

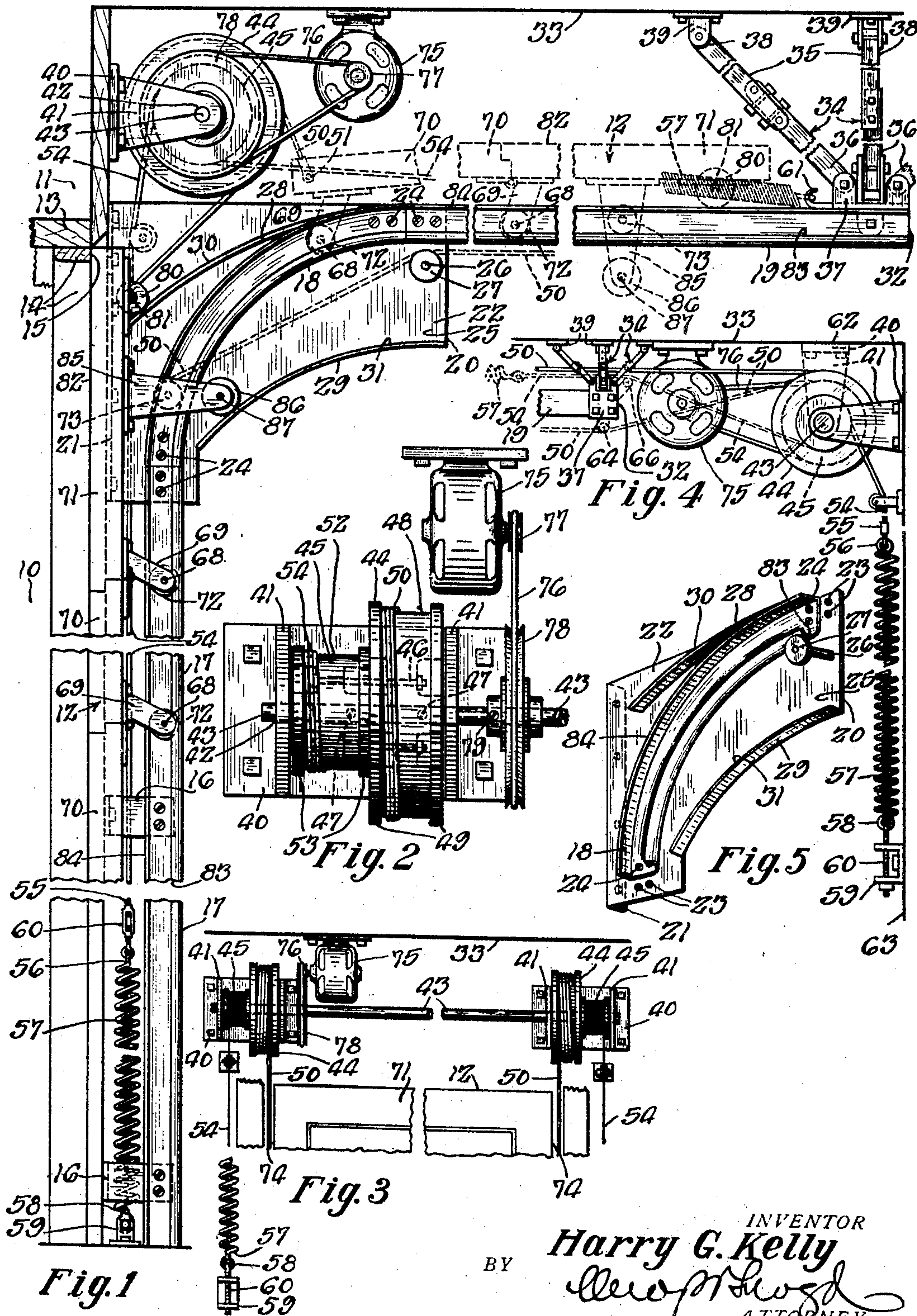
Feb. 14, 1933.

H. G. KELLY

1,897,391

ROLLING DOOR MECHANISM

Filed March 18, 1932



UNITED STATES PATENT OFFICE

HARRY G. KELLY, OF OMAHA, NEBRASKA

ROLLING DOOR MECHANISM

Application filed March 18, 1932. Serial No. 599,801.

The present invention relates to a means of counterbalancing and guiding the closing movement of a rolling door, and as employed in the present instance, it generally relates to the counterbalancing of a door adapted to be opened upwardly in a room with a low ceiling, closed downwardly, the upper portion of said door being moved laterally to be pressed tightly against the stops of a door frame as an incident to the closing of the door.

The objects of the present invention, among others, include the following:

An improved means of counterbalancing the effective weight of a rolling door during its travel between a vertical closed position and a horizontal open position resting on rollers operating upon horizontal track sections.

A novel means of reducing the counterbalancing force commensurately with the reduction of the effective weight of the door during the progress of the door from its vertical closed position to its horizontal supported position when open.

A novel means of reducing the distance of extension of a counterbalancing extensible spring as compared with the distance of travel of the cable connected to the door counterbalanced by the spring.

An unique coordination of the drums of a counterbalancing means for a rolling door whereby the extension of an extensible counterbalancing spring may be adjusted to the variable effective weight of doors of various sizes which may therefore be counterbalanced by similar springs.

An adaptation of a new counterbalancing means to motor operation of the opening and closing of a rolling door.

A novel means of imparting a lateral closing motion to the uppermost section of a sectional rolling door which in its open position is parallel to its supporting track.

A grooved-face pulley secured to the track to change the direction from which the counterbalancing force is applied to the door to assure complete clearance of the open door above the door opening.

These and such other objects of the inven-

tion as may hereinafter appear, are obtained by the novel construction, unique arrangement, and improved combination of the elements illustrated in the accompanying single sheet of drawing disclosing several forms of the invention, and in which:

Figure 1 is a side elevation of the present invention showing alternate anchorages for the counterbalancing means;

Figure 2 is a front elevation of a pair of complementary drums as employed at either side of the door as a part of the counterbalancing means, and illustrating in detail their assembly and operative connection to a prime mover;

Figure 3 is a fragmentary view of the wall of a building illustrating one arrangement about a door in that wall of a counterbalancing means therefor;

Figure 4 is a side elevation of a different form of counterbalancing means disposed upon the ceiling and wall of a room opposite to the wall containing a door for manipulation thereby; and

Figure 5 is a view taken in angular perspective of a door deflecting bracket showing details of construction.

Like reference characters are used to designate similar parts in the drawing and in the description of the invention which follows.

The invention is adapted particularly for use in a garage or an industrial building having a relatively low ceiling. About a wide door opening 10 in a wall 11 of such a building closed by a sectional door 12, there are frame members 13 carrying stops 14 having a face 15 in the plane of the door opening.

Secured by brackets 16 to the wall 11 at either side of the door opening 10 is a vertical track section 17. Adjoining the vertical track section 17 is a curved section 18 terminating in a horizontal track section 19, said vertical track section 17 and horizontal track section 19 being held in registry with said curved section 18 by means of a bracket 20 consisting of a flange 21 attachable to wall 11 or any suitable support and perpendicular to flange 21 a flat member 22 bored with holes 23 registering with similar holes in track sections 17, 18 and 19 to receive bolts 24.

From a face 25 of the bracket 20 opposed to open door 12 extends a spindle 26 carrying a grooved-face pulley 27. Extending perpendicularly from face 25 of the bracket 20 are curved flanges 28 and 29, flange 28 having a face 30 substantially concentric with a face 31 of flange 29, said faces 30 and 31 declining as they approach the face 15 of stops 14.

The free end 32 of the horizontal track section 19 is supported in rigid connection with ceiling 33 by means of adjustable support bracket 34 consisting of an extensible arm member 35 having one end 36 in pivotal connection with a track attachment member 37 secured to track 19, the other free end 38 of arm member 35 being joined hingedly with a ceiling attachment member 39 capable of being attached to said ceiling.

The angle of incidence of extended arm members 35 to the ceiling being variable as well as the length of said joined channel members, said bracket 34 is adjustable to a wide range of heights of the ceiling from track 19.

An unique means for counterbalancing the variable effective weight of a door 12 throughout its movement from a vertical closed position to a horizontal open position, is shown in various forms in Figures 1, 2, 3 and 4.

In Figures 1, 2 and 3 there is a drum-bearing bracket 40, here shown attached to the wall 11 over each of the lateral edges of the door opening 10, each bracket 40 having wings 41 providing bearings 42 for the support of rotatable shaft 43 carrying a drum 44 and a drum 45, the diameter of drum 44 being relatively greater than the diameter of drum 45, said drums 44 and 45 being capable of rotating only in unison during the opening and closing motion of the door 12.

The coordination of the rotation of drums 44 and 45 when said drums are in lateral contact may be provided by bolts 46 extending through opposed holes in the said drums, the connected drums 44 and 45 being freely rotatable in unison about shaft 43, or the drums 44 and 45 may be secured to the shaft 43, which may be made to rotate in the bearings 42. Either method of causing the drums to rotate in unison is adequately effective.

The coordination of the rotation of drums 44 and 45 when said drums are not held in lateral contact by bolts 46 is provided by set screws 47 in drums 44 and 45 extending into shaft 43, so as to anchor both of said drums fixedly to the shaft, said shaft being freely rotatable in bearings 42 of drum bearing standard 41.

It is obvious that drums 44 and 45 may be fixed to shaft 43 by a key-seat connection not shown.

Drum 44 has a circumferential face 48

flanked by flanges 49, there being wound about said drum face 48 a cable 50 having one end fixedly secured to said drum face 48, the free end 51 of said cable 50 being secured to door 12 at approximately its lowest edge.

Drum 45 has a circumferential face 52 flanked by flanges 53, there being wound about face 52 in the opposite direction of the winding of cable 50 on drum 44, a cable 54 having one end attached to face 52 of drum 45 and the other end 55 attached to one end 56 of an extensible spring 57. The other end 58 of spring 57 is secured to a fixed support 59. There is a means of securing the end 55 of the cable 54 to the spring end 56 an adjustable extension element 60 providing adjustment for the application of the counterbalancing spring to drum 45.

Another fixed support being here shown as a hook 61 associated with track attachment member 37 may be used for anchoring the end 58 of extensible spring 57 when said spring is installed in an approximately horizontal position above track section 19.

Since the winding of the cable 54 on the drum 45 is opposite to the direction of winding of the cable 50 on the drum 44 a turning of the drums in a manner to unwind the cable 54 from drum 45 releases the tension of counterbalancing spring 57 simultaneously to the winding of cable 50 onto drum 44 to raise the door and to thereby shift the weight of the door to the horizontal track. As the weight of the door is thus uniformly transferred to the horizontal track section from the support of the cable 54, the urge of the counterbalancing spring 57, which has been decreased in proportion to the door displacement, remains of a magnitude to counterbalance the effective weight of the door upon the cable.

Because the circumference of face 52 of drum 45 is less than the circumference of face 48 of drum 44 the distance of travel of the end 55 of the cable 54 is less than the distance of travel of the cable end 51 for a selected angular movement of the drums. It logically follows that the distance of travel of the movable end of the spring 57 is less than the displacement of the door 12 in its opening or closing movement. This is an important factor in a majority of the installations.

The effective counter-balancing force of any spring 57 is dependent partly on the leverage provided by the ratio of the radii of drums 44 and 45 and partly on the distance of extension of said spring the latter effect is determined directly by the circumference of drum 45. It will be noted that one pair of springs 57 may be used to counterbalance doors of somewhat different effective weights by varying the diameter of drums 45 or changing the relation of the diameters of drums 44 and 45.

The attachment of drums 44 and 45 to the

wall over the door opening being in some installations inadvisable, drum bearing bracket 40 may be secured to an overhanging support or to the wall opposed to door opening 10 as desired.

In Figure 4 we find drum bracket 40 secured to wall 63 opposed to wall 11, and as an alternate position secured to an overhanging support 62 in most cases ceiling 33. In either position drums 44 and 45 are opposed to the free end 32 of the track section 19. The section of cable 50 intermediate the periphery 48 of the drum 44 and the door 12 passes over the grooved face pulley 27 and may pass over a similar pulley 64 carried by bracket 34. Because of the position of the roller 27, the counterbalancing force is applied to door 12 by the cable 50 from an upward and inward direction.

Another rotatable grooved-faced pulley 66 may be carried by the bracket 34 to provide that a connection may be had to the spring 57 if it has its end 58 secured to the wall 11 above the door opening. This is a very likely arrangement, and disposes of the spring above the horizontal track section 19.

In Figure 4, drum bracket 40 is shown secured to wall 63 its drums 44 and 45 being opposed to free the end 32 of the track section 19 as previously described. In this position extensible spring 57 may lie approximately parallel to wall 63 with its end 58 preferably anchored near the floor line of wall 63.

In either position of the drum bracket 40 shown in Figure 4, when the door 12 is in its open position the length of the cable 50 intermediate its anchorage to door 12 and the pulley 64 lies upon the spindles 68 secured to the lower door sections 70, the rollers at that time being disposed in the track section 19.

Also with drum brackets located as shown in Figure 1, during the closing motion of door 12 when its uppermost spindle 68 has passed grooved-faced pulley 27 carried by bracket 20 below track section 19, cable 50 comes into contact with said pulley 27 to be guided and held upwardly and inwardly the uppermost spindle 68 during the final closing and initial opening movements of door.

Between uppermost spindle 68 and the grooved-face pulley 27 there may be another grooved-face pulley 73 associated with the uppermost door section 71 to contact with the cable 50 to further control the direction from which the counterbalancing force is applied to door 12.

With two of the described counterbalancing means being used in a single door installation, each with the face 48 of a drum 44 opposed to one of the two lateral edges 74 of door 12 it is evident that the shafts 43 of said counterbalancing means may be replaced by a single common shaft 43 with the drums 44

and 45 fixedly secured to each end. Such an arrangement provides equalized counterbalancing of both sides of the door 12.

With both pairs of drums 44 and 45 fixedly secured to continuous rotatable shaft 43 it is evident that any outside motive force applied to shaft 43 is transmitted by both drums 44 and cables 50 to door 12 equally at both of the lateral edges 74 of said door. In Figures 1, 2, 3 and 4 the motive force of a motor 75 is applied to shaft 43 by means of a flexible belt 76 passing around a pulley 77 of motor 75 and a pulley 78 fixedly secured to shaft 43 by set screws 79 or key-seat connection (not shown).

However, a chain (not shown) may be substituted for belt 76 or a gear (not shown) carried by motor 75 may mesh with a gear (not shown) carried fixedly by shaft 43 to transmit the motive force of motor 75 to shaft 43 and to drums 44 and door 12 as previously described.

It is obvious that to secure tight closure of uppermost door section 71 against face 15 of stops 14, said uppermost door section 71 must be moved laterally in its final closing movement. To provide such a lateral closing movement of uppermost door section 71 we find in Figures 1 and 5 concentrically curved deflecting faces 30 and 31 of flanges 28 and 29 carried by bracket 20. Contacting with face 30 of flange 28 is a roller 80 rotating on a spindle 81 secured to the uppermost door section 71, said spindle 81 of roller 80 being located a lesser distance from the outer face 82 of door 12 than spindles 68 of rollers 72. Door 12 in its open position is supported by rollers 72 contacting with an inner face 83 of track section 19 and by roller 80 contacting with an upper, outer face 84 of track section 19. Because the roller 80 is located nearer to the outer face 82 of the door 12 than are rollers 72, in the open position of door 12 roller 80 rests on the outer face 84 of the track section 19 and rollers 72 rest on inner face 83 of that track section to support the door 12 in an undistorted plane parallel to the horizontal track section.

During the closing movement of door 12 rollers 72 operate wholly within the track sections 19, 18 and 17, the movement of lower door sections being guided thereby. As the closing movement nears completion roller 80 comes into contact with surface 30 one end of said surface 30 being joined to upper surface 84 of track 19. Roller 80 is thereby deflected to move uppermost door section 71 laterally into contact with surfaces 15 of stops 14 at the completion of the closing motion of door 12.

Uppermost door section 71 carries also near each of its lateral edges 74 a bracket 85 carrying a roller 86 adapted to rotate on a spindle 87 secured to said bracket 85, said spindle 87 being located a greater distance

from outer surface 82 of door 12 than the spindles 68 of rollers 72.

Coincidentally with the contact of the roller 80 with the deflecting surface 30 of flange 28 and during the closing motion of the door 12, roller 86 contacts with face 31 of the curved flange 29, by which the said roller 86 is deflected in complete cooperation with the deflection of roller 80 by face 30 of flange 28.

It is evident that the deflection of the uppermost door section 71 may be accomplished by means of said deflection of roller 86 by its contact with face 31 of flange 29 without the cooperation of the flange 28. The roller 80 may be lifted away from the face 84 of the track section 19 during the closing motion of the door 12 and carried into contact with said face 84 during the opening motion of said door concurrent with the termination of contact of the roller 86 with the flange 29.

What I claim is new and desire to secure by Letters Patent of the United States is:

1. A building having a door opening, a door comprising sections and having a roller on its upper section, and stops at the edge of said opening in combination with means for the manipulation of said sectional door comprising means for guiding said door from a horizontal open position to a vertical closed position, a counterbalancing means comprising drums of unequal diameter and adapted to rotate in unison, a spring having an end suitably anchored, a flexible connecting means between the unanchored end of said spring and the periphery of the smaller of the drums, a second flexible connecting means between the larger of the drums and said door, said second flexible connecting means being wound on the periphery of its respective drum in a manner to unwind as the first mentioned connecting means winds on the smaller of said drums, and a deflecting means comprising a bracket having a curved flange and a roller, said first mentioned connecting means being adapted to wind on said smaller drum pursuant to the closing movement of said door whereby the spring is distorted to increase its contractual urge against the rotation of the drums with the further closing movement of said door in proportion to the weight of said door effectively applied to said second mentioned cable, said roller being disposed upwardly and inwardly said door opening and being adapted to engage said second mentioned cable whereby the force applied to said door by said second mentioned cable is in an upward and inward direction.

2. A building having a door opening, a door comprising sections and having a roller on its upper section, and stops at the edge of said opening in combination with means for the manipulation of said sectional door comprising means for guiding said door from a horizontal open position to a vertical

closed position, a counterbalancing means comprising drums of unequal diameter and adapted to rotate in unison, a spring having an end suitably anchored, a flexible connecting means between the unanchored end of said spring and the periphery of the smaller of the drums, a second flexible connecting means between the larger of the drums and said door, said second flexible connecting means being wound on the periphery of its respective drum in a manner to unwind as the first mentioned connecting means winds on the smaller of said drums, and a deflecting means comprising a bracket having a curved flange and a roller, said first mentioned connecting means being adapted to wind on said smaller drum pursuant to the closing movement of said door whereby the spring is distorted to increase its contractual urge against the rotation of the drums with the further closing movement of said door in proportion to the weight of said door effectively applied to said second mentioned cable, said roller being disposed upwardly and inwardly said door opening and being adapted to engage said second mentioned cable whereby the force applied to said door by said second mentioned cable is in an upward and inward direction, and said flange being adapted to engage said roller on the uppermost door section coincidentally with the final closing movement of said door whereby said uppermost door section is projected laterally into impinged contact with said stops.

HARRY G. KELLY.