May 19, 1936. A. RUSH 2,041,372

DOOR STRUCTURE

Filed June 23, 1930 3 Sheets-Sheet 1

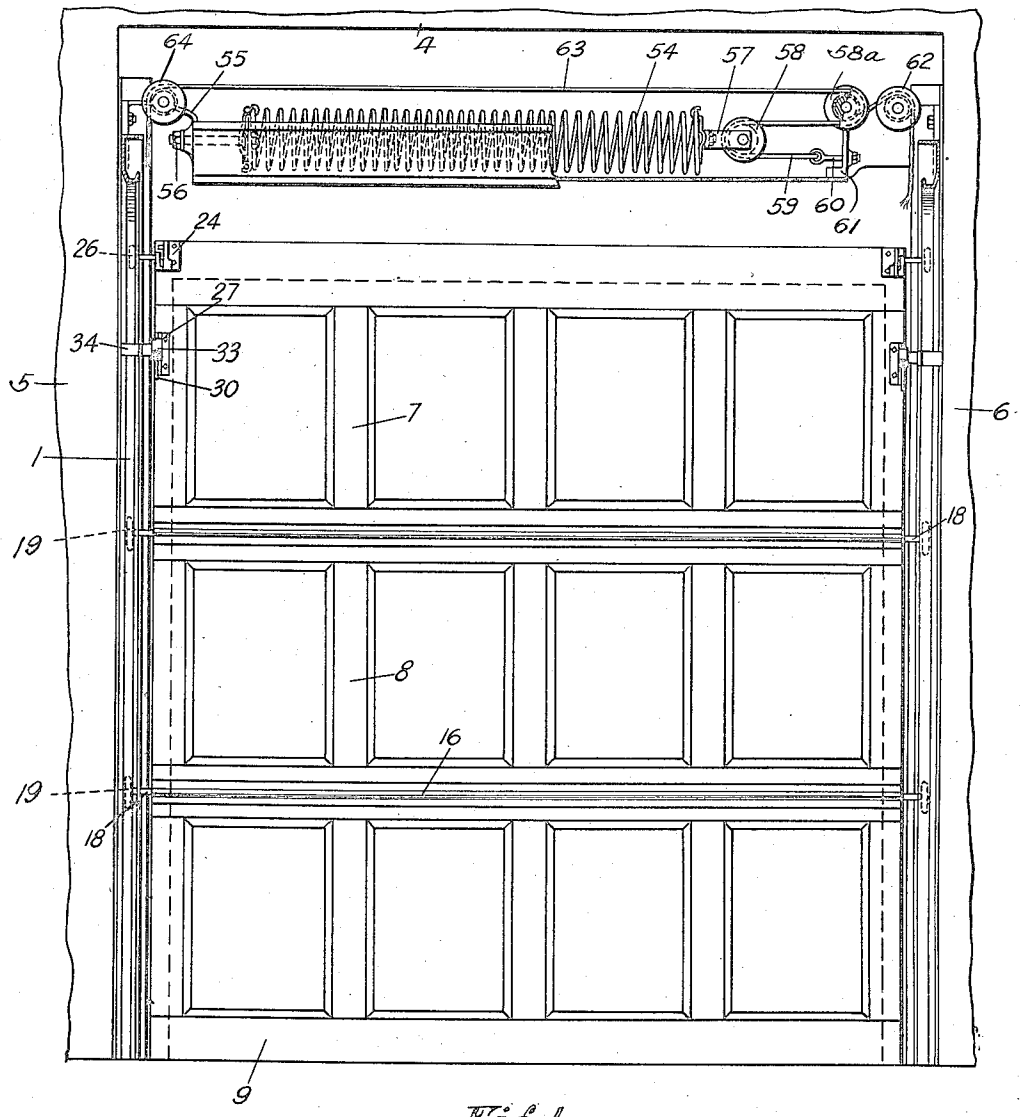


Fig. 1

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May 19, 1936. A. RUSH 2,041,372

DOOR STRUCTURE

Filed June 23, 1930 3 Sheets-Sheet 2

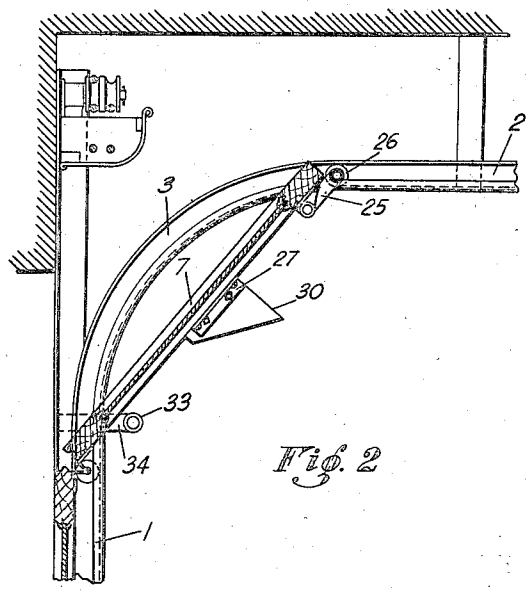


Fig. 2

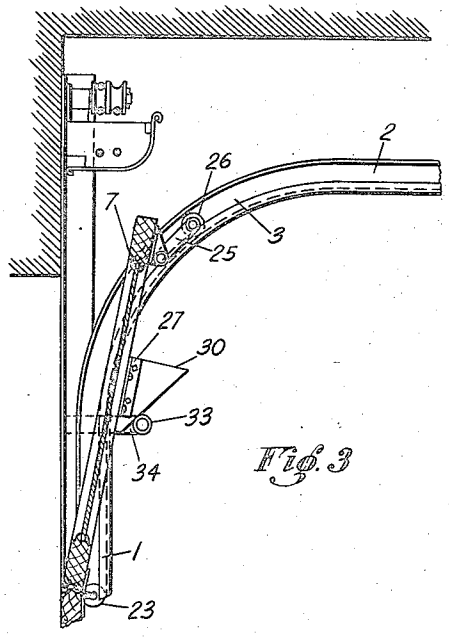


Fig. 3

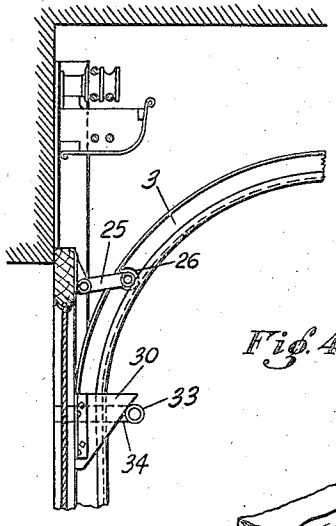


Fig. 4

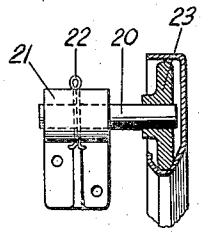


Fig. 13

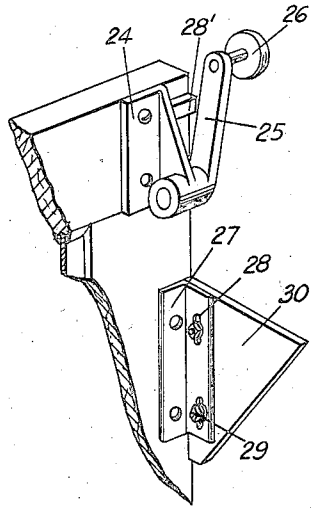


Fig. 5

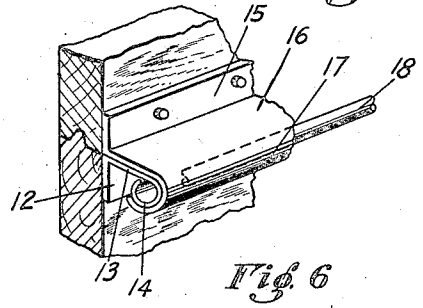


Fig. 6

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DOOR STRUCTURE

Filed June 23, 1930 3 Sheets-Sheet 3

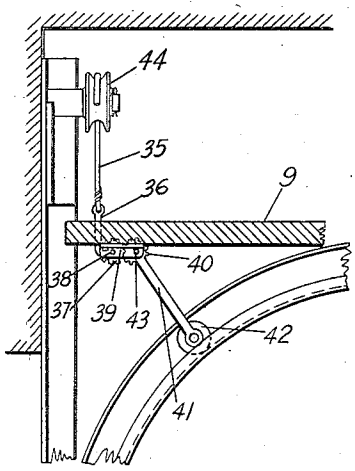


Fig. 7

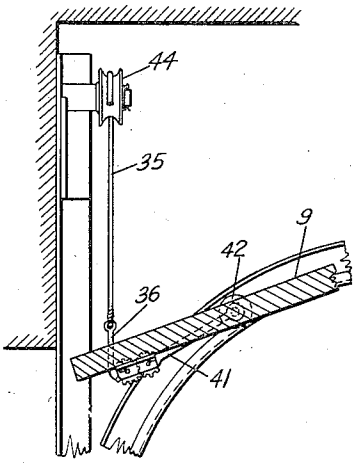


Fig. 8

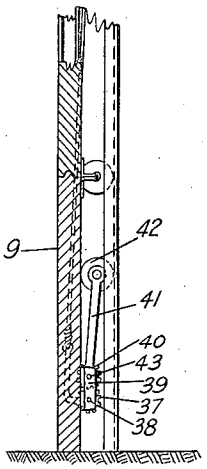


Fig. 9

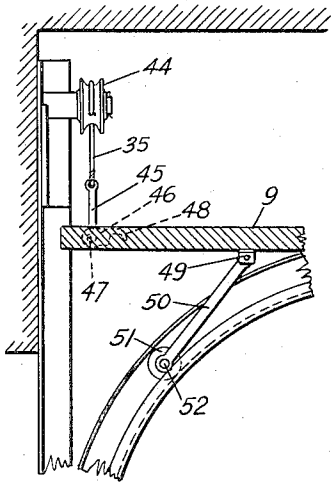


Fig. 10

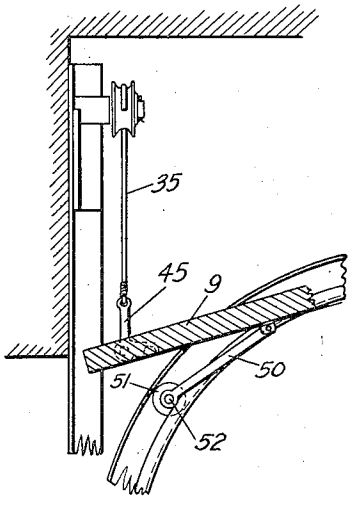


Fig. 11

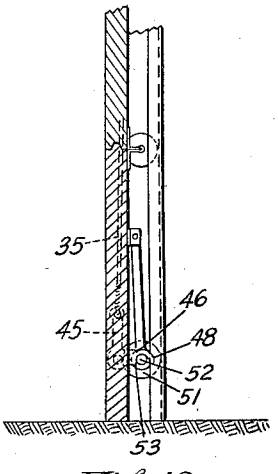


Fig. 12

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Patented May 19, 1936

2,041,372

UNITED STATES PATENT OFFICE

2,041,372

DOOR STRUCTURE

Albert Rush, Columbus, Ohio; Alphonse Roesch, administrator de bonis non of said Albert Rush, deceased, assignor to The Kinnear Manufacturing Company

Application June 23, 1930, Serial No. 463,230

8 Claims. (Cl. 20—19)

My invention relates to door structure. It has to do particularly with that type of door which is generally known as an overhead door, although there are features of this invention which are not necessarily limited to use in this connection.

In the prior art, overhead doors have been utilized but many of them have been possessed of certain undesirable features. For example, difficulty has been experienced in moving the door to such a position that it will entirely clear the doorway, interference usually resulting in the upper part of the doorway with a consequent undesirable lack of head room. Some of the prior art devices have attempted to remedy this difficulty to some extent by providing guiding tracks inclined from the vertical practically throughout the height of the doorway. Another disadvantage of prior art devices, particularly in sectional door construction, has arisen from weakness of the door at the joints between its sections or panels, usually due to the use of a series of spaced hinges without any means for adequately compensating for the resultant weakness.

One of the objects of my invention is to provide an overhead type of door which is of such structure and so mounted that it may be readily moved to a position completely clearing the doorway, so that adequate headroom will be ensured.

Another object of my invention is to provide a door construction and mounting wherein the panels or sections will be disposed in vertical position when closed and wherein the guiding tracks will be substantially parallel with the doorway for the major portion of their length.

Another object of my invention has to do with the provision of a sectional door construction and mounting which will ensure that all parts of the door will be held firmly in contact with the lintel and jambs of the doorway whenever the door is closed.

Another object of my invention is to provide a means associated with the panels or sections of a sectional door which will result in increased rigidity of the door along the joints between the panels or sections and will accomplish this result without the necessity of increasing the thickness of the panels or sections.

Another object of my invention is to provide elevating cables for the door which are so mounted and connected to the door that they will be maintained substantially in the same line of pull throughout all positions of the door and will not be subjected to such pulls as would materially tend to pull them off of the sheaves over which they operate.

My invention preferably takes the form of a sectional door slidable between closed position and a position beneath the ceiling of the room and in approximate parallelism thereto or, at least, a position above the plane of the top of the doorway. These sections are preferably mainly guided between the positions indicated through the medium of rollers carried by the sections and operating in tracks upon opposite sides of the door. These tracks comprise a vertical portion, a horizontal portion, and an intermediate arcuate portion. In conjunction with these parts, I preferably use a device operating upon the principle of the inclined plane. This device becomes automatically effective at the proper time during the closing of the door to force the upper portion of the door firmly into proper sealing relation with the lintel and jambs of the doorway by a swinging motion.

My invention also preferably comprises a means for stiffening my sectional door structure. This means preferably takes the form of a novel hinge construction wherein the hinge elements extend the full width of the door and are of such form that they reenforce the joints between the panels or sections by a beam supporting action.

My invention also preferably contemplates the provision of means for connecting the elevating cable to the door and for connecting the door to its trackways which are automatically adjustable during the opening of the door and particularly during the final stages of this opening to swing the lower end of the door upwardly away from the trackways so that the doorway will be entirely clear while, at the same time, the elevating cables will not be materially drawn out of their vertical line of pull. This means desirably comprises roller supporting links which are pivotally carried by the lower door section and whose rollers operate in the trackways. It also comprises automatically extensible connections between the lower ends of the elevating cables and the door which permit the cables to maintain vertical position while, at the same time, permitting the lower end of the door to swing away from this vertical plane.

The preferred embodiment of my invention is shown in the accompanying drawings wherein similar characters of reference designate corresponding parts and wherein:

Figure 1 is a front elevation of a door structure built in accordance with my invention, and illustrating the door in closed position.

Figure 2 is a vertical sectional view of my door

structure, showing the upper section of the door in partially opened position.

Figure 3 is a view similar to Figure 2 but showing the upper section of the door almost closed and illustrating the action of the inclined plane device.

Figure 4 is a sectional view similar to Figures 2 and 3 but illustrating the position of the upper section of the door when this door is completely closed.

Figure 5 is a detail, in perspective, of one corner of the upper section of the door and showing my inclined plane device and the guiding roller associated therewith.

Figure 6 is a detail in perspective showing a portion of one of the hinges which I preferably utilize to connect adjacent sections of my door and stiffen the joints between such sections.

Figure 7 is a vertical sectional view of my preferred means for connecting the elevating cables to my door, this figure illustrating the fully open position of my door and showing the manner in which it completely clears the doorway.

Figure 8 is a view similar to Figure 7, illustrating the lower section of my door just before it finally moves into fully open position.

Figure 9 is a vertical sectional view, illustrating the parts shown in Figures 7 and 8 in the position which they assume when my door is fully closed.

Figure 10 is a vertical sectional view of a modified form of device for connecting the elevating cables to the lower door section and for guiding said lower door section, this figure illustrating the position of the lower door section when the door is fully opened.

Figure 11 is a view similar to Figure 10 but illustrating the provision of the parts when the door is partially opened.

Figure 12 is a vertical sectional view illustrating the structures shown in Figures 10 and 11 and showing the position which they assume when the door is fully closed.

Figure 13 is a fragmental sectional view of a modified form of bracket for holding the axles and rollers on the door sections.

In the drawings, my invention is shown as comprising a plurality of spaced tracks which each embody the vertical portion **1** (see Figure 2), a horizontal portion **2** and an intermediate arcuate portion **3**. It will be noted that these tracks are preferably disposed upon opposite sides of a doorway which may be designated A and which is provided with a lintel **4** and door jambs **5** and **6** (see Figure 1). It will be noted that the horizontal portions of my tracks are disposed in a plane entirely above the plane of the top of the doorway and will subsequently appear that my door, both in opening and in closing, is caused to move with a swinging movement as well as with a sliding movement for purposes that will be explained.

My door is preferably comprised of a plurality of panels or sections which may vary in number but which, for the purpose of illustration, are shown as three in number. These sections may be designated **7**, **8** and **9**. As shown in Figure 6, each section, with the exception of the bottom section, is provided with a groove on one longitudinal edge thereof with a tongue **11** on the opposite edge thereof. The tongue and groove of adjacent sections are designed to move into interfitting relation when the door is in fully opened or fully closed position.

Adjacent panels or sections of the door are connected together by means of hinges which preferably extend the entire width of the door. Each hinge comprises an inner element embodying a base flange **12** designed to be secured to a panel or section, a web **13** extending outwardly from said base flange and also outwardly from the base of the section or panel to which this element is secured. This element also preferably comprises a curled portion **14**.

Each hinge also comprises an outer element which is complementary to said inner element and which comprises a base **15** designed to be secured to an adjacent panel or section. It also comprises a web **16** and an outer curled portion **17** which contacts with and overlies the web **13** and curled portion **14** to an extent sufficient to interlock these elements together while permitting swinging of the sections upon each other in the manner shown in Figure 2.

The curled portion **14** of the inner hinge element is preferably of such structure as to leave an opening extending throughout the length of the hinge. This opening may serve to receive a rod **18** of cylindrical form extending the full length of the hinge members and projecting beyond the same. Each end of each rod **18** preferably carries a roller **19** which is loosely mounted thereon and which is designed to run in the trackway, as indicated in Figure 1.

A modified form of roller construction and mounting is illustrated in Figure 13 of the drawings. In this form, the cylindrical rods **18** are dispensed with and stub rods or axles **20** are secured in bearings **21**, which align with the hinges, by means of pins **22**. The rollers **23** shown in this form are also loosely mounted upon the stub rods or axles **21**.

The hinge structure described constitutes an important feature of my invention. Since they are supported in the track through the medium of the rods and rollers described, they act as reenforcing members or strips which resist and limit the deflection of the door, whether such deflection be threatened or caused by weight, blowing wind or by other causes. The structure is such that the strength of this resisting or limiting action may be varied at will without varying the thickness of the door sections, merely by increasing or decreasing the distance from the face of the wood section to the outside or free edge of the hinge. This is important for many reasons. For example, it makes possible the provision of doors of various sizes and for various positions of operation with panels or sections of uniform thickness, while providing a simple and effective method of providing adequate reenforcement or resistance to any load or pressure to which a particular door may be subjected.

Another feature of this hinge structure arises from the fact that the rollers are free to compensate for irregularities in the track structure. Tracks of the type frequently used in this type of door structure are sometimes wavy and these floating rollers compensate for this wavy condition.

In order to provide a door with panels or sections of substantial height and, at the same time, have this door movable into such overhead position as to entirely clear the doorway, I have provided my door with certain inherent and auxiliary features that will cause it to move between closed and open position with a compound movement that will enable it to readily move into such open position as will entirely clear the doorway and to move into such closed position as will ef-

fectively close the doorway with adequate pressure. I preferably accomplish this by imparting two certain sections of the door with both a swinging and sliding action.

In the form shown, the central section 8 of the door is guided in the track structure 1—2—3 by rollers such as at 19 or 23, the axes of these rollers being preferably in substantial alignment with the hinges which connect this central section to the sections 7 and 9. Therefore, this central section 8 travels in a path which is entirely fixed by the trackways. In other words, in moving from its fully closed position to its fully open position, the upper rollers of this section or panel guide the upper edge of the panel in a path which is in alignment with the track-ways and the lower edge of this section follows in an identical path.

However, as shown in Figures 2 to 5, inclusive, the upper section 7 of my door is provided adjacent its upper corners and on the face thereof with brackets 24 to which are pivotally secured links 25 whose outer ends carry roller members 26 which are designed to travel in the track-ways 1—2—3. Immediately beneath the brackets 24 are bolted angle plates 27 provided with slotted openings 28 in the leg thereof extending at right angles to the door panel. These angle plates 27 carry inclined plane members 30, adapted to be bolted thereto by means of the bolts 29 passing through suitable spaced openings therein and through the vertically aligned slots 28 of the angle plates which permits of vertical adjustment of the inclined plane members. Furthermore, these inclined plane members are adjustable up or down.

Designed to cooperate with these inclined plane members 30 are transversely aligning rollers 33, Figures 2, 3 and 4, disposed immediately in front of the tracks at a point directly below the arcuate portions 3 thereof. These rollers may be carried by strap members 34, and are so located that when the door section 7, Figure 4, attains a vertical position, the inclined plane members 30 will have wedged themselves tightly thereagainst as will be hereinafter explained.

In operation of this inclined plane structure, considering that the parts are in the position shown, the movement of the door towards closed position carries the upper section 7 of the door into the position indicated in Figure 3 and then into the position shown in Figure 4. In Figure 2, it will be noted that the pivoted links 25 are in abutment with a raised block 26' formed on the face of the panel or section 7 and prevent any further sagging thereof. When the section 7 reaches the position shown in Figure 3, the inclined plane members 30 have started to ride upon the rollers 33 so that the upper edge of the section 7 is being swung towards closed position. Further movement of the door towards closed position results in further swinging the upper edge of this panel or section 7 towards the lintel until the final closed position of the door is reached as shown in Figure 4. At this time, the action of the rollers 33 upon the inclined plane members 30 has forced the upper edge of the door section 7 and the face thereof throughout into firm contact with the jambs and lintel of the doorway, the path of travel of the upper edge of this panel or section being clearly discernible by comparing the position of the edge in Figure 2, with that in Figures 3 and 4. Likewise, during this movement of the upper section 7 into its closed position, the links 25 gradually move out of paralleled relation to the section and into substantially angular relation to the face thereof, serving to offset the tendency of the door to fall outwardly from the track and lower it properly until the inclined members have cooperated with the rollers 33.

In the opening of the door, the reverse action occurs. From this, it will be readily understood that, after leaving the position shown in Figure 4, the parts just described move through the position shown in Figure 3 and through the position shown in Figure 2 and then proceed to travel the horizontal track 2 until the panel or section 7 is substantially in alignment with these trackway portions 2.

The opening of this door is effected by elevating cables which are preferably connected to the bottom section of the door in the manner shown in Figures 7 to 9, inclusive. In this structure, the cables may be designated 35 and are each connected to one leg 36 of an L-shaped member whose other leg is a practically complete gear 37. This gear 37 is rotatably mounted by means of a pin or axle 38 upon a bracket 39 which is secured to the front face of the lower panel of the door section.

The gear 37 is designed to mesh with a gear 40 which forms an integral part of a rod 41 whose opposite end carries a roller member 42 which is rotatably slidable in the track 1—2—3. The gear member 40 is rotatably mounted upon a pin 43 which is likewise journaled in the bracket 39.

The door in closed position is illustrated in Figure 9 and, in this figure, it will be seen that the leg 36 of the L-shaped member and the rod 41 are substantially parallel with the track-way 1. As the door is elevated and particularly as it passes from the vertical track-way into the arcuate and horizontal track-ways, the relative position of the two intermeshing gear members is altered. First, these parts assume the position shown in Figure 8 and, eventually, they arrive at the position shown in Figure 7. In this position shown in Figure 7, it will be noted that the lower end of the door is entirely above the top of the doorway and that the member 41 serves as a strut which assists in maintaining the door in the position shown. It will also be noted that throughout the raising operation, the cables 35 do not materially vary from vertical position and that, therefore, there is no material tendency for the door to pull the cables laterally off the flanges of the sheaves 44, over which these cables run.

In the modified form of the connection between the cables and the lower door section and between this section and the track-ways, each cable 35 is connected to an L-shaped member having one leg 45 and another leg 46. This L-shaped member is pivoted to the door at the juncture of these legs as at 47. It will be noted that the leg 46 of the L-shaped member is provided with a hook or curved finger 48 for the purpose which will shortly be made apparent. A substantial distance above the bottom of the lower door section 9, is a bracket 49 disposed on the front face of the section and adapted for the pivotal support of a link or rod 50 whose outer end carries a roller 51 designed to operate in a track-way 1—2—3.

In operation, with the door closed as shown at Figure 12, the continued elevation of this door causes the bottom section thereof to pass through the position shown in Figure 11 and finally to the position shown in Figure 10. In the position shown in Figure 11, it will be noted that the lower section of the door and the leg 46 of the L-shaped member have moved out of interlocking relation with the axle of the roller 51. As this upper

movement progresses, this lower section swings further until it entirely clears the doorway.

As shown in Figure 12, the leg **45** has moved to such a position that the axle **52** of the roller **51** is embraced by the hook **46** of the leg **45** of the L-shaped member. In this position, the shoulder **53** of this L-shaped member abuts this axle **52** and, inasmuch as the axle is restrained against movement away from the door jamb by the roller operating in the track-way, this leg **45** of the L-shaped member braces against the axle **52** and likewise prevents movement of the lower door section away from the door jamb.

From this structure, it will be seen that I have provided a means for raising the door and guiding it from vertical position into horizontal position entirely above the top of the doorway, so that complete clearance results and maximum head room may be obtained. My door is not limited to a strictly sliding action but it combines therewith a swinging of the upper end and also of the lower end of this door so that it may be readily caused to move from an absolutely vertical position to an absolutely horizontal position or vice versa. Further, this is accomplished by an extremely simple mechanism and one which does not impose any abnormal strain upon the various parts utilized for raising, lowering or guiding the door between raised and lowered positions.

The advantages are too many to enumerate. It will be apparent, however, that this structure makes possible the provision of a vertical track portion for substantially the full height of the doorway and a horizontal track portion which is disposed entirely above the doorway. It further makes possible the provision of such a structure as will permit the door to be moved to a position which will leave the doorway entirely clear and give a maximum amount of head room. Likewise, it renders possible the provision of a door with panels or sections of substantial height and a door which, itself, may be of any desired height, since the means for swinging the upper end of the door into and out of final closing position is separable into parts which need only maintain contact during the actual performance of the function for which they are designed.

My door is preferably equipped with a spring means for maintaining it in such balanced condition that it may be readily moved either to open or closed position, merely by exerting sufficient pressure to initially overcome this balanced condition. The form of apparatus which I preferably use to accomplish this comprises a tension spring **54** (see Figure 1) which is connected at one end to a bracket **55** by means of a bolt **56** and which is connected at its opposite end by means of a link **57** carrying a double sheave **58**. Extending over this double sheave **58** is a cable **59** which is connected to a bolt **60** mounted in a bracket **61** and which extends over the double sheave **58**, thence over a sheave **62** where it joins with one of the cables **35** which is connected at its lower end to the lower section **9** of the door. A second cable **63** extends from a bolt similar to bolt **60**, over the double sheave **58**, thence over a sheave **58a** and then over a sheave **64**. It extends downwardly from this sheave **64** and is connected to one of the cables **35**.

From this description it will be seen that I have provided a door structure of novel form and with numerous advantages, some of which have been enumerated and others of which will appear from the claims to be presented.

Having thus described my invention what I claim is:—

1. Door structure comprising a door comprising a plurality of hinged sections, track-ways, means for guiding said door by said track-ways, an inclined plane member upon the upper section of said door, and a member independent of said track-ways for exerting pressure upon said inclined plane member as the door approaches closed position to swing said upper section into firmly abutting relation to the lintel of the doorway.

2. A door structure comprising a track having a vertical portion, a horizontal portion, and an intermediate connecting portion, a door slidable along said track between open and closed positions, an inclined plane device carried by the door for causing a swinging action of a portion of said door, and means independent of said track for cooperating with said inclined plane device.

3. An overhead door structure comprising a door, trackways for guiding said door between open and closed positions, said door being movable along said trackways between a position in closing relation to a doorway and an open position where it clears the doorway, the lower end of said door being connected to said trackways in such a manner as to permit swinging of the lower end away from the trackways as the door nears open position, said connecting means comprising links pivotally connected to said door and having members which cooperate with said trackways, said links being movable into substantially parallel relation with said door when it reaches closed position, and means for locking said links in such parallel relation to the door.

4. In an overhead door structure a door, trackways for guiding said door between open and closed positions, the lower end of said door being connected to said trackways in such a manner as to permit swinging of the lower end away from the trackways as the door nears open position, said connecting means comprising links pivotally connected to said door and having members which cooperate with said trackways, elevating cables for operating said door, means for connecting said cables to the lower end of said door in such a manner that they will always remain in substantially vertical position, said means comprising pivoted links, said last-named pivoted links being provided with gears which mesh with gears on said first-named pivoted links.

5. In an overhead door structure a door, trackways for guiding said door between open and closed positions, the lower end of said door being connected to said trackways in such a manner as to permit swinging of the lower end away from the trackways as the door nears open position, said connecting means comprising links pivotally connected to said door and having members which cooperate with said trackways, elevating cables for operating said door, means for connecting said cables to said door, said means comprising pivoted links, and means for operatively connecting said first-named links to said second-named links, said means being of such a type that as the door nears open position and the lower end swings away from said trackways, the said first-named links will aid in supporting the lower end of the door away from said trackways and said second-named links will adjust themselves to maintain said cables in substantially vertical position.

6. In an overhead door structure, a door comprising a plurality of sections hingedly connected together, trackways for guiding said door between opened and closed positions, said trackways comprising substantially vertical portions along which the door will lie when in closed position, substantially horizontal portions along which the door will lie when in opened position, and intermediate substantially arcuate connecting portions, means on said door adapted to cooperate with said trackways in guiding said door therealong between opened and closed positions, means for controlling movement of the door including cables, sheaves about which said cables pass which are disposed adjacent the upper end of the doorway and have their axes substantially at right angles to the doorway, pivoted links connected to the door adjacent the lower end thereof for connecting the cables to said door in such a manner that they will always be maintained in a substantially vertical position so as to eliminate danger of the cables slipping off the sheaves, and means for permitting the lowermost section of the door to swing away from the trackways as the door nears completely opened positions, said means being of such a type that the lowermost section of the door will occupy a substantially horizontal position above the doorway with the lowermost edge thereof being substantially directly above the vertical portions of the trackways when the door finally reaches completely opened position, said means including links different from the first mentioned links which are pivotally connected to the lowermost section and which have portions which always cooperate with the trackways and said links being of such length and so arranged as to permit movement of the lowermost edge of the door into the position indicated.

7. In an overhead door structure, a door, trackways for guiding said door between opened and closed positions, means for controlling movement of said door, said means including elevating cables, sheaves about which said cables pass which are disposed adjacent the upper end of the doorway and have their axes substantially at right angles to the doorway, pivoted links connected to the door adjacent the lower end thereof for connecting the cables to said door in such a manner that they will always be maintained in a substantially vertical position so as to eliminate danger of the cables slipping off the sheaves.

8. In an overhead door structure, a door, trackways for guiding said door between opened and closed positions, the lower end of said door being connected to said trackways in such a manner as to permit swinging of the lower end away from the trackways as the door nears opened position, said connecting means comprising links pivotally connected to said door and having members which cooperate with said trackways, elevating cables for operating said door, means for connecting said cables to said door, said means comprising links different from the first-named links pivoted to said door adjacent the lower end thereof.

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