Dec. 3, 1935. J. I. BYRNE 2,023,193

DOOR CONSTRUCTION

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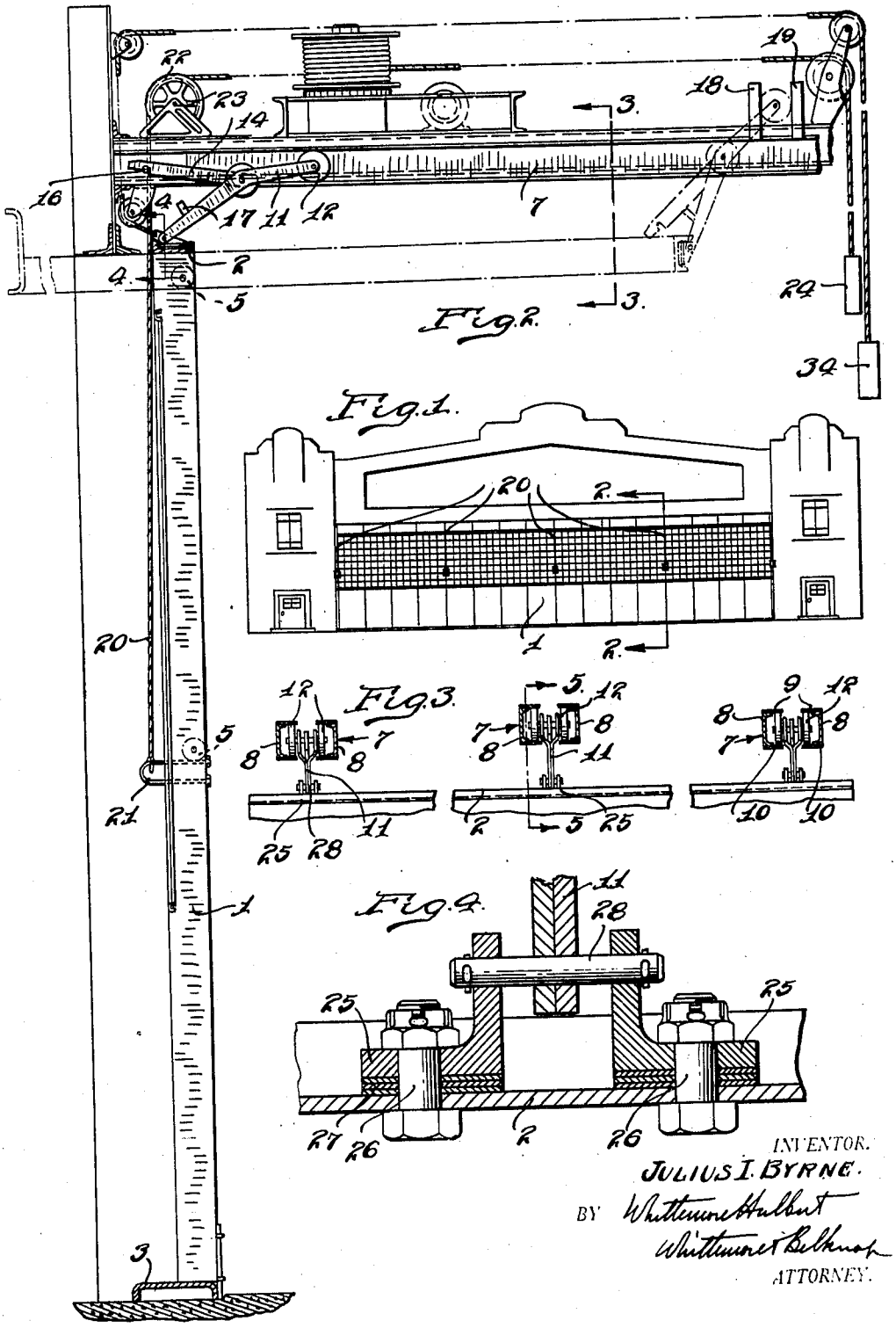

Fig. 2.

Fig. 1.

Fig. 3.

Fig. 4.

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Fig. 7.

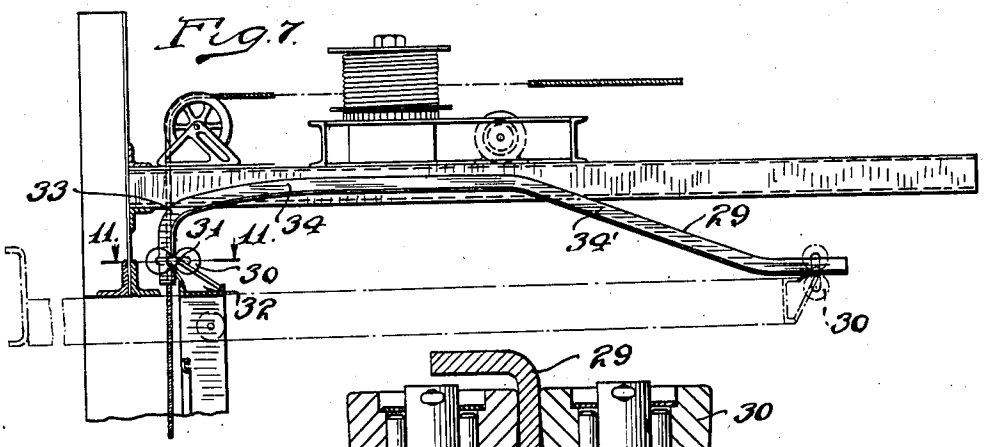


Fig. 11.

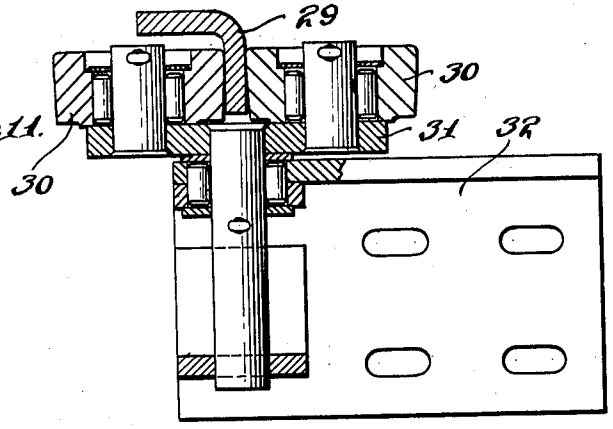


Fig. 6.

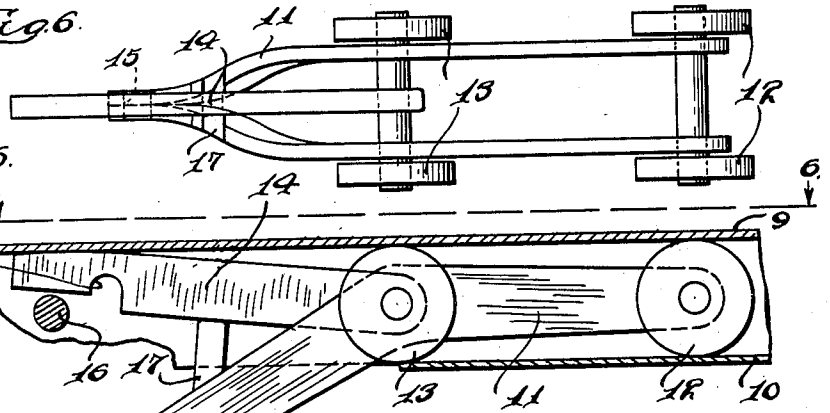
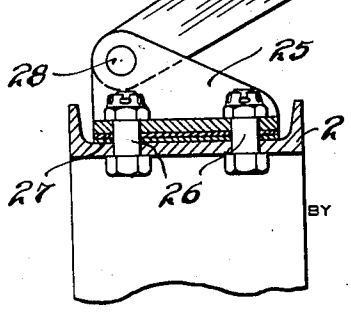


Fig. 5.



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DOOR CONSTRUCTION

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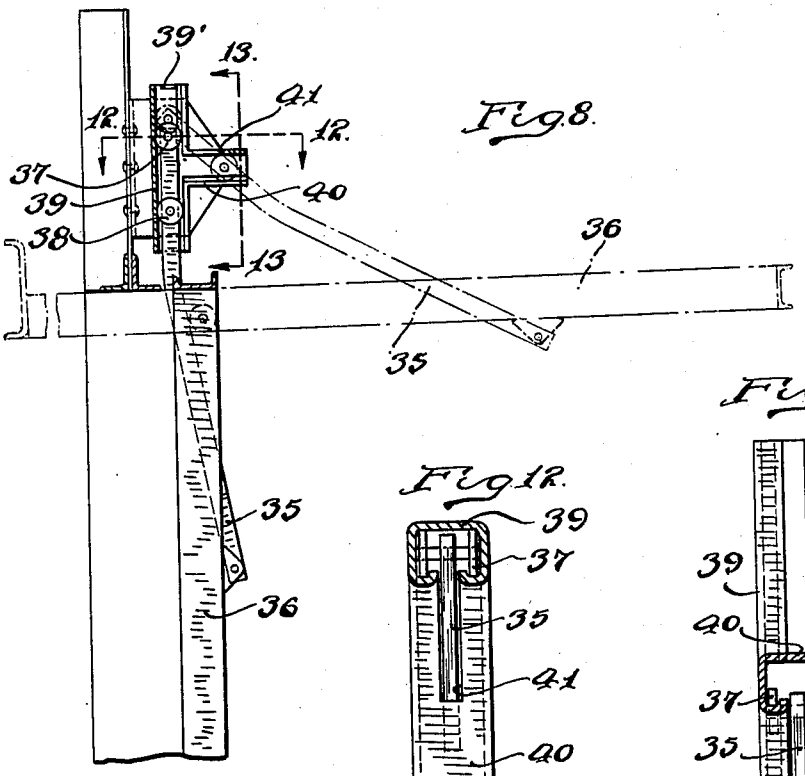

Fig. 8.

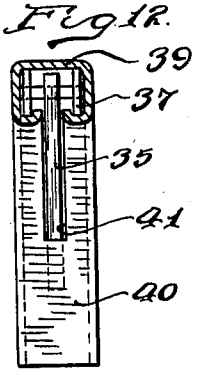

Fig. 12.

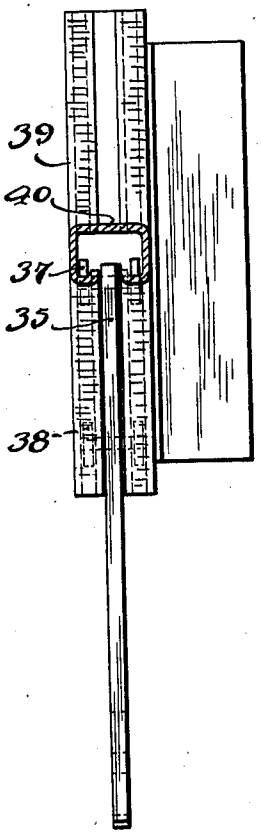

Fig. 13.

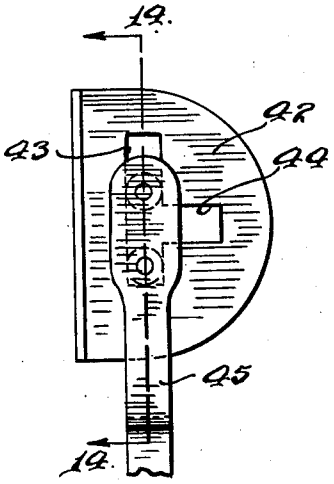

Fig. 9.

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Fig. 10.

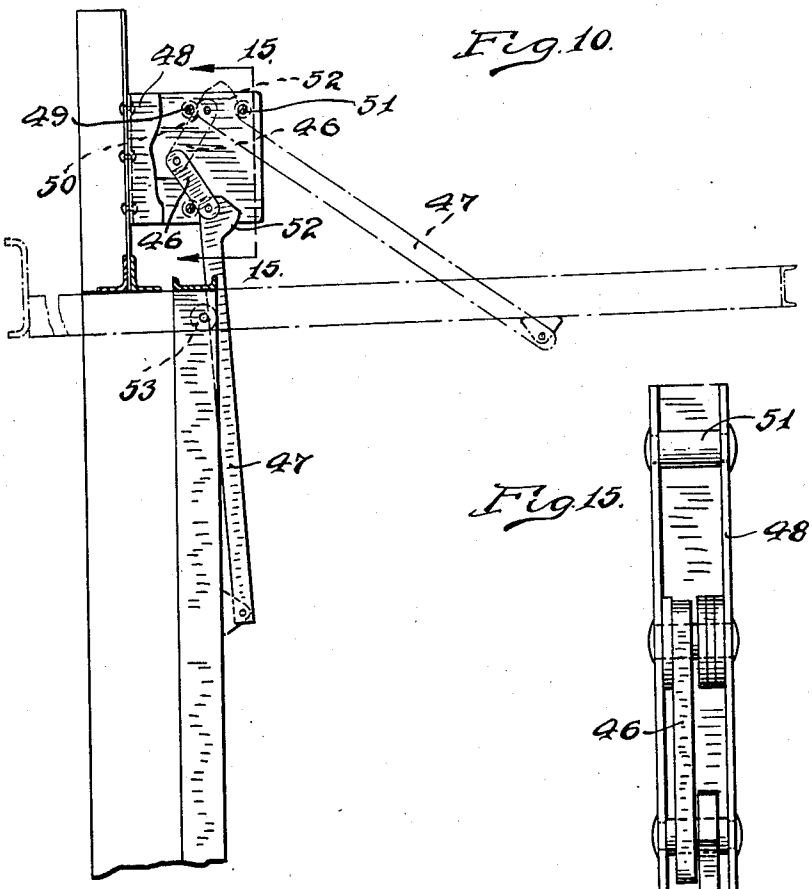


Fig. 15.

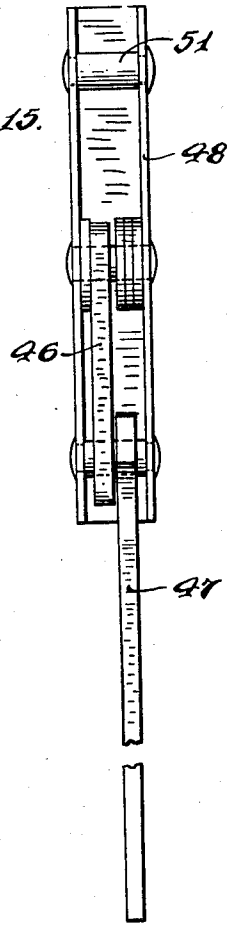
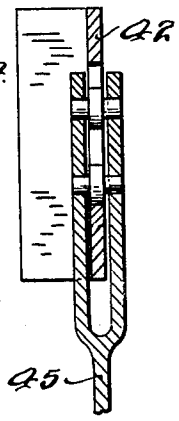


Fig. 14.



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Patented Dec. 3, 1935 2,023,193

UNITED STATES PATENT OFFICE

2,023,193

DOOR CONSTRUCTION

Julius I. Byrne, Detroit, Mich.

Application July 27, 1931, Serial No. 553,460

11 Claims. (Cl. 20—19)

The invention relates to door constructions and refers more particularly to door constructions for use in warehouses, airplane hangars, and the like, in which the doors have considerable width. One of the objects of the invention is to provide an improved door construction which is opened by raising the same and in which the door moves bodily vertically during the first portion of the raising movement and then swings toward horizontal position. Another object is to so construct the door construction that it has positive guiding means. A further object is to so arrange the door construction that provision is made for imperfect location of the parts of the framework of the building to which the tracks of the guiding means are secured. These and other objects of the invention will become apparent from the following description, taken in connection with the accompanying drawings, in which

Figure 1 is a front elevation of a building having a door construction embodying my invention;

Figure 2 is a longitudinal section therethrough;

Figures 3 and 4 are cross sections respectively on the lines 3—3 and 4—4 of Figure 2;

Figures 5 and 6 are detail views of a hanger for the door;

Figures 7, 8, 9 and 10 are views similar to Figure 2, showing modifications;

Figure 11 is a cross section on the line 11—11 of Figure 7;

Figures 12 and 13 are cross sections on the lines 12—12 and 13—13 of Figure 8;

Figure 14 is a cross section on the line 14—14 of Figure 9;

Figure 15 is a cross section on the line 15—15 of Figure 10.

As illustrated in the present instance, the door construction is for use in airplane hangars and, as shown particularly in Figure 1, the door 1 occupies substantially the complete width of the building and has a span sufficient to readily permit passage through the opening closed thereby of any airplane. The door 1, as shown more particularly in Figure 2, has a reinforced metal frame with the top and bottom channel-shaped rails 2 and 3, respectively, and the upright channel-shaped rails 4. The door is adapted to be opened by being raised and it is desirable and important that this door in opening should first move vertically and then be swung or tilted to horizontal position. The vertical movement is preferably about eight inches, but for practical purposes it may be greater or less. The door has secured to its end rails the rollers 5 which are preferably located intermediate the upper and lower edges of the door and which engage suitable upright guide channels 6 secured to the jambs at the sides of the door opening.

In certain cases, such as illustrated in Figures 1, 2 and 3, a series of head guides or tracks is required for the door. In detail, 7 represents the head guides or tracks, there being three in the present instance. Each head guide or track is formed of a pair of channel members 8 spaced apart and facing toward each other and rigidly supported above the door upon the frame work of the building. 9 and 10 are upper and lower guide plates rigidly secured respectively to the upper and lower flanges of the channel members and extending laterally inwardly beyond these flanges for engagement with the hangers 11, there being one hanger for each guide or track.

Each hanger comprises the arm or frame 11 having one end pivotally connected to the upper edge of the door and provided at the other end with a pair of rollers 12 and intermediate its ends with the pair of rollers 13. The rollers are at opposite sides of the arm or frame and are adapted to engage and be positively guided by the plates 9 and 10.

For the purpose of securing vertical movement of the door during the first portion of its raising, each hanger has pivotally secured thereto the latch arm 14 which has at the lower edge of its free end the downwardly opening notch 15 forming a hook adapted to engage the transversely extending pin 16 rigidly secured to and extending between the channel members 8. The latch arm is pivoted to the hanger arm or frame on the same axis as the intermediate rollers 13 and has an effective length approximately equal to that of the portion of the hanger arm or frame between the intermediate rollers and the pivot connecting this arm or frame to the door. The lower plates 10 have their front ends terminating at a point such that when the latch arm is hooked over its pin the intermediate rollers pass beyond the front ends of the lower plates. To release the latch arm from its pin the hanger arm or frame is provided with the detent 17 in the nature of an upwardly extending projection and adapted to engage the latch arm upon upward swinging of the hanger arm or frame and preferably just prior to movement of the intermediate rollers along the upper surfaces of the lower plates 10.

For the purpose of moving the door toward horizontal position and preferably to horizontal position during the final portion of its opening movement, the rear end portions of each guide

or track extend upwardly. More specifically, the upright plates 18 and 19 are rigidly and adjustably secured respectively to the upper plates 9 and upper flanges of the channel members and the lower plates 10 and the lower flanges of the channel members and these plates 18 and 19 are spaced apart a distance sufficient to receive the rear rollers 12 of the hanger, as shown particularly in Figure 2, when the hanger has been moved sufficiently rearwardly, thereby providing for tilting the hanger about its intermediate rollers 13 and lowering by the action of gravity the edge of the door corresponding to the upper edge when the door is closed. The tilting is such that the door in its open position is horizontal and provides maximum clearance.

To raise the door, I have provided the series of linear members 20, such as steel cables, there being five in the present instance. These linear members extend in front of the door when closed and have their lower ends secured to the door by suitable means, such as the clevices 21, which are located preferably near the vertical center of the door. In this connection the rollers 5 are located with respect to these clevices to secure practical operating clearance for the clevices. These linear members extend over the sheaves 22 which are secured upon the shafts 23, which latter are mounted upon the frame work of the building and are located above the door. Suitable counterweights 24 for the door are secured to the linear members 20 and these linear members may be actuated either manually or by power to effect the raising and closing of the door but, as shown, the linear members are power driven. It will be seen that with this arrangement the linear members in raising the door tend to tilt the door in a direction such that its upper edge will move rearwardly.

For the purpose of taking care of inaccuracy in location and more particularly horizontal alignment and spacing of the head guides or tracks 7, provision is made for variably connecting in transverse directions the hangers to the door and the head guides or tracks. Specifically, there is a pair of brackets 25 for each hanger and each of these brackets is adapted to be vertically adjustably secured to the top rail 2 of the door by the securing bolts and nuts 26 and the shims 27 between the foot flanges of these brackets and the web of the top rail. The brackets are spaced apart and receive the pin 28 passing through the hanger arm or frame and forming the pivot therefor and the effective length of this pivot pin between the brackets is appreciably greater than the width of the hanger arm or frame. It will thus be seen that provision is made for taking care of inaccuracy, both vertically and horizontally, so that it is not necessary to accurately align the head guides or tracks.

To assist in closing this door auxiliary means may be provided for applying power to the door in counter relation to the leverage effect and consequent tilting action exerted by the linear members upon the door. As specifically shown, 34 are counterweights connected to the upper edge portion of the door in a manner tending to compel this upper edge portion to move forwardly, these counterweights being such that they counterbalance the tilting effort exerted by the linear members.

In the modification shown in Figures 7 and 11, the parts have the same general arrangement with the exception that the head guides or tracks are different. In this modification each head guide or track comprises the angle bar 29 having a transverse flange, the opposite sides of which are engageable with the rollers 30 which are journalled upon the arm 31. This arm is pivotally connected at its center to the bracket 32, which latter is fixedly secured to the top rail of the door. The front end of each head guide or track has the vertically extending portion 33 for positively guiding the door vertically during the first part of its raising movement. The portion 34 of each head guide or track connecting into the vertically extending portion is upwardly and rearwardly inclined to provide for gradual tilting of the door and the rear portion 34' of each head guide or track is downwardly and rearwardly inclined to positively tilt the door to horizontal position. With this construction it will be seen that the door is positively guided during its raising and closing movements and has during its raising movement an initial vertical movement and then a tilting movement terminating when the door extends horizontally.

In the modification shown in Figures 8, 12 and 13, the head guide or track construction is different and each head guide or track construction comprises links 35 which have their lower ends pivotally connected to one of the faces of the upper portion of the door 26. In the present instance, there are two links 35 at the ends of the door and pivotally connected to its rear face. The upper end of each link is provided with the upper and lower pairs of rollers 37 and 38 respectively spaced longitudinally of the link. Each head track is T-shaped in elevation and has the vertically extending portion 39 and the horizontally extending portion 40 connecting into the vertically extending portion between its upper and lower ends. Both of these portions have the same cross section as the guide or track shown in Figures 7 and 11 with the vertically extending portion opening rearwardly and the horizontally extending portion opening downwardly. The upper part or web of the horizontally extending portion is cut away at 41 to receive the portion of the link 35 above the lower rollers 38 when the link is being moved angularly.

In operation and with the door closed the links will first be moved vertically by reason of their upper and lower rollers being positively guided by the vertically extending portions 39 of each head guide or track. However, when each link is moved upwardly so that its lower rollers register with the transversely extending portion 40 of the head guide or track and its upper rollers engage the stop 39' at the upper end of each vertically extending track portion these lower rollers will automatically enter the horizontally extending portion by reason of the tilting effort produced upon the door by the linear members, so that the door will be moved angularly or tilted to horizontal position.

In the modification shown in Figures 9 and 14, the parts are so constructed that the same operation is secured. However, in this modification there are supporting plates 42 located above the door and extending transversely thereof. Each supporting plate is provided with the T-shaped slot having the vertically extending portion 43 and the horizontally extending portion 44 connecting into the vertically extending portion intermediate its ends. The longitudinally spaced rollers upon the link 45 are engageable in these portions of the slots in the same manner as the rollers with their vertically and horizontally ex-

tending portions of the head guide or track in Figures 8, 12 and 13.

Figures 10 and 15 disclose another modification in which each hanger comprises the upper and lower links 46 and 47, respectively, with the lower end of the lower link pivotally connected to one of the faces of the upper portion of the door when in closed position. Specifically, the lower link is pivotally to the rear face of the door when closed. The upper end of the upper link is pivotally connected to and between the side walls of the supporting U-shaped plate 48 and the lower end of this upper link is pivotally connected to the upper end of the lower link. During the first portion of the raising movement of the door the upper link 46 is movable angularly to assume the position shown in dotted lines, at which time this movement is limited by reason of the transverse pin 49 extending between the side walls of the supporting plate 48 and engageable with an edge portion 50 of the enlarged upper end of the lower link 47. To hold this upper link in its predetermined position of angular adjustment while the door is being tilted upon continued raising thereof, I have provided the transverse stop 51, preferably in the nature of one or more rollers, located between the side walls of the supporting plate 48 and engageable with the edge portion 52 of the enlarged upper end of the lower link 47. Both the edge portions 50 and 52 are concentric with the pivot connecting the upper and lower links so that the upper link is effectively secured in predetermined angular position during the tilting movement of the door. In order to positively control the movement of the door during the upward and downward swinging movements of the upper link of each hanger, the door may be provided with the auxiliary rollers 53 secured to the upper portion of its end rails and engageable with the jamb guides at the sides of the door opening.

What I claim as my invention is:

1. In a door construction, the combination with a door, means for bodily raising said door and track means above said door, of means connected to said door and guided by said track means, and means other than said track means and cooperating with said means connected to said door for compelling said door to move vertically during the first portion of the raising movement.

2. In a door construction, the combination with a door, means for bodily raising said door and stationary track means above said door, of hanger means pivotally connected to said door and engaging said track means, said hanger means being adapted to swing vertically at the front end of said track means and to move rectilinearly along said track means, and latch means cooperating with said hanger means for compelling the pivotal connection between said hanger means and door to move vertically during the first portion of the raising movement.

3. In a door construction, the combination with a door, linear means for bodily raising said door and stationary tracks above said door, of hangers pivotally connected to the upper edge of said door and engaging said tracks, each of said hangers comprising an arm having a pivot for connection to said door and a pair of longitudinally spaced rollers for engaging a track with the roller nearest said pivot adapted to clear said track and permit said hanger to swing vertically, a latch arm pivotally connected to said arm with the axis of the pivot registering substantially with that of said last mentioned roller and the length of the latch arm substantially equal to that portion of the hanger arm between said last mentioned roller and pivotal connection to said door, a stationary member engageable with the free end of said latch arm and adapted to hold the same from movement longitudinally of said track, and means upon said hanger arm engageable with said latch arm upon predetermined upward swinging of said hanger arm to release said latch arm from said retaining member.

4. In a door construction, the combination with a door, means for bodily raising said door and track means above said door, of hanger means connected to said door and engaging said track means, said hanger means comprising an arm having rollers spaced longitudinally thereof, said track means having a rear end portion for engaging and changing the direction of movement of one of said rollers to compel said hanger means to tilt and said door to move to substantially horizontal position during the final portion of the raising movement.

5. In a door construction, the combination with a door and means connected to said door laterally beyond its center of gravity for bodily raising said door, of means for positively guiding said door to compel the same to move vertically during the first portion of the raising movement and to swing toward horizontal position during the succeeding portion of the raising movement, and means acting directly on said door in counterrelation to the leverage effect produced by said raising means.

6. In a door construction, the combination with a door, means for raising said door and track means above said door, of hanger means connected to said door and engaging said track means, said hanger means comprising an arm having rollers spaced longitudinally thereof, said track means having an upright portion at its rear end for engaging and changing the direction of movement of one of said rollers to compel said hanger means to swing and lower the portion of said door to which said hanger means is connected.

7. In a door construction, the combination with a door and means connected to said door for bodily raising the same and exerting a rearward pressure upon its upper portion, of means acting on the upper portion of said door to counterbalance the rearward pressure exerted thereupon.

8. In a door construction, the combination with a door movable from closed position upwardly and angularly to open position and track means positioned above said door in both of said positions and having a transversely extending track portion, of hanger means comprising an arm having upper and lower portions, rollers spaced longitudinally of said upper portion and engaging said track means, and means for pivotally connecting said lower portion to said door, one of said rollers being engageable with said transversely extending track portion thereby providing for swinging of said hanger means during the movement of said door to open position.

9. In a door construction, the combination with a door adapted while moving to open position to initially move substantially vertically upwardly and to subsequently move upwardly and angularly, of means for positively guiding said door during its movement to open position, said guiding means comprising tracks and hangers connected to said door, each hanger comprising an arm and a pair of rollers mounted on said arm,

one of said rollers engaging one of said tracks above said door when the latter is closed, one of said rollers being vertically movable during the initial portion of the opening movement of said door and the other of said rollers being vertically movable during the final portion of the opening movement of said door.

10. In a door construction, the combination with a door movable from closed position upwardly and angularly to open position, of means for positively guiding said door during its movement to open position, said guiding means comprising tracks and hangers connected to said door, each track having an opening and each hanger comprising an arm and a pair of rollers mounted on said arm, one of said rollers engaging its track at all times and the other of said rollers being adapted to move through the opening in its track and also to engage its track.

11. In a door construction, the combination with a door movable from closed position upwardly and angularly to open position, of means for guiding said door during its movement to open position, said guiding means comprising tracks and hangers connected to said door, each track having a substantially rectilinear portion and each hanger comprising an arm and a pair of rollers mounted on said arm, one of said rollers being engageable with the substantially rectilinear portion of its track to move through a substantially rectilinear path and the other of said rollers being movable vertically relative to said substantially rectilinear portion during one portion of the opening movement of said door and being engageable with said substantially rectilinear portion and movable through a substantially rectilinear path during another portion of the opening movement of said door.

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