5, 1930.

As in the case of my copending application referred to, the present invention relates particularly to the type of door which is movable from its normal vertical closed position to an overhead position within the building, the door being supported at its upper end by a trackway and movable through a swinging path by means connected to its other end. Doors of this type operated by the usual mechanisms provided for this purpose possess several disadvantages, and among them the fact that the lower or swinging end of the door is caused to move in a substantially arcuate path of material diameter whereby the swinging edge of the door moves outwardly a substantial distance from the door frame, thus often causing it to strike against the legs of the operator, and making the door inconvenient for use in places where limited space is available.

Moreover, relatively heavy springs usually are employed for assisting in lifting the weight of the door, and the movable ends of such springs travel through substantial distances whereby the tension of the springs is usually reduced to zero at or before the point where the door reaches its overhead position, thus requiring the use of substantial force for moving the door to its fully open position. In order to provide a spring action of such character that the springs are still under some tension when the door reaches an overhead position, the springs usually are strongly tensioned when in closed position, thus requiring that considerable force be expended to move the door to fully closed position, and requiring the use of fastening means for holding the door against the tension of the springs.

In my copending application referred to I have disclosed a door operating mechanism which is highly practicable in operation, and which overcomes the inherent disadvantages referred to in doors of this general character. For example, the proportionate movements of the free ends of the springs are such that a considerable lifting force is exerted by the springs as the door approaches open position, and no means is required for holding the door in closed position against the tension of the springs. Moreover, the outward swinging movement of the lower edge of the door is materially reduced, thus facilitating the operation of the door, and rendering it practicable for use in limited spaces, such as narrow alleys, etc.

An important object of the present invention is to provide a door operating mechanism wherein movement of the door between open and closed positions takes place with a greatly reduced movement of the free ends of the springs, thus reducing the necessary tension of the springs when in closed position, and permitting the retention of a substantial spring lifting force to facilitate the movement of the door to open position.

A further object is to provide an apparatus of this character which is so designed as to facilitate installation whereby free movement of the door is provided when the doorways and other elements are not accurately placed.

A further object is to provide a novel automatic latch mechanism operable when the door reaches open position to prevent the rollers from running beyond the ends of the tracks when the door is moved to open position.

Other objects and advantages of the invention will become apparent during the course of the following description.

In the drawings I have shown one embodiment of the invention. In this showing,

Figure 1 is an inside elevation of the door, the ceiling being shown in section,

Figure 2 is an enlarged fragmentary perspective view of a portion of the operating mechanism including the latch operable for holding the door in open position,

Figure 3 is a detail perspective view of one of the roller assemblies,

Figure 4 is a section on line 4—4 of Figure 1,

Figure 5 is a detail perspective view of a reach rod and associated elements, and,

Figure 6 is a transverse section on line 6—6 of Figure 4.

Referring to the drawings, the invention has been illustrated as being applied to a garage including a floor 10, a door frame 11 and roof 12, the interior of the garage being provided with the usual ceiling 13. As shown in Figures 4 and 6, opposite sides of the door frame are provided with lower sealing strips 14, for a purpose to be described.

Referring to Figures 4 and 6, the numeral 15 designates a pair of channeled guides arranged adjacent each side of the door. One channel of each pair is secured against the inner face of each side of the door frame, while the other channel of the pair is secured in spaced relation to the first named channel by spacing studs 16. A pair of rollers 17 and 18 is arranged within each pair

of channels 15. The lower roller 18 is mounted upon a stub shaft 19 passing through the arms of a yoke 20. The upper roller 17 is similarly mounted upon a stub shaft 21 and this shaft extends through a yoke 22, similar to the yoke 20. The stub shaft 21 projects beyond the yoke 22 and is preferably formed integral with a plate 23, as shown in Figure 5. The portions of the yokes 20 and 22 projecting toward each other are preferably channeled to receive a reach rod 24 secured thereto by fastening elements 25. The lower yoke 20 is provided at one side with a projecting arm 26 having an eye 27 formed at its free end for a purpose to be described.

A bracket 28 is secured against the inner face of each side of the door frame and is pivoted as at 29 to a connecting member 30. The connecting member 30 is provided with an elongated cylindrical portion in which is arranged the lower end of a rod 31. This rod is threaded at its lower end for reception within nuts 32 engageable against the ends of the connecting member, as shown in Figure 4. The upper end of each rod 31 turns inwardly as at 33 for reception in either of a plurality of openings 34 formed in a lever 35.

Each lever 35 is provided intermediate its ends with a plurality of openings 36 to receive bolts 37 by means of which each plate 23 may be secured to one of the levers 35 in selected positions with respect thereto. It will be apparent that the connection between the levers 35 and the plates 23 causes the rollers 17 and 18 to move vertically along their guides when bodily vertical movement of the levers 35 takes place in a manner to be described. During such movement, the rods 31 act as links connecting one end of each lever 35 to the door frame whereby the levers are adapted to swing through fixed paths when partaking of bodily vertical movement.

The other ends of the levers 35 are pivotally connected as at 38 to a bracket 39 secured to the lower end of a door 40. The apparatus is shown in the present instance attached to a door made up of separate door sections secured together by a connecting plate 41 and provided adjacent its lower edge with an angle iron bracing strip 42. It will be apparent however that the apparatus is applicable to a door of unitary or other construction. One bracket 39 is also pivotally connected as at 43 to a latch 44, as clearly shown in Figure 2. The latch is provided with an elongated slot 45 terminating at its lower end in an offset portion 46 adapted to receive a pin 47 carried by the adjacent lever 35. The free end of the latch 44 is turned outwardly as at 48 and is provided with an opening 49 adapted to receive a rod or similar depending handle 50 for operating the latch in a manner to be described. Initial movement of the door away from open position is facilitated by the provision of a handle 50'.

A cleat 51 is secured against the inner face of the door adjacent each edge and extending downwardly from the upper extremity of the door. These cleats project beyond the edge of the door to overlap the door frame and coact with the sealing strips 14 to act as weather stripping for the door. Each cleat 51 is provided with a metal strip 52 secured against its inner face as shown in Figures 1 and 4. The lower ends of the metal strips 52 are curved away from the door as at 53 to engage the strips 14 to assist in guiding the door accurately into position, with the strips 14 and cleats 51 in vertical alinement with each other.

Rails 54 are suspended from the ceiling by straps 55 on opposite sides of the door opening and near the top thereof. The forward ends of these rails are secured to the door frame by brackets 56. The trackways are substantially C-shaped, as shown in Figure 1, and are adapted to receive rollers 57. These rollers are of slightly less width than the space between the sides of the trackways to assist in preventing any binding action between these elements.

U-shaped brackets 58 are secured against the strips 52 near the upper ends thereof. One of these brackets and its associated elements is clearly shown in Figure 3 of the drawings. Each of the rollers 57 is rotatably mounted upon a shaft 59 extending through the arms of one of the brackets 58. A portion of the shaft 59 intermediate its ends is polygonal, as indicated at 60, and extends through a similarly shaped opening in one of the arms of the bracket 58. Nuts 61 are threaded on the end of the shaft 59 which extends through the other arm of the bracket 58 and are adapted to be clamped against opposite sides thereof. This construction permits the shaft 59 to be longitudinally adjusted by proper manipulation of the nuts 61, while the shaft 59 is prevented from rotating, thus preventing the nuts 61 from working loose in operation.

A hanger 62 is secured as at 63 to each of the rails 54. The lower end of each hanger is preferably offset inwardly as shown in Figure 2 and is provided with a series of openings 63 to selectively receive a transverse pin 64. Each pin 64 supports a spring clip 65 the ends of which are adapted to engage beneath one of the upper turns of a coil spring 66. These springs are relatively long and substantially vertically arranged as shown in Figures 1 and 4, and have their lower ends engaging hooks 67 carried by threaded rods 68. Each rod 68 extends through one of the eyes 27 and is received in clamping nuts 69 engageable against the top and bottom faces of the eye 27.

The operation of the apparatus is as follows:

The door normally occupies a closed position, in which it is vertically arranged against the strips 14, while the cleats or strips 51 lie against the inner faces of the sides of the door frame. The arrangement of the strips 14 and 51 provides adequate weather stripping as will be apparent.

When the door is in the vertical position referred to, the springs 66 obviously are under tension, and thus exert a constant upward force. When the door is in the position referred to, however, the projecting end 33 of each rod 31 moves past the plane of the shaft 19 and pivot pin 29, at each side of the door, and accordingly the tendency of the springs to move the arms 26 upwardly tends to swing the upper ends of the levers 35 toward the door, thus tending to hold the lower edge of the door inwardly against the strips 14 and hold the door in closed position. Thus aside from a lock to prevent unauthorized opening of the door, no fastening means is necessary to hold the door in closed position, since the springs 66 are employed for this purpose.

When it is desired to open the door, the operator grasps the handle 50' to swing the lower edge of the door outwardly, whereupon the upper ends of the rods 31 will move inwardly beyond the vertical plane referred to, and the upper ends of the rods 31 will be free to swing inwardly as the springs 66 transmit a lifting movement to the levers 35 through the reach rods 24 and associated elements. As this vertical movement takes

place, the rollers 17 and 18 obviously roll in the guides 15.

Since the lower ends of the rods 31 are connected to fixed pivot points, it will be apparent that the ends 33 of these rods swing through fixed arcs, and accordingly the opposite ends of the levers 35 are caused to move through fixed predetermined paths as the shafts 21 transmit vertical bodily movement to the levers 35. Doors of this general character usually are constructed in such a manner that the lower edges of the doors partake of movement about an arc of a circle of substantial radius, and accordingly the doors swing outwardly a considerable distance from their door openings. Such constructions are disadvantageous for the reasons previously referred to, and such disadvantages are overcome to a considerable extent with the present construction. It will be noted that the outward swinging movement of the lower edge of the door is determined by the distance between the edge of the door and the shafts 21, while the vertical movement of the edge of the door will be equal to twice the distance between the edge of the door and the ends 33 of the rods 31. Accordingly it will be apparent that the free edge of the door partakes of a substantially elliptical movement, thus minimizing the outward movement of the door when it is moved to open position.

It will be apparent that the rollers 57 travel in the trackways 54 as the door moves toward open position. During such movement, it will be apparent that the springs 66 constantly tend to lift the lower edge of the door to its overhead position. The operating mechanisms for doors of the overhead swinging type usually are limited to the use of relatively short springs which are maintained under relatively great tension when the doors are closed, but which lose their tension before the doors reach open position due to the proportionate travel of the lower ends of the springs. Such constructions not only require that the springs be arranged under considerable tension when the doors are closed, but they also require that a greater lifting force be transmitted manually to the doors to move them to fully open position due to the loss in tension of the springs as the open position is approached. With the present construction it will be apparent that springs of a length nearly equal to the height of the door may be employed, and since the vertical movement of the free edge of the door is substantially greater than the movement of the shafts 21, a materially shorter proportionate movement of the free ends of the springs is required, thus permitting these springs to remain under tension throughout the movement of the door, and thus greatly facilitating the movement of the door to fully open position. In other words, a more uniform lifting movement is transmitted by the springs to the door throughout the movement of the latter than has been possible with prior constructions. The difference in the vertical movements of the free edge of the door and the shafts 21, and the use of the reach rods 24 permits the use of much longer springs whereby the desired result referred to is accomplished. Moreover, the use of rollers at the two ends of each reach rod renders the movement of the door much smoother than is provided by the usual prior constructions.

As the door moves toward open position, the angle between the levers 35 and the door gradually increases until these elements reach the relative angular positions shown in Figure 2. During such movement, the pin 47 of the latch mechanism travels downwardly through the slot 45 of the latch 44, and when the fully open door position is reached, the pin 47 will be in registration with the offset end 46 of the latch slot, and the latch will drop to the position shown in Figure 2. The pin 47 under such conditions is in the lower extremity of the latch slot, and accordingly further movement of the door is prevented. Accordingly the operator need not move the door an unnecessary distance when swinging it back to closed position, and the latch mechanism also functions to prevent the rollers 57 from traveling beyond their desired maximum limits of travel. The latch mechanism, moreover, prevents accidental movement of the door to closed position, since the arrangement of the pin 47 in the offset end 46 of the latch slot prevents downward movement of the free edge of the door until the latch is released. It will be noted that the latch readily may be released merely by pulling outwardly on the handle or cable 50, and a continued pulling movement transmitted to the cable will start the door on its downward movement.

It has been found that doors of this character frequently do not operate with smoothness and precision due to the carelessness of mechanics who install the apparatus. For example, the rollers sometimes bind against the sides of the overhead trackways, and it also occurs in some installations that one side of the door will drag against the floor when the door is in closed position, and factors such as these will render the operation of a door extremely difficult. With the present construction, a dragging edge of the door readily may be lifted by turning one of the lower nuts 32 downwardly and then similarly operating the corresponding upper nut 32, thus lifting the rod 31 and transmitting a sufficient lifting movement to the adjacent edge of the door to prevent it from dragging upon the ground. The mounting of the rollers 57 also permits these members to be properly adjusted for individual installations. The polygonal portion 60 of each roller shaft prevents turning movement thereof, but such polygonal shaft portions are slidable in the arms of the brackets 58 through which they extend. Accordingly the rollers 57 may be adjusted axially by proper manipulation of the nuts 61, and accordingly the rollers may be prevented from dragging against the sides of their respective trackways.

It is to be understood that the form of the invention herewith shown and described is to be taken as a preferred example of the same and that various changes in the shape, size and arrangement of parts may be resorted to without departing from the spirit of the invention or the scope of the subjoined claims.

I claim:

1. The combination with a door frame and a door adapted to assume a vertical position in said frame to form a closure therefor, of trackway means for supporting the upper end of the door for movement substantially laterally away from the door frame, a lever connected at one end to the door frame and at its other end to the lower end of the door, elongated depending means connected at its upper end to said lever, and a spring having its upper end fixed adjacent the top of the door frame and its lower end connected to said depending means at a point spaced a substantial distance from the upper end thereof.

2. The combination with a door frame and a door adapted to assume a vertical position in said

frame to form a closure therefor, of trackway means for supporting the upper end of the door for movement substantially laterally away from the door frame, a lever connected at one end to the lower end of the door, a relatively long link connected between the other end of the lever and the door frame, a depending reach rod pivotally connected to said lever intermediate the ends thereof, and a spring having its upper end fixed adjacent the top of the door frame and its lower end connected to the lower end of said reach rod.

3. The combination with a door frame and a door adapted to assume a vertical position in said frame to form a closure therefor, of trackway means for supporting the upper end of the door for movement substantially laterally away from the door frame, and operating means for each edge of the door, each operating means comprising a lever connected at one end to the lower end of the door, a relatively long link connected between the other end of the lever and the door frame, a vertical guide, a reach rod vertically arranged in said guide, rollers carried by the ends of said reach rod and vertically slidable in said guide, the upper end of said reach rod being pivotally connected to said lever intermediate its ends, and a relatively long spring fixed at its upper end adjacent the top of the door frame and connected at its lower end to the lower end of said reach rod.

4. The combination with a door frame and a door adapted to assume a vertical position in said frame to form a closure therefor, of trackway means for supporting the upper end of the door for movement substantially laterally away from the door frame, a lever connected at one end to the lower end of the door, operating means connected to said lever for effecting movement of the lower end of the door in a fixed path to an overhead position, a latch pivotally connected to the door at a point spaced from the point of connection thereof with said lever, said latch being provided with a slot, and a pin carried by said lever and operable in said slot and engageable with one end thereof when the door reaches its overhead position for limiting the movement of the door beyond such position.

5. The combination with a door frame and a door adapted to assume a vertical position in said frame to form a closure therefor, of trackway means for supporting the upper end of the door for movement substantially laterally away from the door frame, a bracket carried by the door adjacent its lower edge, a lever pivotally connected at one end to said bracket, operating means connected to said lever for effecting movement of the lower end of the door in a fixed path to an overhead position, a latch pivotally connected to said bracket at a point spaced from the pivotal connection thereof with said lever, said latch being provided with a longitudinal slot having a transverse extension in the end thereof remote from the pivot of the latch, and a pin carried by said lever and operable in said slot, said latch being movable downwardly by gravity when the door reaches its overhead position whereby the transverse extension of said slot receives said pin to prevent movement of the door in either direction.

6. The combination with a door frame and a door adapted to assume a vertical position in said frame to form a closure therefor, of trackway means for supporting the upper end of the door for movement substantially laterally away from the door frame, a lever connected at one end to the lower end of the door, a relatively long link pivotally connected at one end to the other end of the lever, a connecting member pivoted to the door frame and provided with an opening therethrough, the other end of said link being threaded and extending through said opening, nuts threaded on the last named end of said link and engaging respectively against the top and bottom of said connecting member, and spring means tending to exert a lifting force upon said lever intermediate the ends thereof.

7. The combination with a door frame and a door adapted to assume a vertical position in said frame to form a closure therefor, of trackway means for supporting the upper end of the door for movement substantially laterally away from the door frame, a lever connected at one end to the lower end of the door, a relatively long link pivotally connected at one end to the other end of the lever, a connecting member pivoted to the door frame and provided with an opening therethrough to receive the other end of said link, nuts threaded on the last named end of said link and engaging respectively against the top and bottom of said connecting member, said lever being adapted to assume a substantially vertical position when the door is in such position, a vertical reach rod pivotally connected at its upper end to said lever, and a spring fixed at its upper end adjacent the top of the door frame and connected at its lower end to the lower end of said reach rod.

8. Apparatus of the character described comprising means for supporting the upper end of a door for movement substantially laterally away from a door frame, a lever connected at one end to the door frame and at its other end to the lower end of the door, elongated depending means connected at its upper end to said lever intermediate the ends thereof, and a spring having its upper end fixed adjacent the top of the door frame and its lower end connected to said depending means at a point spaced a substantial distance from the upper end thereof.

9. Apparatus of the character described comprising trackway means for supporting the upper end of a door for movement substantially laterally away from a door frame, a lever connected at one end to the lower end of the door, a relatively long link connected between the other end of the lever and the door frame, a depending reach rod pivotally connected to said lever intermediate the ends thereof, a vertical guide for said reach rod, and a spring having its upper end fixed adjacent the top of the door frame and its lower end connected to the lower end of said reach rod.

10. Apparatus of the character described comprising trackway means for supporting the upper end of a door for movement substantially laterally away from the door frame, and operating means for each edge of the door, each operating means comprising a lever connected at one end to the lower end of the door, a relatively long link connected between the other end of the lever and the door frame, a vertical guide, a reach rod vertically arranged in said guide, rollers carried by the ends of said reach rod and vertically slidable in said guide, the upper end of said reach rod being pivotally connected to said lever intermediate the ends thereof, and a relatively long spring fixed at its upper end adjacent the top of the door frame and connected at its lower end to the lower end of said reach rod.

11. Apparatus of the character described comprising trackway means for supporting the upper

end of a door for movement substantially laterally away from the door frame, a lever connected at one end to the lower end of the door, operating means connected to said lever for effecting movement of the lower end of the door in a fixed path to an overhead position, a latch pivotally connected to the door at a point spaced from the point of connection thereof with said lever, said latch being provided with a slot, and a pin carried by said lever and operable in said slot and engageable with one end thereof when the door reaches its overhead position for limiting the movement of the door beyond such position.

12. Apparatus of the character described comprising trackway means for supporting the upper end of a door for movement substantially laterally away from a door frame, a bracket carried by the door adjacent its lower edge, a lever pivotally connected at one end to said bracket, operating means connected to said lever for effecting movement of the lower end of the door in a fixed path to an overhead position, a latch pivotally connected to said bracket at a point spaced from the pivotal connection thereof with said lever, said latch being provided with a longitudinal slot having a transverse extension in the end thereof remote from the pivot of the latch, and a pin carried by said lever and operable in said slot, said latch being movable downwardly by gravity when the door reaches its overhead position whereby the transverse extension of said slot receives said pin to prevent movement of the door in either direction.

13. Apparatus of the character described comprising trackway means for supporting the upper end of a door for movement substantially laterally away from the door frame, a lever connected at one end to the lower end of the door, a relatively long link pivotally connected at one end to the other end of the lever, a connecting member pivoted to the door frame and provided with an opening therethrough to receive the other end of said link, nuts threaded on the last named end of said link and engaging respectively against the top and bottom of said connecting member, and spring means tending to exert a lifting force upon said lever intermediate the ends thereof.

14. Apparatus of the character described comprising trackway means for supporting the upper end of a door for movement substantially laterally away from a door frame, a lever connected at one end to the lower end of the door, a relatively long link pivotally connected at one end to the other end of the lever, a connecting member pivoted to the door frame and provided with an opening therethrough to receive the other end of said link, nuts threaded on the last named end of said link and engaging respectively against the top and bottom of said connecting member, said lever being adapted to assume a substantially vertical position when the door is in such position, a vertical reach rod pivotally connected at its upper end to said lever intermediate the ends thereof, and a spring fixed at its upper end adjacent the top of the door frame and connected at its lower end to the lower end of said reach rod.

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