March 20, 1951 H. H. HALL 2,545,775

GARAGE DOOR OPERATING DEVICE

Filed May 2, 1946 3 Sheets-Sheet 1

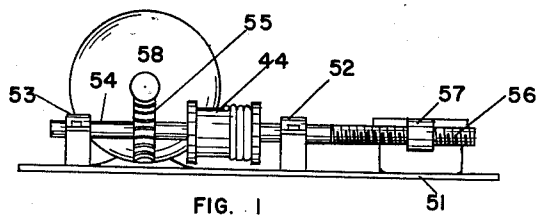


FIG. 1

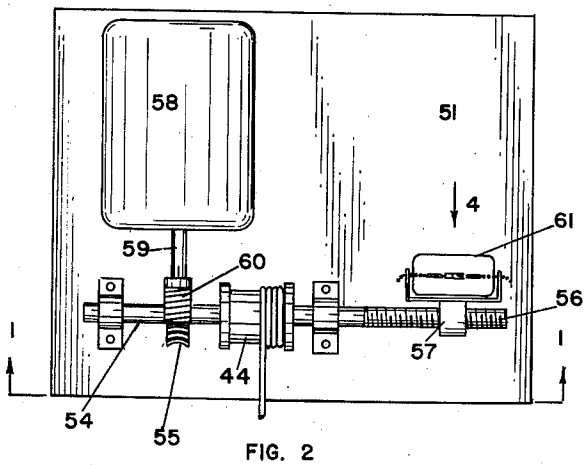


FIG. 2

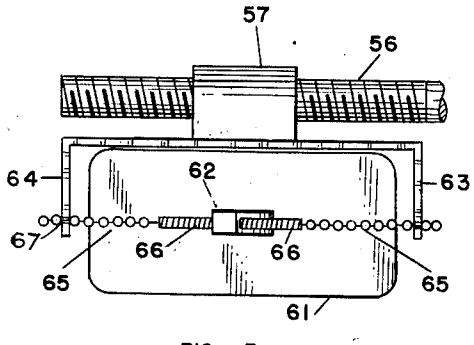


FIG. 3

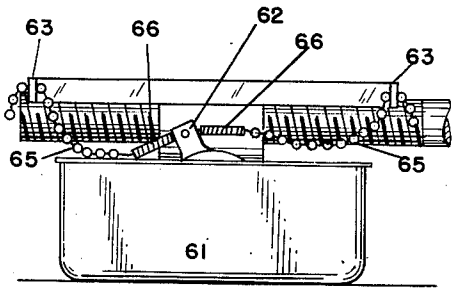


FIG 4

INVENTOR.
HARVEY H. HALL

BY Martin E Anderson

ATTORNEY

March 20, 1951 H. H. HALL 2,545,775

GARAGE DOOR OPERATING DEVICE

Filed May 2, 1946 3 Sheets-Sheet 2

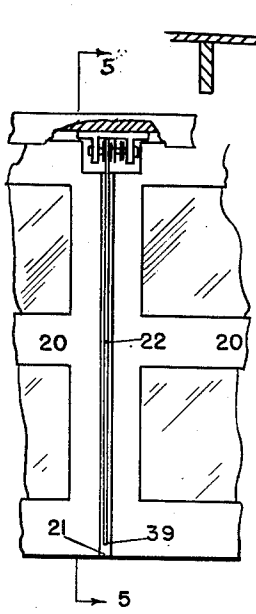


FIG. 6

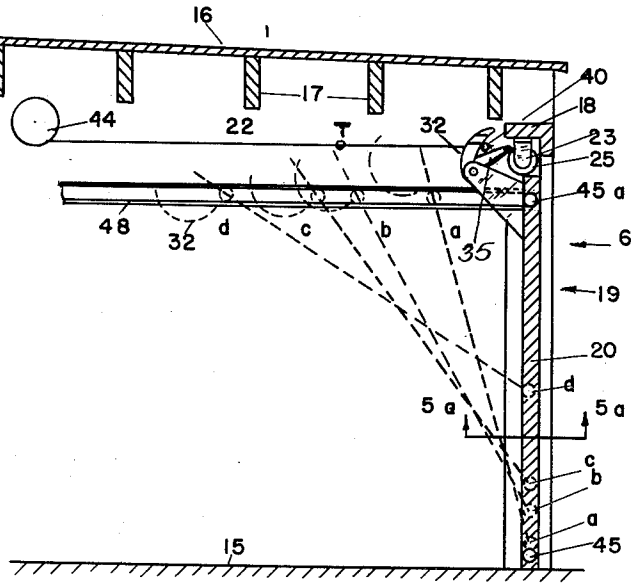


FIG. 5

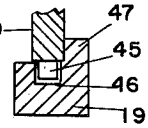


FIG. 5a

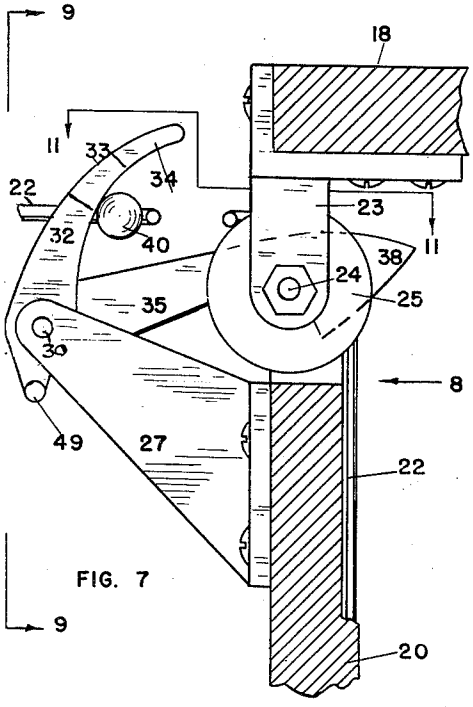


FIG. 7

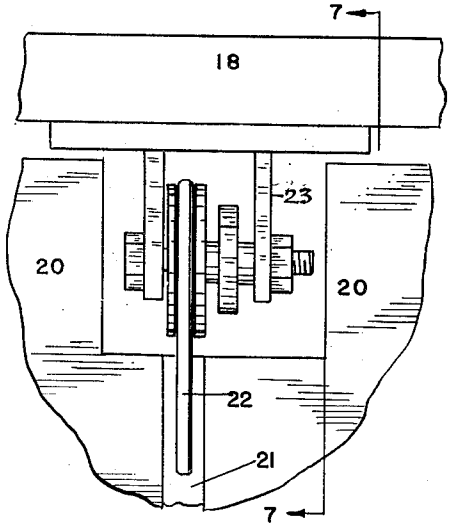


FIG. 8

INVENTOR.

HARVEY H. HALL

BY

Martin E. Anderson

ATTORNEY

March 20, 1951 H. H. HALL 2,545,775

GARAGE DOOR OPERATING DEVICE

Filed May 2, 1946 3 Sheets-Sheet 3

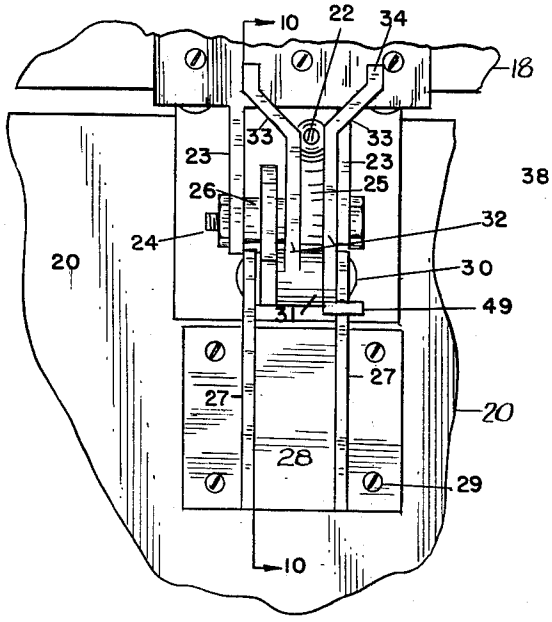


FIG. 9

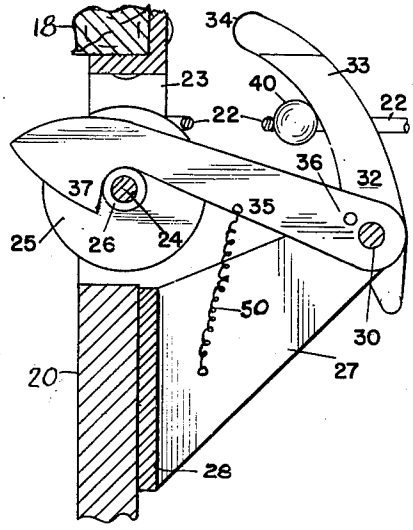


FIG. 10

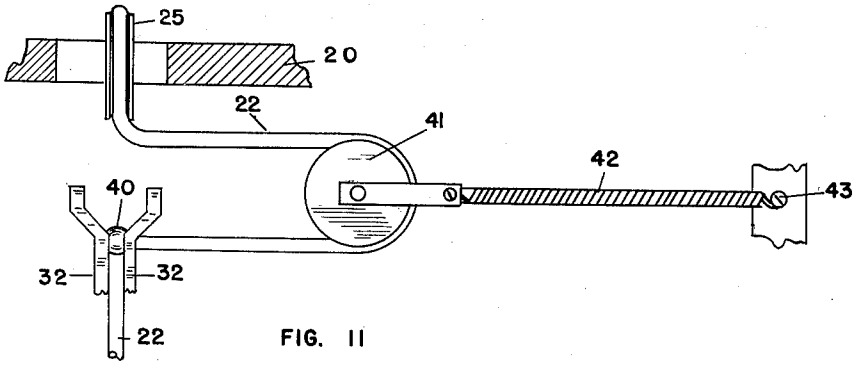


FIG. 11

INVENTOR.
HARVEY H. HALL
BY
Martin E. Anderson
ATTORNEY

Patented Mar. 20, 1951

2,545,775

UNITED STATES PATENT OFFICE

2,545,775

GARAGE DOOR OPERATING DEVICE

Harvey H. Hall, Denver, Colo.

Application May 2, 1946, Serial No. 666,648

4 Claims. (Cl. 268—74)

1

This invention relates to improvements in door operating devices and has reference more particularly to an improved garage door an means for operating and latching the same.

Garage doors of the type that operate on vertically positioned hinges are very unsatisfactory and therefore many doors have been invented of which the type usually referred to as "overhead doors" is most popular for the small garages.

It is the object of this invention to produce a garage door and operating means which shall be of simple and substantial construction and of such a design that the cost of the material and the installation will be comparatively low.

Another object of the invention is to produce a garage door, of the overhead type, which does not require counterweights or springs to assist in its operation.

A further object of the invention is to produce a garage door of such a construction that it can be operated by means of a small electric motor controlled by means of switches positioned in convenient locations outside of the garage.

A still further object of the invention is to produce a door operating means of such construction that after the door starts operating, the movement will be uniform and smooth and free from jerks resulting from sudden application of the lifting force.

Another object of this invention is to produce a construction in which the initial force applied to the door during the opening operation will be applied in such a manner that the component thereof utilized in lifting the door, shall be very large in proportion to the total amount of force.

Another object of the invention is to produce a door operating means of such construction that it will automatically latch the door against unauthorized opening from outside and which latching or locking means will be automatically released when force is applied by the opening mechanism.

Another object of the invention is to produce a simple and substantial motor winch having a limit stop that can be readily adjusted to de-energize the motor at any desired point in the opening and closing operation.

Another object of the invention is to produce a garage door of such construction that stops can be provided along the outer edge of the door to effect a closed seal against the entrance of dust, dirt and rain.

The above and other objects of the invention that may appear as the description proceeds are attained by means of a construction and an arrangement of parts that will now be described in detail and for this purpose reference will be had to the accompanying drawings in which the invention has been illustrated in its preferred form, and in which:

2

Figure 1 is a side elevation of the electrically operated winch mechanism, looking upwardly through plane 1—1, Figure 2;

Figure 2 is a top plan view;

Figure 3 is a top plan view of the limit stop switch operating mechanism;

Figure 4 is a view of the switch mechanism looking in the direction of arrow 4, Figure 2;

Figure 5 is a section through a garage door taken on line 5—5, Figure 6;

Figure 5a is a section taken on line 5a—5a, Figure 5.

Figure 6 is a vertical elevational view of the outside of the door, looking in the direction of arrow 6, Figure 5, a portion being broken away to better disclose the construction;

Figure 7 is a section taken on line 7—7, Figure 8;

Figure 8 is an elevation looking in the direction of arrow 8, in Figure 7;

Figure 9 is an elevation looking in the direction of arrows 9—9, in Figure 7;

Figure 10 is a view, partly in section, taken on lines 10—10, Figure 9;

Figure 11 is a view more or less diagrammatic, taken along line 11—11, Figure 7.

In the drawing reference numeral 15 designates a garage floor and reference numeral 16 the roof, which is supported on rafters 17. Reference numeral 18 designates a plate that forms the upper member of the door frame. The vertical members of the door frame have been designated by reference numeral 19, while the door has been designated by reference numeral 20. The door has been shown as constructed of two parts which are preferably separated a short distance at the center, as shown in Figure 6, and indicated by reference numeral 21. The space between the doors forms a groove for the cable 22, as will hereinafter be pointed out. Instead of the doors being spaced apart, a groove may be provided.

Secured to the under surface of plate 18 is a bracket having two downwardly extending arms 23 that form supports for the shaft 24 on which is journaled a pulley 25. This pulley is spaced on one side by a ferrule 26. The pulley and the ferrule are both rotatable on shaft 24.

Secured to the inside of the door is a bracket having spaced lugs 27 that have been shown as formed integral with a plate 28 which is secured

to the door by means of bolts or screws 29. A pivot pin, either a bolt or a rivet 30, extends between the upper ends of lugs 27 and supports a hook-like member having a hub 31 and two spaced fingers 32.

The fingers are outwardly flared, along the part indicated by reference numeral 33, and terminate in inwardly extending hooks 34. Hub 31 and fingers 32 are preferably formed from cast metal. A latching pawl 35 is pivoted on pin 30 and is held against relative rotation with respect to the fingers 32 by means of a pin 36. This pawl may be cast integrally with hub 31, if found desirable. The free end of the pawl has a laterally extending surface 37 that engages the ferrule 26 in the manner shown in Figure 10. The free end is tapered on both sides as shown and terminates in a point 38. The stranded wire cable 22 is attached to the lower end of the door at the point designated by reference numeral 39 and passes over pulley 25. This cable is provided with an enlargement 40, which is of greater diameter than the distance between fingers 32 and which will therefore not pass between the fingers. When the door is closed, there is some slack in the cable, which has been indicated in Figure 11, and positioned in the bight of the cable is a pulley 41 to which a spring 42 is attached. This spring is anchored to the garage at the point 43 and is always under a tension. The cable, after it passes between fingers 32, extends to the winch drum 44 as indicated in Figure 5.

Referring now more particularly to Figures 5 and 6, it will be observed that the door is provided at its lower end with rollers 45 that project into groove 46 in the door frame 19. The outer stop has been designated by reference numeral 47. Supported from the garage is a track, like that designated by reference numeral 48, which may be considered, for the purposes of this description, as being a channel-shaped member with parallel flanges. The door is provided near its top with rollers 45*a* that are positioned in the channel. The distance between the rollers 45 and 45*a* is, of course, constant and when the door is moved inwardly at the top, rollers 45 will gradually move upwardly. In the drawing several positions of the door have been shown, the one shown in full line being the zero position. The other positions have been designated by reference characters, *a*, *b*, *c* and *d*. It will be observed that when the door moves from the zero position to the position *a*, the lower roller moves a very short distance and when the door moves from *a* to *b*, the lower roller moves a somewhat greater distance. The distance between rollers 45 and 45*a* forms the hypothenuse of a right angle triangle. Due to the different distances moved by the rollers at the beginning of the door opening, it follows that the tension in cable 22 is resolved into two components, one of which moves the door inwardly and the other of which lifts it upwardly. At the beginning, a comparatively small force suffices to move the door inwardly along track 48 and at the same time the comparatively short distance that the bottom moves upwardly requires only a rather small force. After the door has moved inwardly to points *c* and *d*, the force required to move the door upwardly farther than this would be very great, if exerted on the upper end of the door, and therefore the apparatus has been so designed and constructed that, after the door has reached a position between *b* and *c*, the force that initially urges the door inwardly is transferred so as to be exerted in the cable lying on the outside of the door and which is attached at the lower end thereof. To effect this transfer of force fingers 32 have been provided. Fingers 32 have a limited rotary motion about pivot 39 and the extent of this angular motion is limited by some suitable means such as outwardly extending finger 49 that engage lugs 27, in the manner shown in Figures 7 and 9. Any other suitable stop mechanism may be employed and the one described has been shown merely as illustrative of means for this purpose. When the door is closed, pawl 35 hooks over and engages the ferrule 26 in the manner shown in Figures 7 and 10. The first effect of a tension exerted in cable 22 is therefore to turn the fingers 32 and pawl 35 in a clockwise direction when viewed as in Figure 10, thereby unlocking the door so that the upper end may move inwardly. A spring 50 may be attached between pawl 35 and one of the lugs 27 to move the pawl into latching position. However, if the weight of pawl 35 is sufficient to accomplish this, the spring may be omitted.

Referring now again to Figure 5, it will be observed that the lower end of cable 22, being fastened to the door, moves upwardly in a straight line and since the cable passes around pulley 25 which is secured to the garage, that point remains stationary. The enlargement 40 being in engagement with fingers 32 follows the inward movement of the door and as the door moves inwardly, the cable, which makes a right angle turn about the pulley 23 and extends thence straight to the winch drum, forms with the door a right angle triangle. This increases the distance between point 39 and the enlargement 40 as the door moves towards open position and this, in turn, takes up the slack that has been shown in Figure 11. As soon as the slack is taken out of the cable, the tension in the cable will be transferred from fingers 32 to point 39 and instead of moving the door by exerting an inward force on the upper end thereof, a lifting force is now exerted which raises the door and the latter follows the track 48, until it finally gets into a position where it is substantially horizontal.

Attention is called at this point to the fact that rollers 45 are near the lower end of the door and move in groove 46 and therefore the door will not project out beyond the wall of the garage when it is in open position. Since garages are usually positioned adjacent an alley, a door that extends beyond the building line or the rear wall of the garage, is always in danger of being struck by a loaded truck traveling through the alley.

Attention is directed in particular to the operation just described whereby the force for opening the door is first exerted in an inward direction on the upper end of the door and then transferred to the lower end of the door and exerted in an upward direction and to the fact that this transfer takes place without any sudden jolts being produced.

The means which has been illustrated in Figure 11, for taking up the slack in the cable, is more or less diagrammatic and is intended to illustrate one means for this purpose. An inspection of Figure 5 shows that the lower end of the cable moves upwardly much slower than the upper end of the door moves inwardly so that during the short time when the slack is used up, there is very little movement of the cable about pulley 25. Any other suitable equivalent means for taking up the

slack may be substituted for the one described and shown, if desired.

Referring now to Figures 1 to 4, inclusive, which illustrate one form of the winch mechanism, reference numeral 51 designates a base that is supported in any suitable way from the roof or walls of the garage. The base carries two bearings 52 and 53 in which is rotatably mounted a shaft 54. The shaft has shoulders abutting the bearing so that it will not move longitudinally. A worm wheel 55 is secured to the shaft between the bearings. Shaft 54 terminates in a threaded portion 56 that carries a traveling nut 57. A reversible electric motor 58 is secured to the base and the motor shaft 59 terminates in a worm 60 that cooperates with the worm gear 55. When the motor operates, shaft 54 with its drum 44, rotates and since nut 57 cannot rotate for reasons that will presently appear, it will travel longitudinally on the bolt. Secured to the base is a switch box 61 that contains a lever operated switch of the desired type. The handle of the switch has been designated by reference numeral 62. A bracket having arms 63 and 64 is secured to nut 57 and extends slightly more than half the distance across the switch box. Chains 65 and spring 66 connect the ends of arms 63 with the lever 62, in the manner shown in Figures 3 and 4. The combined lengths of the springs and chains is greater than the distance between the arms 63 and the chains are therefore slack in the center position of the traveling nut with respect to the switch box. When the nut 57 approaches either end of its traveling, it will take up the slack in the corresponding chain and put the corresponding spring under tension. When the tension becomes sufficient, the switch will "snap" to its other position, opening the circuit, thereby stopping the motor. When the circuit is again closed as by an electric switch positioned outside of the garage, the motor will commence rotating in the other direction and the traveling nut will also move in the opposite direction until a predetermined position of the door has been reached, thereupon the switch will be reversed by the other chain and spring.

Since circuits of this type are old and well known, it has not been illustrated.

The parts must be so adjusted that when the motor is operating to open the door, it will stop when the door has reached open position, the worm drive being nonreversible will hold the door in any position in which it may be when the motor stops operating.

When the door is moved to closed position, the weight of the door will keep the cable taut as it is unrolled from the winch drum.

When the enlargement 40 reaches a position like that indicated by T in Figure 5, the fingers 32 will move upwardly into engagement with this enlargement and thereafter as the door closes, a little slack will accumulate in the cable between the fingers and pulley 25 and this will be taken up by pulley 41 and spring 42. When the door reaches closed position, pawl 35 will engage over the ferrule 26 and latch the door against accidental opening. In the drawing the end 38 of the pawl has been shown as exposed on the outside of the door, but in the actual construction this is enclosed by a cover which has not been shown, but which is provided to prevent anyone outside of the garage from unlocking the door.

Attention is again directed to Figures 2, 3 and 4, more particularly to the spring 66. Although the length of the chains can be readily altered and adjusted because they are merely fastened in slots 67, it is still difficult to obtain the exact lengths. When the spring are added, there will be no breakage if the chains are slightly shorter than they should be.

Having described the invention what is claimed as new is:

1. In an automatic power operated garage door of the rigid overhead type in which the upper end of the door moves inwardly at the beginning of the opening movement, means for opening the door comprising a winch drum, a cable having one end attached to the drum, a pulley supported in fixed position above the top of the door, the cable passing around the pulley, downwardly along the outside of the door and attached to the latter adjacent its lower end, means for guiding the movement of the lower end of the door comprising spaced vertical tracks, means for supporting and guiding the upper end of the door comprising inwardly extending tracks, two upwardly extending and outwardly concave spaced fingers secured to the door, on its inner surface, adjacent its upper end, the fingers being rockable through a small angle about a pivot carried by the door and spaced inwardly therefrom, the fingers straddling the cable, an enlargement on the cable between the fingers and the pulley, and means for latching the door in closed position comprising a pawl operatively connected with the finger assembly and rotatable therewith, the pawl being moved to unlatching position when tension is applied to the cable.

2. An automatic power operated rigid garage door of the overhead type comprising, a pair of vertical, spaced, parallel tracks and a pair of spaced, substantially horizontal tracks, extending inwardly from points near the upper ends of the first tracks, a door between the tracks, track followers at the lower end of the door movable along the vertical tracks, track followers at the upper end of the door movable along the upper tracks, means for opening said door comprising, a winch mechanism having a drum, secured to the inside of the garage, a pulley secured to the garage at a point over the door, a cable passing over the pulley, one end of the cable being fastened to the winch drum and the other to the outside of the door near the lower end thereof, and means comprising two spaced fingers secured to the inside of the door for effecting a connection with the cable when the cable is wound onto the winch drum, said means automatically releasing after the door has moved inwardly to a predetermined point, due to the change in the angle of the door relative to the vertical.

3. An automatic power operated door for use in buildings having a door frame provided on each vertical side with a guide track, a rigid door positioned between the tracks, the lower end of the door having track followers mounted for movement along the tracks, an inwardly extending track at the top of the door, a track follower near the top of the door operatively related to the inwardly extending track to support and guide the upper end of the door when it is moved to open position, a pulley supported in fixed position over the door, a winch mechanism comprising a drum supported at a fixed point, spaced from the pulley, a cable having one end connected with the winch, passing over the pulley thence downwardly along the outside of the door with its end secured to the door near the bottom thereof, two upwardly extending spaced fingers secured to the inside of the door, adjacent its

upper end, the fingers straddling the cable, an enlargement on the cable between the fingers and the pulley, the length of the cable from the enlargement to its point of attachment to the door being greater than the actual distance, whereby, when the door is in closed position, there will be slack in the cable, and whereby when the winch is operated to wind the cable onto the drum, the enlargement will engage the fingers exerting a force moving the upper end of the door inwardly until the slack in the cable has been used up, whereupon the force of the cable will be transferred to the point where it is attached to the door.

4. In an automatic power operated garage door opening mechanism of the type described, the combination of spaced, substantially vertical tracks arranged along each side of the doorway, a track extending inwardly from a point near the top of each vertical track, a rigid door positioned between the vertical track, rollers adjacent the lower end of the door positioned to ride on the vertical tracks, rollers adjacent the top of the door positioned to ride on the inwardly extending tracks, the door and the track forming a substantially right triangular structure when the upper end of the door is moved inwardly, a pulley supported in a fixed position above the door when it is in closed position, a motor operated winch drum, a cable passing over the pulley, one end of

the cable being connected with the winch drum and the other to the outside of the door near its lower end, the cable being longer than the actual distance from the drum to its point of attachment when the door is closed, two rearwardly and upwardly extending spaced fingers secured to the inside of the door near the top, the fingers straddling the cable when the door is closed, the cable having an enlargement between the pulley and the fingers, in engagement with the fingers when the door is closed, the slack in the cable being between the enlargement and the point where the cable is attached to the door, the fingers automatically moving out of engagement with the enlargement when the door has tilted inwardly a predetermined amount.

HARVEY H. HALL.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,792,119	Peele	Feb. 10, 1931
1,848,311	Brower	Mar. 8, 1932
1,936,269	Schaffert et al.	Nov. 21, 1933
2,099,191	Blodgett	Nov. 16, 1937
2,166,746	Bartel	July 18, 1939
2,277,932	Mowers	Mar. 31, 1942