

A. T. PRESCOTT.
COUNTERBALANCING MECHANISM.
APPLICATION FILED OCT. 8, 1909.

980,126.

Patented Dec. 27, 1910.

4 SHEETS—SHEET 1.

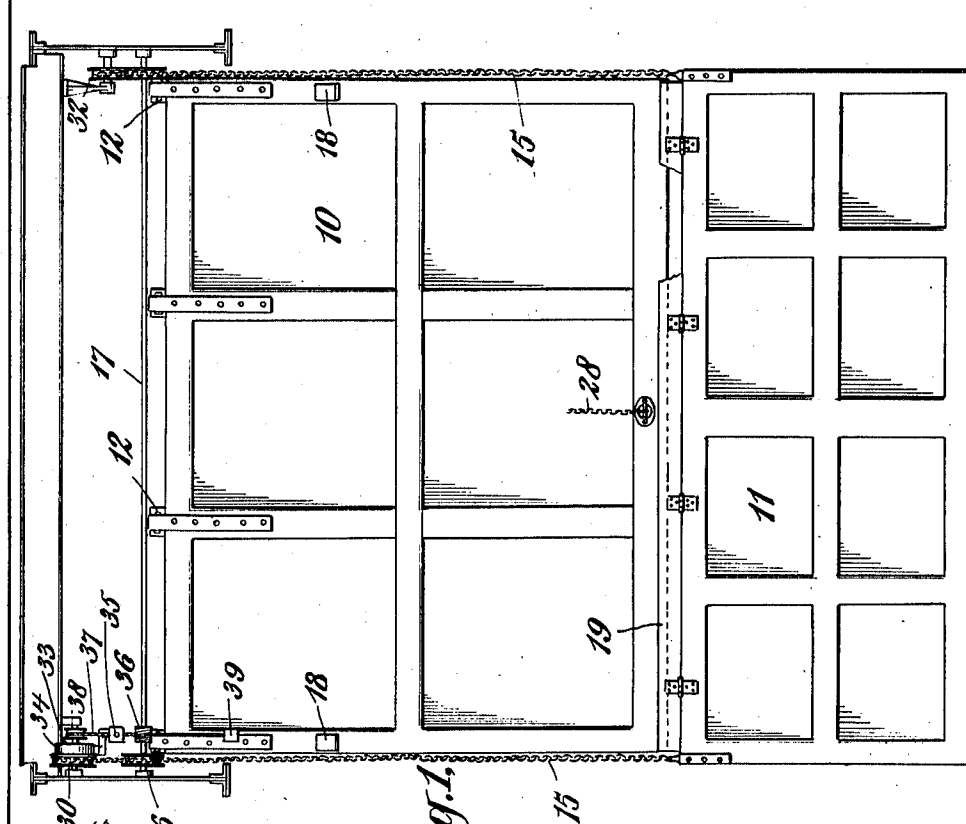
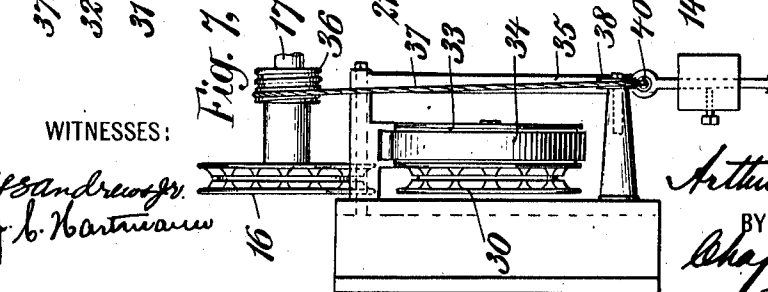
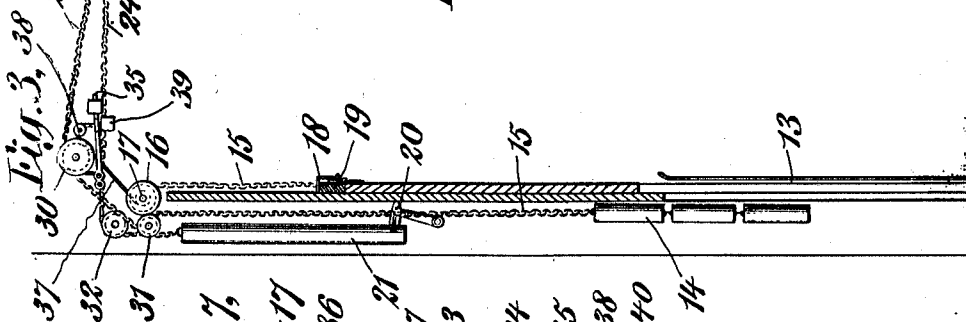


Fig. 1.



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4 SHEETS-SHEET 2.

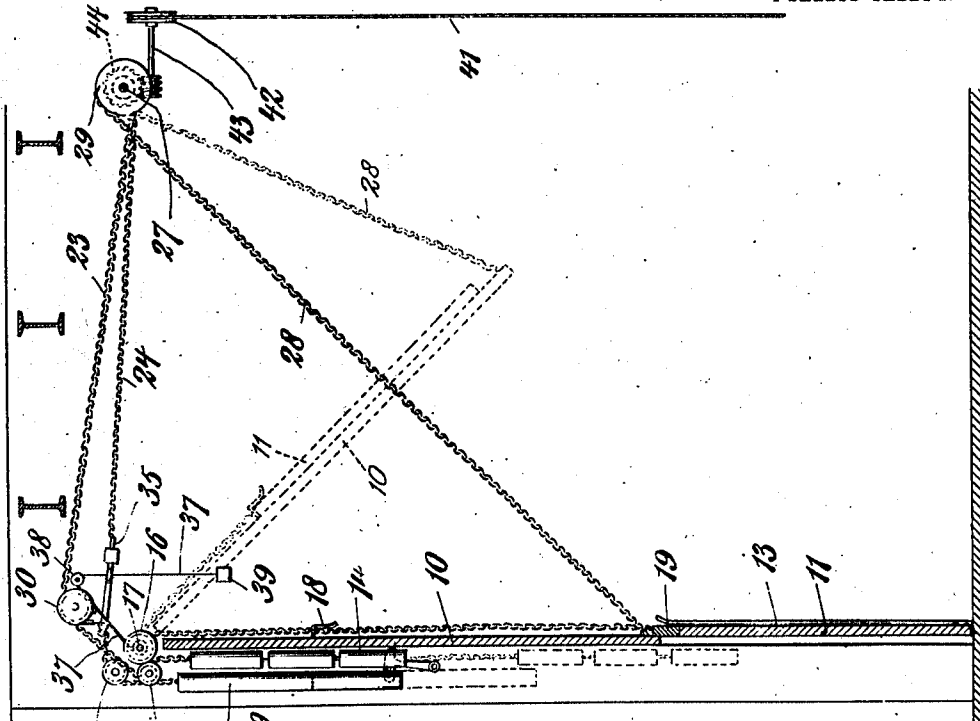


Fig. 2.

Fig. 5,

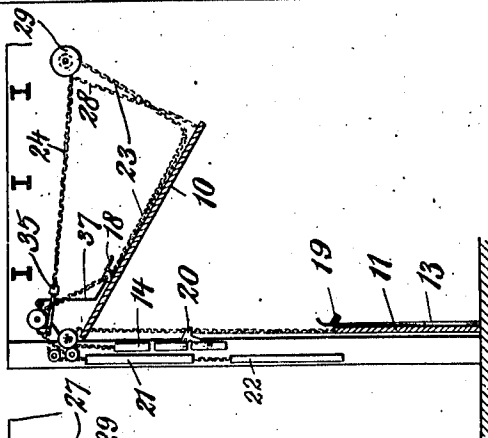
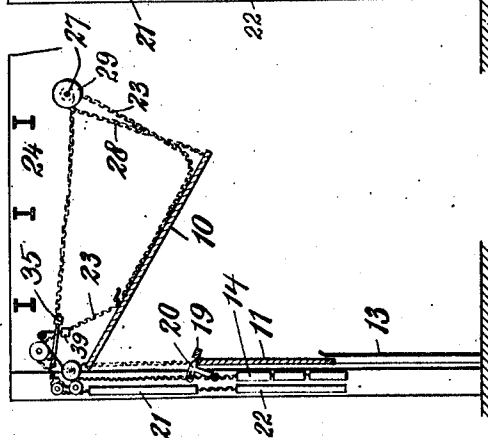


Fig. 4.



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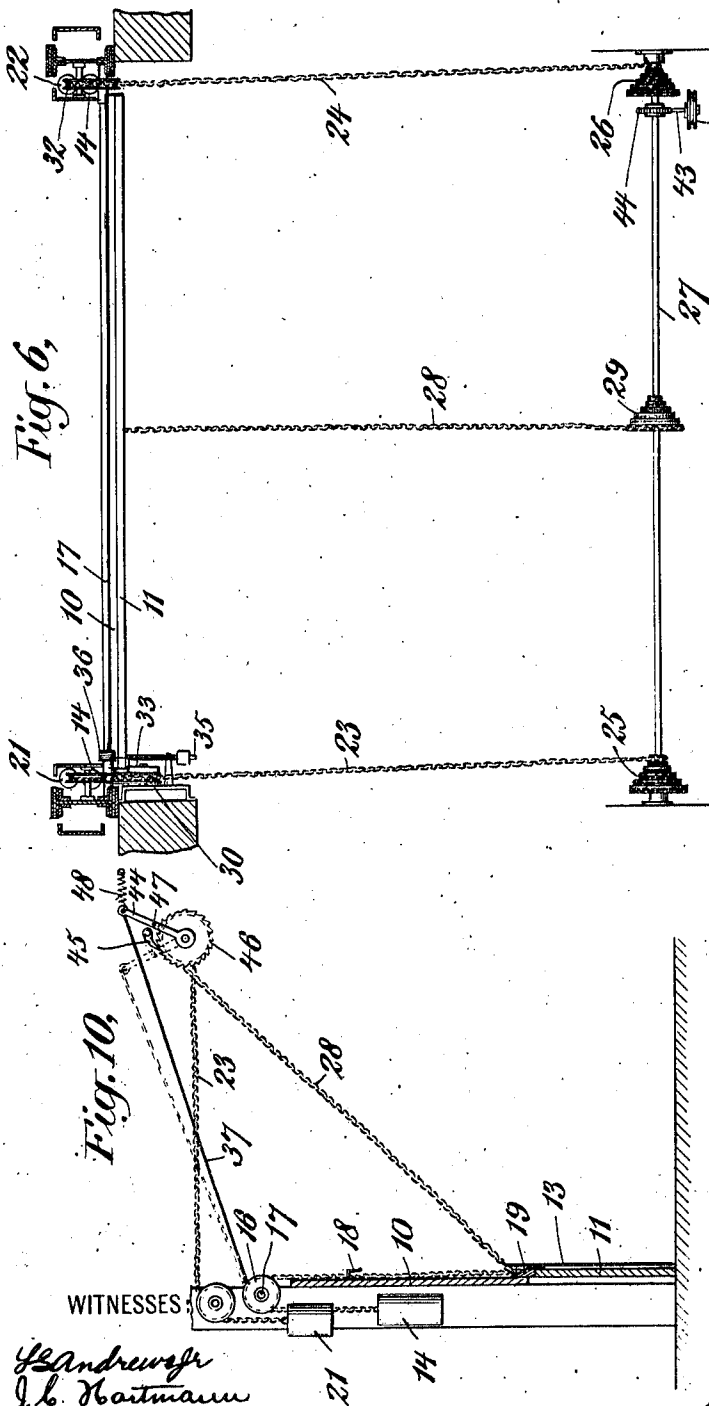
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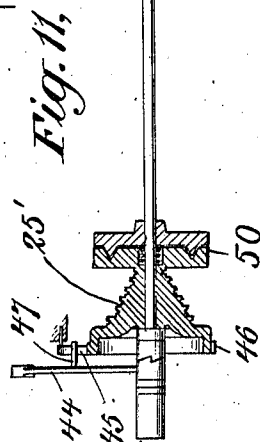
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4 SHEETS—SHEET 3.

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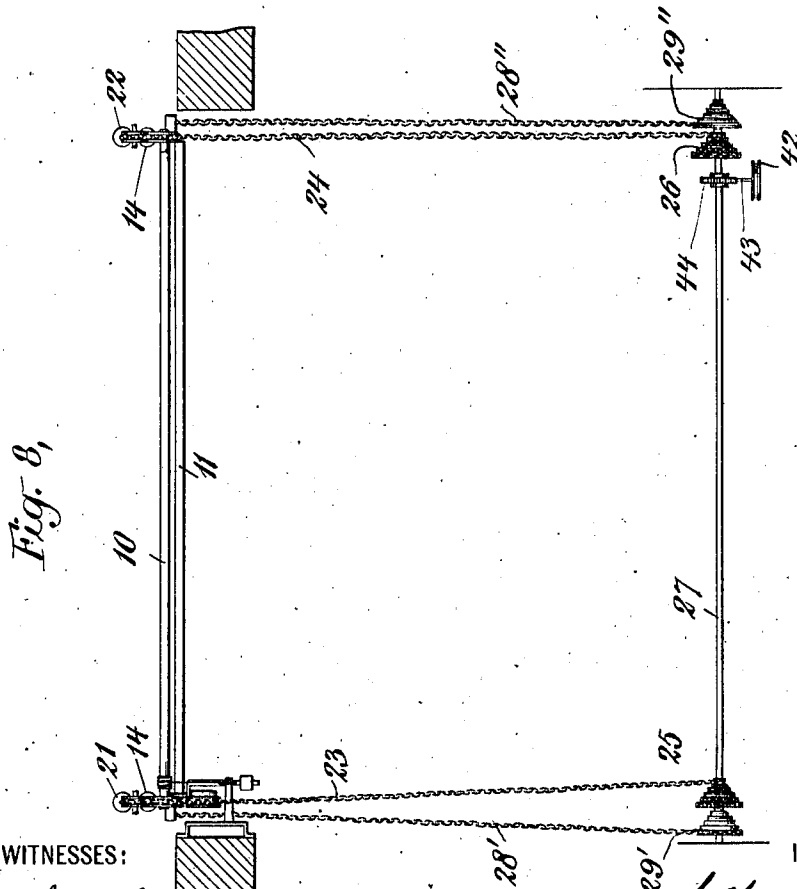
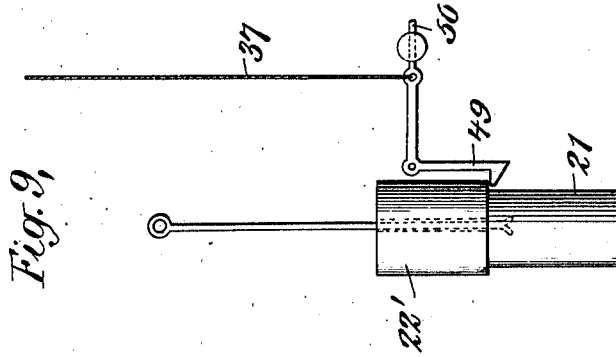
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4 SHEETS—SHEET 4.



WITNESSES:

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UNITED STATES PATENT OFFICE.

ARTHUR T. PRESCOTT, OF EAST ORANGE, NEW JERSEY, ASSIGNOR TO GEORGE H. FROTHINGHAM CO., A CORPORATION OF NEW YORK.

COUNTERBALANCING MECHANISM.

980,126.

Specification of Letters Patent. Patented Dec. 27, 1910.

Application filed October 8, 1909. Serial No. 521,785.

To all whom it may concern:

Be it known that I, ARTHUR T. PRESCOTT, a citizen of the United States of America, and a resident of East Orange, county of Essex, and State of New Jersey, have invented certain new and useful Improvements in Counterbalancing Mechanism, of which the following is a specification, reference being had to the accompanying drawings, forming a part thereof.

My invention relates to counterbalancing mechanism, and particularly to means for counterbalancing a vertically swinging mass of varying weight, proportionately to such weight. Vertically swinging doors, coal chutes, hatchway covers, and the like, are frequently made in a plurality of sections, one of which may be caused to swing vertically by itself, or a plurality of which may be caused to swing vertically together, and the main object of my present invention is to automatically provide for the proper counterbalancing of the vertically swinging mass whether the mass shall comprise but a single section or a plurality thereof.

For the purposes of simplicity and clearness of description, but without intending to thereby place any limitation or restriction upon my invention, I have described the same as applied to a two-section warehouse or freight shed door in which either one or both sections may be swung vertically at will, one of the said sections being also adapted to be moved vertically in right lines, and I have shown counterbalancing mechanism comprising a group of weights, part of which is arranged to counterbalance the single section when it is arranged to be swung alone, and the other part of which is arranged to be brought into play to counterbalance the movement of the door when both sections are caused to be swung together.

My invention also consists in certain novel details of construction and combinations of parts including a self locking operating means for the main door section, the locking feature also acting upon the counterbalancing means so as to support the same even though the means normally connecting it with the door be totally disengaged therefrom, and an automatic stop for limiting the movement of the vertically movable section when it is raised independently

of the other section after the said other section has been swung out of the way.

In order that my invention may be thoroughly understood, I will now proceed to describe an embodiment thereof in detail, having reference to the accompanying drawings illustrating the same, and will then point out the novel features in claims.

In the drawings: Figure 1 is a view in front elevation of a two-section warehouse door with counterbalancing and operating mechanism connected therewith, constructed in accordance with my invention. Fig. 2 is a view in side elevation thereof, the door sections being shown in vertical transverse section. Fig. 3 is a similar view except that the lower section of the door is shown as in its raised position against the upper section, the upper section being closed as in Figs. 1 and 2; parts of the operating mechanism having been removed in order to save space. Figs. 4 and 5 are similar to Fig. 2, but upon a smaller scale, showing the various parts in different positions. Fig. 6 is a top view showing particularly the operating and counterbalancing mechanism. Fig. 7 is a detail top view upon an enlarged scale of certain parts of the operating and counterbalancing mechanism at one end of the door. Fig. 8 is a detail view showing a slightly modified form of the means connecting the upper door section with its operating mechanism. Fig. 9 is a detail fragmentary view of a modified form of the means for controlling the counterbalancing weights. Fig. 10 is a vertical transverse sectional view showing a further modification of the means for controlling the counterbalancing weights. Fig. 11 is a detail view in part front elevation and part longitudinal section of certain parts of the operating mechanism of the construction shown in Fig. 10.

The two-section class of door is used largely for warehouses and freight sheds, particularly those located on docks, and the arrangement is convenient because it allows for a variety of openings. The upper door section 10 is pivoted to swing vertically about horizontally disposed pivots 12 while the lower door section 11 is arranged to slide vertically in guideways 13. The guideways are so disposed that the lower door section will slide radially with respect to the upper door section 10 over the front

face thereof when the said upper section is closed (see Figs. 2 and 3), but it is also permitted to slide vertically behind the upper door section when the said upper door section is open as appears in Figs. 4 and 5. In this way the lower door section may be raised vertically while the upper door section is closed so as to leave an opening large enough for hand trucks to pass in and out, or the lower door section may be raised while the upper door section is closed and then the upper and lower door sections may be swung inward and upward together, so as to leave a much larger opening whereby larger trucks may pass therethrough or freight may be swung in and out there-through on a rope. Again, in some instances, is it desirable to have an opening for ventilation or light, in which case the lower door section may remain closed and the upper door section only be swung inward and upward, as appears in Fig. 5, or the upper and lower portion of the doorway may be opened while the middle part is closed, by first swinging open the upper door section and then raising the lower door section to the position shown in Fig. 4.

The counterbalancing mechanism I provide is designed to properly and proportionately balance the movements of the door sections under all of the foregoing conditions.

The door section 11 is provided with counter-balancing weights 14 connected thereto by chains or other flexible connections 15 which pass over pulleys 16 upon a longitudinal shaft 17. Both of the pulleys are preferably secured fast upon the said shaft whereby the uniform rotation of the pulleys compels a uniform lifting stress upon the door section and consequently insures a parallel movement thereof. Stops 18 are provided upon the upper door section 10 to limit the vertical movement of the lower door section when the same is thus lifted against the front face of the said upper door section. The counterbalancing weights 14 may conveniently be of a weight substantially equal to that of the lower door section, whereby the said lower door section may be lifted and lowered with a minimum of effort. The lower door section, as a whole, is of such height as to just overlap the lower edge of the upper door section when both sections are closed, as in Figs. 1 and 2, but the lower door section 11 is preferably provided with a hinged flap 19 at its upper end which may be swung down when the lower door section is in its lowermost position and it is desired to swing open the upper door section. In Fig. 5 the parts are shown with the lower door section in its lowermost position, the hinged flap down, and the upper door section swung upward. When the upper door section is thus swung

upward the lower door section may still be moved vertically, and to limit the upper movement thereof under such conditions I have provided a pivoted stop 20, such as will engage the upper edge of the lower door section when at the desired limit of its movement under these conditions; the parts are so shown in Fig. 4. This stop is preferably pivoted so as to permit of its being pushed out of the way by the upper door section when the same is closed (see Figs. 2 and 3).

From the foregoing it will be seen that the lower door section may be vertically raised and lowered when the upper door section is either open or closed,—in the latter case the lower door section will be raised over the face of the upper door section and will be limited in its movement by the stops 18, while in the former case it will be raised behind the upper door section and will be limited by the pivoted stop or stops 20. In either case the counterbalancing weights 14 will operate to balance the movements thereof.

The upper door section which is swung vertically about the pivots 12, as has been mentioned above, may be so swung after the lower door section has been raised over the face thereof as is shown in Fig. 3, or while the lower door section is in its lowermost position, as is shown in Fig. 5. The weight to be lifted will be very much greater in the former event than in the latter, because, of course, of the additional weight of the lower door section. In order to counterbalance the movement of the upper door section under either of these conditions I have provided two counterbalancing weights 21—22 therefor, one only adapted to be operatively employed when the upper door section is lifted alone, and the other to be employed in addition when the weight of the lower door section is added thereto. The weights 21 and 22 are connected with the upper door section by means of chains or other flexible connecting means 23 and 24 which are connected respectively at one end with the said weights, and at the other end with cone elements 25—26 mounted fast upon a shaft 27, and by a chain 28 which is removably secured at one end to the said upper door section at the lower end thereof, and at its other end is secured to and around a cone element 29 also mounted upon the said shaft 27. The chain 23 passes over two direction pulleys 30—31 while the chain 24 may conveniently pass over a single direction pulley 32. The direction pulley 30 may be conveniently in the form of a sprocket wheel so arranged as to have a positive engagement with the chain 23, whereby the chain will only be permitted to move over the pulley as the pulley revolves.

Secured to the pulley 30 is a brake wheel 13.

33, the periphery of which is adapted to be engaged by a brake band 34. The brake band 34 is operated by a weighted lever 35 the weight of which normally tends to operate the brake so as to hold the pulley 30 against rotation, the effect being hence to normally support the weight 21 and to prevent any counterbalancing action thereof upon the upper door section 10. The parts are arranged to be in such position when the lower door section is in its lowermost position, as is shown in Figs. 1, 2, and 5, the weight 22 being sufficient at such times to counterbalance the weight of the upper door section 10 alone. When, however, the lower door section 11 is raised upon the face of the door of the upper door section 10 (as is shown in Fig. 3), the brake mechanism is arranged to be released so as to free the pulley 30 and permit the second weight 21 to come into play, the combined weights being then sufficient to counterbalance the two door sections when moving together.

The release of the brake mechanism is brought about in the following manner: The chains 15 in passing around the pulley 16 upon the shaft 17 cause the said shaft to revolve as the lower door section is raised or lowered as has been stated above; and the said shaft is provided with a drum 36 around which is coiled a cord 37, the other end of the cord passing over a direction pulley 38, and being provided at its free end with a button or weight 39. The free end of the cord passes through an eye 40 in the weighted lever 35, the button or weight 39 being disposed below the same, and the length of the cord 37 is such that as the lower door section 11 is raised to its uppermost position the winding up of the cord 37 upon the drum 36 will cause the button 39 to engage the underside of the weighted lever 35 and to lift the same so as to free the brake band from engagement with the brake drum 33. Conversely, when the lower door section is lowered the cord 37 will be unwound from the drum 36 and the downward movement of the button 39 will permit the weighted lever 35 to move downward to again operate the brake. It will be observed that the pivoted stop 20 at the rear of the upper door section is arranged somewhat lower than are the stops 18, whereby when the lower door section is raised up behind the upper door section the upward movement thereof will not be sufficient to release the brake mechanism, or, in other words, sufficient cord 37 will not be wound up upon the drum 36 to cause the button 39 to lift the weighted lever 35. This, of course, is essential because the lower door section is only lifted up behind the upper door section when the upper door section is moved freely and independent of the lower door section, and in such case the single weight

22 is the only one which is desired to be in operation to counterbalance the weight of the single upper door section 10.

The cone elements 25—26—29 are provided to compensate for the increase of effective weight of the swinging door section or sections as the same leaves the vertical position and approaches a horizontal position, or in other words, to compensate for the varying load which increases from zero to maximum as the door is opened and similarly decreases as the door is closed, whether the mass to be lifted includes the two door sections or only one. These cone elements are in the form of conical or conoidal drums or fuses, the surfaces of which are so shaped as to cause the weights to be lifted at varying speeds to correctly or approximately correctly counterbalance the door in all its positions.

The vertically swinging movements above described may be conveniently effected by power imparted to the shaft 27, and such power may be imparted in any desired manner. In the present instance I have shown such means as comprising an endless chain 41 which is allowed to hang freely from a pulley 42 secured upon a short cross shaft 43, and a worm and worm wheel gearing 44 connecting the same with the said shaft 27. The advantages of such a construction are, first, that it is self-locking and will hold the door in any position to which it is moved, and second, after the door has been closed it permits further movements of the operating mechanism to allow the chain 28 to be readily unhooked or detached from the door so as to permit the lower door section to be raised and lowered over the face of the upper door section, yet at the same time holding the counterbalancing weight 21 from running away.

If preferred, and where convenient, two chains 28'—28'' may be employed in lieu of the single chain 28, which chains may be connected with the lower end of the upper door section over the edge of the lower door section, as is shown in the detail Fig. 8. In such case two similar cone elements 29'—29'' will, of course, be employed upon the shaft 27. In this construction it is not necessary to disconnect the chains 28'—28'' from the upper door section when the same is closed and the lower door section is raised or lowered.

It will be readily understood that many variations and modifications of the means for increasing or decreasing the counterbalancing load employed for the door sections may be employed within the spirit and scope of my invention, and in Fig. 9 I have shown one such modification in which the second weight 22' may be actually carried upon, and supported by, the first weight 21 when the increased load is required, and be held in-

active at other times by means of a dog 49 which is carried by a weighted lever 50 corresponding to the weighted brake operating lever 35 of the other views, the said lever being connected to, and operated by, the cord 37.

In Figs. 10 and 11 I have shown another modification in which the cord 37 instead of lifting the weighted lever 35, is connected with a clutch operating lever 44 by which the cone element 25' may be secured to, or released from, operative engagement with the shaft 27. When the lower door section 11 is raised up and the cord 37 is wound up upon the drum 36, the lever 44 will be pulled over to operate the friction clutch 50 so as to operatively connect the cone element 25' with the shaft 27, while at the same time a pawl 45 will be lifted out of engagement with the ratchet wheel teeth 46 with which the said cone element 25' is provided, a pin 47 being carried by the lever 44 for such engagement with the said pawl. The two weights will now be in operative engagement with the upper door section to counterbalance the movement thereof and of the lower section carried with it. When the lower door section moves downward and the cord 37 is permitted to unwind, the lever 44 will be moved backward by means of a spring 48 provided for such purpose whereby the clutch will be released and the conical drum or fusee 25' will be disconnected from the shaft 27, the pawl 45 being, however, also released so that it will drop into engagement with the ratchet wheel teeth 46, whereby the weight 21 will be held in its uppermost position and will be prevented from exerting its influence to counterbalance the door.

What I claim is:

1. The combination with a horizontally pivoted element and counterbalancing means for applying a counterbalancing load thereto, of an element radially movable with respect to the said pivoted element, and means operated by the radial movement of the second said element to increase the said counterbalancing load.

2. The combination with a horizontally pivoted element and counterbalancing means for applying a counterbalancing load thereto, of an element radially movable with respect to the said pivoted element and in one position angularly movable therewith about its pivoted axis, and means operated by the movement of the second said element to its latter said position to increase the said counterbalancing load.

3. The combination with a horizontally pivoted object comprised in a plurality of sections, and means for lifting the same to move it angularly about its pivotal support, of counterbalancing means therefor, means for moving one section with relation to another, other than in the direction

of the said angular movement, and means actuated by the said relative movement to vary the counterbalancing load.

4. The combination with a horizontally pivoted object comprised in a plurality of sections, and means for moving the same angularly about its pivotal axis, of counterbalancing means for applying a counterbalancing load thereto, means for moving one section radially with relation to the other, and means actuated by the said radial movement in one direction to increase the counterbalancing load.

5. The combination with a horizontally pivoted element and a plurality of counterbalancing weights therefor, of an element radially movable with respect to the said pivoted element, and means operated by the radial movement of the second said element to vary the number of the said counterbalancing weights actively employed.

6. The combination with a horizontally pivoted element, and another element radially movable with respect thereto from a position out of engagement with the first said element to a position to be engaged thereby and angularly moved therewith, of counterbalancing means for applying a counterbalancing load to the first said element in its angular movement, and means actuated by the radial movement of the second said element to vary the said counterbalancing load.

7. The combination with a horizontally pivoted element, and another element radially movable with respect thereto from a position out of engagement with the first said element to a position to be engaged thereby and angularly moved therewith, of counterbalancing means for applying a counterbalancing load to the first said element in its angular movement, and means actuated by the radial movement of the second said element to its latter said position with respect to the first said element, to increase the said counterbalancing load.

8. The combination with a horizontally pivoted element, and another element radially movable with respect thereto from a position out of engagement with the first said element to a position to be engaged thereby and angularly moved therewith, of a plurality of counterbalancing weights for applying a counterbalancing load to the first said element in its angular movement, and means actuated by the radial movement of the second said element to vary the number of the said counterbalancing weights actively employed.

9. The combination with a two-section element one section of which is pivotally suspended and the other of which is movable into and out of lifting engagement with the first said section, a counterbalancing weight for the first said section, a second

counterbalancing weight therefor, restraining means for holding the second said counterbalancing weight against movement, and means operated by the movement of the second said section into lifting engagement with the first said section to release the said restraining means.

10. The combination with a two-section element one section of which is pivotally suspended and the other of which is movable into and out of lifting engagement with the first said section, a counterbalancing weight for the first said section, a second counterbalancing weight therefor, a direction pulley, a flexible connection between said second counterbalancing weight and the first said element, and engaging the said direction pulley, means for preventing the rotation of the said pulley, and means operated by the movement of the second said section into lifting engagement with the first said section, to free the same and thus permit the free rotation of the said pulley.

11. The combination with a two-section element one section of which is pivotally suspended and the other of which is movable into and out of lifting engagement with the first said section, a counterbalancing weight for the first said section, a second counterbalancing weight therefor, a direction pulley, a flexible connection between said second counterbalancing weight and the first said element, and engaging the said direction pulley, a brake drum connected with said direction pulley, a brake in engagement therewith, and means operated by the movement of the second said section into lifting engagement with the first said section, to release the said brake.

12. The combination with a two-section door one section of which is adapted to be moved into and out of lifting engagement with the other section, of counterbalancing means for the latter section, and means controlled by the moving of the former section into lifting engagement with the latter to increase the said counterbalancing load.

13. The combination with a two-section door one section of which is pivotally suspended and the other section of which is adapted to be moved into and out of lifting engagement with the first said section, of independent counterbalancing means for the two said sections, and means controlled by the moving of the latter section into lifting engagement with the former, to increase at such times the counterbalancing load upon the first said section.

14. The combination with a two-section door one section of which is pivotally suspended and the other section of which is adapted to be moved into and out of lifting engagement with the first said section, of means for counterbalancing the latter section when it is so moved, means for counter-

balancing the former section when the same is moved about its pivotal support, and means controlled by the moving of the second said section into lifting engagement with the first said section, to increase at such times the counterbalancing load upon the first said section.

15. The combination with a two-section door one section of which is pivotally suspended and the other section of which is adapted to be moved into and out of lifting engagement with the first said section, of a counterbalancing weight for the second said section, a counterbalancing weight for the first said section, another counterbalancing weight for the first said section, and means operated by the moving of the second said section into lifting engagement with the first said section to operatively engage the last said counterbalancing weight with the first said door section, and operated by the moving of the second said section out of lifting engagement with the first said section to operatively disconnect the last said weight from the first said door section.

16. The combination with a two-section door one section of which is pivotally suspended and the other section of which is vertically movable in right lines, of independent counterbalancing means for the two said door sections, and means operated by the vertical movement of the second said door section to increase the counterbalancing load upon the said pivotally suspended door section.

17. The combination with a two-section door one section of which is pivotally suspended and the other section of which is arranged to move vertically in right lines, of a counterbalancing weight for the said vertically movable section, an element rotated by the relative movement of the said section and counterbalancing weight, counterbalancing means for the said swinging door section, and means controlled by the said rotatable element for varying the counterbalancing load for the said swinging door section.

18. The combination with a two-section element one section of which is pivotally suspended and the other of which is movable into and out of lifting engagement with the first said section, a counterbalancing weight for the first said section, a second counterbalancing weight therefor, a counterbalancing weight for the second said section in its movement into and out of lifting engagement with the first said section, an element rotated by the relative movement of the second said element and its counterbalancing weight, and means controlled by the movement of the said rotated element for restraining or releasing the second said counterbalancing weight.

19. The combination with a two-section door one section of which is pivotally sus-

pendent and the other section of which is arranged to move radially with respect thereto into and out of lifting engagement therewith, of counterbalancing means for the first 5 said section comprising two independent weights, flexible connections between them and the first said door section, and independent direction pulleys therefor, restraining means for preventing the movement of one 10 of the said direction pulleys whereby one of the said weights will be normally held against movement, a rotatable element operated by the radial movement of the second said door section into lifting engagement 15 with the first said door section, and means operated by the rotatable movement of the said element for releasing the said restraining means.

20 20. The combination with a two-section door one section of which is pivotally suspended, and the other section of which is vertically movable in right lines to a position upon the face of the first said section when the first said section is closed, or to a 25 position behind and clear of the first said section when the first said section is swung open, of a stop for limiting the right line movement of the second said door section under the first mentioned conditions, and a 30 second stop for limiting the said right line movement of the second said door section under the second said conditions to prevent its moving as far as under the said first mentioned conditions.

35 21. The combination with a two-section door, one section of which is pivotally suspended and the other section of which is vertically movable in right lines, of a stop

for limiting the right line movement of the second said section when the first said section is in one position, and another stop for 40 limiting the right line movement of the second said section to a different degree, when the first said section is in another position.

22. The combination with a two-section 45 door one section of which is pivotally suspended and the other section of which is vertically movable in right lines, of counterbalancing means for the door, means operated by the movement of the second said 50 section for varying the counterbalancing load of the counterbalancing means, a stop for limiting the right line movement of the second said section when the first said section is in one position, and another stop for 55 limiting the right line movement of the second said section to a different degree, when the first said section is in another position.

23. The combination with a two-section 60 door, one section of which is pivotally suspended and the other section of which is vertically movable in right lines, of a stop upon the first section for limiting the right line movement of the second section when 65 the first said section is in one position, and a stop carried by a portion independent of the door for limiting the right line movement of the second said section to a different degree when the first said section is in another position. 70

In witness whereof, I have hereunto set my hand this 3rd day of October, 1909.

ARTHUR T. PRESCOTT.

Witnesses:

D. ENID DEUTSCH,
HORATIO O'KEEFE.