

Dec. 26, 1939.

J. E. BROWNING

2,184,774

DOOR OPERATING AND LOCKING MECHANISM

Filed March 20, 1939

8 Sheets-Sheet 1

BY *A. B. Wilson & Co.* Attorneys.

Dec. 26, 1939.

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DOOR OPERATING AND LOCKING MECHANISM

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8 Sheets-Sheet 2

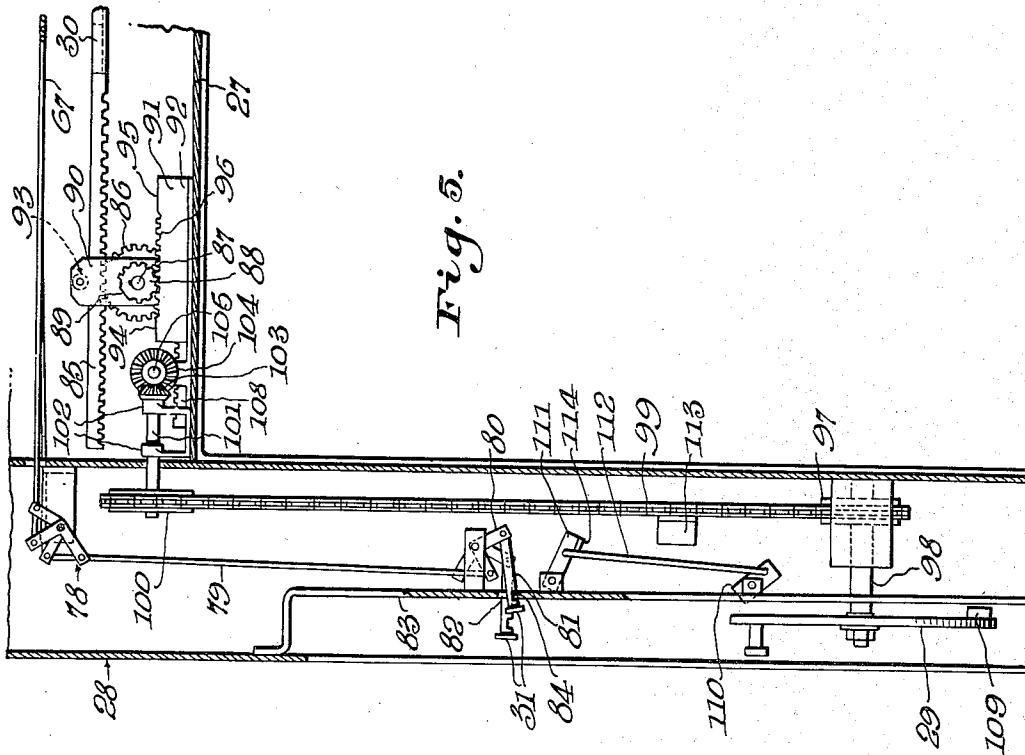


Fig. 5.

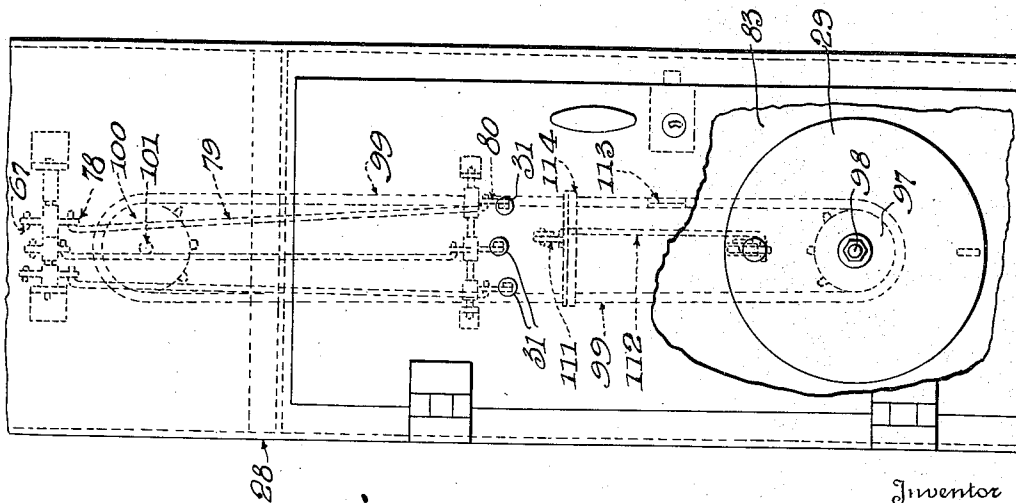


Fig. 4.

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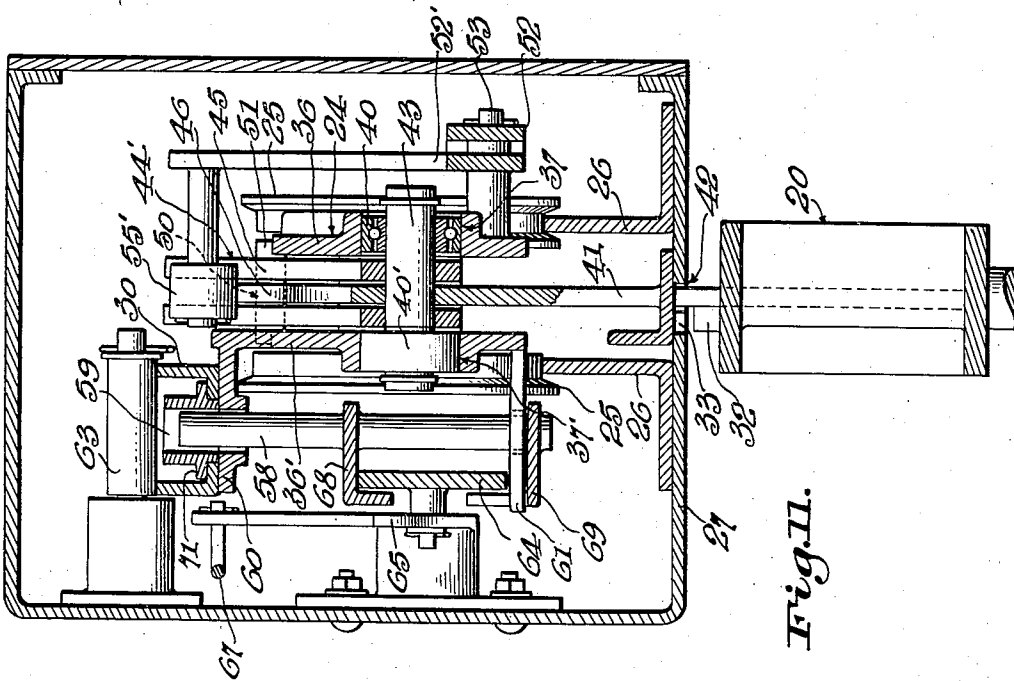
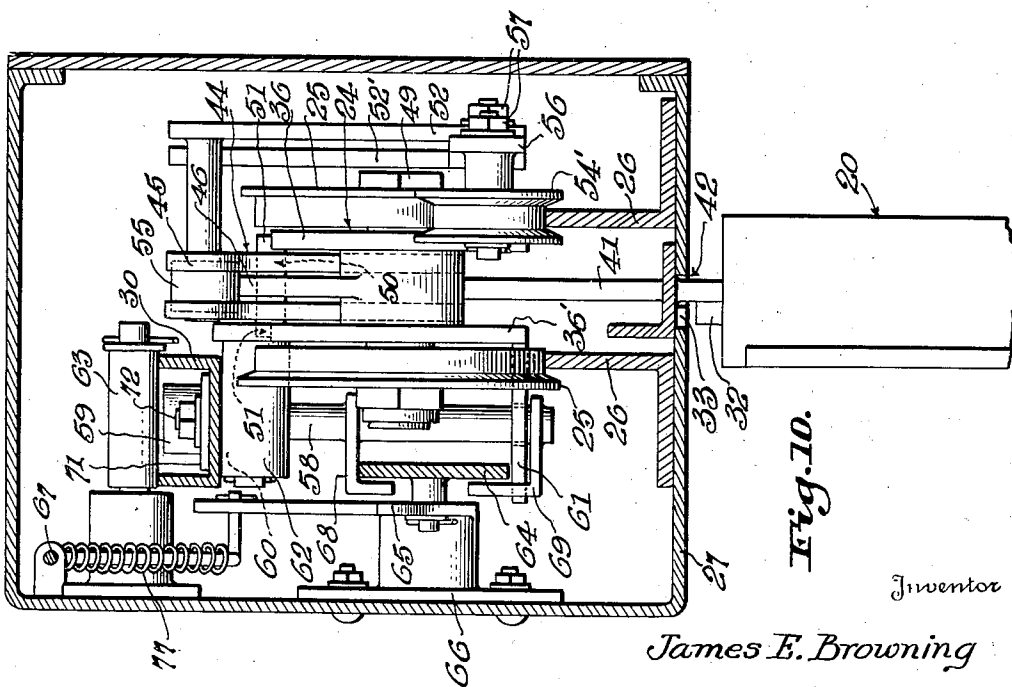
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DOOR OPERATING AND LOCKING MECHANISM

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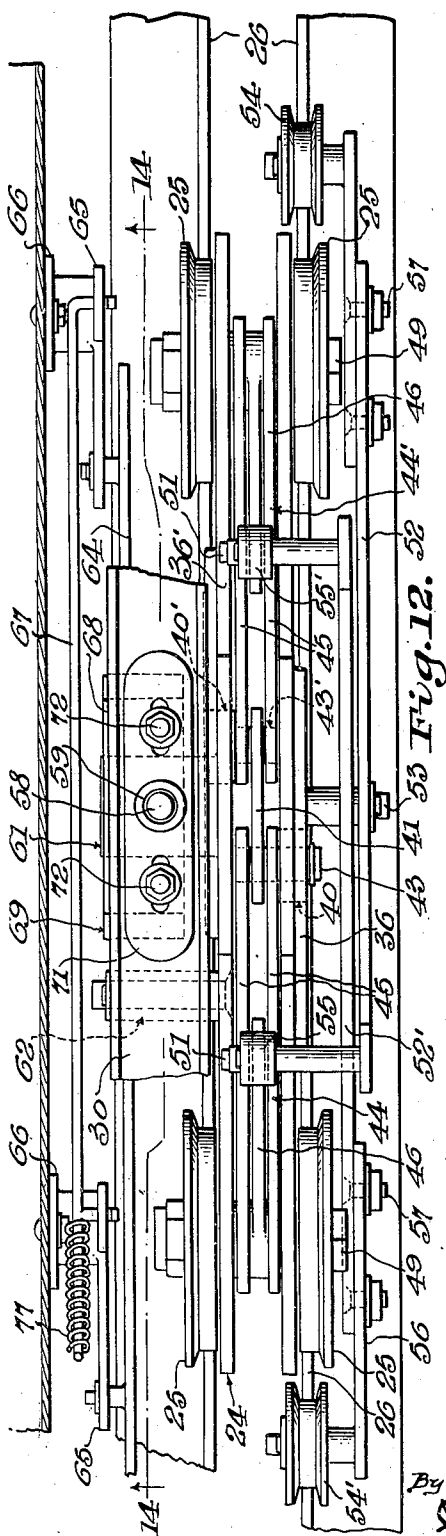
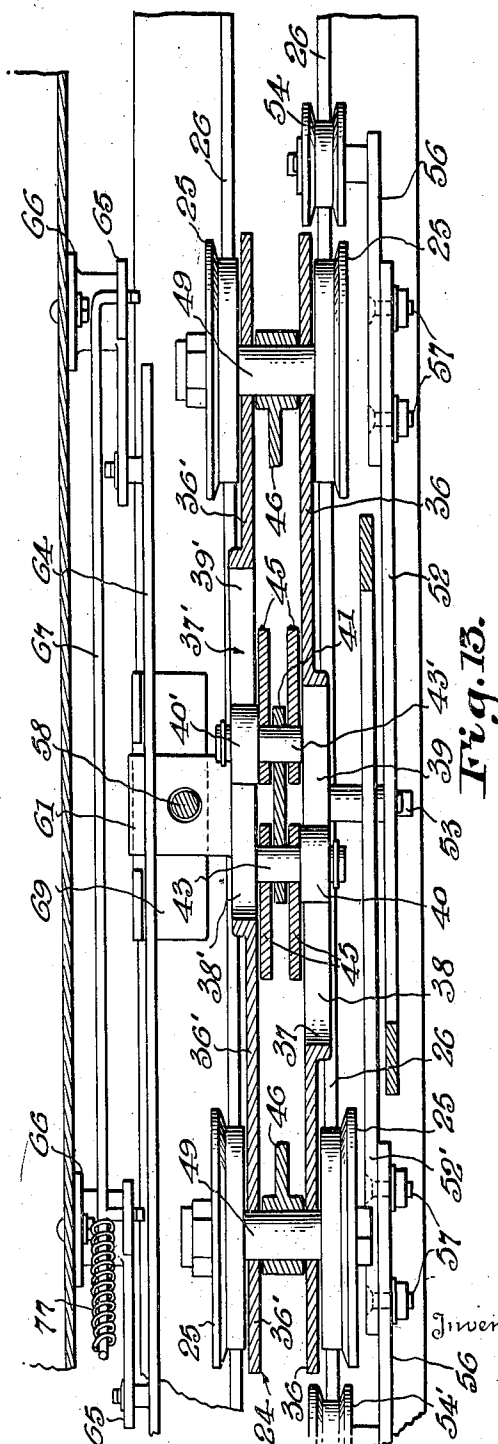
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DOOR OPERATING AND LOCKING MECHANISM

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DOOR OPERATING AND LOCKING MECHANISM

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Fig. 14.

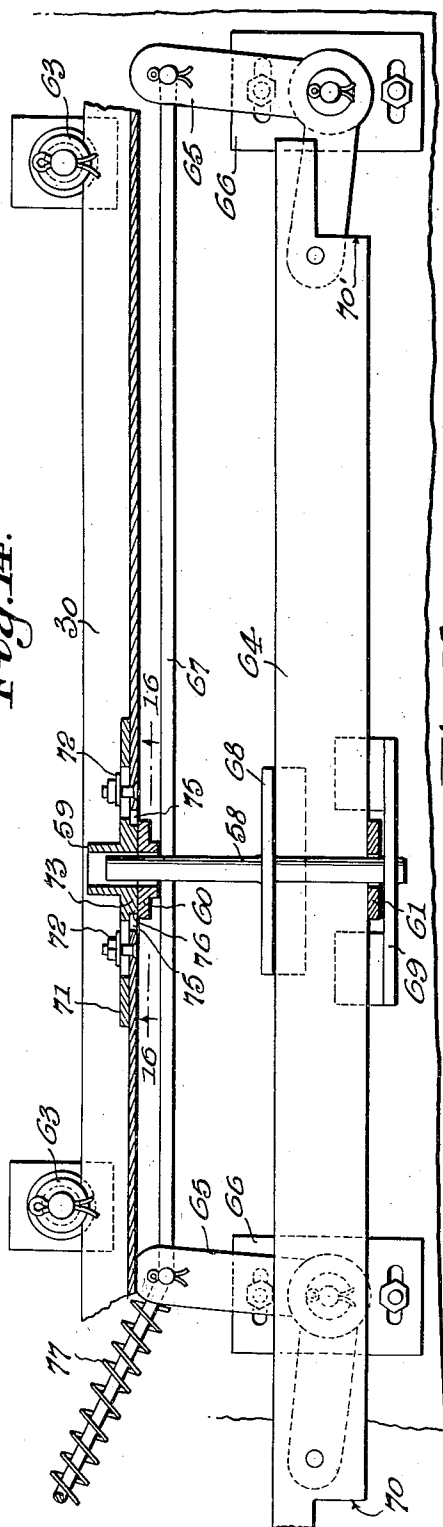


Fig. 15.

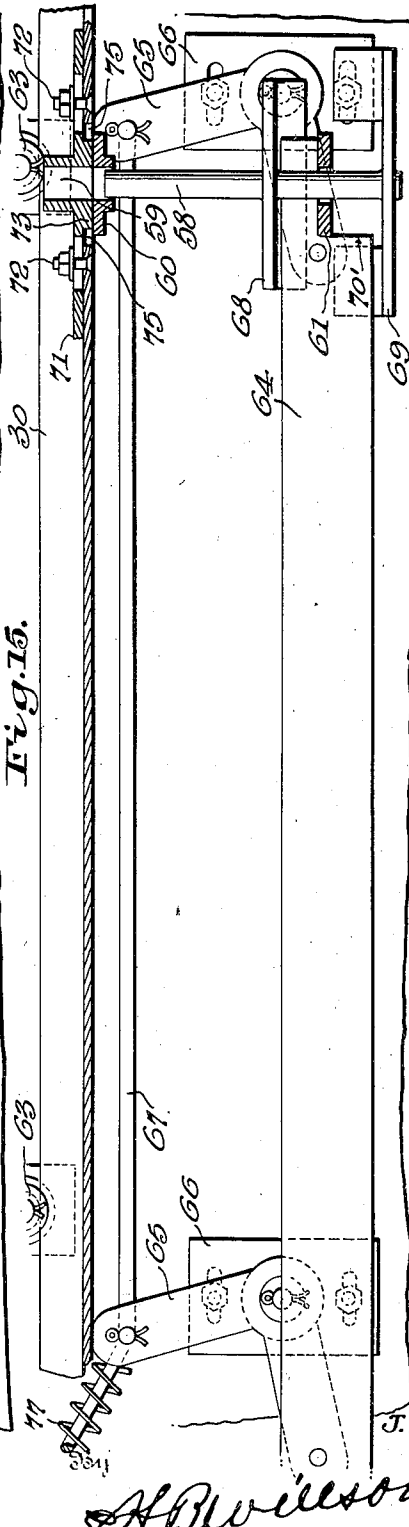
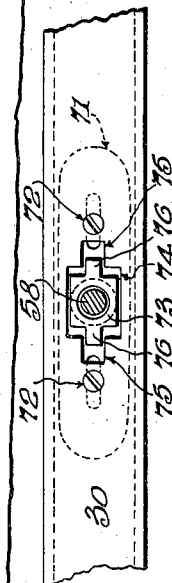


Fig. 16.



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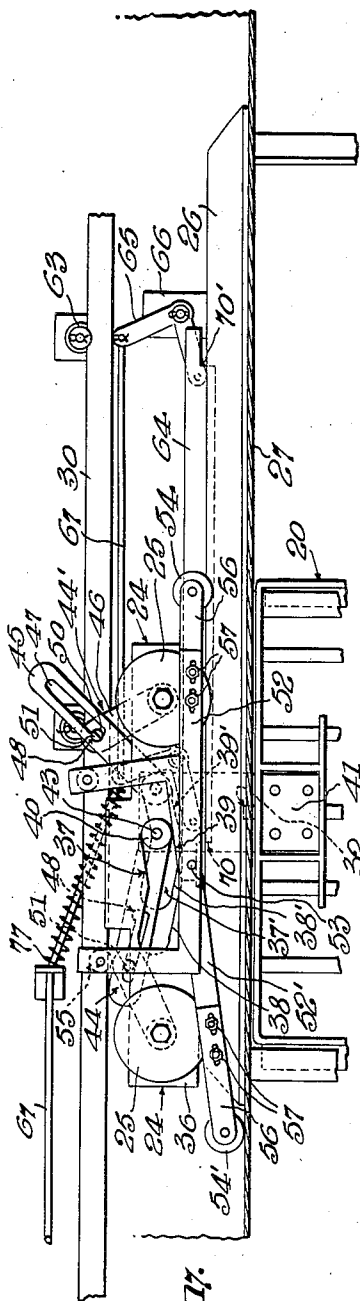


Fig. 17.

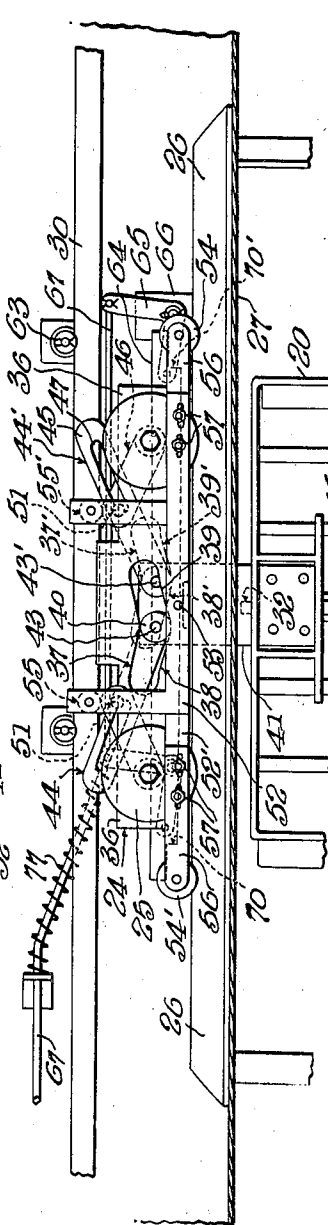


Fig. 18.

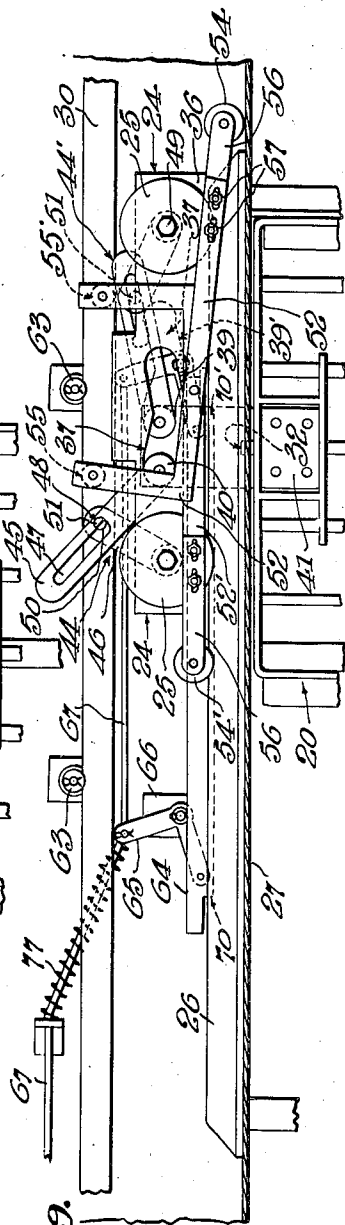


Fig. 19.

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UNITED STATES PATENT OFFICE

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DOOR OPERATING AND LOCKING
MECHANISM

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or of one-half to Claude V. Birkhead and
Werner N. Beckmann, both of San Antonio,
Tex., copartners doing business as Birkhead,
Beckmann, Stanard & Vance

Application March 20, 1939, Serial No. 263,091

22 Claims. (Cl. 189-7)

The invention relates to mechanisms for oper-
ating and locking doors and it is particularly ap-
plicable for controlling jail cell doors from a
control booth or the like.

5 The principal object of the invention is to
provide a comparatively simple and inexpensive,
yet a safe and reliable mechanism which may be
quickly and easily operated to open or close any
selected door or doors, and to lock and unlock the
same.

10 Each door is suspended from an elevated track-
supported carriage which is operable at will, and
one of the foremost objects of the invention is to
provide for limited movements of the carriage
with respect to the door for the purpose of utiliz-
15 ing these limited carriage movements to effect
door locking and unlocking.

Further objects are to provide door locking
means controlled by vertical movements of the
door and to make novel provision whereby the
20 above mentioned limited movements of the car-
riage with respect to the door will be utilized to
impart the required vertical movements to said
door to lock and unlock the same.

25 Another object is to provide novel and ad-
vantageous means for locking the door carriages
as well as the doors, providing an additional
safeguard.

30 A still further object is to provide novel means
for selectively or simultaneously connecting any
or all of the door carriages with a single carriage
operating member, whereby any one of the doors
or a number thereof may be opened or closed at
will.

35 A still further object is to make novel and ad-
vantageous provision for actuating the above
mentioned carriage operating member at a rela-
tively slow speed with consequent relatively great
power until the door has been well started to-
40 ward open or closed position, and for then actu-
ating said operating member with comparatively
great speed.

45 The operating means for the above mentioned
carriage-operating member preferably includes
a hand wheel by means of which said operating
means is actuated to either open or close any
selected door or doors, and still another object of
the invention is to provide novel means for stop-
ping the rotation of said hand wheel in either
50 direction when the door opening or door closing
operation has been completed, overcoming any
liability of straining or breaking any of the parts
which move under the influence of said hand
wheel by excessive turning of the latter in either
55 direction.

With the foregoing and minor objects in view,
the invention resides in the novel subject matter
hereinafter described and claimed, description
being accomplished by reference to the accom-
panying drawings.

Figure 1 is a side elevation partly broken away
and in section showing the invention associated
with three cell doors, one of said doors being
shown in closed position, another partially opened
and the third completely opened.

Figure 2 is an enlarged horizontal sectional
view substantially on line 2-2 of Figure 1.

Figure 3 is a detail vertical section on line
3-3 of Figure 2.

Figure 4 is an enlarged elevation partly broken
away looking toward the left end of Figure 1.

Figure 5 is an enlarged sectional view corre-
sponding to the left end portion of Figure 1.

Figure 6 is an enlarged side elevation showing
the means for actuating the door carriage operat-
ing bar.

Figure 7 is a horizontal sectional view on line
7-7 of Figure 6.

Figure 8 is a vertical transverse section on
line 8-8 of Figure 6.

Figure 9 is an enlarged elevation partly in sec-
tion showing the upper portion of one of the
doors, the carriage for this door and the various
structural features associated with said carriage.

Figures 10 and 11 are transverse sectional views
on lines 10-10 and 11-11 respectively of Fig-
ure 9.

Figure 12 is a top plan view partly in section
showing the parts illustrated in Figure 9.

Figure 13 is a horizontal sectional view on line
13-13 of Figure 9.

Figure 14 is a vertical longitudinal sectional
view on line 14-14 of Figure 12 showing the
vertically movable bar which is instrumental in
connecting the carriage with the carriage-operat-
ing member and in locking said carriage.

Figure 15 is a view similar to Figure 14 but
showing the manner in which the vertically mov-
able bar locks the carriage when the latter is dis-
connected from the carriage operating bar.

Figure 16 is a detail horizontal sectional view
on line 16-16 of Figure 14.

Figure 17 is a side elevation showing the upper
portion of one of the doors, the carriage of this
door and the relative positions of carriage-carried
parts and door when the latter is locked in closed
position.

Figure 18 is a view similar to Figure 17 but il-
lustrating the relation of parts when the car-

riage is moving the door toward open or closed position.

Figure 19 is a similar view illustrating the relation which occurs when the door is locked in open position.

Features of construction have been illustrated which may be considered as preferred but the present disclosure is to be considered as illustrative rather than limiting, for numerous variations may be made within the scope of the invention as claimed.

For illustrative purposes, the invention has been shown associated with the doors 20 of three cells 21, 22 and 23 but it could of course be used with any desired number of cell doors or with other kinds of doors. The doors 20 are suspended from overhead carriages 24 having flanged wheels 25 to travel on horizontal tracks 26 suitably mounted upon the bottom of an elongated casing structure 27 which is appropriately mounted over the doorways of the bank of cells. At one end of the cell bank, I have shown a control cabinet 28 in which is a hand wheel 29 constituting the prime mover for the actuating means of a horizontal carriage-operating bar 30 which is suitably mounted in and extends longitudinally of the housing 27. The cabinet 28 also contains a plurality of indexing push-buttons or the like 31 which are operable to connect any one or more of the door carriages 24 with the operating bar 30, whereby movement of this bar 30 will move the connected carriage or carriages. The push-buttons 31 also serve to apply and release a locking means for the carriages as will hereinafter appear.

Each carriage 24 is so connected with its respective door 20, that it may move in either direction to a limited extent with respect to said door, before starting to open the latter, after completely opening the latter, before starting to close the door and after completely closing said door, and I make novel provision whereby these limited carriage movements with respect to the door, are utilized to effect vertical movements of said door to and from locked position.

Any suitable provision may be made for locking the door 20 when it is moved vertically in one direction and for unlocking it when moved vertically in the other direction. In the present disclosure, the upper end of the door 20 is provided with a projection 32 (see Figs. 9, 10 and 11) which is receivable in an opening 33 in the bottom of the housing 27 when said door is completely closed and lifted, said projection being also receivable in another opening similar to 33 when the door is completely opened and lifted. I have also shown hook-shaped slots 34 in some of the edge bars of the door 20 (see Fig. 3) engageable with fixed pins 35 carried by the fixed door frame. These slots and pins interengage and lock the door closed at its lower end while the projection 32 and opening 33 are locking the upper end of said door. These provisions for utilizing vertical movements of the door to lock and unlock the same, are of course merely illustrative of various ways in which the results could be accomplished. Moreover, while in the present disclosure, the door is locked when it is raised and unlocked when it is lowered, it will be obvious that an arrangement could be provided to lock upon door lowering and release upon door raising.

The various features of construction associated with any one of the carriages 24, are duplicated in connection with all of the other car-

riages and hence a description in connection with one, will suffice. For this description, attention is invited more particularly to Figures 9 to 19, inclusive.

The carriage 24 in the present disclosure is provided with two longitudinally extending chassis bars 36 and 36' disposed in parallel relation, said bars having longitudinally extending slots 37 and 37' in their central portions, the slot 37 being formed in the bar 36 and the slot 37' in the bar 36'. The slot 37 is provided with end portions which incline and diverge widely toward the upper edge of the bar 36, the lower edges 38 and 39 of said inclined ends constituting cams for a purpose to appear. The slot 37' is shaped in the same manner and is provided with cam surfaces 38' and 39' corresponding to the cams 38 and 39. The two slots 37 and 37' are offset from each other longitudinally of the carriage 24. Two rollers or other shoes 40 and 40' are received in the two slots 37 and 37' respectively, said rollers being suitably mounted on a vertical door hanger 41 which passes through a longitudinal slot 42 in the bottom of the housing 27, the lower end of said hanger being suitably secured to the door 20 and the upper end of said hanger being positioned centrally between the carriage chassis bars 36 and 36'. In the present disclosure, the rollers 40 and 40' are mounted on horizontal pins 43 and 43' which pass through and are welded to the hanger 41. Preferably, the extremities of the slots 37 and 37' are so shaped that the rollers 40 and 40' come to rest on horizontal surfaces when the door is locked open or closed, whereby said rollers will have no tendency to roll down the inclined slot portions which would cause strain upon the carriage locking means to be described. The offset relation of the slots 37 and 37' prevents the door from swinging longitudinally of the track.

Two toggles 44 and 44' are provided between the end portions of the chassis bars 36 and 36', said toggles each comprising an inner link 45 pivoted to the hanger 41, and an outer link 46 pivoted to the carriage 24, the two links being slidably and pivotally connected with each other. The inner end of each link 45 is, in the present disclosure, pivoted to the hanger 41 by mounting it upon the pin 43 or 43', and if desired, each toggle may have two of these links 45, as in the present disclosure. The outer end of each link 45 is provided with a longitudinal slot 47, the upper edge wall of which is preferably formed with a notch 48 at its inner end. The outer link 46, in the present showing, is pivoted to the carriage 24 by mounting it upon one of the axles or the like 49 of the carriage wheels 25. The inner end of this link 46 carries a pin 50 which is received in the slot 47 to seat in the notch 48, said pin having projecting portions 51 on its ends resting slidably upon the chassis bars 36 and 36'. When the toggle is upwardly buckled, the notch 48 engaging the pin 50, prevents the link 46 from swinging toward the outer end of the slot 47 to a position past the dead center of pin 49.

When the rollers 40 and 40' are at the centers of the slots 37 and 37', both toggles 44 and 44' are buckled upwardly to some extent as seen in Figures 9 and 18. These are the positions 70 which the two toggles occupy when the door 20 is being moved in either direction by the carriage 24, and as long as said toggles 44 and 44' are held against further upward buckling, it will be seen that said carriage may have no horizon-

tal movement with respect to said door, so that any movement of said carriage is directly imparted to the door to open or close the same as required. Provision is made for holding the toggles 44 and 44' against said further upward buckling during the opening and closing movements of the door 20 but for allowing said further buckling of one toggle or the other when the door has completed its opening or closing movement. When the toggle 44' is permitted to buckle upwardly to an extreme position (see Fig. 17) after the door 20 has been completely closed, the carriage 24 may move to the left to an extreme position and during this carriage movement, the cams 39 and 39' coact with the rollers 40 and 40' to lift the hanger 41 and the door, thus locking the latter in closed position by interengaging the locking means 32 and 33, and 34 and 35 as above explained. When the other toggle 44 is permitted to buckle upwardly to an extreme extent (see Fig. 19) with the door 20 entirely open, the cams 38 and 38' lift the rollers 40 and 40', thereby lifting the hanger 41 and the door 20 to cause the latter to be locked in open position, for instance, by engagement of the stud 32 with another opening such as 33. Needless to say, when extreme upward buckling of the toggle 44 is permitted, the carriage 24 may move to an extreme position beyond that which it occupies when it has just completed the door closing movement. When the door is to be moved from its closed position (Fig. 17), the carriage 24 is given a return movement with respect to said door and this return movement causes the cams 39 and 39' to again lower the door, thus unlocking the same. The two toggles 44 and 44' then occupy the positions shown in Figs. 9 and 18, in which positions they are locked until the door opening movement is completed. Similarly, when the door is to be moved from the open position (Fig. 19), the carriage 24 is given a return movement with respect to said door and this return movement lowers the door to free it for movement. By the time this door lowering has occurred, the two toggles 44 and 44' again occupy the positions shown in Figs. 9 and 18 in which position, they are locked until the door closing movement has been completed.

For locking the two toggles 44 and 44' in door-driving position (Figs. 9 and 18) for permitting toggle 44' to buckle further upward when the door is closed (Fig. 17) and for allowing toggle 44 to buckle further upward when the door is open, (Fig. 19), I make use of two levers 52 and 52' both extending longitudinally at the outer side of the chassis bar 36 and both fulcrumed to said chassis bar upon a suitable lateral stud 53. The outer ends of the levers 52 and 52' carry rollers or other shoes 54 and 54' respectively, engaging one of the carriage track rails 26, the roller 54 being adapted to leave said rail when the door has been completely opened (Fig. 19), thus permitting tilting of the lever 52, and the roller 54' being adapted to move from said rail when the door has been completely closed (Fig. 17) permitting tilting of lever 52'. Thus, as the two levers 52 and 52' hold the two toggles 44 and 44' in their door-driving position (Fig. 18) preventing any movement of the carriage with respect to the door, release and tilting of one lever or the other will allow the required upward buckling of one toggle or the other and will thus permit the necessary movement of the carriage with respect to the door to effect vertical movement of the latter to and

from locked position, whether the door be locked open or locked closed.

Both levers 52 and 52', in the present showing, are of right angular form, the upper end of lever 52 carries a roller 55 to lie upon a portion of the toggle 44, and the upper end of lever 52' carries a roller 55 to lie upon a portion of the toggle 44' (see Figs. 9, 10, 11 and 18). As long as the rollers are held down upon the toggles 44 and 44', the latter cannot buckle upwardly beyond their door-driving position (Figs. 9 and 18) but release of lever 52 (Fig. 19) allows roller 55 to free the toggle 44, and release of lever 52' allows 55' to release toggle 44', and whenever one toggle or the other is released, the carriage 24 continues to move to an extreme position and such carriage movement is utilized to lift the door 20 to locked position as above explained.

In order that the rollers 54 and 54' may be set to coact at the proper instant with the ends of the track rail 26 upon which said rollers travel, it is preferable that provision be made for adjusting said rollers to some extent longitudinally of said rail. This may be done by providing the levers 52 and 52' with adjustable terminals 56 carrying said rollers, and I have illustrated bolt and slot connections 57 between these terminals and the major portions of said levers.

Each carriage 24 carries a coupling pin 58 which is vertically slidable into and from a socket 59 carried by the carriage-operating bar 30 (see more particularly Figs. 9, 11, 12, 14 and 15). This coupling pin 58 is slidably mounted, in the present disclosure, in apertured lugs 60 and 61 which are rigidly carried by and project rearwardly from the upper and lower portions of the rear chassis bar 36' of the carriage 24. The upper lug 60 may well contact with the lower side of the bar 30 but undue friction may here be prevented by providing the carriage 24 with a roller 62 (Figs. 9, 10 and 12) upon which said bar rests, upward movement of said bar away from the roller 62 being prevented by a series of rollers 63 which are suitably mounted in the housing 27 and rest upon said bar.

It will be seen that when the coupling pin 58 is lowered from the socket 59 (Fig. 15), the carriage 24 carrying said pin will be disconnected from the operating bar 30, whereas raising of said coupling pin (Fig. 14) will cause it to operatively connect the carriage with the bar 30 so that movement of the latter may be transmitted to the former. Novel provision is made for effecting these movements of the coupling pin 58, for locking the carriage 24 when said pin is lowered (Fig. 15) and for unlocking said carriage when said pin is raised (Fig. 14). In attaining these ends, the structure now to be described is preferred.

A coupling pin operating bar 64 extends longitudinally within the rear portion of the housing 27 and is mounted for vertical movements but is held against appreciable horizontal movements. For illustrative purposes, this bar 64 is carried by two bell cranks 65 which are preferably adjustably mounted in the housing 27, upon suitable supports 66. These bell cranks 65 are pivoted to a longitudinal rod 67 which is directly under the control of one of the push-buttons 31 previously mentioned (Figs. 1, 4 and 5). Thus, the bar 64 may be moved upwardly and downwardly at will and provision is made to connect this bar with the coupling pin 58 for moving the latter to and from the carriage-driving position

of Figs. 9, 11 and 14. In the present disclosure, the pin 58 carries upper and lower guides 68 and 69 slidably engaged with the bar 64. While the carriage 24 is moving the door toward open or closed position, the guide 68 rests upon bar 64 and holds the coupling pin 58 engaged with the socket 59, possible descent of said bar 64 being then prevented due to the fact that this bar then rests upon the lug 61 or directly overlies said lug, as seen in Figs. 10, 11 and 14. The ends of the bar 64 are notched as shown at 70 and 70' to clear the lug 61 when the carriage has completed the door-closing or door-opening operation and has moved to its extreme door-locking position. Thus, when the bar 64 is moved downwardly to free the coupling pin 58 from the carriage operating bar 30, one or the other of the notches 70, 70' will engage the lug 61 (Fig. 15), thereby locking the carriage 24 in its final position, and providing an additional safeguard against possible unauthorized opening of the door.

The drive socket 59 is preferably carried by a base plate 71 connected with the bar 30 at 72 in such manner that it may be adjusted longitudinally of the latter to the requisite position. The plate 71 is provided with a boss 73 projecting downwardly into an opening 74 in the bar 30, the lower side of said boss being flush with the lower side of said bar to prevent catching of the coupling pin 58 upon same. The ends of the opening 74 are formed with narrow notches 75 and the boss 73 is provided with lugs 76 slidably received in these notches, the whole providing a structure which permits adjustment of the socket 59, yet overcomes any liability of the coupling pin 58 catching on any part when bar 30 is being moved with respect to said pin to operate another door.

A spring 77 is preferably relied upon to move the rod 67 in the proper direction to raise the bar 64 which controls the coupling pin 58, and an inward push on one or another of the push-buttons 31 (Figs. 1, 4 and 5) is utilized to move said rod 67 in the other direction to lower said bar 64 (Fig. 15). For illustrative purposes, rod 67 is pivoted to a bell crank 78 in the control cabinet 28 (Figs. 1, 4 and 5), a vertical rod 79 is connected with said bell crank, another bell crank 80 is connected with rod 79, and a horizontal rod or the like 81 connects with 80 and passes through an opening 82 in a vertical panel 83 within the cabinet 28, said rod or the like 81 being provided with one of the push-buttons 31. A push on this button rocks the bell crank 80, pulling upon rod 79, thereby rocking bell crank 78 and pulling upon rod 67 to effect lowering of the bar 64 to the position shown in Fig. 15, in which position it frees the carriage from the bar 30 and locks said carriage. The rod or the like 81 may be provided with a notch 84 to engage the edge wall of the opening 82 to hold the parts in the positions to which they are moved by the push button 31 and whenever the notch is released from the edge of the opening, the spring 77 will lift the bar 64 to carriage-releasing position (Fig. 14) at the same time engaging the coupling pin 58 with the socket 59 or positioning said pin in readiness for such engagement should the bar 30 then occupy a position in which 59 is not in alinement with 58. Should this condition occur, pin 58 will simply strike the bottom of bar 30 and while this bar is being moved to the proper position, said bar will slide upon the upper end of the pin and the latter will move

into the socket 59 as soon as the latter becomes alined with said pin.

In operating the carriage-actuating bar 30, it is advisable to move same slowly and with relatively great power until the inertia of the door has been overcome and to then move said bar more rapidly. For accomplishing these results, I prefer the mechanism shown more particularly at the upper portion of Fig. 5 and in Figs. 6, 7 and 8. The end of the bar 30 toward the cabinet 28, carries a rack bar 85 meshing with a gear 86 on a short horizontal shaft 87, the ends of said shaft 87 being provided with smaller gears 88 each of which is provided with a flat peripheral portion 89 for a purpose to appear. The shaft 87 is rotatably mounted on an appropriate carriage 90 which is slidable between two parallel tracks 91 suitably secured to a base plate 92, said carriage 90 having a roller or the like 93 for holding the rack 85 engaged with the gear 86. The tracks 91 are provided at one end with flat surfaces 94, at their other ends with flat surfaces 95, and between their ends with rack teeth 96. With the parts positioned as in Fig. 6, the flat portions 89 of the gears 88 are in contact with the flat track portions 94. Thus, when the carriage 90 is moved to the right, said gears 88 and the gear 86 will be locked against rotation and will simply push the rack 85 at the speed of the carriage, 29 then sliding upon 94. When 89 slides from 94, however, the continued movement of the carriage 90 causes the gears 88 to mesh with the rack teeth 96, whereupon said gears 88 are rotated with the result that they rotate the gear 86 and cause the latter to move the rack 85 with greater speed than that of the carriage 90. When the gears 88 leave the rack teeth 96, the flat portions 89 of said gears slide upon the flat track portions 95 with the result that the gears 88 and 86, and shaft 87, establish a direct connection between carriage 90 and rack 85 so that bar 30 will again move at the same speed as the carriage.

It will be seen from the above that the mechanism of Figs. 6, 7 and 8 not only moves the door relatively slowly and with comparatively great power until its inertia is overcome when starting said door toward open or closed position, but that said mechanism will slow down the door motion at the end of its opening and closing movements, permitting the door to come more gently to rest.

Movement of the carriage 90 in door-opening or door-closing direction, is effected by rotating the hand wheel 29 (Figs. 1, 4 and 5). I have shown a sprocket 97 behind the panel 83 and secured to the shaft 93 of said hand wheel, said sprocket 97 engaging an endless sprocket chain 99 whose upper portion passes around a sprocket 100 on a short shaft 101 mounted in suitable bearings 102 on the base plate 92 (Figs. 5, 6 and 7). Shaft 101 is provided with a beveled pinion 103 meshing with a beveled gear 104 on a transverse shaft 105 which is mounted in a suitable bearing 106 on the base plate 92. Shaft 105 carries a spur pinion 107 meshing with a rack 108 which is secured to the carriage 90. It will thus be seen that by turning the hand wheel 29 several revolutions in one direction, the proper motion may be transmitted to the carriage-operating bar 30 to effect door opening, and that reverse rotation of said hand wheel will so move said bar 30 as to effect door closing. It is desirable to provide a positive stop for the hand wheel 29 when bar 30 should be stopped at either end of 75

its travel, overcoming strain and possible injury to intervening parts.

I have shown a stop 109 secured to the rear side of the hand wheel 29 to engage a movable stop 110 carried by the panel 83, said stop 110, however, being out of the path of 109 as long as rotation of the wheel 29 is required. A pivoted setting device 111 is provided for the stop 110, however, connected therewith by a link 112, and a trip 113 is provided on the chain 99 to abut the portion 114 of said setting device when the proper movement of the carriage-actuating bar 30 is almost completed in either direction. Thus, by the time this bar movement has been completed, 113 has raised 111 and swung 110 into the path of 109 to prevent further rotation of the hand wheel 29.

Before explaining the general operation, let it be remembered that all movements of the carriage-operating bar 30 are imparted thereto by rotating the hand wheel 29, that there is one of the push-buttons 31 for each of the doors 20 and that with all of the doors closed, all of said push-buttons are held in their innermost positions by the notches 84 (Fig. 5). With the push-buttons in these positions, the operating connections 80, 79, 78, 67 and 65, hold all of the bars 64 downwardly to lock the carriages 24 in the door closed position shown in Fig. 17, all of the coupling pins 58 being then lowered from engagement with their respective sockets 59 (on the carriage-operating bar 30). With the carriages 24 thus locked in door-closed position, the doors 20 are held in raised locked position by means of the cams 39 and 39' and the rollers 40 and 40'. Assume now that any door is to be opened. The proper push-button 31 is released and the spring 77 moves the rod 67 to cause the bell cranks 65 to raise the bar 64 by the selected door carriage. The upward movement of bar 64 engages the coupling pin 58 with the socket 59 of the carriage-operating bar 30 as seen in Figs. 9, 11 and 14. Now, the hand wheel 29 is rotated to cause the various driving connections to move the bar 30 in door-opening direction. The first movement of this bar 30 moves the carriage 24 with respect to the closed door 20, thereby causing the cams 39 and 39' and the rollers 40 and 40' to lower the door hanger 41 and the door. By the time this door lowering has occurred, the roller 54' has moved onto the rail 26 from the position shown in Fig. 17, causing the lever 52' to hold the toggle 44' in the position to which it has returned during the door lowering movement of the carriage 24. The parts then occupy the positions shown in Fig. 18 and the carriage continues to move the door to open position. By the time the door has been fully opened, the roller 54 of the lever 52 has moved from the rail 26, causing said lever 52 to free the toggle 54, thereby permitting movement of the carriage 24 to the extreme position of Fig. 19, with the result that the cams 38 and 38' coast with the rollers 40 and 40' to lift the door 20 to a locked-open position. This having been done, the proper push-button 31 may be pushed in and fastened by the notch 84, thus causing lowering of the bar 64 as seen in Figs. 15 and 19, to disengage the coupling pin 58 from the operating bar 30 and to lock the carriage by engagement of the notch 70' of bar 64 with the lug 61 of said carriage.

When any door is to be closed, upward movement of the bar 64 is effected so that the pin 58 may properly connect the carriage with the operating bar 30 and said bar 64 can free the carriage.

The parts then are in readiness for door-closing movement. The initial movement of the bar 30 moves the carriage 24 to the left from its Fig. 19 position, thereby lowering the door 20 to an unlocked position. By the time this has occurred, roller 54 has engaged the rail 26 to lock the toggle 44 in the position to which it has returned, so that continued movement of the carriage will drive the door to closed position. When the door reaches this position, roller 54' drops from the rail 26 (Fig. 17) permitting toggle 44' to buckle upwardly, allowing the necessary further movement of the carriage 24 to effect lifting of the door to locked position. When the carriage reaches this extreme door-locked position, bar 64 is again lowered to lock the carriage and at the same time to disengage the coupling pin 58 from the carriage-operating bar 30, the carriage locking function being then performed by engagement of notch 70 (Fig. 17) with the lug 61 of the carriage.

Obviously, any door may be opened or closed independently of the others, or any number of the doors may be operated simultaneously, and the required results are expeditiously obtained by the use of a safe and reliable mechanism.

When using a locking means similar to that herein disclosed, it is possible if desired, to have the door locked with material of cross-sectional area equal to the cross-sectional area of the wall containing the door. Such a provision would make the door become virtually a part of the wall in strength and security when said door occupied locked position. The result may be accomplished by providing enough of the lock pins 35 to cause total cross-sectional area of pins to equal the cross-sectional area of the cell front wall. The present day ways of locking cell doors provides small notches at the bottom and top of the door and sometimes in the middle and at one side, into which a small lock bar is dropped or turned. When the door is opened, these notches are exposed and may be injured with tools unless protected by expensive housings.

While preferred features have been illustrated, attention is again invited to the possibility of making variations within the scope of the invention as claimed.

What is claimed is:

1. In a door-operating and locking mechanism, a horizontally movable carriage for the door; operating means for said carriage; connecting means between said door and said carriage having provision for allowing limited horizontal movement of said carriage to an extreme position beyond its door-closed position and for allowing limited horizontal return movement of said carriage from said extreme position prior to door opening; and locking means for the door applied and released by said limited movements of said carriage.

2. In a door-operating and locking mechanism, a horizontally movable carriage for the door; operating means for said carriage, and connecting means between said door and said carriage, said connecting means having provision for allowing limited horizontal movement of said carriage to an extreme position beyond its door-closed position, for allowing limited horizontal return movement of said carriage from said extreme position prior to door opening, and for allowing limited vertical movement of said door to and from a locked position; said connecting means including means whereby said limited horizontal movements

of said carriage will move said door to and from said door-locked position.

3. In a door-operating and locking mechanism, a horizontally movable carriage for the door, said carriage having a longitudinal inclined upwardly facing cam, a shoe on said door resting on said cam and suspending the door for vertical movement under the influence of said cam, said cam being so pitched as to move the door vertically to a door-locked position when said carriage is moved to an extreme position beyond its door-closed position, and to move said door vertically to unlocked position when said carriage is moved in door opening direction from said extreme position, and operating means for said carriage.

4. In a door operating and locking mechanism, a horizontally movable carriage for the door; operating means for said carriage, and connecting means between said door and said carriage, said connecting means having provision for allowing limited horizontal movement of said carriage to extreme positions beyond its door-closed and door-open positions, and for allowing limited horizontal return movements of said carriage from either of said extreme positions before starting to open or close the door; and means for locking said door in closed and open positions, said locking means being controlled by said limited movements of said carriage.

5. In a door operating and locking mechanism, a horizontally movable carriage for the door; operating means for said carriage, and connecting means between said door and said carriage, said connecting means having provision for allowing limited horizontal movement of said carriage to extreme positions beyond its door-closed and door-open positions, for allowing limited horizontal return movements of said carriage from either said extreme positions before starting to open or close the door, and for allowing limited vertical movement of the door to and from a locked position; said connecting means including means whereby said limited horizontal movements of said carriage to either of said extreme positions will vertically move said door to said locked position and either of said limited horizontal return movements of said carriage will vertically move said door to unlocked position.

6. In a door operating and locking mechanism, a horizontally movable carriage for the door, said carriage having two longitudinal upwardly facing cams inclined in opposite directions; means on said door cooperable with said cams in suspending the door and cooperable with said cams in vertically moving the door, said cams being arranged to vertically move the door to a locked position when said carriage is moved to an extreme position beyond either its door-closed position or its door-open position, and to vertically move said door to an unlocked position when said carriage is returned from either of its extreme positions, and operating means for said carriage.

7. In a door-operating and locking mechanism, a horizontally movable carriage for the door; operating means for said carriage; connecting means between said door and said carriage having provision for allowing limited horizontal movement of said carriage to an extreme position beyond its door-closed position and for allowing limited horizontal return movement of said carriage from said extreme position prior to door opening; locking means for the door applied and released by said limited movements of said carriage; and means holding the carriage against movement with respect to the door during the door-closing

movement of said carriage, said holding means having means whereby it is automatically released when said door-closing movement of the carriage is complete, permitting movement of said carriage to said extreme position to effect door locking.

8. In a door operating and locking mechanism, a horizontally movable carriage for the door; operating means for said carriage; connecting means between said door and said carriage having provision for allowing limited horizontal movement of said carriage to an extreme position beyond its door-closed position and for allowing limited horizontal return movement of said carriage from said extreme position prior to door opening; locking means for the door applied and released by said limited movements of said carriage; a toggle connected at one end with said carriage and at its other end with the door for transmitting the door-closing movement of the carriage to the door; and means for holding said toggle in operative position until said door is completely closed and for then effecting release of said toggle, permitting movement of the carriage to said extreme position to effect door locking.

9. In a door operating and locking mechanism, a horizontally movable carriage for the door; operating means for said carriage; connecting means between said door and said carriage having provision for allowing limited horizontal movement of said carriage to an extreme position beyond its door-closed position and for allowing limited horizontal return movement of said carriage from said extreme position prior to door opening; locking means for the door applied and released by said limited movements of said carriage; a toggle connected at one end with said carriage and at its other end with the door for transmitting the door-closing movement of the carriage to the door; a lever fulcrumed on the carriage and associated with said toggle to hold the latter in operative position as long as said lever is held in a predetermined position; and a fixed horizontal track cooperable with said lever for holding the same in said predetermined position during door closing and for releasing said lever when the door is completely closed, permitting movement of the carriage to said extreme position to effect door locking.

10. In a door operating and locking mechanism, a horizontally movable carriage for the door; operating means for said carriage, and connecting means between said door and said carriage, said connecting means having provision for allowing limited horizontal movement of said carriage to extreme positions beyond its door-closed and door-open positions, and for allowing limited horizontal return movements of said carriage from either of said extreme positions before starting to open or close the door, means controlled by said limited movements of the carriage for locking the door in both closed and open positions; and means for holding the carriage against movement with respect to the door during the door-closing and door-opening movements of said carriage, said holding means having means whereby it is automatically released when the door has been completely closed or completely opened.

11. In a door operating and locking mechanism, a horizontally movable carriage for the door; operating means for said carriage, and connecting means between said door and said carriage, said connecting means having provision

for allowing limited horizontal movement of said carriage to extreme positions beyond its door-closed and door-open positions, and for allowing limited horizontal return movements of said carriage from either of said extreme positions before starting to open or close the door, means controlled by said limited movements of the carriage for locking the door in both closed and open positions; two toggles extending longitudinally of the carriage, said toggles being so connected with the carriage and door that one transmits door-closing motion from the carriage to the door when held in operative position, and the other transmits door-opening motion from said carriage to the door when held in operative position; and means for holding both toggles in operative position during the door-closing and door-opening movements of said carriage and for releasing either toggle when its motion-transmitting function has been performed.

12. In a door operating and locking mechanism, a horizontally movable carriage for the door; operating means for said carriage, and connecting means between said door and said carriage, said connecting means having provision for allowing limited horizontal movement of said carriage to extreme positions beyond its door-closed and door-open positions, and for allowing limited horizontal return movements of said carriage from either of said extreme positions before starting to open or close the door, means controlled by said limited movements of the carriage for locking the door in both closed and open positions; two toggles extending longitudinally of the carriage, said toggles being so connected with the carriage and door that one transmits door-closing motion from the carriage to the door when held in operative position, and the other transmits door-opening motion from said carriage to the door when held in operative position; two levers fulcrumed on said carriage, said levers being so associated with said toggles that one lever will hold one toggle in operative position as long as said one lever is held in predetermined position, and the other lever will hold the other toggle in operative position as long as said other lever is held in predetermined position; and a fixed horizontal track cooperable with said levers for holding them in said predetermined position during the door-closing and door-opening movements of the carriage and for releasing the lever associated with either toggle when this toggle has performed its motion-transmitting function.

13. In a door operating means, a horizontally elongated carriage to travel upon a horizontal track, said carriage having a cam between its ends provided with inclined ends which incline toward the ends of the carriage, a door hanger having a portion resting on said cam between said inclined ends thereof, whereby movement of the carriage in either direction with respect to the hanger will lift the latter; two toggles on the end portions of said carriage and normally buckled upwardly to some extent, each of said toggles comprising an inner link pivoted at its inner end to said hanger and having a longitudinal slot in its outer end, an outer link pivoted at its outer end to said carriage, and a pin on the inner end of said outer link received in said slot and normally abutting the inner end of this slot; and releasable means for normally holding both toggles against further upward buckling, whereby movement of said carriage in either direction will correspondingly move said hanger, and release of either toggle will allow said further

upward buckling thereof, permitting movement of the carriage with respect to the hanger and causing one end of said cam to lift said hanger.

14. In a door operating means, a horizontally elongated carriage to travel upon a horizontal track, said carriage having a cam between its ends provided with inclined ends which incline toward the ends of the carriage, a door hanger having a portion resting on said cam between said inclined ends thereof, whereby movement of the carriage in either direction with respect to the hanger will lift the latter; two toggles on the end portions of said carriage and normally buckled upwardly to some extent, each of said toggles comprising an inner link pivoted at its inner end to said hanger and having a longitudinal slot in its outer end, an outer link pivoted at its outer end to said carriage, and a pin on the inner end of said outer link received in said slot and normally abutting the inner end of this slot; and two track-controlled levers fulcrumed on said carriage and having portions normally lying upon said toggles to prevent further upward buckling thereof, whereby movement of said carriage in either direction will correspondingly move said hanger, and release of either toggle will allow said further upward buckling thereof, permitting movement of the carriage with respect to the hanger and causing one end of said cam to lift said hanger.

15. In a door operating and locking mechanism, a horizontally movable door carriage; a horizontally movable operating member for said carriage; a coupling member movably mounted on said carriage for connecting it with and disconnecting it from said operating member; a horizontal bar near said carriage and parallel with the line of travel thereof; means mounting said bar for vertical movement with respect to said carriage and for prohibiting horizontal movement of said bar; means slidable along said bar and so connecting this bar with said coupling member that the latter may be moved to and from operative position by vertically moving said bar; and means for vertically moving said bar; said bar and carriage having coacting portions for automatically locking said carriage when said bar is moved to the position in which it releases said coupling member, and vice versa.

16. In a door operating mechanism, a horizontally movable door carriage, a horizontally movable operating member for said carriage; a coupling member movably mounted on said carriage for connecting it with and disconnecting it from said operating member; a horizontal bar near said carriage and parallel with the line of travel thereof; means mounting said bar for vertical movement with respect to said carriage and for prohibiting horizontal movement of said bar; means slidable along said bar and so connecting this bar with said coupling member that the latter may be moved to and from operative position by vertically moving said bar; and means for vertically moving said bar.

17. In a door operating mechanism, a door operating bar having a rack at one end; a gear meshing with said rack; means for holding said gear in mesh with said rack; a second gear bodily rotatable with the first mentioned gear and having a flat tooth-free peripheral portion; a carriage upon which both of said gears are mounted; means mounting said carriage for movement longitudinally of said rack, operating means for said carriage, a fixed straight track upon which said flat portion of said second gear slides during part

of the carriage travel, thereby holding the two gears against rotation and causing the first mentioned gear to move said rack of the operating bar at the same speed as the carriage, and a fixed rack with which said second gear meshes when said flat portion of said second gear slides from said straight track, whereby upon continued movement of said carriage the two gears will be driven, thereby causing the first mentioned gear to rapidly move the rack of said operating bar.

18. In a door operating mechanism having means movable to two positions for connecting a door carriage with a carriage-operating member and for disconnecting said carriage from said member; spring means for moving the first named means to one of said positions; manually actuated means for moving said first named means to its other position, said manually actuated means including a slidable manually operable rod having a notch; and a panel having an opening through which said rod passes, said notch being engageable with the edge wall of said opening to hold said manually actuated means in said other position.

19. In a door operating mechanism, a chain to be driven in one direction to open a door and in the other direction to close the door; a driving sprocket around which said chain is trained; a hand wheel for driving said sprocket; a stop

fixedly carried by said hand wheel; a movable stop mounted stationarily with respect to the rotation of said hand wheel; and setting means for moving said movable stop into the path of the wheel-carried stop when the door has been opened or closed, said setting means having an actuator secured to said chain.

20. A structure as specified in claim 3; said cam having a horizontal portion on which said shoe comes to rest when the door occupies its locked position.

21. A structure as specified in claim 6; together with two additional cams duplicating those aforesaid and offset longitudinally of the carriage therefrom, and additional means on said door offset longitudinally thereof from the aforesaid door-carried means and cooperable with said additional cams in the same way said aforesaid means and cams cooperate, whereby to hold the door against swinging longitudinally of carriage path.

22. A structure as specified in claim 13; each of said inner links of said toggles having a notch in the inner end of the upper wall of its slot to receive said pin, holding said outer link against swinging toward the outer end of said slot when the toggle is upwardly buckled.

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