

June 16, 1931.

R. S. PEELLE

1,810,496

ELEVATOR DOOR

Filed Dec. 3, 1926

4 Sheets-Sheet 2

Fig. 2.

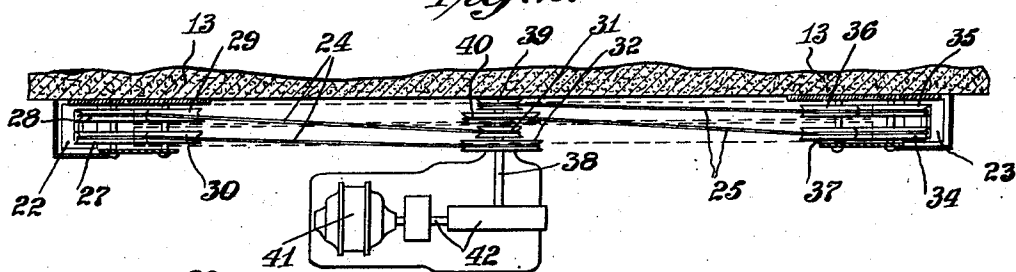


Fig. 3.

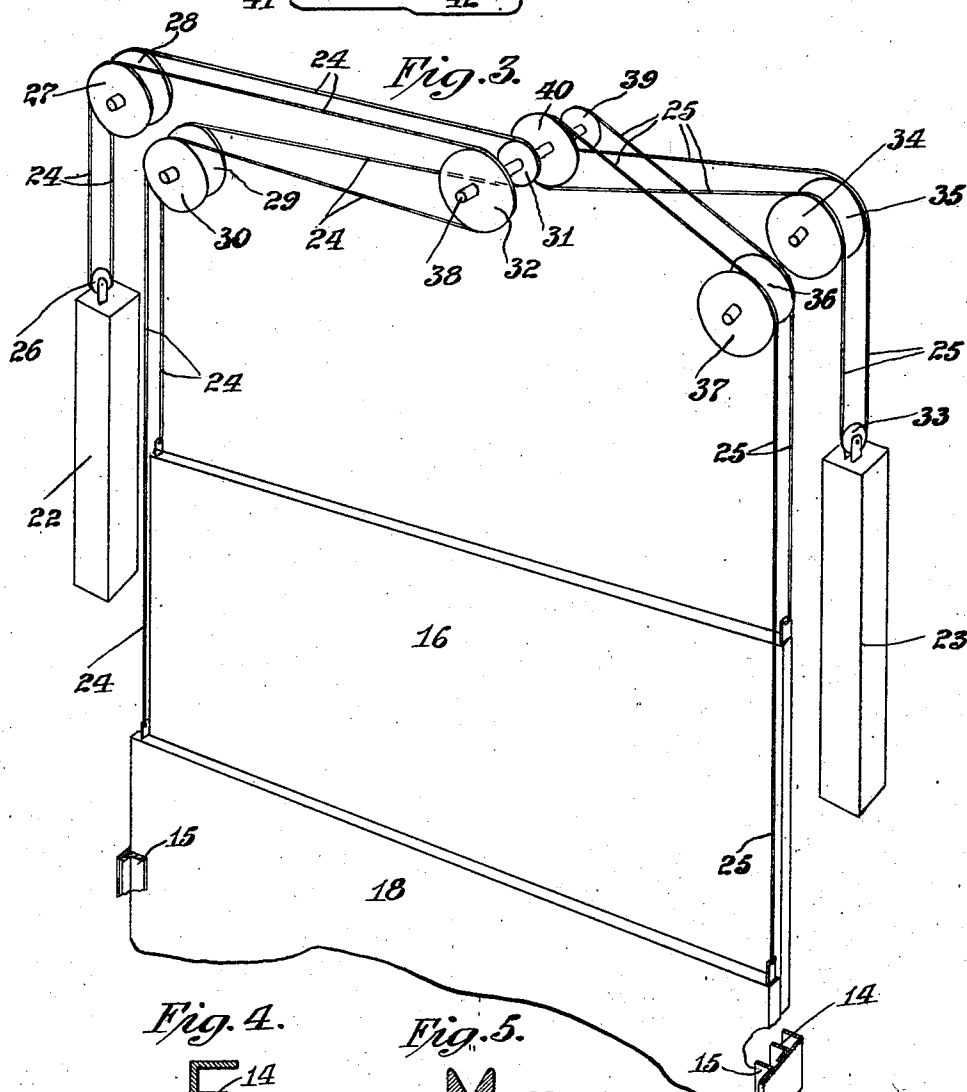


Fig. 4.

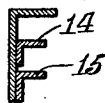
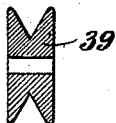


Fig. 5.



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Fig. 6.

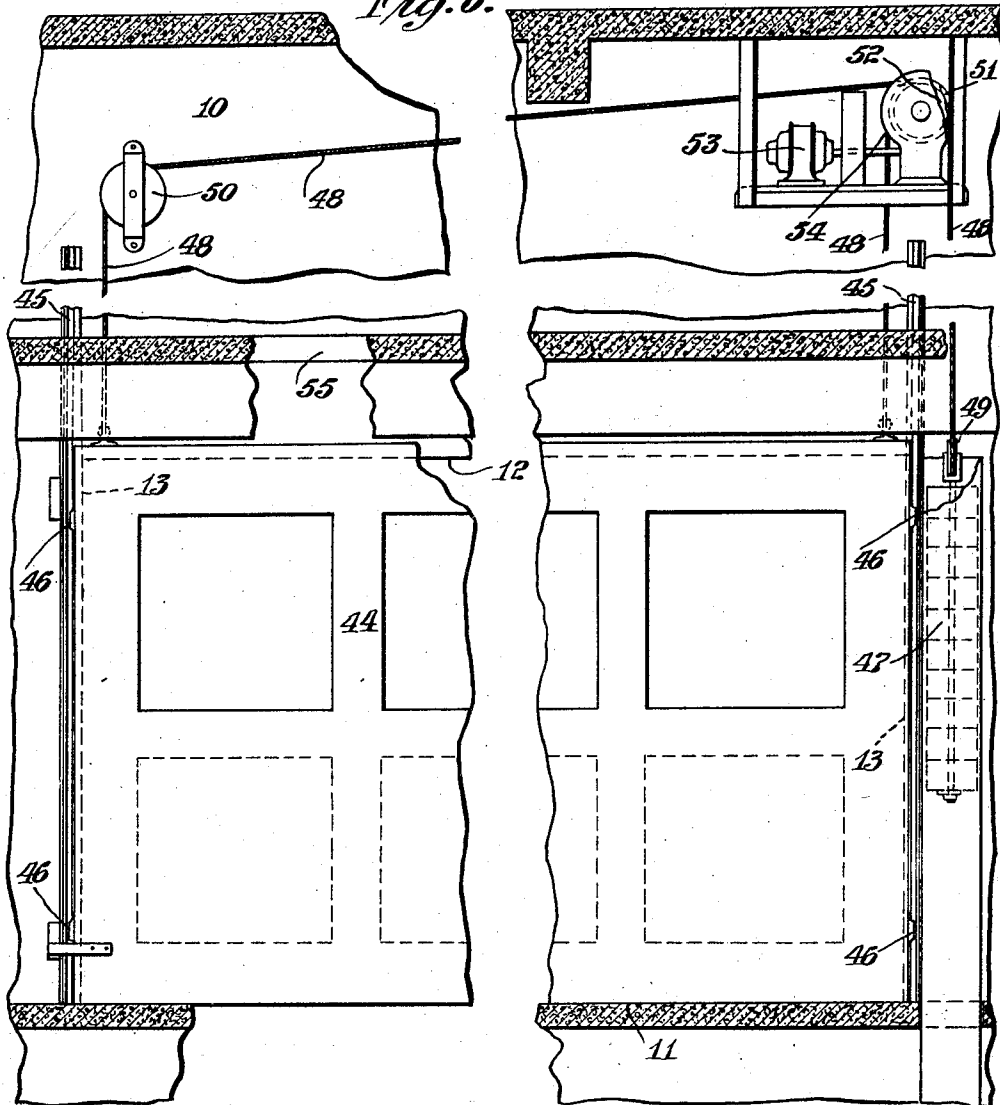
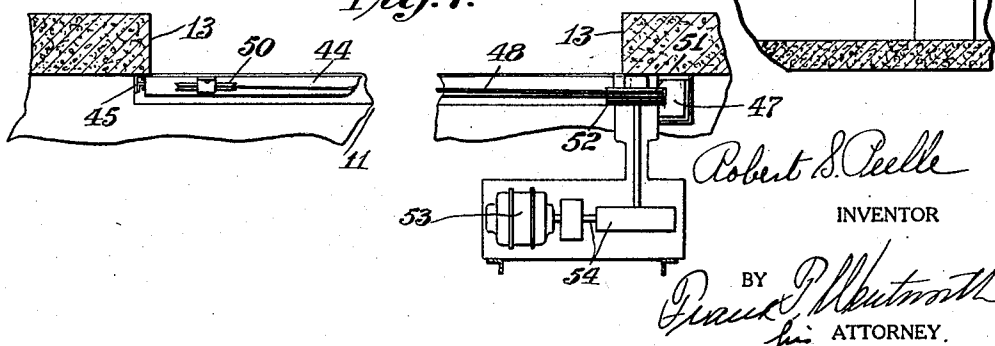


Fig. 7.



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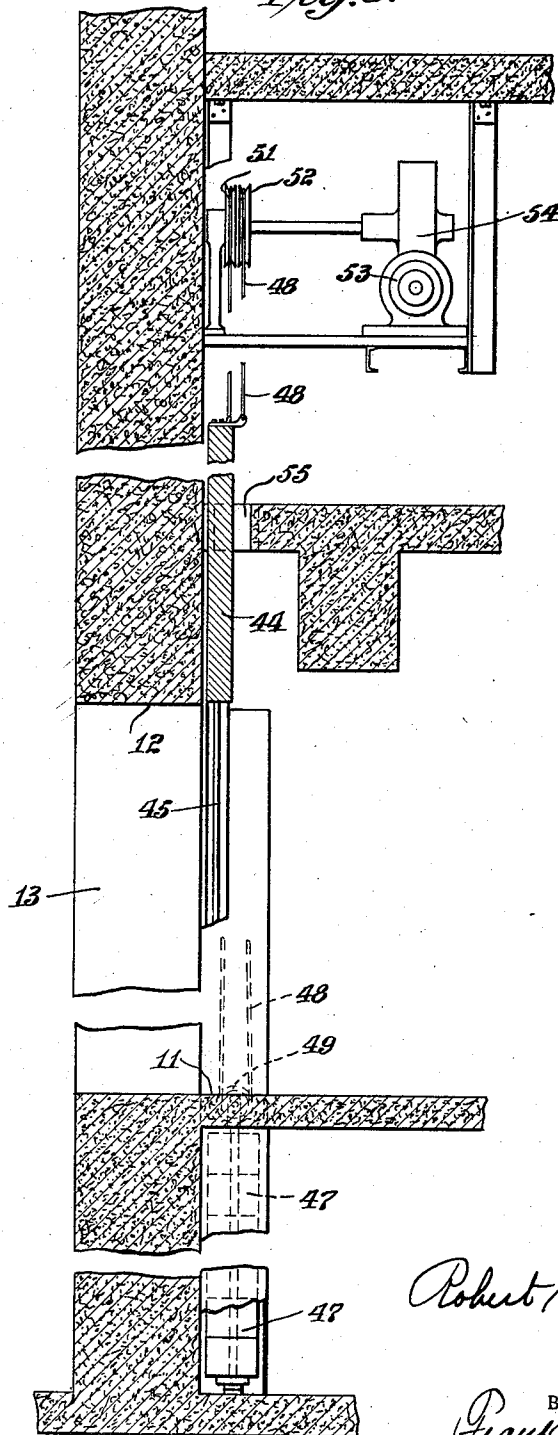
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4 Sheets-Sheet 4

Fig. 8.



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UNITED STATES PATENT OFFICE

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ELEVATOR DOOR

Application filed December 3, 1926. Serial No. 152,362.

The invention relates to elevator doors, and more particularly to full automatic doors composed of one or more sections having movement in one direction for opening the door and movement in the other direction for closing the door.

The invention has particular applicability to doors of the telescoping type which usually have two sections mounted upon opposite guide rail structures each having parallel guides. With the actuation of such doors, which ordinarily have two sections only, the lower door section stops at the sill of a door opening, and in the opening and closing movement travels at twice the speed of the upper section. Such doors are commonly used under conditions where the available space within an elevator shaft will not admit of the installation of counterbalanced doors in the shaft. The guide rail structure of such doors is mounted upon the wall of the elevator shaft upon the floor side.

Under some conditions of use, instead of using two sections, a single panel is used, the dimensions of which are sufficient to completely close the door opening. Such panels have either a downward or an upward sliding movement.

In the accompanying drawings, I have illustrated the embodiment of the invention in connection with both the telescoping type of doors and the single vertically movable panel type of doors.

Doors of the type above referred to are commonly used to close what may be termed "isolated" door openings, such as the ground floor openings of elevator shafts or of buildings. In the upper floors of buildings, counterbalanced or pass type counterbalanced doors are commonly used, since there is usually space for the installation of such doors in a shaft above the ground floor. While I have referred to the use of such doors in elevator shafts, it is obvious that they may be used in other connections, such as loading platform openings, wharves or piers, churches, and in other connections where available space is a factor.

The main object of my present invention is to provide doors of the type above referred

to, which will not only embody therein power operative means for imparting both opening and closing movement to the door, but an automatically acting mechanical limit stop mechanism included in this power actuated mechanism which will automatically stop the application of power to the doors upon the completion of either the opening or the closing movement thereof, irrespective of a continued actuation of the electric motor developing such power. By such a construction, I not only secure ease in the movement of the door, but am enabled to provide a much simplified actuating mechanism which is reliable in its operation and has remarkably low maintenance cost. The mechanism employed may also be installed at a relatively lower cost than mechanisms commonly used in other types of full and semi-automatic doors.

With the use of my invention in doors of the telescoping type, I am enabled to use a single counterweight operative upon both the upper and the lower section of the door but without interfering with the mechanical limit stop movement, and without regard to the necessary differential in the rate of travel of the flexible connections acted upon by the power mechanism and connected with both sections.

The invention consists primarily in an elevator door embodying therein a vertically slidable panel, guides adjacent the opposite sides of a door opening, means upon said panel co-operating with said guides, a counterweight, means limiting the downward movement of said counterweight and said panel, flexible connections between said counterweight and said door, a pinch groove pulley about which said flexible connections pass, a source of power, and operative connections between said source of power and said pulley, whereby the load of the door and said counterweight upon opposite sides of said pulley permits the application of power for either raising or lowering the door, and the relieving of said connections from the load of either said door or said counterweight will prevent a further application of power to the door; and in such other novel features

of construction and combination of parts as are hereinafter set forth and described, and more particularly pointed out in the claims hereto appended.

5 Referring to the drawings,

Fig. 1 is a condensed view of a two-section telescoping elevator door embodying the invention;

Fig. 2 is a plan view thereof;

10 Fig. 3 is a perspective view showing the run of the flexible connections;

Fig. 4 is a detail horizontal section of one guide rail structure;

15 Fig. 5 is a cross-sectional view of the pinch groove pulley;

Fig. 6 is a condensed view of a single panel, upwardly movable door embodying the invention;

Fig. 7 is a plan view thereof; and

20 Fig. 8 is a side view thereof with the door in the opened position.

Like numerals refer to like parts throughout the several views.

In the embodiment of the invention, shown in Figs. 1 to 5 of the drawings, which discloses a telescoping type of door and a type having a much greater range of use than the single panel type, I have shown the wall of the building at 10, the sill of the door opening at 11, the lintel of the door opening at 12, and the side jambs at 13. As stated, this door opening may be in the wall of an elevator shaft or in any other location in a building.

35 Ordinarily upon the floor side of the wall and adjacent each jamb 13 is a guide rail structure consisting of vertically extending parallel guide rails 14 and 15 extending from adjacent the sill 11 to a height sufficient to permit the full opening of the door. There are various arrangements of rails now in use, any one of which may be employed.

Slidably mounted upon the guide rails 14 is an upper door section 16 having shoes 17 co-operating with said rails in a manner to bring this door section close to the wall of the shaft. Co-operating with the guide rails 15 is a lower door section 18 having guide shoes 19 co-operating with said rails.

50 The rail structures substantially close the space upon opposite sides of the door, the upper door section substantially closes the space at the lintel of the door opening, and the lower door section engages the sill 11 which not only acts as means for stopping this section, but substantially closes the opening at this point. Any construction which will arrest downward movement of the upper door section 16 may be employed, it having been the common practice to employ hooks indicated in Fig. 1 of the drawings at 20, which co-operate with fittings 21 above the lintel of the door opening.

Aside from the fact that the invention is particularly applicable to large, heavy doors,

the detailed construction of the two sections of the door and the manner of mounting them is not different from telescoping doors of the ordinary type.

It may be added that the doors illustrated in the drawings are approximately ten feet wide by fourteen feet high, and weigh between twelve and fifteen hundred pounds.

70 The door is provided with counterweighting means such as the hanging counterweights 22 and 23 in housings adjacent each guide rail structure, flexible connections 24 and 25 passing from said counterweights respectively to, and being connected with, the tops of the door section 16 and of the door section 18. In the embodiment of the invention shown, which is desirable by reason of its simplicity, the connections 24 consist of a continuous cable, rope or other flexible means, one end of which is connected with the section 16 and the other end of which is connected with the section 18. At a point intermediate its ends, said connections 24 pass about a pulley 26 of the first class carried by the counterweight 22, and about parallel guide pulleys 27 and 28 for properly positioning said connections in relation to said pulley 26. Said connections also pass about parallel guide pulleys 29 and 30 for properly positioning them with relation to the door sections 16 and 18.

Arranged in the length of the run of the connections 24 is a pinch pulley actuating mechanism, the arrangement of this mechanism being such as to cause the load of the doors to be applied to the connection at one side of the pulley, and the load of the counterweight to be applied to the connection at the other side of the pulley. Where two sections are to be actuated with a differential rate of travel, I employ in this mechanism two pinch groove pulleys 31 and 32, the diameter of one of which as 32 is greater than the diameter of the other pulley 31. In the form of the invention shown in the drawings, the pulley 31 is approximately one-half the diameter of the pulley 32, the construction of the sections 16 and 18 requiring the latter, which is actuated from the pulley 32 to have twice the travel of the former, which is actuated from the pulley 31.

110 The connections 25 operate upon the other side of the sections 16 and 18 in the same manner as heretofore described with relation to the connections 24, the pulley upon the counterweight 23 being indicated at 33, the parallel guide pulleys positioning the connections 25 in relation to said pulley 33 being shown at 34 and 35, and the parallel guide pulleys for guiding the connections between the door sections being shown at 36 and 37.

Mounted upon the same shaft 38 upon which the pinch groove pulleys 31 and 32 are mounted, are a pair of pinch groove pulleys 39 and 40 corresponding in arrangement and

dimensions with the pulleys 31 and 32 and having the function of imparting the same movement to the side of the door with which the connections 25 are connected, as is imparted to the side of the door with which the connections 24 are connected. To secure this result, it is necessary to cross the flexible connections 25 intermediate the guide pulleys and pinch groove pulleys, as clearly shown in Fig. 3 of the drawings.

The pinch groove pulleys 31 and 32 and 39 and 40 are driven from a motor 41 through any desired transmission mechanism 42, this motor 41 being a reversible source of power.

With high doors, it is necessary to provide clearance for the upward movement of both door sections above the lintel 12, which, in the form of the invention illustrated in the drawings, is done by means of a slot or clearance way 43 formed in the floor above the opening closed by the door.

Referring to Figs. 6 to 8 of the drawings, I have here shown an embodiment of the invention employing but a single upwardly slidable panel. In this embodiment of the invention, this single panel is shown at 44, and co-operates with a door opening of the character heretofore described. With this construction, a single guide rail 45 is used upon the wall of the shaft adjacent each jamb 13, the shoes 46 upon opposite edges of the door section co-operating with this guide. A single counter-weight 47 is slidably mounted in a housing at one side of the door opening.

Extending between this counterweight and the opposite sides of the door panel are flexible connections 48, these connections having opposite ends connected with the top of the door panel and passing at a point intermediate the ends about a pulley 49 of the first class carried by the counterweight 47. Said connections 48, which may be a metal cable, a rope, or other flexible material, is guided in relation to one side of the door opening by a

guide pulley 50 and passes from this guide pulley 50 to the other side of the door and about one of two parallel pinch groove pulleys 51 to the pulley 49 and back over the other pulley 52, which last named pulley thus acts in addition to its power transmission function, as a guide for the flexible connections. These pulleys 51 and 52 also serve as a guide for the reaches of the connections 48 passing to and from the equalizing pulley 49.

The pulleys 51 and 52 have power applied thereto from a motor 53 through any desired power transmission mechanism, 54.

The door, shown in Figs. 6 to 8, is approximately eighteen feet wide, and nine feet high, and weighs from 1500 pounds to a ton. Since the door must have a run of approximately nine feet to clear the door opening, a slot indicated at 55 is provided in the floor above this door to permit the necessary

movement, and the guide pulleys, and the

actuating mechanism are positioned in the floor above that in which the door opening is, and the guides 45 extend through the slot. This arrangement is also true of the construction shown in Figs. 1 to 5. Where there is sufficient head room for the full movement of the door without having it pass through the floor above, this arrangement is not required, although under conditions requiring these large heavy doors, it is usually necessary to employ an arrangement such as is immediately above described.

With both types of doors shown and described, and in other types of doors embodying the invention, it is necessary to determine the length of the flexible connections 24 and 25 and 48 with regard to the necessary run of the door and of the counterweight or counterweights, and to provide the necessary clearance for the full range of movement of these parts required in the operation of the door.

While in connection with the structures shown in Figs. 1 to 5 I have described the pulleys 26 and 33 as being of the first class, this is strictly true only so far as the portion of the connections connected with the upper door section 16 is concerned, since so far as the portion of the connections secured to the section 18 is concerned, these pulleys are of the second class.

The movement of the counterweights in this form of the invention will equal three-fourths of the height of the door. By reason of the differential travel of the two door sections, and the equalizing effect secured by said pulleys 26 and 33 with the movements of the door upwardly, the counterweights will move downwardly a distance equalling the full upward movement of the upper door section, which is the slow moving section, and one-fourth the movement of the lower section, which is the more rapidly moving section.

Consequently, in this form of the invention, the counterweights will have a run of seven and one-half feet, with a ten foot opening movement of the door, and clearance for this amount of movement only, is required below the bottom of the counterweights.

In the form of the invention shown in Figs. 6 to 8, where there is no differential in the speed of movement of different parts of the connections, the pulley 49 serves merely as an equalizing pulley to ensure the application of the load of the counterweight to both sides of the door and upon both pinch groove pulleys 51 and 52. Hence the run of the counterweight will be substantially equal to that of the run of the door, and with a nine foot door, clearance must be provided below the bottom of the counterweight of nine feet, even though a pocket must be formed below the sill 11 of the door opening.

In both forms of the invention, the sill of

the door opening serves to stop downward movement of the door, the supplemental means 20—21 referred to in connection with the door section 16 being used to stop downward movement of the upper section. The bottom of the housing for the counterweights, in both forms of the invention, serves to stop a downward movement of the counterweights.

It is obvious, however, that other means may be provided for stopping the downward movement of the door and of the counterweight, if the conditions of installation require. It is essential, however, that some positive stop be provided for both the door and the counterweight, so that upon the completion of both the closing and the opening movements, the connections between the door and the counterweight will be relieved of the load either of the door or of the counterweight in order to automatically and instantly stop the transmission of power through the pinch groove pulleys.

The operation of doors embodying the invention is as follows:—

Referring more particularly to Figs. 1 to 5 of the drawings, when it is desired to open the door, power is applied to the motor 41 to turn the pinch groove pulleys 31—32—39—40 with a contra-clockwise movement. Since when the doors are closed the full load of the counterweight is upon the connections 24 and 25 upon one side of said pulleys, and the connections upon the other side are relieved from the load of the door, this turning movement of the pulleys will meet with resistance from the door sufficient to develop frictional resistance between said connections and the pulleys to cause the paying out of the connections toward the counterweight and the taking up of the connections with a lifting action, on toward the doors. By using pulleys of different diameters arranged as described, not only will this action occur simultaneously as to opposite sides of the door, but the resulting movement of the door sections will have that differential in the speed of the two sections necessary to have both sections simultaneously reach substantially the same position with relation to the lintel 12 at the completion of the opening movement.

As heretofore described, the use of compensating or equalizing pulleys upon the counterweight about which the flexible connections at each side of the door pass, ensures not only a continuing application of the load of the counterweight to both door sections, but a movement of the counterweight which will be the average of the quantity of movement of both door sections.

With the conclusion of the full opening movement of the door, the counterweight comes to rest upon the bottom of the housing therefor, or other stop device, thus relieving the connections between same and the door

sections from the load of this counterweight and instantly making the pinch groove pulleys inoperative to impart further lifting movement to the door. The load of the doors, however, will still be applied to the portion of the connections between same and the pinch groove pulleys so that with the reversal of the direction of the application of power to these pulleys, or with a clockwise movement thereof, the operation above described will be reversed, the doors being lowered and the counterweight being raised. Upon the completion of the closing movement, the lower door section will be stopped by the sill, and the upper door section will be stopped by the hooks and lintel fittings, so that the connections upon the door side of the pinch groove pulleys will be relieved from the load of the door and make said pulleys inoperative to apply further power to the counterweight.

While with the completion of the opening movement of the door, the connections upon one side of the pinch groove pulleys will be relieved from the load of the counterweight, and with the completion of the closing movement of the door, the connections upon the other side of said pulleys will be relieved from the load of the door, and thus limit the operative effect of said pulleys to that required to either open or close the door, it is apparent that at all times, the door and the counterweight will have a balancing action as to each other, and, when the pinch groove pulleys are at rest, the connections will be frictionally engaged therewith, so that with the starting of the rotation of said pulleys in either direction, according to the position of the door, they will immediately be operative to cause movement of the door. It is also obvious that the door may be stopped in any position by merely interrupting the power to the motor actuating said pulleys.

Referring to the embodiment of the invention shown in Figs. 6 to 8, the weight of the door upon one side of the pinch groove pulleys 51 and 52 and of the counterweight 47 upon the other side of said pulleys, will develop that frictional resistance between the connections 48 and said pulleys, necessary to overcome the balanced condition between the counterweight and the door, and cause the movement of the door in either direction. Since the connections upon opposite sides of the door will be taken up or paid out at the same rate, it is obvious that the movement of the counterweight 47 will be the same as that of the single panel, the equalizing device 49 upon the counterweight 47 merely ensuring the same pressure conditions between the connections and each pulley 51—52.

With the engagement of the counterweight 47 with the bottom of the housing for same, or with other means arresting downward movement of said counterweight, or

with the engagement of the panel 44 with the sill of the door, the load at one side or the other of said pinch groove pulleys will be relieved to immediately interrupt the operation of these pulleys so far as causing movement of the door is concerned. As with the telescoping type of door, there is always a counterweighting action between the panel and the counterweight which, when the pulleys 51 and 52 are idle, will maintain that friction condition between same and the connections 48, necessary to ensure the turning of the pulleys resulting in movement of the door.

The action of a single panel door is similar to that of the lower door section in the form of the invention shown in Figs. 1 to 5.

In both forms of the invention shown, not only will there be great ease of movement when starting the door in either direction, but also with the continued run of the doors, the operation of the door requires very little power because of the counterbalancing action of the door and the counterweight.

The mechanism for actuating the pinch groove pulleys is of a well known standard construction embodying a stop mechanism therein which is made inoperative with the application of power to the pulleys. This mechanism need not be employed, however, since with an approximate balancing of the door and the counterweight, there is no tendency of the loss of control of the door.

In the accompanying drawings, I have shown how a door having a single or a plurality of panels movable upon vertically extending guides, may be constructed to secure the desired mode of operation. While the run of the flexible connections as shown in each instance has been found highly desirable in use, it is obvious that there may be changes in the details of construction and arrangement of parts, if required by the particular conditions in a building in which the doors are to be installed.

It is therefore not my intention to limit myself to the particular construction and arrangement of parts shown, since variation therefrom may be made without departing from the spirit and scope of the invention.

Having described the invention, what I claim as new and desire to have protected by Letters Patent, is:—

1. An elevator door embodying therein a vertically slidable panel, guides adjacent the opposite sides of a door opening, means upon said panel co-operating with said guides, a counterweight, means limiting the downward movement of said counterweight and said panel, flexible connections between said counterweight and said door, a pinch groove pulley about which said flexible connections pass, a source of power, and operative connections between said source of power and said pulley, whereby the load of the door and

said counterweight upon opposite sides of said pulley permits the application of power for either raising or lowering the door, and the relieving of said connections from the load of either said door or said counterweight will prevent a further application of power to the door.

2. An elevator door embodying therein a plurality of panels vertically slidable in the same direction and in parallel planes, guides adjacent the opposite sides of the door opening, means upon said panels co-operating with said guides respectively, counterweighting means, means limiting the downward movement of said counterweighting means and said panels respectively, flexible connections between said counterweighting means and each of said panels, pinch groove pulleys operative upon different portions of said connections, said pulleys being of different diameters to impart simultaneous movement with a differential in speed, to said panels, guides for said connections between said pulleys and said panels respectively, and between said pulleys and said counterweighting means, a source of power, and operative connections between said source of power and said pulleys, whereby the load of the door and said counterweighting means upon opposite sides of said pulleys permits the application of power for either raising or lowering the door, and the relieving of said connections from the load of either said door or said counterweighting means will prevent a further application of power to the door.

3. An elevator door embodying therein a plurality of panels vertically slidable in the same direction and in parallel planes, guides adjacent the opposite sides of the door opening, means upon said panels co-operating with said guides respectively, counterweighting means, means limiting the downward movement of said counterweighting means and said panels respectively, flexible connections, an equalizing device carried by said counterweighting means about which said connections pass, the opposite ends of said flexible connections being connected with said panels respectively, pinch groove pulleys operative upon different portions of said connections, said pulleys being of different diameters to impart simultaneous movement with a differential in speed, to said panels, guides for said connections between said pulleys and said panels respectively, and between said pulleys and said counterweighting means, a source of power, and operative connections between said source of power and said pulleys, whereby the load of the door and said counterweighting means upon opposite sides of said pulleys permits the application of power for either raising or lowering the door, and the

relieving of said connections from the load of either said door or said counterweighting means will prevent a further application of power to the door.

5 4. An elevator door embodying therein a plurality of panels, vertically slidable in the same direction and in parallel planes, guides
10 adjacent the opposite sides of a door opening, means upon said panels co-operating with said guides respectively, a plurality of counterweights, means limiting the downward movement of each of said counterweights and each of said panels, flexible connections between one of said counterweights
15 and one of said panels, and between the other of said counterweights and the other of said panels, two pinch groove pulleys operative upon each of said connections, the diameter of one of the pulleys operative upon each connection being greater than that of the other
20 to impart simultaneous movement with a differential in speed to said panels, guides for each of said connections between said pulleys and said panels respectively, and between
25 said pulleys and said counterweights, a source of power, and operative connections between said source of power and said pulleys, whereby the load of the door and said counterweights upon opposite sides of said pulleys
30 permits the application of power for either raising or lowering the door, and the relieving of said connections from the load of either said door or said counterweights will prevent a further application of power to the
35 door.

5. An elevator door embodying therein a plurality of panels, vertically slidable in the same direction and in parallel planes, guides
40 adjacent the opposite sides of a door opening, means upon said panels co-operating with said guides respectively, a plurality of counterweights, means limiting the downward movement of each of said counterweights and each of said panels, flexible connections,
45 equalizing devices upon said counterweights respectively about which said connections respectively pass, the opposite ends of each of said connections being secured to said panels respectively, two pinch groove pulleys operative upon each of said connections, the diameter of one of the pulleys operative upon each connection being
50 greater than that of the other to impart simultaneous movement with a differential in speed to said panels, guides for each of said connections between said pulleys and said panels respectively, and between said pulleys and said counterweights, a source of power,
55 and operative connections between said source of power and said pulleys, whereby the load of the door and said counterweights upon opposite sides of said pulleys permits the application of power for either raising or lowering the door, and the relieving of said
60 connections from the load of either said door

or said counterweights will prevent a further application of power to the door.

6. An elevator door embodying therein a plurality of panels, vertically slidable in the same direction and in parallel planes, guides
70 adjacent the opposite sides of a door opening, means upon said panels co-operating with said guides respectively, a plurality of counterweights, means limiting the downward movement of each of said counterweights and each of said panels, flexible connections between one of said counterweights and one of said panels, and between the other of said counterweights and the other of said panels,
75 two pinch groove pulleys operative upon each of said connections and arranged intermediate the sides of the door, the diameter of one of the pulleys operative upon each connection being greater than that of the other to impart simultaneous movement with a differential in speed to said panels, guides for each of said connections between said pulleys and said panels respectively, and between said pulleys and said counterweights,
80 the flexible connections at one side of the door between said pinch groove pulleys and said guides being crossed to ensure similar movement of both sides of the door, a source of power, and operative connections between
85 said source of power and said pulleys, whereby the load of the door and said counterweights upon opposite sides of said pulleys permits the application of power for either raising or lowering the door, and the relieving of said connections from the load of either
90 said door or said counterweights will prevent a further application of power to the door.

7. An elevator door embodying therein a plurality of panels, vertically slidable in the same direction and in parallel planes, guides
105 adjacent the opposite sides of a door opening, means upon said panels co-operating with said guides respectively, a plurality of counterweights, means limiting the downward movement of each of said counterweights and each of said panels, flexible connections, equalizing devices upon said counterweights respectively about which said connections respectively pass, the opposite ends of each of said connections being secured to
110 said panels respectively, two pinch groove pulleys operative upon each of said connections and arranged intermediate the sides of the door, the diameter of one of the pulleys operative upon each connection being greater than that of the other to impart simultaneous movement with a differential in speed to said panels, guides for each of said connections between said pulleys and said panels respectively, and between said pulleys and said
115 counterweights, the flexible connections at one side of the door between said pinch groove pulleys and said guides being crossed to ensure similar movement of both sides of the door, a source of power, and operative con-
120
125
130

nections between said source of power and said pulleys, whereby the load of the door and said counterweights upon opposite sides of said pulleys permits the application of power for either raising or lowering the door, and the relieving of said connections from the load of either said door or said counterweights will prevent a further application of power to the door.

8. An elevator door embodying therein a plurality of panels, vertically slidable in the same direction and in parallel planes, guides adjacent the opposite sides of a door opening, means upon said panels co-operating with said guides respectively, a plurality of counterweights, means limiting the downward movement of each of said counterweights and each of said panels, flexible connections, equalizing devices upon said counterweights respectively about which said connections respectively pass, the opposite ends of each of said connections being secured to said panels respectively, two pinch groove pulleys operative upon each of said connections and arranged intermediate the sides of the door, the diameter of one of the pulleys operative upon each connection being greater than that of the other to impart simultaneous movement with a differential in speed to said panels, guiding means for said connections respectively, each comprising parallel guide pulleys between the pinch groove pulleys operative upon the connections and a counterweight, and parallel guide pulleys over which each of said connections pass from the pinch groove pulleys operative thereon to said door sections respectively, the flexible connections at one side of the door between said pinch groove pulleys and said guides being crossed to ensure similar movement of both sides of the door, a source of power, and operative connections between said source of power and said pulleys, whereby the load of the door and said counterweights upon opposite sides of said pulleys permits the application of power for either raising or lowering the door, and the relieving of said connections from the load of either said door or said counterweights will prevent a further application of power to the door.

In witness whereof I have hereunto affixed my signature this 20th day of November, 1926.

ROBERT S. PEELLE.