

June 9, 1936.

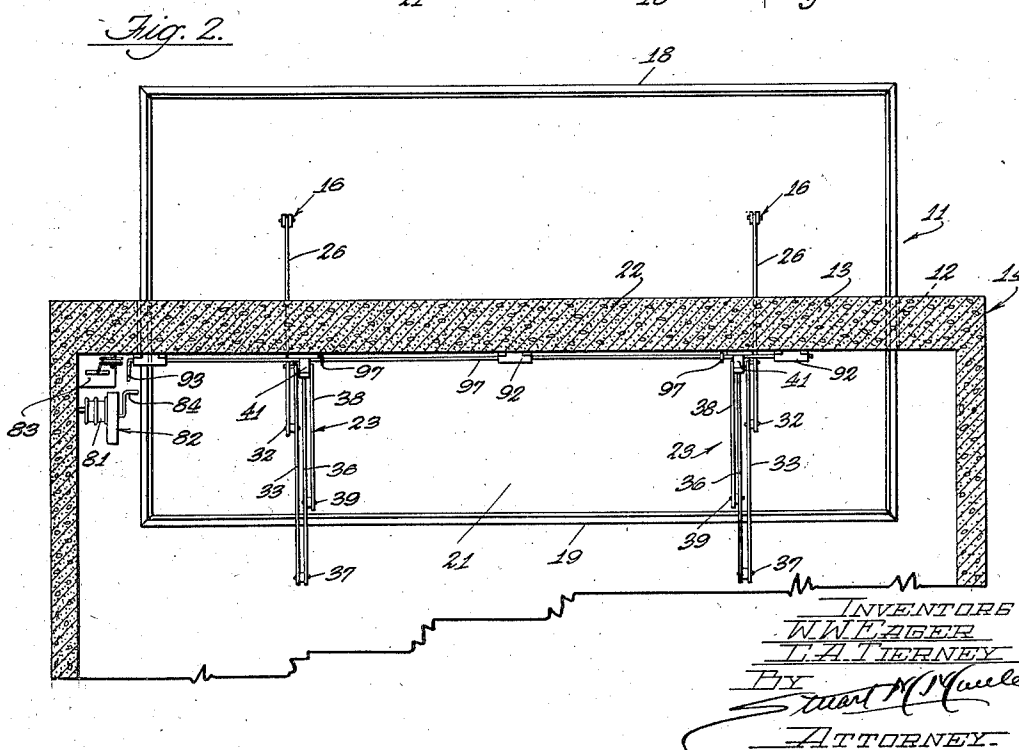
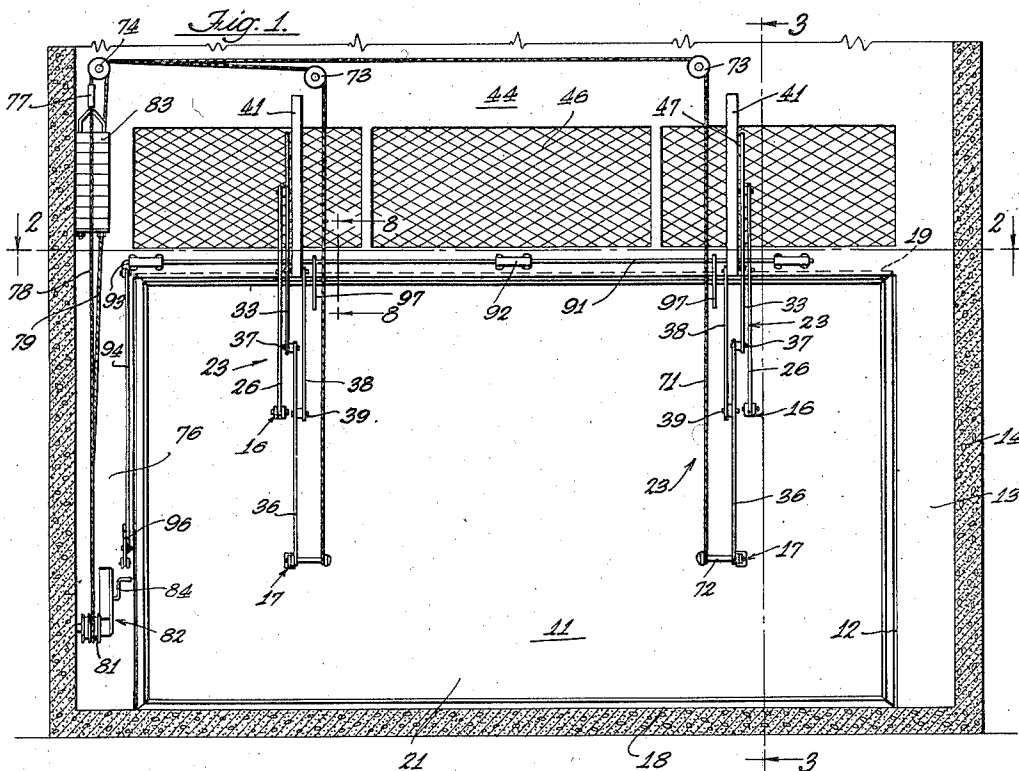
W. W. EAGER ET AL

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DOOR MOUNTING

Filed April 27, 1933

3 Sheets-Sheet 1



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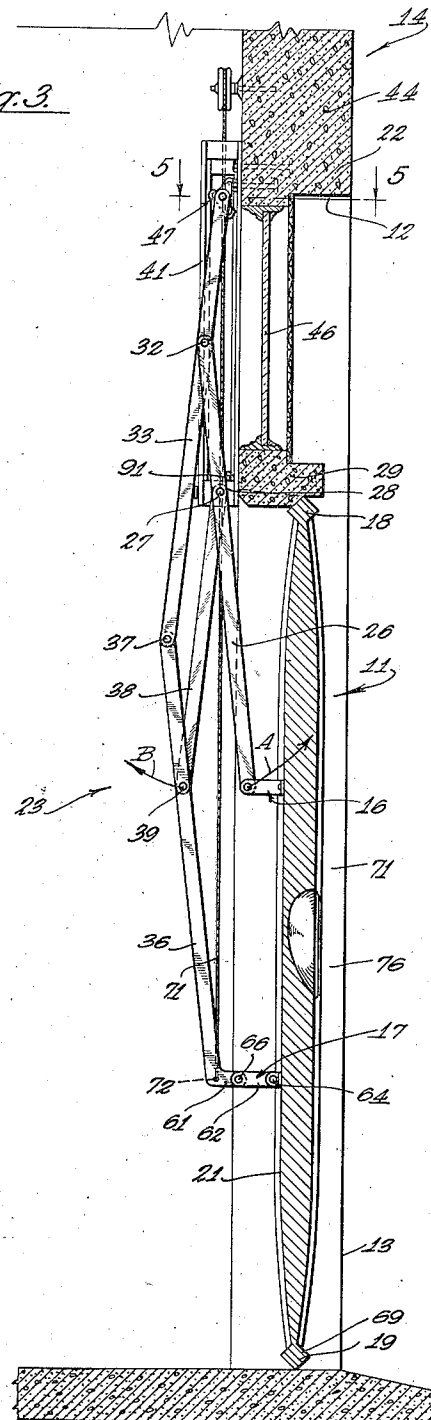
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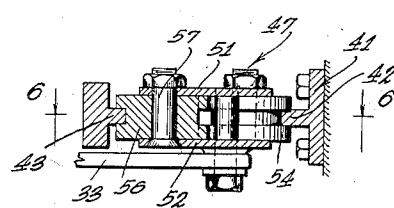
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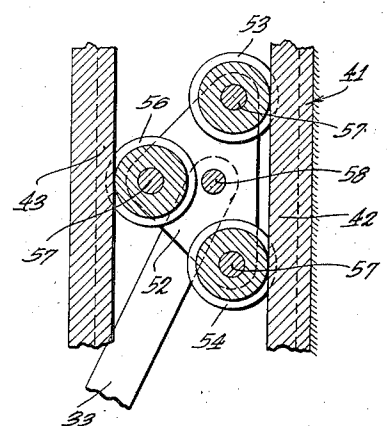
*Fig. 3.*



*Fig. 5.*



*Fig. 6.*



INVENTORS  
W. W. EAGER  
L. A. TIERNEY  
By *W. W. Eager*  
ATTORNEY

**June 9, 1936.**

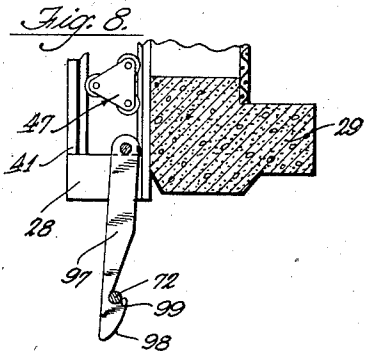
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**2,043,473**

## DOOR MOUNTING

Filed April 27, 1933

3 Sheets-Sheet 3



## UNITED STATES PATENT OFFICE

2,043,473

## DOOR MOUNTING

Wesley W. Eager, Los Angeles, and Columbus A.  
Tierney, San Marino, Calif.

Application April 27, 1933, Serial No. 668,196

14 Claims. (Cl. 20—16)

This invention relates to devices for mounting and operating closures such as garage and airplane hangar doors, and which are disposed in overhead position when open.

5 An object of our invention is to provide a closure mounting and operating device of such a nature that it eliminates all torque in the closure, thereby making it possible to support and operate one piece closures for such wide openings as the  
10 doorways of market buildings, airplane hangars and multiple car garages, without having to design the closure to resist the excessive torque to which the closures would be subjected were they supported and operated by more conventional  
15 means.

Another object is to provide a supporting and operating device which is particularly adapted for, but which is not necessarily limited to, use in conjunction with a closure of the type forming  
20 the subject matter of our co-pending application, Serial No. 667,628 filed April 24, 1933, now Patent No. 2,037,369, Apr. 14, 1936.

A more detailed object is to provide a closure supporting device which picks up the weight of  
25 the closure at a plurality of points spaced throughout one of the faces thereof so that the bending and wracking stresses to which the closure is subjected are reduced to a minimum and the torsional stresses are substantially eliminated  
30 regardless of the length of the closure.

A further object is to provide a supporting device for a door wherein the door is opened by raising it to an overhead position, and which disposes the door when open so that it extends  
35 through the upper part of the doorway, sloping outwards and downwards from adjacent the lintel, with the result that the opened door serves as an efficient awning adapted to protect persons and objects in or near the doorway from sun  
40 and rain.

Another object is to so design the supporting device that as the closure moves to open or closed position it follows such a path that practically  
45 no interference is afforded to persons occupying positions on the outside of and relatively close to the doorway.

Another object is to incorporate an efficient counterbalancing device with the supporting mechanism whereby the door will remain without  
50 fastening in any position to which it can be moved.

A further object, however, is to provide as a precautionary measure releasable means for locking  
55 the closure in open position, so as to eliminate

all danger of the door falling accidentally through failure of any of the supporting members.

It is a further object of our invention to provide a closure supporting and operating device having the above described characteristics which is relatively simple and inexpensive in construction,  
5 efficient and absolutely safe in operation, capable of moving its associated closure to open or closed position with the utmost facility, and which is generally superior in points of strength and dura-  
10 bility.

Our invention possesses other objects and advantageous features, some of which, with the foregoing, will be set forth in the following description of the embodiments of our invention  
15 which are illustrated in the drawings accompanying and forming a part of the specification. It is to be understood that we do not limit ourselves to the showing made by the said drawings and description, as we may adopt variations of  
20 the preferred forms within the scope of our invention as set forth in the claims.

Referring to the drawings:

Figure 1 is an inside elevation of the front portion of a building having a door supported by our  
25 improved closure supporting device, operatively associated therewith.

Fig. 2 is a horizontal sectional view, the plane of section being taken upon the line 2—2 of Fig. 1 with the direction of view as indicated.  
30

Fig. 3 is an enlarged vertical sectional view, the plane of section being indicated by the line 3—3 of Fig. 1 and the direction of view by the arrows, and showing the door in closed position.

Fig. 4 is a view similar to Fig. 3, but showing  
35 the door in open or elevated position.

Fig. 5 is an enlarged detail view in horizontal section showing the construction of one of the guides which forms a portion of our closure supporting device. The plane of section may be assumed to have been taken upon the line 5—5 of Fig. 3, with the direction of view as indicated.  
40

Fig. 6 is a vertical sectional view, the plane of section being taken upon the line 6—6 of Fig. 5, with the direction of view as indicated.  
45

Fig. 7 is a view similar to Fig. 4, but showing a slightly modified form of closure supporting device.

Fig. 8 is a detail view in enlarged vertical section showing the safety device which we have  
50 incorporated with our closure supporting mechanism. The plane of section may be assumed to have been taken upon the line 8—8 of Fig. 1, with the direction of view as indicated.

Our improved closure supporting structure has  
55

been illustrated as having been operatively incorporated with a garage door 11 which serves as the closure for a doorway 12 in the front wall 13 of a garage 14. It should be understood, however, that our supporting device is not limited for use in conjunction with garage doors, but is adapted for use in conjunction with a wide variety of relatively large doors, for example, airplane hangar doors, doors for market buildings, and the like. One of the peculiar characteristics of our improved door supporting structure is that it picks up the weight of the closure or door at a plurality of points which are so spaced throughout the area of one of the faces of the door that all torque within the door is eliminated. This makes it possible to use a door of practically unlimited length as far as the construction of the door itself is concerned. In fact, the only limitation upon the length of door which may be employed is the width of doorway which may be provided between supporting columns, whereas heretofore the limitation in this connection has always been in the length of door which could be constructed and satisfactorily supported. In airplane hangar construction, for instance, it is desirable to employ an exceedingly wide door so as to permit unrestricted entrance or exit of one or a plurality of airplanes; but where it was necessary to provide a closure for such a doorway, it was necessary to restrict the width of the doorway because of the fact that a door of the desired width would have to be of such exceedingly heavy construction that it would be impossible to support it for satisfactory operation. This disadvantage has satisfactorily been overcome by means of our improved door operating device. Thus it may be seen that our improvement is adapted to be embodied in a wide variety of large buildings, such as multiple car garages, fire houses, and practically any type of construction which requires a very wide, unrestricted doorway.

More specifically described, our supporting mechanism is connected to the door 11 through the expedient of a plurality of brackets 16 and 17 arranged in pairs wherein the brackets 16 and 17 of each pair are in substantially vertical alignment and with all the upper brackets 16 in axial alignment with each other and in parallelism with the axial alignment of all the lower brackets 17. In other words, the brackets are arranged in two lines, which are parallel to each other and to the upper and lower edges 18 and 19 respectively of the closure 11. Moreover, these two lines are spaced equidistantly from each other and from the upper and lower edges 18 and 19, or substantially so, as best shown upon Figures 3 and 4. Although the brackets 16 and 17 may be affixed to either the inner or the outer face of the door 11, it is preferred that they be carried by the inner face 21, inasmuch as this will position all the supporting mechanism inside the building or other structure 22 with which the door 11 is associated.

The supporting mechanism comprises a set 23 of arms pivotally interconnected as will be hereinafter described and a track or guideway, associated with each of the pairs of brackets 16 and 17, as clearly shown upon Figs. 1 and 2. It should be explained that although but two such sets 23 have been illustrated, the number of sets 23 employed will be dependent upon the length of door to be supported, i. e., upon the width of the doorway 12 which is to be con-

trolled by a single closure. Hence in the installation illustrated, the closure 11 is in such size as will ordinarily be employed in a two or three car garage, but by increasing the number of pairs of brackets 16 and 17 and the number of sets 23 of arms accordingly, the door 11 of practically any desired length may satisfactorily be supported. However, inasmuch as each of the several sets 23 is identical with any of the others associated with the same door, it will suffice for the purpose of the present disclosure to describe in detail but one of them.

The upper bracket 16 of each pair has pivoted thereto an arm 26, which is also pivoted as by a suitable pin 27 to a bracket 28 rigid with the lintel 29 which forms a portion of the door frame 31 with which the door 11 is associated. Instead of terminating at the bracket 28, however, the arm 26 extends beyond so as to enable it to be pivoted as by a pin 32 to a lever 33. Another arm 36 is pivoted by means to be described later to the lower bracket 17 of each pair. The upper end of the arm 36 is pivoted as by a pin 37 to the lower end of the lever 33; and intermediate the ends of the arm 36 a link 38 is pivoted as by a pin 39. The other end of the link 38 is rotatably mounted upon the pin 27 or upon a separate pin, if preferred, which pivots the upper end of the link 38 in axial alignment with the pivotal mounting of the arm 26 upon the bracket 28. Thus it may be seen that the arms 26 and 36 are in reality levers and that the upper ends thereof, i. e., those portions of the arms 26 and 36 which are above the pivot pins 27 and 29 respectively, co-operate with the link 38 and the lever 33 to define a parallelogram.

Extending upwards from the bracket 28 is a trackway 41 which preferably comprises two opposed tracks 42 and 43 (see Figs. 5 and 6). This trackway extends upwards past the lintel 29 and is secured adjacent its upper end to any suitable supporting structure, such as a part of the framework 44 of the building above the windows 46 which frequently are employed above a doorway, such as transom windows. A guiding member 47 is associated with the trackway 41 and comprises a pair of opposed plates 51 and 52 between which three rollers or casters 53, 54 and 56 are journaled as by suitable pivot pins 57. Two rollers, say the rollers 53 and 54, engage one of the tracks, say the track 42, and the other roller 56 engages the other track 43, thereby mounting the guiding member 47 firmly between the tracks 42 and 43 for vertical reciprocatory motion as guided by the trackway 41. The upper end of the lever 33 is pivotally engaged as by a pin 58 with the guiding member 47.

The parts are so proportioned and arranged that in order for the door 11 to lie in a substantially vertical plane when in closed position, the lower end of the arm 36 is offset as indicated at 61 toward the door and still this offset portion is spaced far enough from the door to permit the interposition of a link 62 between the offset end of 61 and the associated lower bracket 17. The link 62 is pivoted to both the bracket 17 and the offset end 61 of the arm 36, as by pins 64 and 66 respectively. Comparison of Figures 3 and 4 will demonstrate how the inclusion of the offset end 61 and the link 62 in each set 23 of supporting members causes the door when in open position to incline outwards and downwards. It will be observed that when open, the offset end 61 of the arm 36 extends away from the door 11, the effect 75

being that the portion of the door with which the lower bracket 17 is associated is raised to a greater elevation than the portion with which the upper bracket 16 is associated. Obviously this positions the lower edge 19 of the door at a greater elevation than the upper edge 18, causing the door to slope outwards and downwards. The importance of this detail is that it permits the door, when opened, to operate efficiently as an awning to protect persons and objects occupying positions in or near the doorway from sun and rain. The inclination of the door 11 causes water which would otherwise tend to collect upon its upper surface to flow outwards away from the building and toward the upper edge 18 of the door, so that if any drip occurs from this edge of the door it will be far enough away from the building to avoid damage to articles within the doorway. This is one of the reasons that our supporting structure is particularly adapted for use in conjunction with the closure forming the subject matter of our co-pending application, Serial No. 667,628 as mentioned hereinabove, inasmuch as this particular closure is so constructed that a convenient gutter 69 is provided at the edge 19, as will readily be understood by reference to the co-pending application.

The several sets 23 of arms serve merely as guiding means for restricting movement of the door when being opened or closed to a certain predetermined type and direction of movement, whereas the means for raising and lowering the door are preferably in the form of a cable 71 or other suitable flexible tension member associated with each set 23 of supporting members. Each of these cables is affixed to the offset end 61 of the associated arm 36 as by a pin 72, which is shown more or less diagrammatically upon Fig. 1, where it is illustrated as being considerably longer than in actual usage, for the purpose of clarifying the drawings. From the pin 72 the cable 71 extends upwards to a sheave 73, which is rotatably mounted adjacent the upper end of the associated trackway 41. From their respective sheaves 73 the several cables 71 preferably extend to a common sheave or set of sheaves 74 above one of the door jambs 76. From the sheave or sheaves 74 all the cables 71 extend downwards to be affixed preferably through the expedient of turnbuckles 77 to one of the runs 78 of an endless cable 79, which is engaged upon one of the sheaves 74 or a separate sheave in axial alinement therewith if desired, and at its lower portion upon the drum or gypsy 81 of a windlass 82. Connected into the same run 78 as that to which the cables 71 are connected, is a counterweight 83 of such weight that preferably it is adapted to retain the door 11 in any position, either open or closed or any intermediate position, to which the door can be moved. Hence by operating the handle 84 the door 11 may be raised or lowered, depending upon the direction in which the handle 84 is turned.

By operating the windlass 82 in the proper direction, sufficient tension may be imposed upon those portions of the cables 71 which extend downwards from their respective sheaves 73, thereby urging the door 11 to move upwards toward the lintel 29. However, because of the engagement of the arms 26 which are pivoted for movement about the axes of their respective pivots 27, with the upper brackets 16 on the door, the upper part of the door is caused to move outwards with the brackets 16 moving in the direc-

tion of the arrow A of Fig. 3. The links 38 also are pivoted for movement about the same pin 27, with the result that the pivots 39 move in the direction of the arrow B. Owing to the fact that the link 38 and the lower portion of the lever 33 are portions of a parallelogram, they as well as the upper portions of the arms 26 and 36 will be maintained in parallelism with each other, the result being that as the link 38 swings in the direction of the arrow B the lever 33 moves downwards in rotary motion about the moving pivot established by the pin 32. Thus it becomes apparent that the lever 33 serves as a guide for the upper end of the arm 36, whereby the motion of the arm 36 is so limited that the lower end of the arm moves straight upwards in a substantially vertical path. The combination of these two movements of the upper brackets 16 and the lower brackets 17 respectively, that is to say, with the upper brackets moving in a truly circular path and the lower brackets in straight upward motion, causes the upper edge 18 of the door to move straight outwards in a substantially horizontal path and the lower edge 19 of the door to move upwards and inwards in a curved path. One of the advantages of this peculiar type of motion of the door is that most of the portions of the door which are level with or below the level of the height of the average person are caused to move outwards any appreciable difference until they are elevated high enough to avoid danger of interference with persons occupying positions adjacent to the doorway. Hence there is little danger of injuring or inconveniencing persons walking or standing adjacent the door when the door is opened or closed, even though it be impossible for the person operating the windlass 82 to observe such persons.

Whereas the entire weight of the door is picked up at intervals throughout its length by means of the several cables 71 which are connected to the counterbalance 83, we have deemed it advisable to provide as a precautionary measure a safety device for retaining the door in open position even in the event of failure of any of the above described operating means. Extending along the inner face of the lintel 22 is a shaft 91 rotatably mounted in suitable hangers 92 and having a crank 93 affixed thereto at one end of the shaft, this crank being disposed adjacent one of the jambs 76. A push rod 94 is pivoted to the crank 93 and extends downwards therefrom to an operating handle 96 whereby the parts may be so manipulated as to impart rotary motion to the shaft 91. Adjacent each of the trackways 41 an aduncate detent 97 is rigidly affixed to the shaft 91; and each of these detents is adapted to become engaged upon any suitable member carried by the lower end 61 of the associated arm 36 or the associated lower bracket 17, such, for example, as an extension of the associated pin 72. Preferably the detents 97 are retained in engaging position by gravity and the lower end 98 of each is inclined so that as the door moves to its upper extreme of motion the detents 97 are all thrust aside by the pins 72 until the pins move into registry with the socket portions 99 of the detents 97, whereupon the detents move by gravity so as to engage their respective pins 72. Accordingly the door 11 cannot be lowered again until the handle 96 is so manipulated as to withdraw the several detents 97 from engagement with their respective pins 72.

Figure 7 shows a slightly modified form of closure supporting mechanism which is adapted for

use in buildings where the headroom is relatively limited; i. e., where there is not sufficient height above the lintel 101 to accommodate a vertical trackway. In this modification the trackway 102 extends horizontally inwards from the lintel 101 and carries a guiding member 103 similar to the guiding member 47 previously described. The door 104 is provided with brackets 105 and 107 similar to the brackets 46 and 17 previously described; and to these brackets arms 108 and 109 respectively are pivoted, the latter being offset as indicated at 111 and having a link 112 interposed between the offset portion and associated lower bracket 107, this structure preferably being the same as that already described. The upper arm 108, however, does not extend beyond the bracket 113 which is secured to the lintel 101; and the upper end 114 of the lower arm 109 is sufficiently longer than the corresponding portion of the arm 36 of the previously described modification to permit it to be pivoted as by a pin 116 to the guiding member 103. Hence in this modification, as the door is raised by pulling upwards upon the several cables which are connected to the door adjacent the several lower brackets 107, it moves in the same type of motion as the door 11 previously discussed. The upper brackets 105 move upwards and outwards in a circular path, whereas the lower brackets 107 move upwards in a straight path, inasmuch as the central portion of the arm 109 moves in a circular path and the upper end of the arm 109 moves straight inwards along the trackway 102.

We prefer to provide means for illuminating the area immediately underlying the closure 11 or 104 as the case might be when in open position. This is best accomplished by incorporating reflectors 121 and 122 respectively into the doors 11 and 114, each reflector lying flush with that surface of the door which is outermost when closed and underneath when open. Each reflector 121, 122, is provided with a suitable light source 123, to which electrical energy is supplied by any suitable electrical connections (not shown); and preferably the reflectors 121, 122 are of such design that they cast their light downwards and inwards, substantially as indicated upon Fig. 4.

One of the important features of the first-described modification of our door supporting structure is the improved illumination of the interior of the building which is made possible through its use. Full advantage is taken of all the light entering the building through the transom windows 46 above the door opening by constructing the door of highly reflective material, such as sheet aluminum, and by painting the ceiling with light colored paint. Under such circumstances, light entering through the transom windows will either pass directly downwards past the inner edge 19 of the closure, or reflect upwards from the upper surface of the closure under the ceiling and thence be reflected downwards again to illuminate the interior of the building and particularly those portions which are more remote from the door opening, these being the portions of the room which usually are most poorly illuminated.

We claim:

1. In combination with a movably mounted closure disposed in a substantially vertical plane when closed, means for guiding said closure into elevated position in a plane inclining outwards and downwards, said guiding means being adapted to guide the upper edge of said closure in a substantially straight path outwards from said

vertical plane and the lower edge upwards and inwards in a curved path to a greater elevation than said upper edge.

2. A supporting structure for a closure disposed in a substantially vertical plane below a lintel when closed, comprising a plurality of pairs of arms pivotally connected to a face of said closure intermediate the top and bottom edges thereof, one arm of each of said pairs being pivotally connected to said lintel, and means for maintaining the arms of each pair substantially parallel to each other.

3. A supporting structure for a closure disposed in a substantially vertical plane below a lintel when closed, comprising a plurality of aligned brackets carried by said lintel, a pair of arms associated with each of said brackets and pivotally connected to a face of said closure at spaced positions, one arm of each of said pairs being pivotally connected to the associated bracket, a link pivoted to each of said brackets and to the other arm of the associated pair, and means for maintaining the arms of each pair substantially parallel to each other.

4. A supporting structure for a closure disposed in a substantially vertical plane below a lintel when closed, comprising a plurality of aligned brackets carried by said lintel, a pair of arms associated with each of said brackets and pivotally connected to a face of said closure at spaced positions, one arm of each of said pairs being pivotally connected to the associated bracket, a link pivoted to each of said brackets and to the other arm of the associated pair below the upper end of said other arm and adapted to maintain the associated pair of arms substantially parallel to each other.

5. A supporting structure for a closure disposed in a substantially vertical plane below a lintel when closed, comprising a plurality of aligned brackets carried by said lintel, a pair of arms associated with each of said brackets and pivotally connected to a face of said closure at spaced positions, one arm of each of said pairs being pivotally connected to the associated bracket, a link pivoted to each of said brackets and to the other arm of the associated pair below the upper end thereof, guiding means connected to said upper end of each of said other arms and adapted to maintain the associated pair of arms substantially parallel to each other, and means interposed between the lower end of each of said other arms and said closure for spacing said lower end further from said closure when closed than when open, whereby the bottom edge of said closure is disposed higher than the top edge thereof when open.

6. A supporting structure for a closure disposed in a substantially vertical plane below a lintel when closed, comprising a plurality of aligned brackets carried by said lintel, a pair of arms associated with each of said brackets and pivotally connected to a face of said closure at spaced positions, one arm of each of said pairs being pivotally connected to the associated bracket, a link pivoted to each of said brackets and to the other arm of the associated pair below the upper end thereof, guiding means connected to said upper end of each of said other arms and adapted to maintain the associated pair of arms substantially parallel to each other, and the lower end of each of said other arms being offset toward said closure when closed and away from the closure when open, and a link interposed be-

tween said closure and the offset end of each of said other arms.

7. A supporting structure for a closure disposed in a substantially vertical plane below a lintel when closed, comprising a plurality of aligned brackets carried by said lintel, a pair of arms associated with each of said brackets and pivotally connected to a face of said closure at spaced positions, one arm of each of said pairs being pivotally connected to the associated bracket, a link pivoted to each of said brackets and to the other arm of the associated pair below the upper end thereof, a track associated with each of said brackets, and a roller connected to the upper end of each of said other arms and engaged upon the associated track.

8. A supporting structure for a closure disposed in a substantially vertical plane below the lintel when closed, comprising a plurality of aligned brackets carried by said lintel, a pair of arms associated with each of said brackets and pivotally connected to a face of said closure at spaced positions, one arm of each of said pairs being pivotally connected to the associated bracket and extending upwards therepast, a link pivoted to each of said brackets and to the other arm of the associated pair below the upper end thereof, a track extending upwards from adjacent each of said brackets, a lever pivoted to the upper ends of both arms of each pair, and a roller journaled on each of said levers and engaged upon the associated track.

9. A supporting structure for a closure disposed in a substantially vertical plane below a lintel when closed, comprising a plurality of aligned brackets carried by said lintel, a pair of arms associated with each of said brackets and pivotally connected to a face of said closure at spaced positions, one arm of each of said pairs being pivotally connected to the associated bracket, a link pivoted to each of said brackets and to the other arm of the associated pair below the upper end thereof, a track extending horizontally from adjacent each of said brackets, and a roller journaled upon the upper end of each of said other arms and engaged upon the associated track.

10. A supporting device for a closure, comprising a plurality of brackets rigid with a face of said closure and arranged in pairs, the corresponding brackets of the several pairs being axially aligned in two parallel rows parallel to the top and bottom edges of the closure, an arm pivotally connected to each of said brackets, one arm associated with each pair of brackets being pivoted to a supporting structure above said closure, and means for maintaining the arms of each of said pairs substantially parallel to each other.

11. A supporting device for a closure, comprising a plurality of brackets rigid with a face of said closure and arranged in pairs, the corre-

sponding brackets of the several pairs being axially aligned parallel to the top and bottom edges of the closure, an arm pivotally connected to each of said brackets, one arm associated with each pair of brackets being pivoted to a supporting structure above said closure, a link pivoted at one end to said supporting structure adjacent each of said pivotally connected arms and at the other end to the other of the associated arms, and means for maintaining the arms of each pair substantially parallel to each other.

12. A supporting device for a closure, comprising a plurality of brackets rigid with a face of said closure and arranged in pairs, the corresponding brackets of the several pairs being axially aligned parallel to the top and bottom edges of the closure, an arm pivotally connected to each of said brackets, one arm associated with each pair of brackets being pivoted to a supporting structure above said closure, a link pivoted at one end to said supporting structure adjacent each of said pivotally connected arms and at the other end to the other of the associated arms, means for maintaining the arms of each pair substantially parallel to each other, and means interposed between one of the arms of each pair and said closure for compensating for inaccuracies of construction of said supporting structure.

13. A supporting device for a closure, comprising a plurality of brackets rigid with a face of said closure and arranged in pairs, the corresponding brackets of the several pairs being axially aligned parallel to the top and bottom edges of the closure, an arm pivotally connected to each of said brackets, one arm associated with each pair of brackets being pivoted at one end to said supporting structure adjacent each of said pivotally connected arms and at the other end to the other of the associated arms, means for maintaining the arms of each pair substantially parallel to each other, one of said arms being offset toward said closure to dispose the end thereof closer to the closure when closed and further from said closure when open, and a link interposed between each of said offset arms and the bracket associated therewith and pivoted to both.

14. In combination with a movably mounted closure disposed in a substantially vertical plane when closed, means for guiding said closure into elevated position in a plane inclining outwards and downwards, said guiding means being adapted to guide the upper edge of said closure outwards from said vertical plane and the lower edge upwards and inwards to a position higher than said upper edge, said guiding means when the closure is closed being entirely disposed on that side of said plane toward which said lower edge of the closure moves when opening.

WESLEY W. EAGER.  
COLUMBUS A. TIERNEY.