

March 12, 1935.

S. MADSEN

1,994,142

DOOR OPERATING MECHANISM

Filed April 24, 1930

3 Sheets-Sheet 1

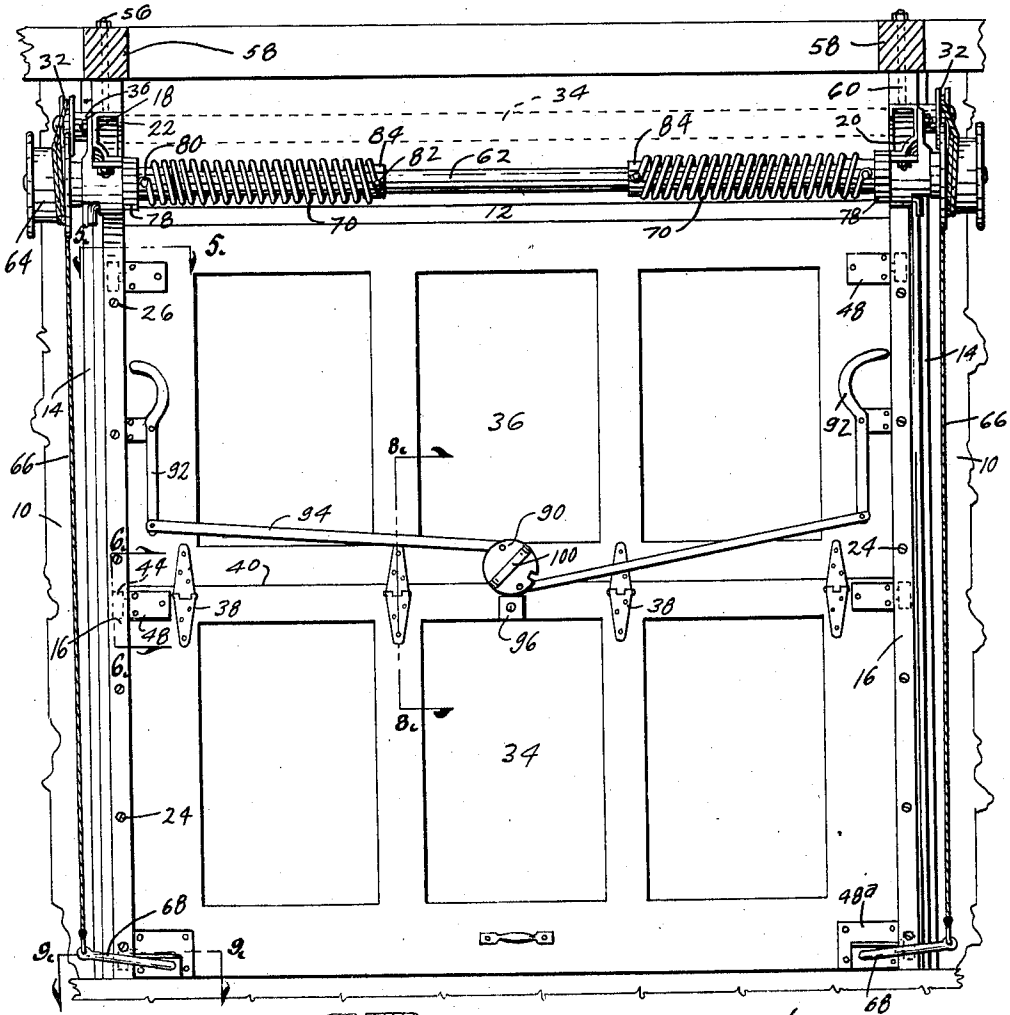


Fig. 1

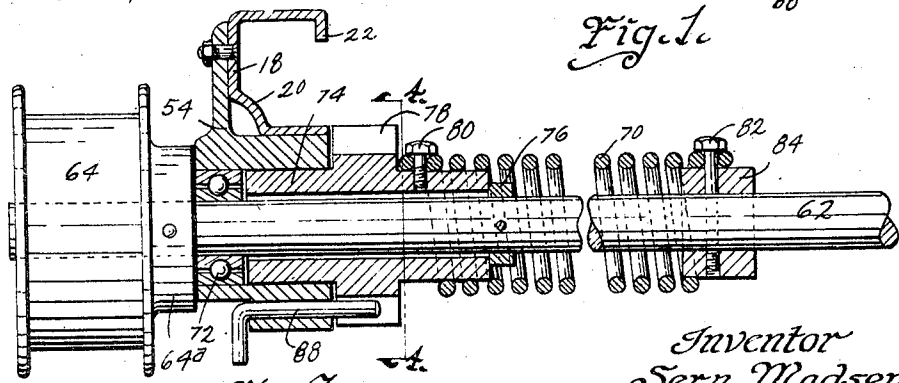


Fig. 3

Witness
Raymond Wilson

Inventor
Sern Madsen
by Bair, Freeman, & Sinclair
Attorneys

March 12, 1935.

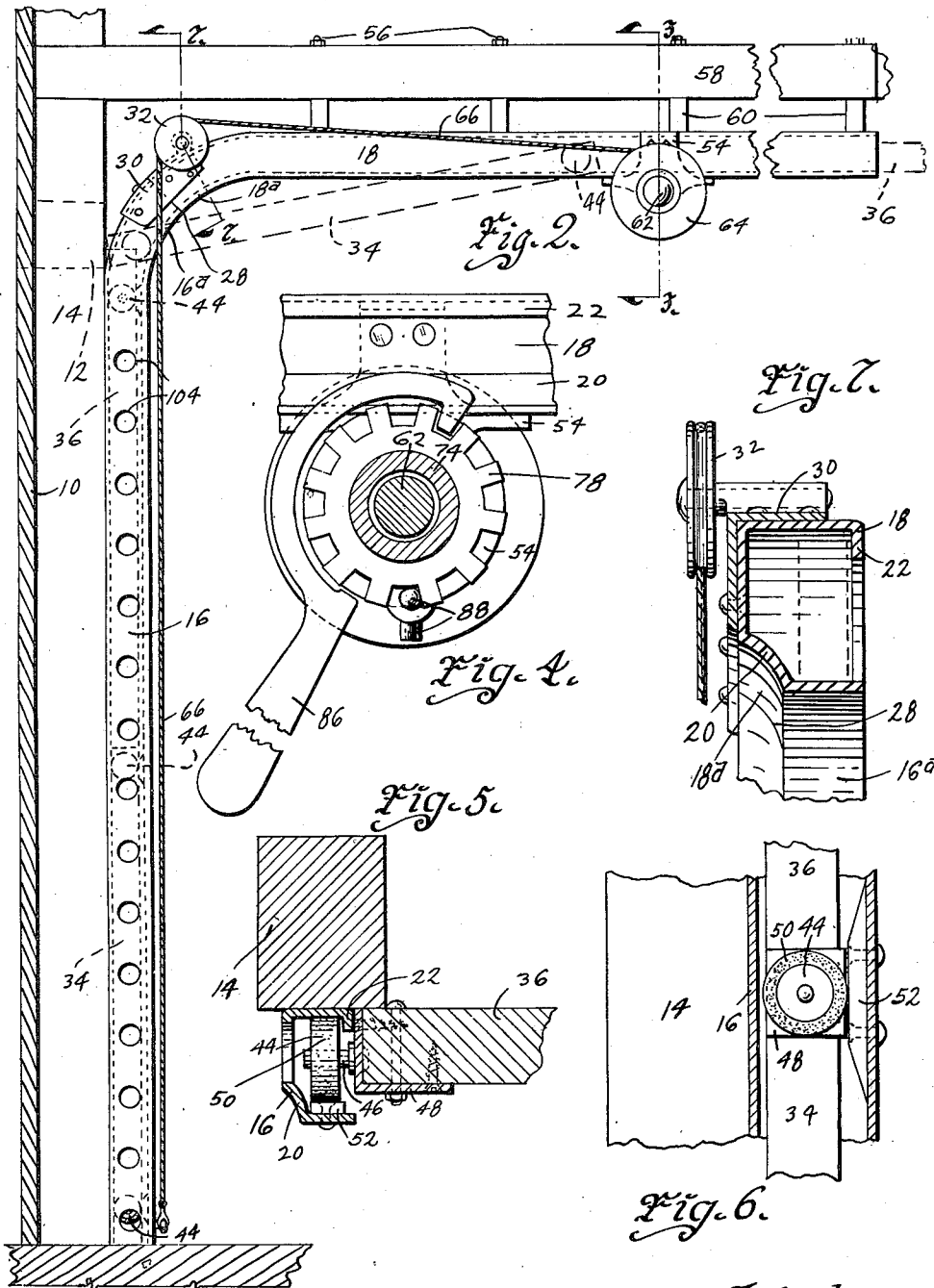
S. MADSEN

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3 Sheets-Sheet 2



Witness
Raymond Wilson

Inventor
Sern Madsen
by *Bair, Freeman & Sinclair*
Attorneys

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S. MADSEN

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3 Sheets-Sheet 3

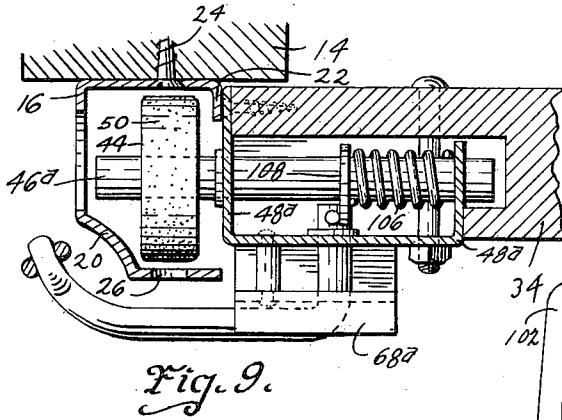


Fig. 9.

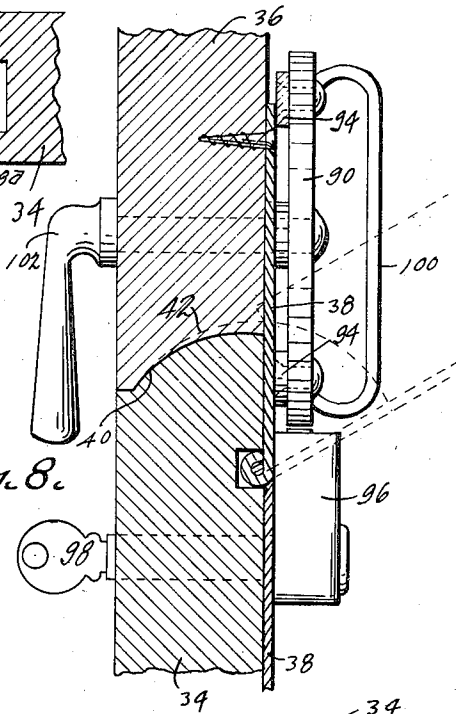


Fig. 8.

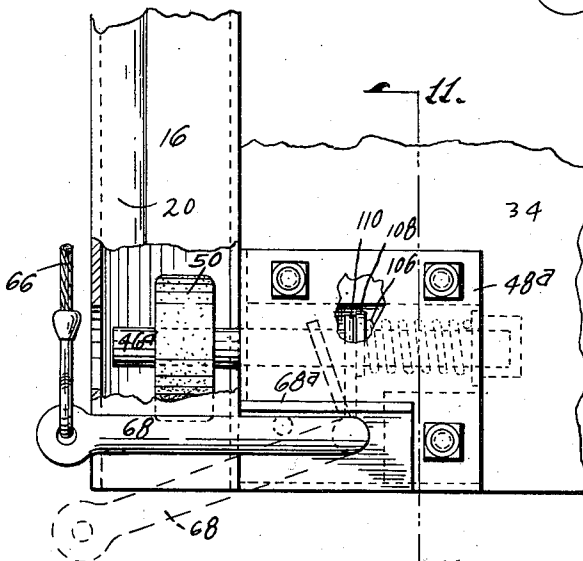


Fig. 10.

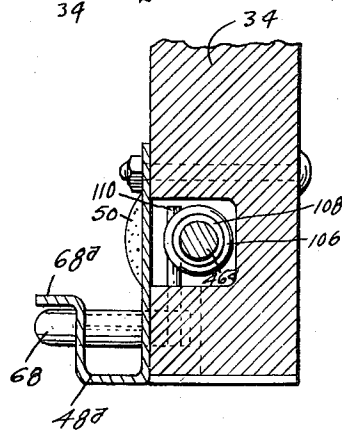


Fig. 11.

Witness
Raymond Wilson

Inventor
Soren Madsen
by Bair, Freeman & Sinclair
Attorneys

UNITED STATES PATENT OFFICE

1,994,142

DOOR OPERATING MECHANISM

Sern Madsen, Clinton, Iowa, assignor, by mesne assignments, to The Yoder-Morris Company, Cleveland, Ohio, a corporation of Ohio

Application April 24, 1930, Serial No. 446,941

6 Claims. (Cl. 20—19)

The object of my invention is to provide a door of the type made in sections and hinged along horizontal lines with tracks for supporting the door and relative to which the door may be moved from a vertical closed position to a horizontal position adjacent the ceiling or roof of a garage or other building in which the door is mounted, the door and supporting means itself being of simple, durable and inexpensive construction.

A further object is to provide L shaped supporting tracks and rollers which are secured to the side edges of the door sections, the vertical portions of the tracks being adapted for securing to the vertical side jambs of the door opening and the backwardly curved horizontal portions of the track being adapted for securing to a ceiling or roof so that the door may assume a horizontal position beneath the ceiling or roof and out of the way when it is open.

Another object is to provide a track of such cross-sectional shape that it may serve both as a track and a wind stop adjacent the edges of the door.

Still a further object is to provide balancing means for counter-balancing the weight of the door, such means consisting of a spring operated shaft, cable drums and cables, the shaft being mounted in bearings which are supported on the horizontal portions of the track.

A further object is to provide a counter-balancing means of novel construction whereby assembly and mounting thereof is facilitated.

Another object is to provide a safety bolt arrangement whereby breakage of the balancing shaft, the cables for connecting the doors with the drums on the balancing shaft, the balancing springs or other parts, will not allow the door to slide downwardly to closed position, due to the weight thereof, but the locking bolt will automatically coast with openings formed in the track members to prevent such closing of the door.

Still a further object is to provide a continuously closed wiper type of joint between the door sections to prevent an operator from getting his fingers pinched by the door sections as they pivotally operate relative to each other during the raising and lowering movements of the door.

Another object is to provide rollers for supporting the door, the rollers having resilient faces whereby to cushion the device and make it noiseless during operation.

With these and other objects in view my invention consists in the construction, arrangement and combination of the various parts of my device, whereby the objects contemplated are attained, as hereinafter more fully set forth, pointed out in my claims, and illustrated in the accompanying drawings, in which:—

Figure 2 is a side elevation of the same.

Figure 3 is an enlarged, sectional view on the line 3—3 of Figure 2 illustrating part of the counter-balancing means.

Figure 4 is a sectional view on the line 4—4 of Figure 3, illustrating a ratchet and pawl mechanism for holding springs of the counter-balancing means under tension.

Figure 5 is a sectional view on the line 5—5 of Figure 1 illustrating the coaction between the side jamb, tracks for the door, the door and the supporting roller thereof.

Figure 6 is an enlarged, sectional view on the line 6—6 of Figure 1, illustrating a cam means for retaining the door in tightly closed position against the side jambs of the door opening.

Figure 7 is a sectional view on the line 7—7 of Figure 2, illustrating a pulley over which the door supporting cables extend.

Figure 8 is an enlarged sectional view on the line 8—8 of Figure 1, illustrating the joint between the sections of the door.

Figure 9 is an enlarged, sectional view on the line 9—9 of Figure 1, illustrating a safety bolt construction.

Figure 10 is an enlarged, inside elevation of the safety bolt construction, parts thereof being broken away and parts being shown in section; and

Figure 11 is a sectional view on the line 11—11 of Figure 10.

On the accompanying drawings I have used the reference numeral 10 to indicate the wall of a garage or other building. A door opening is provided in the wall 10 and is defined by a head jamb 12 and side jambs 14.

My door construction includes vertical track members 16 and horizontal track members 18. The track members 16 and 18 are substantially channel shaped in cross section as shown in Figure 3 for instance, with the exceptions of a head portion 20 and a flange 22 extending lengthwise of the track members.

The track members 16 are adapted for securing to the vertical side jambs 14 as for instance by means of countersunk screws or bolts 24 to which access may be had with a screw driver through openings 26 formed on the inner flange of the channel shaped track members 16. (See Figure 9.)

The horizontal track members 18 are of a shape similar to the track members 16 to simplify manufacturing processes and expenses.

In order to make the track members 16 and 18 of similar shape they are provided with 45 degree elbows 16a and 18a which terminate at the joint 28, which is arranged at an angle of forty-five degrees so that the track members 16 and 18 may be arranged at right angles to each other.

riveted or otherwise secured to the track members 16 and 18 and on which a pulley 32 is journaled.

As best shown in Figure 1, it will be obvious that the tracks are made in pairs, one for each side of the door and two of the pulleys 32 are provided.

The door itself consists of a pair of sections indicated at 34 and 36. The sections 34 and 36 are hinged together by hinges 38. The joint 40 between the sections 34 and 36 is curved as best shown in Figure 8.

The curve is formed from a radius from a center slightly offset from the center of the hinges 38 so that as the door moves from a vertical open position to a horizontal closed position and the hinges bend during this operation there will be a practically continuous wiper type of joint between the door sections 34 and 36 as indicated by dotted lines.

The further the door sections hinge from alignment the wider this joint becomes, and the nearer the door sections come to alignment the closer the joint becomes as fully shown in Figure 8 by the dotted line 42. This construction eliminates an open crack in which an operator's fingers might be crushed when lowering the door.

The door sections 34 and 36 are supported by rollers 44 which are journaled on studs 46 projecting from brackets 48. The brackets 48 are suitably secured to the door sections by means of screws and bolts or the like. (See Figure 5.)

It may here be mentioned that the rollers 44 are faced with resilient material 50 so that the operation of the door is silent. The rollers 44 are free to move longitudinally of the axes of the studs 46 but are limited against movement in the channel shaped track members 16 and 18 by the beads 20 and the flanges 22.

In this way the door sections 34 and 36 are free to move sidewise relative to the rollers and are guided by the flanges 22 which are arranged close to the side edges of the door sections for the purpose of forming in conjunction therewith a wind stop joint.

The resilient facing 50 contacts with the beads 20 and flanges 22 so as to silence any side movement of the rollers when they contact with the beads and flanges during the operation of the door.

The diameter of each roller 44 is substantially less than the distance between the flanges of the channel shaped track members so as to prevent any binding of the door during raising or lowering movements.

When the door is in closed position, however, it is desirable to have it tightly pressed against the jamb and this may be done by means of cam blocks 52 (see Figures 2, 5 and 6) arranged at the positions assumed by the rollers when the door is closed. The cam blocks 52 are coincident with the rollers 44, which are shown in dotted lines in Figure 1. The thickness of the cam blocks 52 is such that the door is pressed tightly against the side jambs 14 when the door is in closed position, but not too tight to permit of manually sliding the door when in the position shown in Figures 1, 2, 5 and 6.

It is desirable to counter-balance the door so that the entire weight thereof will not have to be contended with when opening it. I provide a counter-balancing means in the form of bearing members 54 secured to the horizontally extending tracks 18 and supported thereby.

The tracks 18 themselves are in turn supported by means of bolts or the like 56 extending

through rafters 58 or other suitable supports and if necessary blocking 60 may be interposed between the rafters and the track sections.

The bearing members 54 rotatably support a balancing shaft 62 to which is secured drums 64. Cables 66 are secured to the drums 64 and wound thereon. The cables extend from the drums over the pulleys 32 and connect with arms 68 of the safety bolts hereafter to be described.

Thus, the weight of the door may be supported by the cables and the balancing shaft 62 in conjunction with a pair of springs 70 under tension and acting upon the shaft 62 to rotate it.

Ball bearings 72 are preferably provided for journaling the shaft 62 relative to the bearing members 54. The races of the ball bearings 72 are free to move longitudinally in the bores of the bearing members 54 but are limited against outward movement by hubs 64a on the drums 64.

The ball bearings 72 are limited against inward movement by means of sleeves 74 (extending into the bore of the bearing members 54) which are in turn held against movement away from the ball bearings 72 by collars 76 secured to the balancing shaft 62.

Ratchet teeth 78 are formed on the sleeves 74 and one end of each spring 70 is secured by means of a cap screw 80 or the like to the sleeves 74. The opposite end of each spring 70 is secured by a cap screw 82 or the like to collars 84 and to the shaft 62 all as best shown in Figure 3.

The sleeves 74 may be rotated by engaging a spanner wrench 86 with the ratchet teeth 78 for rotating the sleeve 74.

The sleeves may be locked in any desired position for maintaining the tension of the springs 70 by pawls 88 which are merely pins slidably mounted in the bearing members 54, (see Figures 3 and 4).

The positioning of the balancing shaft and associated parts on the track portions 18 is a very desirable construction, inasmuch as the balancing shaft assembly may be completed and then lifted into place and secured to the tracks 18, after which the springs 70 may be placed under tension as desired.

For locking the door in closed position any desired type of lock may be used and on the drawings I have illustrated a rotatable disc 90, pivoted levers 92 and links 94.

Referring to Figure 1, the disc 90 may be rotated clockwise for extending the upper ends of the arms 92 between the inner flanges of the track members 16 and the door member 36.

This will allow slight upward movement of the door, but as soon as the upper rollers start into the curved portion 16a of the tracks 16 any further opening of the door will be prevented. A lock 96 is provided for locking the disc 90 by a key 98 and thereby locking the door in closed position (see Figure 8). Operating handles 100 and 102 are provided for rotating the disc 90.

In connection with my door I have provided a safety lock to prevent closing of the door in the event that any part of the balancing mechanism should become broken.

The safety lock feature consists of openings 104 formed in the vertical track members 16 and spring extended studs 46a provided in the lowermost rollers 44. Each locking bolt structure comprises a spring 106 interposed between a portion of a supporting bracket 48a and a

shoulder 108 formed on the stud 46a, (see Figures 9, 10, and 11). The locking bolt arm 68 is pivotally mounted in the bracket 48a and is adapted to normally engage a flange 68a thereof. A pin 110 extends upwardly from the arm 68 and contacts with the shoulder 108.

It will be obvious that the weight of the door imposed on the cables 66 will maintain the arms 68 against the flanges 68a and keep the studs 46 in retracted position against the action of the springs 106.

However, when the cable 66 is released by breaking thereof, a breakdown of the pulley 32, breakage of the drum 64, the shaft 62 or the spring 70, the spring 106 will force the stud 46a outwardly against the web of the channel shaped track member 16 and into one of the openings 104 when the stud 46a comes in alignment therewith. This position is illustrated in dotted lines in Figure 10 of the drawings.

A safety feature of this character in order to really be safe, must be operated from time to time. By my present construction it is operated every time the door is raised to open position.

It will be obvious that when the door section 34 assumes the dotted line position shown in Figure 2 the weight on the cable will be much less, and furthermore the cable will be at a decided angle relative to its original lifting position on the arm 68 so that the studs 46a will be extended by the springs 106 while, and each time, the door is moved to open position. The track members 16, it will be noted, do not have any openings 104 above a point substantially spaced below the pulley 32 so that the extended studs 46a will engage the webs of the track members and will, therefore, permit closing of the door from the dotted line position in Figure 2.

There are two balancing springs. Generally only one of these or one cable will fail, and thus never more than one-half the weight of the door will ever have to be stopped by the safety bolt.

Some changes may be made in the construction and arrangement of the parts of my device without departing from the real spirit and purpose of my invention, and it is my intention to cover by my claims, any modified forms of structure or use of mechanical equivalents, which may be reasonably included within their scope.

I claim as my invention:—

1. In a device of the class disclosed, door jambs defining a door opening, track members along said jambs, a door having projections for travel on said track members, a bearing member, a balancing shaft journaled in said bearing member, a drum on said shaft, a cable on said drum, connected with said door, a ratchet wheel rotatable within said bearing, a pawl for retaining the ratchet wheel in a desired position, and a spring having one end secured to the ratchet wheel and its other end secured to the balancing shaft to balance the weight of said door.

2. In a device of the class disclosed, door jambs defining a door opening, vertically arranged track members along said jambs, a door having projections for travel on said track members, a bearing member, a balancing shaft journaled in said bearing member, a drum on said shaft, a cable on said drum connected with said door, a ratchet wheel,

a pawl for retaining the ratchet wheel in a desired position, said ratchet wheel engaging one end of said bearing member and thereby limited against movement in one direction longitudinally of its axis, means on the shaft to limit it against movement in an opposite direction, and a spring having one end secured to the ratchet wheel and its other end secured to the balancing shaft to balance the weight of said door.

3. In a device of the class disclosed, door jambs defining a door opening, track members along said jambs, a door having projections for travel on said track members, a bearing member, a balancing shaft journaled in said bearing member, a drum on said shaft, a cable on said drum connected with said door, a ratchet wheel, a pawl for retaining the ratchet wheel in a desired position, said ratchet wheel engaging one end of said bearing member and thereby limited against movement in one direction longitudinally of its axis, means on the shaft to limit it against movement in an opposite direction, said drum engaging said bearing member and thereby limiting the shaft against movement in the first mentioned direction, and a spring having one end secured to the ratchet wheel and its other end secured to the balancing shaft to balance the weight of said door.

4. In a device of the class disclosed, a slidable door, a track therefor, spaced openings in said track, a safety bolt on the door, counterbalancing means for the door, said counterbalancing means including a cable, said safety bolt comprising a spring extended, slidably mounted bolt for coaction with one of the openings in said track, a retracting lever connected with said cable whereby the weight of the door maintains the bolt retracted, and a roller for supporting the door and journaled on said bolt.

5. In a device of the class disclosed, a slidable door, an L-shaped track therefor, spaced openings in said track, a safety bolt on the door, counterbalancing means for the door, said counterbalancing means including a cable, said safety bolt comprising a spring extended bolt for coaction with one of the openings in said track, and a retracting lever connected with said cable whereby the weight of the door maintains the bolt retracted, the door, during its sliding movement relative to the L shaped track from closed to open position, assuming a position adjacent full open position where the weight of the door is sufficiently reduced on the cable so that said spring extended bolt will be extended.

6. In a door operating mechanism, spaced tracks related to a door opening, a door comprising articulatable hinged sections for closing said opening, shafts on said sections having rollers arranged to engage said tracks to slidably support the door sections thereon, counterbalancing means for said door, said means including a cable, the lowermost roller carrying shaft at one side of said door being slidably mounted, a spring normally acting on said shaft to slide it outwardly, a retracting lever connected with said cable and operated by the weight of the door to maintain said shaft in retracted position, and spaced means on said track arranged to be engaged by said shaft when it is moved outwardly.