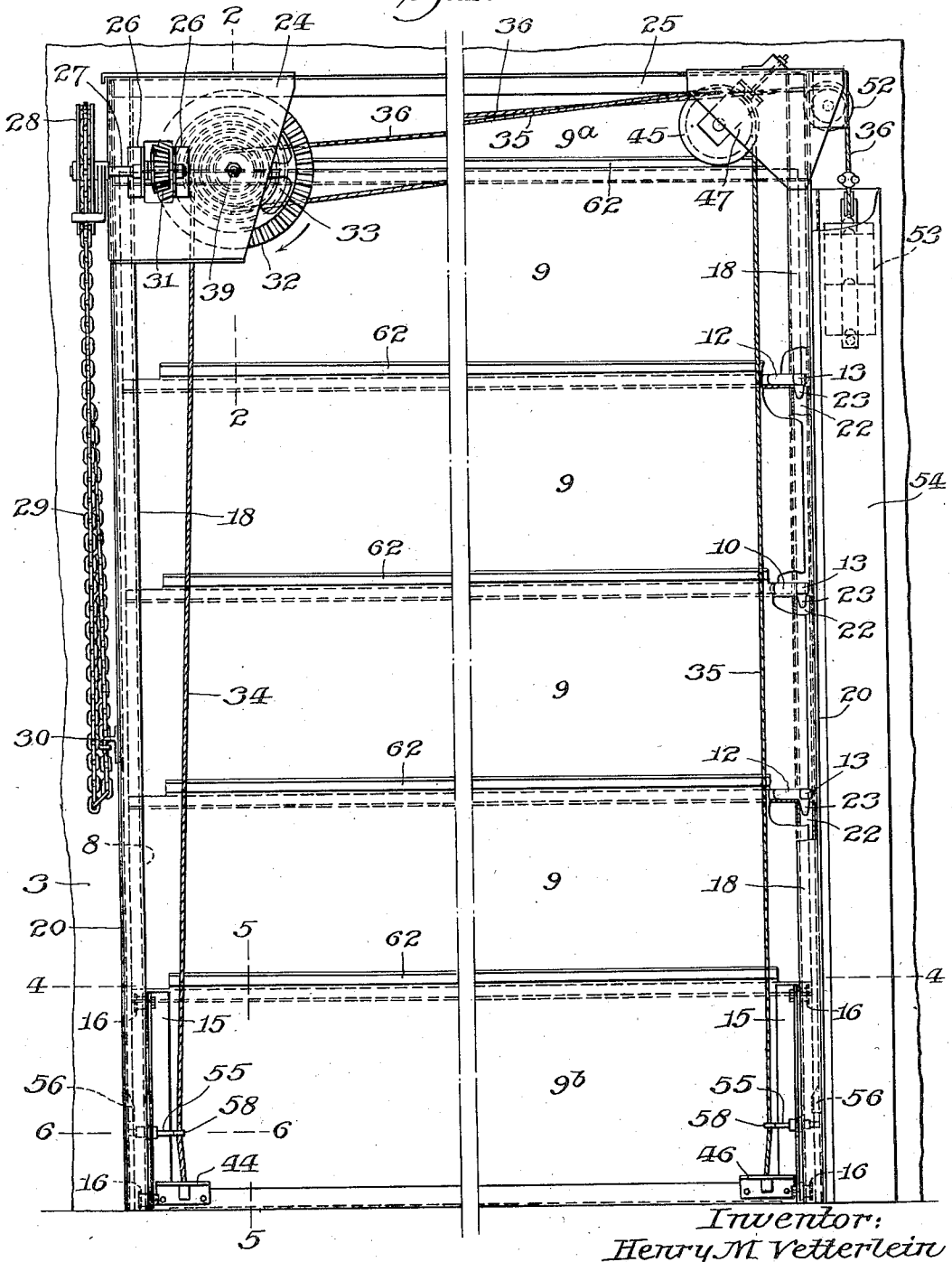
July 9, 1935. H. M. VETTERLEIN 2,007,552

DOOR

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Fig. 1.



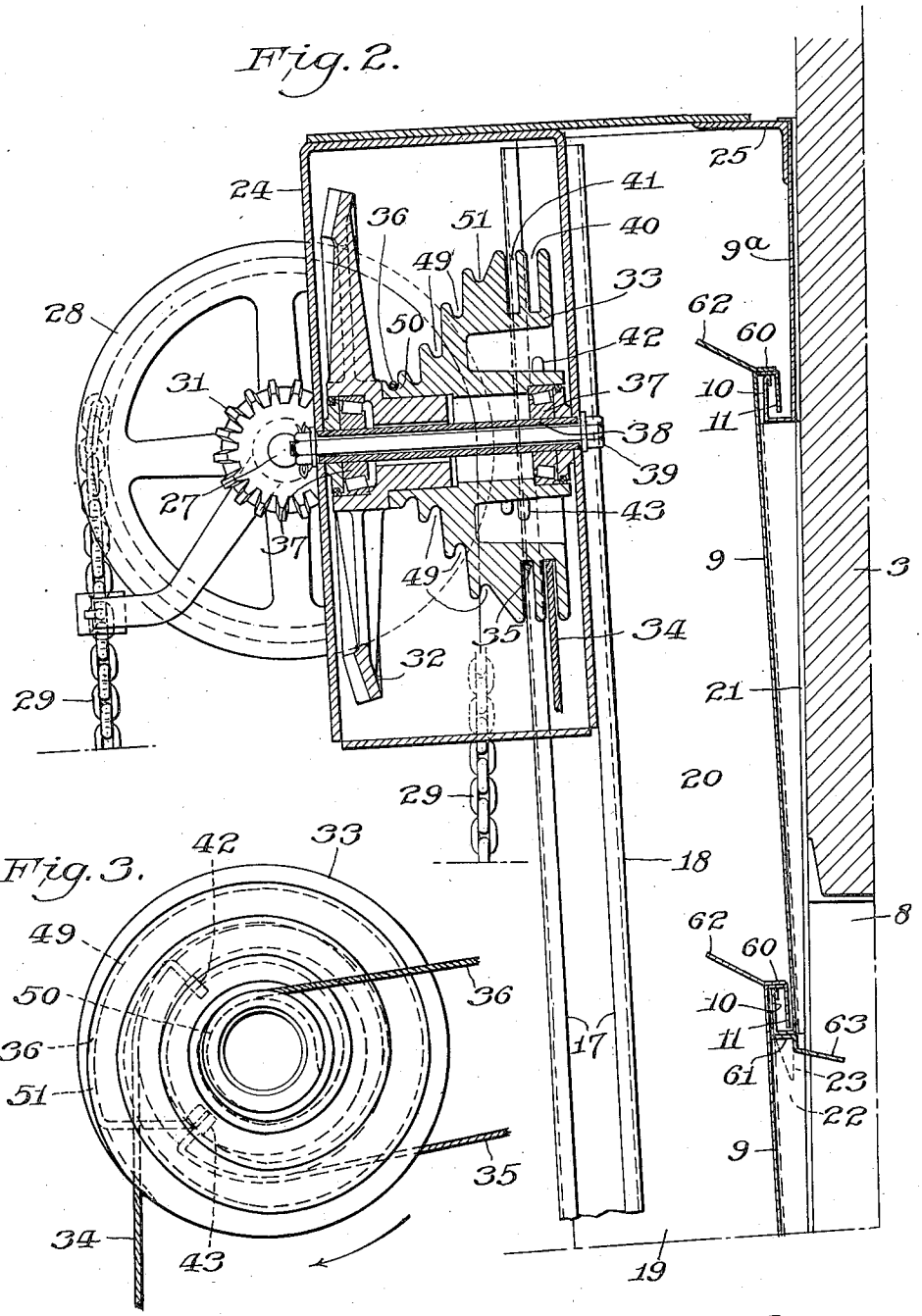
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DOOR

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Fig. 2.



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Fig. 4.

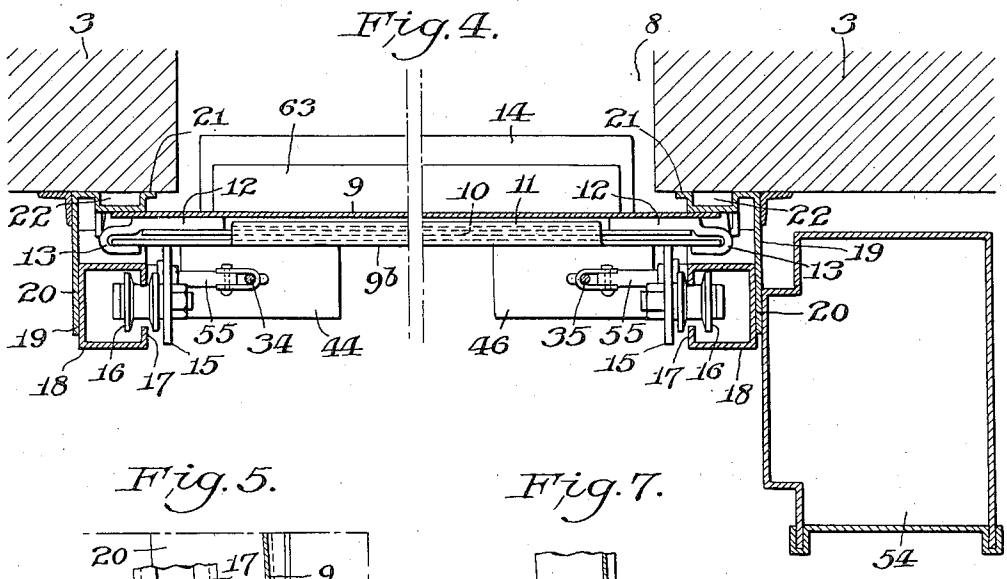


Fig. 5.

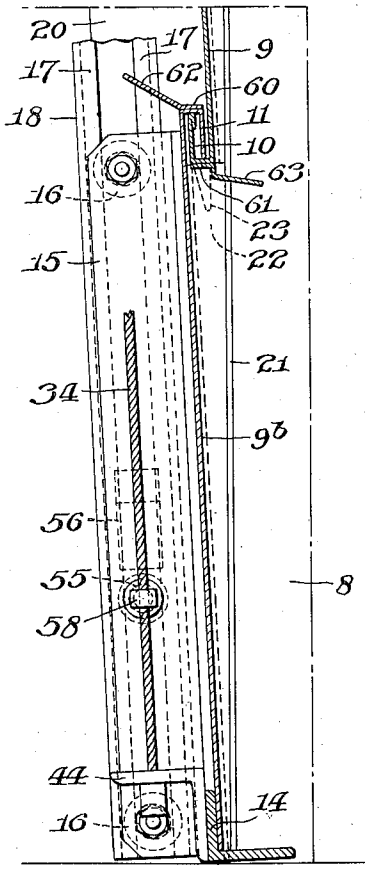


Fig. 7.

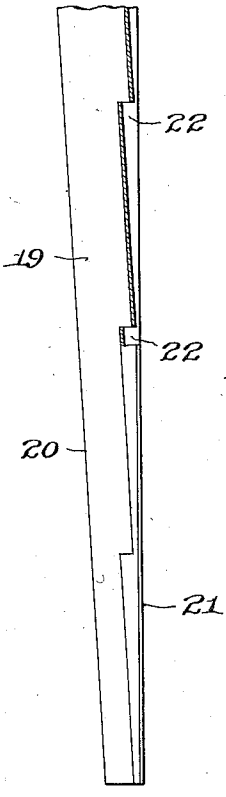
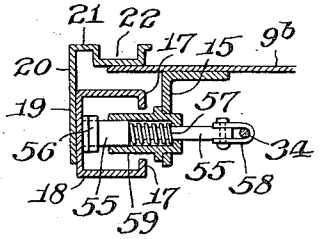


Fig. 6.



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2,007,552

UNITED STATES PATENT OFFICE

2,007,552

DOOR

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Application June 18, 1932, Serial No. 617,990

10 Claims. (Cl. 189—60)

This invention relates to improvements in shutters or doors of the general character shown and described in my previous Letters Patent Nos. 1,636,200 and 1,743,696.

Shutters or doors of this general character comprise a plurality of vertically movable panel plates constructed to be supported by one another and to be raised and lowered into open and closed positions, respectively, when one of the plates is raised and lowered, in combination with means operable to raise and lower the plates and to guide them during the raising and lowering thereof. When the said plates are raised by the said means the plates successively add their weight thereto, and when the plates are lowered by the said means it is relieved of the weight of said plates successively.

An important object of my present invention is to provide a novel and advantageous means for counterbalancing the weight of said plates with respect to the means for raising and lowering them whereby the variations in the weight of the plates supported by such means will be compensated for by the counterbalancing means so that the plates actually supported by the raising and lowering means will be properly counterbalanced at all times during the opening and closing of the shutter or door.

Another object of the invention is to improve the guiding means for the panel plates; another object is to provide a novel means for stiffening and strengthening the panel plates; and a further object is to provide a novel means operated automatically by the plate raising and lowering means to lock the shutter or door when the plates thereof are lowered and to unlock the same when the plates are raised.

The invention resides in the elements and the combinations of them hereinafter described and claimed.

In the accompanying drawings, illustrating the invention,

Figure 1 is an elevation, partly in section, showing my improved shutter or door applied to the wall of a building having an opening therein adapted to be closed by the door, as seen from the interior of the building and showing the door in the closed position.

Figure 2 is a vertical section, on line 2—2 of Fig. 1, showing part of the operating mechanism and adjuncts, omitting the bearing for the chain wheel and omitting the cable from certain places in the spiral groove of the cable receiver.

Figure 3 is a face view of the winding receiver for the cables for raising and lowering the door.

Figure 4 is a horizontal section of the door, on line 4—4 of Fig. 1.

Figure 5 is a vertical section, on line 5—5 of Fig. 1.

Figure 6 is a horizontal section, on line 6—6 of Fig. 1, showing one of the locking bolts and associated parts.

Figure 7 is a vertical section, showing the pockets in one of the angle plates for receiving the projections on the panel plates of the door.

Referring to the drawings, 3 designates a building wall having a door opening 8 therein.

My improved door is arranged to close the opening 8, as shown in Fig. 1 and to be raised to clear the same.

The door comprises a plurality of parallel, horizontally extending, panel plates 9 which are vertically slidable relatively to one another to open and close the door, as shown and described in my aforesaid Letters Patent No. 1,743,696.

The upper plate 9^a shown in Fig. 1, or the front plate 9^a, as shown in Fig. 2, is secured to the wall 3 above the opening 8 and supports all the door plates beenath it when the door is in the closed position, or all but the bottom plate 9^b which may rest upon the floor.

The bottom edge portion of each door plate, excepting the lowermost plate 9^b is bent to form a rearwardly and upwardly turned flange or hook 10, and the upper edge portion of each plate, excepting the uppermost plate 9^a, is bent to form a forwardly and downwardly turned flange or hook 11.

The lower corners of the plates of the shutter, excepting the bottom plate, each have a block 12 secured thereto, and each block is provided with a hook 13 which embraces and is slidably engaged with the lateral edge portion of the next adjacent plate forwardly thereof, so that each plate may slide vertically through the hooks 13 of the next adjacent rearward plate when the plates of the door are raised to the open position or lowered to the closed position, by raising and lowering the lowermost plate 9^b, the same as shown and described in the said Letters Patent Nos. 1,636,200 and 1,743,696.

When the plates of the door are raised from the closed to the open position by raising the bottom plate 9^b, the top hooks 11 are successively withdrawn from the bottom hooks 10, and the bottom hooks 10 of the plates successively engage the side hooks 13 thereof and lift them into the elevated position and thus successively add the

weight thereof to the bottom plate 9b; and, thereafter, when the door is lowered to the closed position the top hooks 11 of the plates successively enter the bottom hooks 10, to suspend the plates from one another and successively add their weight to the top plate 9a. As the bottom plate 9b is not provided with a hook like the hooks 10 of the plates above it, the plate 9b is provided with a bottom bar 14 which is adapted to engage the hooks 13 of the next plate above it when the door is raised or opened.

The bottom plate 9b has two parallel angle bars 15 secured to the respective end portions thereof and these bars 15 are provided with upper and lower guiding rollers 16 which are journaled on pins or studs projecting from the bars.

These guiding rollers 16 enter the spaces between the parallel, interned flanges 17 of inclined channel bars 18 which are secured to the inwardly or rearwardly extending flanges 19 of angle plates or bars 20, the forward flanges 21 of which are secured to the wall 3 on the respective sides of the door opening 8 and form guiding walls for the panel plates of the door or shutter. The rollers 16 are provided with annular end flanges which embrace the channel bar flanges 17 and maintain the rollers in proper working relation to the bars. The channel bars 18 extend from the top to the bottom of the door, or substantially so, and they serve to guide the bottom plate 9b and cause it to remain substantially in an inclined plane parallel to the bars 18, as shown in Fig. 5, in its raised and lowered positions and during the up and down movements thereof when the door is opened and closed.

The flanges 21 of the angle plates 20 are provided with pockets 22 for the reception of downwardly extending projections 23 on the blocks 12, and the projections 23 are adapted to be withdrawn from the pockets 22 when the plates of the door are raised, and to enter the same when the plates are lowered, the same as illustrated and described in the said Letters Patent No. 1,743,696. The flanges 21 follow the vertical inner surface of the building wall 3, and the channel bars 18 diverge upwardly and rearwardly with respect thereto and are set at the proper angle with respect thereto to move the bottom plate 9b away from the wall 3 when it is raised and toward the same when it is lowered to permit the panel plates to nest back of one another when the door is raised or opened and to cause the projections 23 to enter the pockets 22 when the door is lowered or closed.

The pockets 22 are arranged above one another in vertical series on the respective sides of the door opening 8, and the rearward wall of each pocket 22 which faces the channel bars 18 rearwardly thereof extends parallel to the bar 18 to engage or be in close proximity to the forward surface of the panel plate adjacent thereto when the door is closed, as shown in Figs. 2, 4, 5 and 6; and the movements and positions of the plates 9 are guided and controlled at all times by the plate 9b and parts of the guiding walls 21 and the engagement of the hooks or flanges 10 and 11 with the bodies of the plates 9, so that each plate 9 remains in and moves through a plane of its own which is parallel to but spaced from the planes of the plate 9b and the adjacent plates 9. This control of the positions and movements of the plates 9 causes them to be packed in close and firm relationship between the plate 9b and the walls 21 when the plate 9b is raised to open the door, and causes the projections 23 to be accurately guided into the pockets 22 in direct lines when the plate 9b is lowered to close the door, and lends firmness and rigidity to the entire door structure at all times.

I shall now describe my improved means for raising and lowering and for counterbalancing the door.

A sheet metal housing 24 is provided at one side of the upper portion of the door and it is secured to and supported by one of the angle plates 20 and a horizontal angle bar 25 which extends between the two angle plates 20 at the respective sides of the door and along the top of the fixed door plate 9a and is suitably bolted or otherwise secured thereto and to the wall 3.

This housing 24 supports bearings 26 in which a short horizontal shaft 27 is journaled on the outside of the housing. The outer end portion of the shaft 27 has a grooved chain wheel or pulley 28 secured thereto and carrying a depending endless chain 29 adapted to be operated by hand to turn the wheel 28 and thereby turn the shaft 27. The side of the angle plate 20 adjacent to the chain 29 is provided with a suitable hook 30 with which a link of the chain may be engaged for a purpose hereinafter explained. The shaft 27 has a bevel pinion 31 secured thereto and extending through a wall of the housing 24 to the interior thereof. The portion of the pinion 31 within the housing is in mesh with a bevel gear wheel 32 which is located within the housing and has a hub portion extending axially into and secured to a rotatable part or receiver 33 for the door raising and lowering cables 34 and 35 and the door counterbalancing cable 36. The gear wheel 32 and the cable receiver 33 are adapted to be rotated as a unit on roller bearings 37 which surround and are supported by a sleeve 38 which extends between opposite walls of the housing 24 and which is secured thereto by a bolt 39 extending through the sleeve and the housing walls.

It will now be understood that the gear wheel 32 and therewith the cable receiver 33 may be rotated in either direction by operating the chain 29 by hand to turn the pulley 28 in either direction.

The cable receiver 33 is provided with two deep, peripheral, parallel grooves 40 and 41 whose bases or bottoms are concentric with the turning axis of the receiver, and the upper ends of the door raising and lowering cables 34 and 35 extend into these grooves 40 and 41 and are secured to the bases thereof, at 42 and 43, respectively, as shown in Figs. 2 and 3. The cable 34 extends downwardly from the receiver 33 and has its lower end portion attached to an angle bracket 44 which is secured to the bottom portion of one side of the bottom door plate 9b. The cable 35 extends from the receiver 33 to and over and down one side of a grooved guiding pulley 45 to an angle bracket 46 which is secured to the bottom portion of the side of the bottom door plate opposite to the side thereof to which the bracket 44 is secured, and the lower end of the cable 35 is attached to the bracket 46. The guiding pulley 45 is rotatably supported by a bracket 47 which, in turn, is supported by the upper end portion of one of the angle plates 20 and the horizontal angle bar 25.

The widths of the grooves 40 and 41 are substantially equal to or slightly in excess of the diameters of the cables 34 and 35 therein, and, when the chain 29 is operated by hand to turn cable receiver 33 in the direction of the arrow in Figs. 1 and 3, the cables 34 and 35 will be wound

within their grooves 40 and 41 and upon the receiver 33 and upon themselves in spiral form to raise the bottom door plate 9b and thereby cause it to raise the door plates above it and thus raise or open the door as previously explained. When the chain 29 is operated by hand to turn the cable receiver 33 in the direction reversely of the arrow in Figs. 1 and 3, the door will be closed by the lowering of the plates thereof as previously explained.

The cable receiver 33 has formed in the periphery thereof a spiral groove 49 which winds around and advances helically along the axis of the receiver and which gradually recedes or extends outwardly from said axis from a low point 50 near the gear wheel 32 to a high point 51 farther from the gear wheel. This groove 49 receives the door counterbalancing cable 36, one end of which is secured or attached to the receiver at or near the high point of the groove, and, when the door is in the down or closed position, the cable 36 extends from the high point 51 of the groove 49 spirally through the same to or near the low point 50 thereof, and, from the low point 50, the cable 36 extends from the receiver 33 to and over and down one side of a grooved guiding pulley 52 which is rotatably supported by the bracket 47. The end portion of the cable extending down from the pulley 52 is attached to a counterweight 53 which is adapted to be lowered and raised within a vertically-extending, surrounding guard or enclosure 54 which is formed of sheet metal and secured to the angle plate 20 at the adjacent side of the door.

The gravity action of the weight 53 on the cable 36 causes it to tend to turn the cable receiver 33 in the direction of the arrows in Figs. 1 and 3, and thus the weight 53 serves as a counterbalance for the plates of the door. When the door is in the down or closed position, the cable 36 extends from or near the low point 50 of the spiral groove 49 to the pulley 52, and the counterbalancing effect of the weight 53 is sufficient to counterbalance the weight of the bottom door plate 9b and permit the chain 29 easily to be operated to turn the cable receiver 33 in the direction of the arrows in Figs. 1 and 3 to raise the bottom plate; and, when the chain 29 is operated to turn the receiver 33 in the direction of said arrows, the cable 36 is unwound from the receiver 33 and the weight 53 is thus permitted to descend within the guard 54 while the cables 34 and 35 are wound upon the receiver 33, and this relative cable unwinding and winding operation takes place during the entire raising or opening of the door. The gradual recession of the spiral groove 49 from the axis of the receiver 33 between the low and high points 50 and 51 thereof, respectively, causes the gravity pull of the weight 53 to progressively increase its counterbalancing effect upon the door plates as the plates 9 above the bottom of plate 9b successively add their weight thereto during the door opening operation, as previously described.

When the chain 29 is operated to turn the receiver 33 in a direction reversely of the direction of the arrows in Figs. 1 and 3 to lower or close the door, as previously described, after the same has been raised or opened, the reverse of the operations of the cables 34, 35 and 36, with respect to the receiver 33, as just described, takes place; that is to say, the cables 34 and 35 are unwound from the receiver 33 and the cable 36 is wound thereon. During the winding of the cable 36 upon the receiver 33 it is wound thereon from a position at or near the high point 51 of the spiral groove 49 to a position at or near the low point 50 of the groove 49 so that the gravity pull of the weight 53 progressively decreases its counterbalancing effect upon the door plates, in accordance with the weight thereof, as the plates 9 successively add their weight to the top, fixed plate 9a, and the plate 9b is relieved of the weight of the plates 9 successively, during the door closing operation.

The gradual recession of the spiral groove 49 from the axis of the receiver 33 between the low and high points 50 and 51 thereof, respectively, is so related to the panel plates of the door and to the movements thereof during the door opening and closing operations that the door will be properly and uniformly counterbalanced in all positions of the panel plates thereof for the even and uniform operation of the opening and closing mechanism.

The angle bars 15 at the respective sides of the bottom panel plate 9b carry locking bolts 55 which are slidable in sleeves 59 secured within openings in the bars, as shown in detail in Fig. 6. The sleeves 59 extend into the channel bars 18 and the bolts 55 are adapted to be projected to positions beneath blocks 56 secured within the channel bars when the door is down or in the closed position. The bolts 55 are urged toward the locking position by springs 57, which encircle the bolts within the sleeves between shoulders formed on the bolts and inturned end flanges on the sleeves. The inner ends of bolts 55 have links or yokes 58 secured thereto through which the door raising and lowering cables 34 and 35 extend at the respective sides of the door.

After the chain 29 is operated to turn the cable receiver 33 in a direction reversely of the arrows in Figs. 1 and 3 to lower the door to the closed position, a slight additional pull is exerted upon the chain after the door is completely closed and the cables 34 and 35 no longer support the door plates. This additional pull raises the counterbalancing weight 53 slightly or produces a strain upon its cable 36 sufficiently to produce a slackness in the cables 34 and 35, and this slackness permits the springs 57 to project the bolts 55 into the locking position beneath the blocks 56. After the bolts 55 have been projected into the locking position, the chain 29 is engaged with the hook 30 to support the weight 53 and thus preserve the slackness in the cables 34 and 35 and permit the springs 57 to hold the bolts in locking position.

When it is desired to raise or open the door, the chain 29 is first disengaged from the hook 30 and the weight 53 is permitted to draw the cables 34 and 35 taut, and as they are thus drawn taut they withdraw the bolts 55, against the action of the springs 57, from the locking position beneath the blocks 56. This done, the chain 29 may be operated, as previously explained, to turn the cable receiver 33 to raise or open the door.

The upper and lower longitudinal edge portions of each panel plate 9 have supplemental plates 60 and 61, secured to the bent portions thereof which form the hook flanges 11 and 10 thereof, respectively. These supplemental plates 60 and 61 extend longitudinally of the panel plates 9 and substantially parallel to the hook flanges 11 and 10 thereof and they extend outwardly from the panel plates on opposite sides of the plane of the body thereof and form stiffening flanges 62 and 63 which strengthen the panel

plates and preserve the parallel relationship of all parts of the plates and the hook flanges thereof. It will be observed that the hook flange and stiffening flange of each longitudinal edge portion of each plate **9** are located one on one side and one on the opposite side of the plane of the body of the plate, and that the stiffening flanges of the respective edge portions of each plate are located on opposite sides of said plane, and that the hook flanges of the respective edge portions of each plate are located on opposite sides of said plane. This construction permits the bodies of the panel plates and the stiffening flanges thereof to nest together with the plates back of one another and the flanges above and below one another when the plates are raised to open the door.

The bottom plate **9b** also has a plate **60** secured to its upper longitudinal edge portion and providing a stiffening flange **62** the same as the plates **9** above it.

I claim:

1. The combination of a frame structure having an opening therein, a shutter including a plurality of vertically movable plates constructed to be supported by one another and to be raised and lowered when one of said plates is raised and lowered, means operable to raise and lower said one of said plates, guiding bars at the respective sides of the shutter, and guiding rollers journaled on said one of said plates adjacent to the upper and lower ends thereof for engaging said bars one above the other said one of said plates supporting the remaining plates when raised and being prevented by said rollers from tilting relatively to said bars.

2. The combination of a frame structure having an opening therein, a shutter, including a plurality of vertically movable plates constructed to be supported by one another and to be raised and lowered when one of said plates is raised and lowered. means operable to raise and lower said one of said plates, inclined channel bars at the respective sides of the shutter for guiding said one of said plates, and guiding rollers journaled on said one of said plates and extending into said channel bars and maintaining said one of said plates substantially in parallel relation thereto.

3. The combination of a frame structure having an opening therein, a shutter including a plurality of vertically movable plates constructed to be supported by one another and to be raised and lowered when one of said plates is raised and lowered, means operable to raise and lower said one of said plates, channel bars located at the respective sides of the shutter for guiding said one of said plates and each having parallel spaced flanges directed toward each other, and guiding rollers journaled on said one of said plates and extending into the spaces between the flanges of said bars, said rollers having annular flanges for embracing the channel bar flanges.

4. The combination of a frame structure having an opening therein, a shutter including a plurality of vertically movable plates constructed to be supported by one another and to be raised and lowered when one of said plates is raised and lowered, means operable to raise and lower said one of said plates, guiding bars at the respective sides of the shutter, parallel angle bars secured to the respective sides of said one of said plates, and guiding rollers journaled on said angle bars and engaging said guiding bars.

5. The combination of a frame structure having an opening therein, a shutter including a plurality of vertically movable plates constructed to be supported by one another and to be raised and lowered when one of said plates is raised and lowered, means operable to raise and lower said one of said plates, and a locking device for said one of said plates automatically operated by said means to release said one of said plates when said means is operated to raise the same and means to operate said device to lock said one of said plates when said means is operated to lower the same.

6. The combination of a frame structure having an opening therein, a shutter including a plurality of vertically movable plates constructed to be supported by one another and to be raised and lowered when one of said plates is raised and lowered, means operable to raise and lower said one of said plates, said means including a cable drawn taut while raising and lowering said one of said plates and having a slackness therein when said one of said plates is in the lowered position, a locking bolt carried by said one of said plates and connected to said cable and adapted to engage a part fixedly related to said frame structure to lock said one of said plates in the lowered position, and a spring urging said bolt into locking position, said cable when drawn taut withdrawing said bolt from locking position and said spring projecting said bolt into locking position when said cable is slack.

7. An elongated shutter or door panel plate having one of its longitudinal edge portions bent to form a hook flange wholly on one side of the plane of the body of the plate and having a longitudinally extending supplemental plate secured to said bent edge portion outwardly thereof and extending outwardly therefrom on the opposite side of said plane and providing a stiffening flange.

8. An elongated shutter or door panel plate having a longitudinally extending stiffening flange and a substantially parallel hook flange on each of its longitudinal edge portions, said flanges of each edge portion being located one on one side and one on the opposite side of the plane of the body of the plate, the stiffening flanges of the respective edge portions being located on opposite sides of said plane, the hook flanges of the respective edge portions being located wholly on opposite sides of said plane, said hook flanges being formed by bent edge portions of said plate, and said stiffening flanges being formed by supplemental plates secured to said bent edge portions outwardly of said hook flanges.

9. The combination of a frame structure having a door opening therein and guiding walls at the respective sides thereof, inclined guiding bars rearwardly of and spaced from said walls and diverging upwardly and rearwardly with relation thereto, a shutter for said opening including a plurality of vertically movable plates extending between said walls and said bars and constructed to be supported by one another and to be raised to an open position and lowered to a closed position when one of said plates is raised and lowered, and means operable to raise and lower said one of said plates, said one of said plates having elements cooperating with said bars to guide and maintain it in all its positions substantially in a plane parallel to said bars, and the remaining plates having cooperating parts guiding and maintaining each of them in all positions thereof substantially in an inclined plane parallel to but spaced from the planes of adjacent plates for movement toward and from said guiding walls.

10. The combination of a frame structure having a door opening therein and guiding walls at

the respective sides thereof having pockets therein spaced one above another, inclined guiding bars rearwardly of and spaced from said walls and diverging upwardly and rearwardly with relation thereto, a shutter for said opening including a plurality of vertically movable plates extending between said walls and said bars and constructed to be supported by one another and to be raised to an open position and lowered to a closed position when one of said plates is raised and lowered, certain of said plates having projections adapted to enter certain of said pockets when the plates are lowered and to be withdrawn from said pockets when the plates are raised, and means operable to raise and lower said one of said plates, said one of said plates having elements cooperating with said bars to guide and maintain it in all its positions substantially in a plane parallel to said bars, and the remaining plates having cooperating parts guiding and maintaining each of them in all positions thereof substantially in an inclined plane parallel to but spaced from the planes of adjacent plates for movement toward and from said guiding walls.

HENRY M. VETTERLEIN.