March 5, 1935. F. J. SULLIVAN 1,993,690

DOOR OPERATING MECHANISM

Filed Nov. 5, 1930 2 Sheets-Sheet 1

Fig. 1.

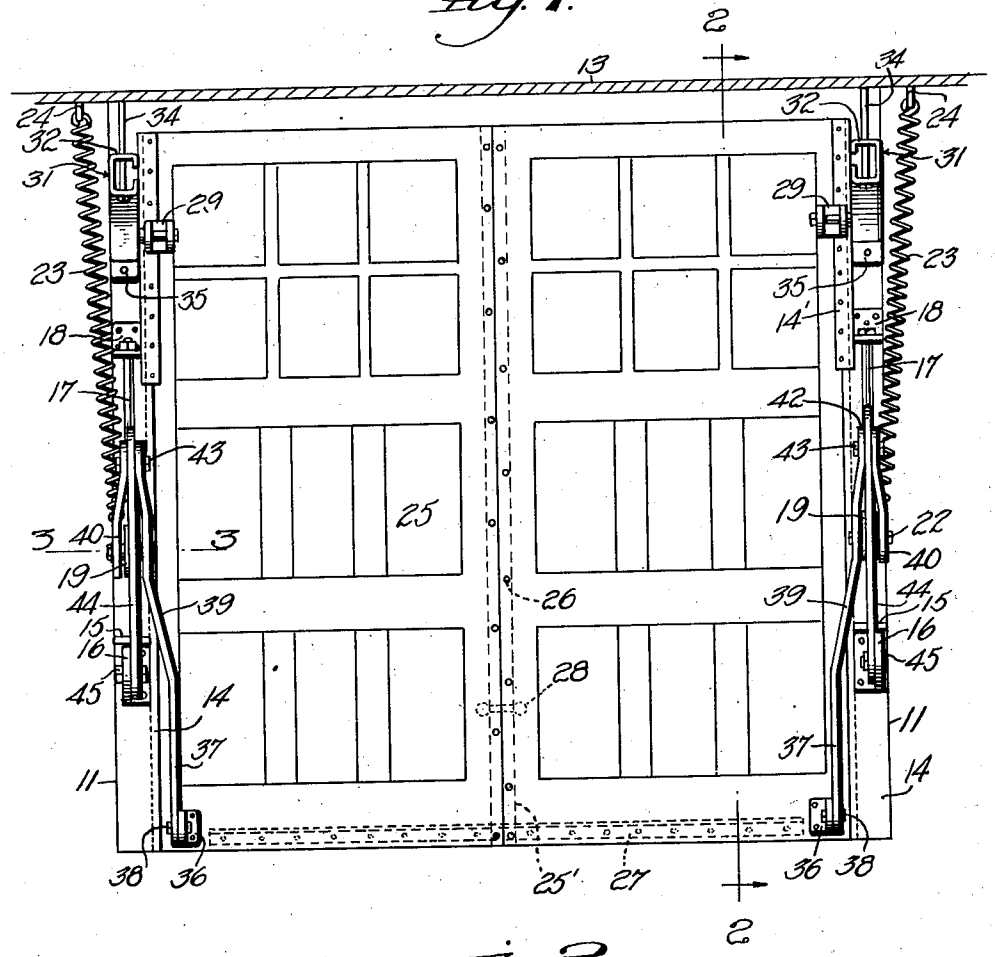
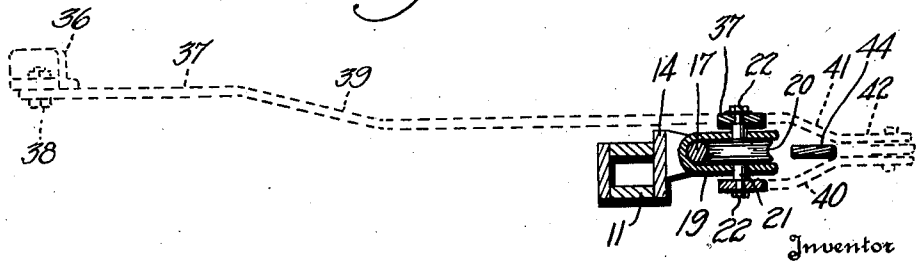


Fig. 3.



Inventor

FRANK J. SULLIVAN

By C. L. Parker Jr.

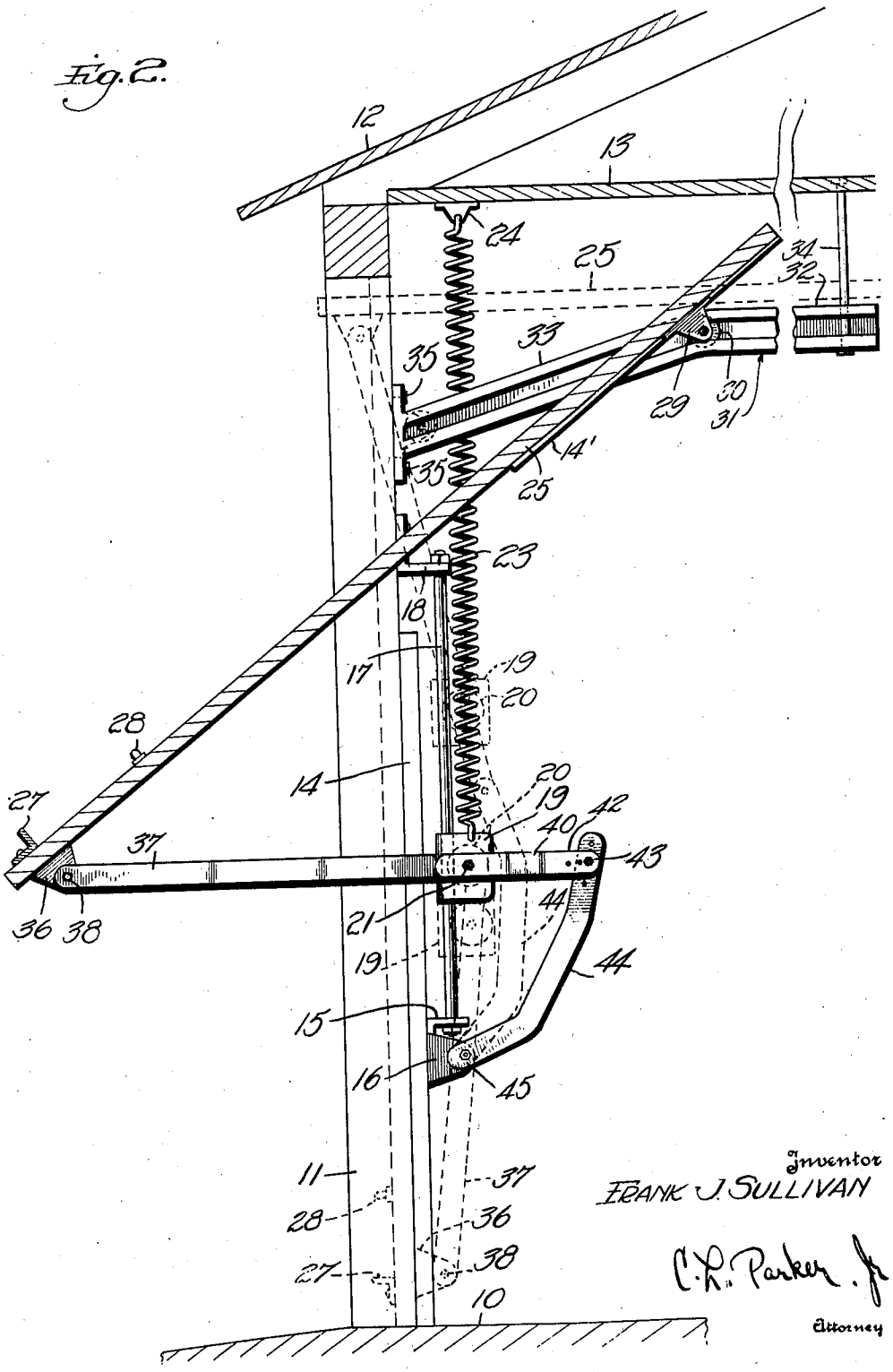
Attorney

March 5, 1935. F. J. SULLIVAN 1,993,690

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Fig. 2.



Inventor

FRANK J. SULLIVAN

C. L. Parker, Jr.

Attorney

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DOOR OPERATING MECHANISM

Frank J. Sullivan, Oshkosh, Wis.

Application November 5, 1930, Serial No. 493,616

18 Claims. (Cl. 20—19)

This invention relates to door operating mechanisms, and more particularly to a mechanism for operating garage doors and the like.

The present invention relates particularly to that type of door wherein the door 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. Devices of this character ordinarily possess several disadvantages. For example, the 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. Furthermore, relatively heavy springs usually are employed for assisting in lifting the weight of the door, and if the spring is sufficiently strong to overcome the weight of the door, some means must be employed for holding the door in closed position against the tension of the spring. The doors sometimes are substantially balanced by the spring tension and accordingly very loosely remain in closed position, thus further requiring means for holding the door against swinging movement. Moreover, the distance through which the free edge of the door moves through its swinging movement is so great as to require very long springs which contract in operation through a substantial portion of their length thus reducing the tension of the springs to nearly zero as the door approaches open position.

An important object of the present invention is to provide novel door operating mechanism wherein spring means is provided for overcoming the weight of the door to assist it in its movement to open position, and wherein the spring means operates further to tend to hold the door in closed position until it is manually moved from such position.

A further object is to provide a door operating mechanism of the character described which is of such a character as to reduce the outward movement of the swinging edge of the door away from the building as the door is moved upwardly from closed position.

A further object is to provide a novel operating mechanism for doors wherein the springs employed are reduced in length, and partake of a substantially shorter relative degree of movement as the door moves to operative position to permit the springs to resiliently support the door throughout its movement to open position.

A further object is to provide a door operating mechanism of the character referred to which is relatively simple in construction and which may be moved between open and closed positions with the expenditure of minimum effort.

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 a face view taken from the interior of the building,

Figure 2 is an enlarged section on line 2—2 of Figure 1, and,

Figure 3 is a section on line 3—3 of Figure 1, some of the parts being illustrated in a second position by dotted lines.

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 2 and 3, one portion of the door frame extends inwardly as at 14 to form a sealing strip, for a purpose to be described, and this strip extends upwardly through approximately two-thirds of the height of the door frame.

A bracket 15 is secured against the inner face of each door frame at a point spaced from the bottom thereof and the lower portion of the bracket includes inwardly extending ears 16 for a purpose to be described. A vertical rod 17 is arranged adjacent the inner face of each door frame in spaced parallel relationship thereto, and the lower end of each rod 17 is secured to one of the brackets 15. The upper end of each rod 17 is connected to a bracket 18 secured against each of the door frames. A rider 19 is movable vertically along each rod 17. Each of the riders is substantially U-shaped as shown in Figure 3, having its base portion extending around one of the rods 17. A pulley 20 is journalled between the arms of each rider, and a shaft 21 rotatably supports the pulley. It will be noted that the shaft 21 is provided with extended reduced extremities 22, for a purpose to be described.

A spring 23 is connected at its lower end to each of the riders 19, and the upper end of each spring is connected to a suitable bracket 24 secured to the ceiling 13. The springs are of the tension type and exert a constant upward force on the riders 19, for a purpose to be described.

The numeral 25 designates a door adapted to close the opening defined by the door frame 11, as shown in Figure 1. The door may be made

as a single unit, or it may comprise two sections secured together by a connecting strip 25' having fastening elements 26 passing through the connecting strip and through the door sections. The door may be of any suitable structural or ornamental type, as will be apparent. The lower edge of the door is provided, preferably upon its outer face, with an angle iron or similar reinforcing strip 27 which is adapted to reinforce the door against sagging when in open position. The door further may be provided with a handle 28 to assist in starting the door in its initial movement toward open position.

The door normally occupies the position shown in Figure 1, and supplemental weather strips 14' extend from the upper extremities of the strips 14 to the top of the door. These strips are carried by the door, as will be apparent.

A bracket 29 is secured against the rear face of the door adjacent each edge thereof. Each of these brackets is substantially U-shaped and carries a roller 30 mounted at one side thereof and movable in a trackway indicated as a whole by the numeral 31. The trackway is substantially C-shaped in cross section, as shown in Figure 1, and includes a horizontal rear portion 32 and a downwardly inclined forward portion 33. The rear end of the horizontal portion of each trackway is suspended from and supported by the ceiling 13 by a heavy rigid bolt 34. The opposite end of the trackway is secured against the door frame by bolts 35, as shown in Figure 2.

The door is provided near its lower end and adjacent each edge portion thereof with a bracket 36 pivotally connected to one end of a lever 37, as at 38. Intermediate its ends, each lever 37 is bent outwardly as at 39 to offset the portion of the lever secured to the door from the edge thereof. One of the axial projections 22 of each shaft 21 passes through one of the levers 37 near its opposite end, while the other projection 22 similarly passes through an arm 40. The other end of the arm 40 and the corresponding portion of the lever 37 converge toward each other as at 41 to form adjacent parallel extremities 42, as shown in dotted lines in Figure 3.

The portions 42 of the arm 40 and lever 37 are pivotally connected as at 43 to one end of a link 44. The pivot pin 43 is adapted to be arranged in either of a plurality of openings 43', as shown in Figure 2, to adjust the length of the lever 37 and link 44. Each link 44 is pivotally connected at its other end as at 45 to the bracket ears 16.

The operation of the device is as follows:

The door normally occupies the dotted line position shown in Figure 2, when closed. In this position of the parts, the pivot pin 43 is arranged inwardly of a plane passing through the pivot pins 38 and shafts 21. The springs 23 exert an upward force tending to move the rider 19 upwardly, together with the lever 37, but since the pivot pin 43 will be arranged in the position described, it will be apparent that the force of the springs will tend to swing the links 44 in the direction of the door, thus preventing the adjacent ends of the levers 37 from swinging downwardly as would be necessary to permit the lower end of the door to swing outwardly and upwardly. Thus it will be apparent that the springs normally operate to hold the door tight against the strip 14, and no separate fastening means is necessary to retain the door in closed position.

When it is desired to open the door, the operator may grasp the handle 28 and pull it outwardly against the previously described tension of the spring which tends to hold the pivot pins 43 in normal position. This initial opening movement swings the long ends of the levers 37 outwardly and the opposite ends inwardly, thus swinging the pivot pins 43 toward the solid line position indicated in Figure 2. As soon as the pivot pins 43 swing inwardly past the plane of the shafts 21 and pivot pins 38, the lever 37 will be free to swing, and the springs 23 will exert an upward force to move the riders 19 upwardly. The short ends of the levers will swing downwardly under the influence of the spring tension, while the long ends of the levers will swing upwardly to move the lower edge of the door upwardly and outwardly. The various pivots of the lever 37 obviously are so located that the pivot pins 38 move upwardly to a greater extent than do the shafts 21. It also will be apparent that the springs do not extend to the bottom of the door when the latter is in closed position. These two features permit the use of a shorter spring, and the movement of the spring when elevating the door does not cause the same proportionate shortening of the spring as is common in most constructions. Accordingly the spring exerts a lifting force throughout the upward movement of the door.

It will be apparent that the levers 37 pivot about the shafts 21, and that these shafts move upwardly during the opening movement of the door. This feature permits shorter lever lengths to be employed whereby the door does not swing outwardly away from the door frame to as great an extent as takes place in most structures of this type, the path of movement of the lower end of the door being substantially elliptical rather than semi-circular. After the levers 37 reach the horizontal position shown in Figure 2, further upward movement of the lower edge of the door causes the entire lengths of the levers to move upwardly about the pivot axis 43, whereby the riders 19 move upwardly along the rods 17.

As the door moves upwardly and inwardly, the rollers 30 travel up the inclined portions 33 of the trackways and then inwardly along the horizontal portions thereof. The door continues to move upwardly and inwardly until it reaches the horizontal dotted line position shown in Figure 2. At this point, the links 44 will again assume the dotted line position shown in Figure 2. The doorway will then be fully opened and unobstructed. The door readily may be closed by reversing the operations referred to, and when the door reaches closed position, the pivot pins 43 will again move past a plane through the pivot axes 38 and 45 to permit the spring to perform its function of holding the door snugly in closed position.

In this connection, it will be noted that approximately two-thirds of the height of the door at its edge portions will bear against the strips 14 to seal the door against wind, rain or the like. The upper portion of the door above the strips 14 will be similarly sealed by the strips 14'.

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 means for supporting the upper end of the door for move-

ment substantially laterally away from the door frame at one side thereof, mechanical connections between the door and door frame for causing the lower end of the door to swing upwardly and away from the opposite side of the door frame as the upper end of the door moves away from the door frame, said mechanical connections including a lever pivotally connected at one end to the door, and a link pivotally connected at one end to the door frame and at the other end to the other end of the lever, and resilient means adapted to transmit a lifting force to the lower portion of the door through said mechanical connections, said link being operative when the door is closed for preventing the transmission of a lifting movement from said resilient means to the door and for utilizing the force of said resilient means for holding the door in closed position.

2. The combination set forth in claim 1, provided with a vertically guided member connected between said resilient means and said lever to transmit the force from the former to the latter, said link occupying a position when the door is closed with its pivot points arranged substantially in the plane of the lifting force transmitted from said resilient means to said mechanical connections.

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 means for supporting the upper end of the door for substantially lateral movement away from one side of the door frame, a lever pivotally connected to the door near the lower end thereof, a vertically guided member pivotally connected to the lever intermediate its ends, a link pivotally connected at its ends respectively to the door frame and to the other end of said lever, and a spring having its upper end fixed and its lower end connected to said vertically guided member to exert a lifting force to the lower end of said door tending to swing it upwardly and outwardly away from the other side of the door frame.

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 means for supporting the upper end of the door for substantially lateral movement away from one side of the door frame, a lever pivotally connected to the door near the lower end thereof, a vertically guided member pivotally connected to the lever intermediate its ends, a link pivotally connected at its ends respectively to the door frame and to the other end of said lever, and a spring having its upper end fixed and its lower end connected to said vertically guided member to exert a lifting force to the lower end of said door tending to swing it upwardly and outwardly away from the other side of the door frame, said link being adapted to assume a position when the door is closed, with its pivot points arranged substantially in a common plane with said spring to prevent the transmission of a lifting movement to the door.

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 substantially lateral movement away from one side of the door frame, a vertical guide carried by the door frame, a rider slidably connected to said guide, a spring connected to said rider and exerting a constant lifting force thereto, a lever pivotally connected intermediate its ends to said rider and pivotally connected at one end to the door adjacent the lower end thereof, and means operatively connected to said lever to cause said rider to move vertically along said guide as said lever swings about its pivotal connection with said rider.

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 substantially lateral movement away from one side of the door frame, a vertical guide carried by the door frame, a rider slidably connected to said guide, a spring connected to said rider and exerting a constant lifting force thereto, a lever pivotally connected intermediate its ends to said rider and pivotally connected at one end to the door adjacent the lower end thereof, and a link connected between the door frame and the other end of said lever to cause said rider to move vertically along said guide as said lever swings about its pivotal connection with said rider.

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 substantially lateral movement away from one side of the door frame, a vertical guide rod carried by the door frame, a rider slidably connected to said guide rod and including a roller operating thereagainst, a tension spring substantially vertically arranged with its upper end fixed and its lower end connected to said rider for transmitting a constant lifting force thereto, a lever pivotally connected intermediate its ends to said rider and at its outer end to the door adjacent the lower end thereof whereby the lower end of the door is adapted to swing away from the opposite side of the door frame, and a link connected at its ends respectively to the door frame and the other end of said lever to cause said rider to move vertically along said guide as said lever swings about its pivotal connection with said rider, said link being adapted to assume a position when the door is closed with its pivotal connections substantially in a common plane with said spring.

8. The combination with a door frame and a door adapted to assume a vertical position in said frame to form a closure therefor, of means for supporting the upper end of the door for substantially lateral movement away from one side of the door frame, a lever pivotally connected at one end to said door adjacent the lower end thereof, a link pivotally connected at one end to the other end of said lever, the other end of said link being pivotally connected to the door frame, a spring connected to exert a lifting force to said lever intermediate the ends thereof, and means connected to said lever intermediate its ends for guiding it for vertical movement adjacent and parallel to the door frame.

9. Apparatus of the character described comprising trackway means for supporting the upper end of a door for substantially lateral movement away from one side of the frame of the door, mechanical connections between the door and door frame for causing the lower end of the door to swing upwardly and outwardly away from the opposite side of the door frame, said mechanical connections including a bodily vertically movable lever pivotally connected at one end to the door, and a link pivotally connected at its ends respectively to the door frame and the other

end of said lever, and resilient means adapted to transmit a lifting force to the lower portion of the door through said mechanical connections, said link being operative when the door is closed for preventing the transmission of a lifting movement from said resilient means to the door and for utilizing the force of said resilient means for holding the door in closed position.

10. Apparatus of the character described comprising trackway means for supporting the upper end of a door for substantially lateral movement away from one side of the frame of the door, mechanical connections between the door and door frame for causing the lower end of the door to swing upwardly and outwardly away from the opposite side of the door frame, said mechanical connections including a lever pivotally connected at one end to the door, and a link pivotally connected at its ends respectively to the frame of the door and the other end of said lever, pivotal means supporting said lever intermediate its ends for bodily vertical movement, and resilient means adapted to transmit a lifting force to the lower portion of the door through said mechanical connections, said link being operative when the door is closed for preventing the transmission of a lifting movement from said resilient means to the door.

11. Apparatus of the character described comprising trackway means for supporting the upper end of a door for substantially lateral movement away from one side of the door frame, a lever pivotally connected at one end to the door near the lower end thereof, a vertically guided member pivotally connected to said lever intermediate its ends, a link pivotally connected at its ends respectively to the door frame and to the other end of said lever, and a spring having its upper end fixed and its lower end connected to said vertically guided member to exert a lifting force to the lower end of said door tending to swing it upwardly and outwardly away from the other side of the door frame.

12. Apparatus of the character described comprising trackway means for supporting the upper end of a door for substantially lateral movement away from one side of the door frame, a lever pivotally connected at one end to the door near the lower end thereof, a vertically guided member pivotally connected to said lever intermediate the ends thereof, a link pivotally connected at its ends respectively to the door frame and to the other end of said lever, and a spring having its upper end fixed and its lower end connected to said vertically guided member to transmit a lifting force to the lower end of said door tending to swing it upwardly and outwardly away from the other side of the door frame, said link being adapted to assume a position with its pivot points arranged substantially in a common plane with said spring when the door is closed to prevent the transmission of a lifting movement to the door.

13. Apparatus of the character described comprising trackway means for supporting the upper end of a door for substantially lateral movement away from one side of the door frame, a vertical guide carried by the door frame, a rider slidably connected to said guide, a spring connected to said rider and transmitting a constant lifting force thereto, a lever pivotally connected intermediate its ends to said rider and at one end to said door adjacent the lower end thereof, and means operatively connected to said lever to cause said rider to move vertically along said guide as said end of said lever swings about its pivotal connection with said rider.

14. Apparatus of the character described comprising trackway means for supporting the upper end of a door for substantially lateral movement away from one side of the door frame, a vertical guide carried by the door frame, a rider slidably connected to said guide, a spring having its upper end fixed and its lower end connected to said rider to exert a constant lifting force thereto, a lever pivotally connected intermediate its ends to said rider and at one end to the door adjacent the lower end thereof, and a link connected between the door frame and the other end of said lever to cause said rider to move vertically along said guide as the first named end of said lever swings about its pivotal connection with said rider.

15. Apparatus of the character described comprising means for supporting the upper end of a door for substantially lateral movement away from one side of a door frame, a lever pivotally connected at one end to the door adjacent the bottom thereof, a link pivotally connected at one end to the other end of said lever, the other end of said link being pivotally connected to the door frame, means for guiding said lever at a point intermediate its ends for vertical movement adjacent and parallel to the door frame, and a spring transmitting a lifting force to said lever at a point intermediate its ends.

16. Apparatus of the character described comprising means for supporting the upper end of a door for substantially lateral movement away from one side of the door frame, a member pivotally connected to the door, a second member pivotally connected at one end to the door frame and at the other end to said first named member, means intermediate the ends of said first named member for guiding it vertically, and means transmitting a constant lifting force to said first named member intermediate its ends.

17. Apparatus of the character described comprising means for supporting the upper end of a door for substantially lateral movement away from one side of the door frame, a member pivotally connected at one end to the door, a second member pivotally connected at one end to the door frame and at the other end to the other end of said first named member, a vertically guided member pivotally connected to said first named member intermediate the ends thereof, and means transmitting a constant lifting force to said first named member intermediate the ends thereof.

18. Apparatus of the character described comprising means for supporting the upper end of a door for lateral movement away from one side of the door frame, a lever pivotally connected at one end to the door, a member pivotally connected at its ends to the other end of said lever and the door frame respectively, a rider pivotally connected to said lever intermediate the ends thereof, means for guiding said rider for vertical movement, and means for transmitting a constant lifting force to said lever intermediate the ends thereof.

FRANK J. SULLIVAN.