Nov. 24, 1925. 1,563,241

E. E. TOON

DOOR OPERATING AND LOCKING MECHANISM

Filed May 5, 1924 3 Sheets-Sheet 1

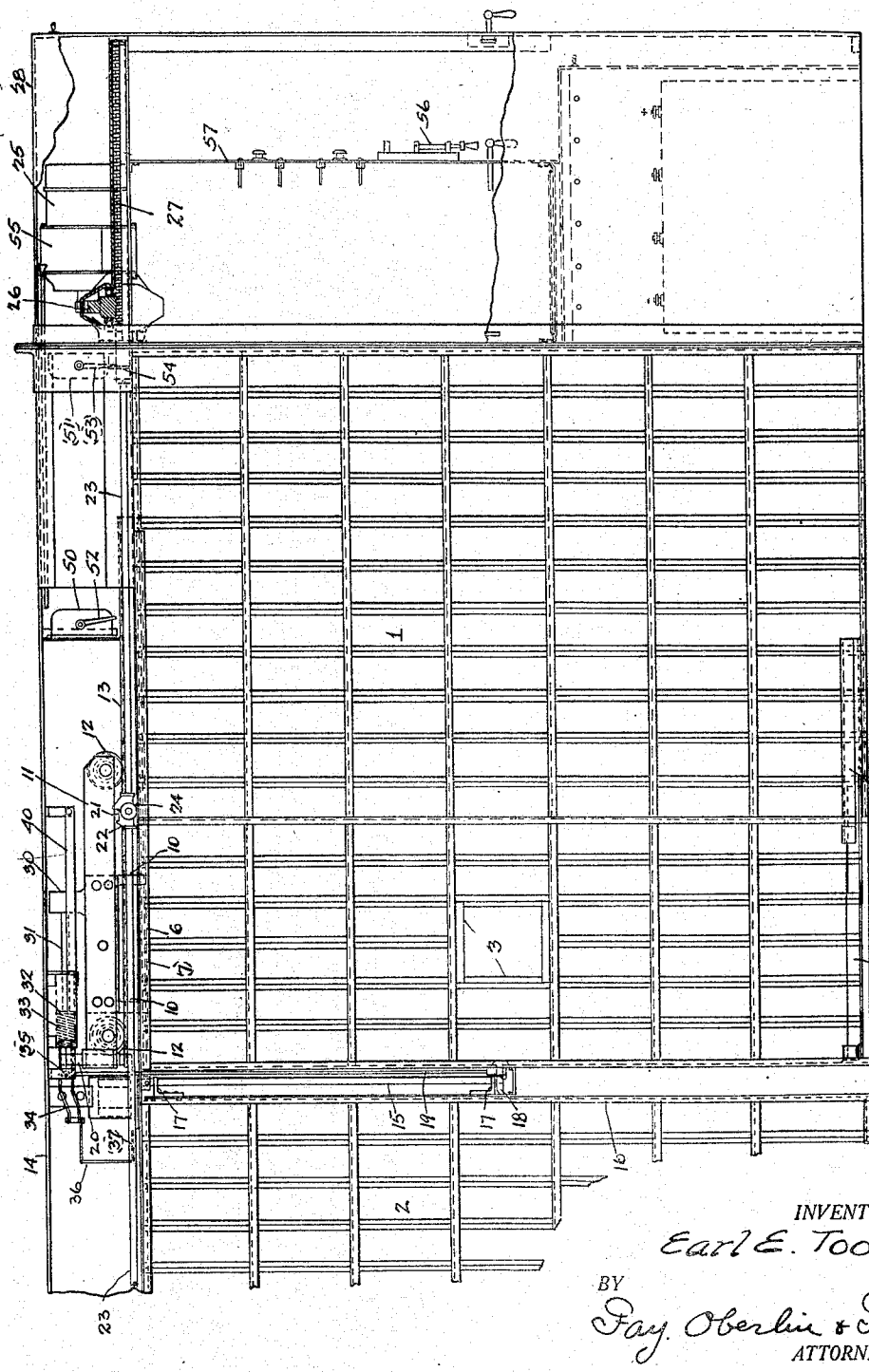


Fig. 1.

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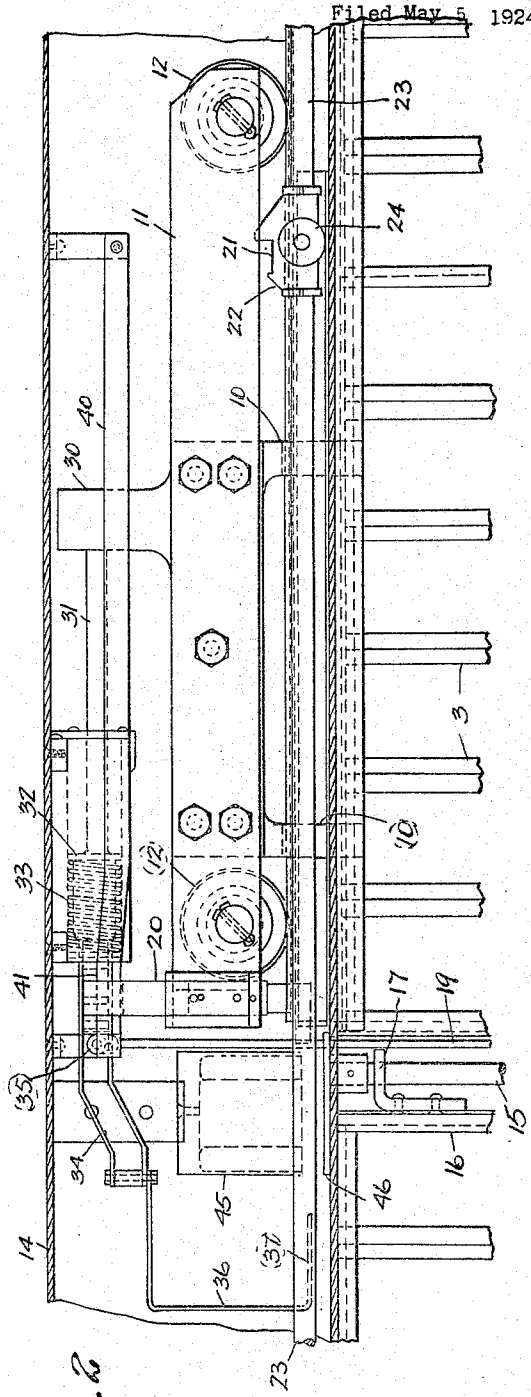


Fig. 2

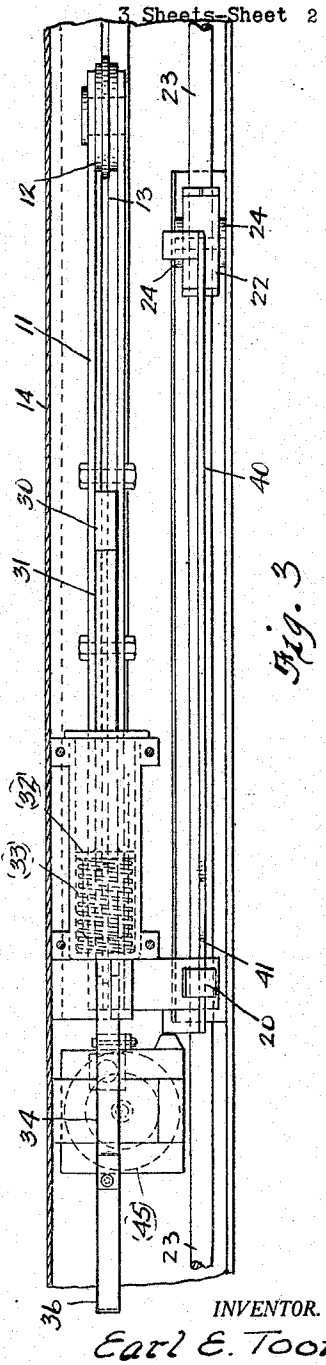


Fig. 3

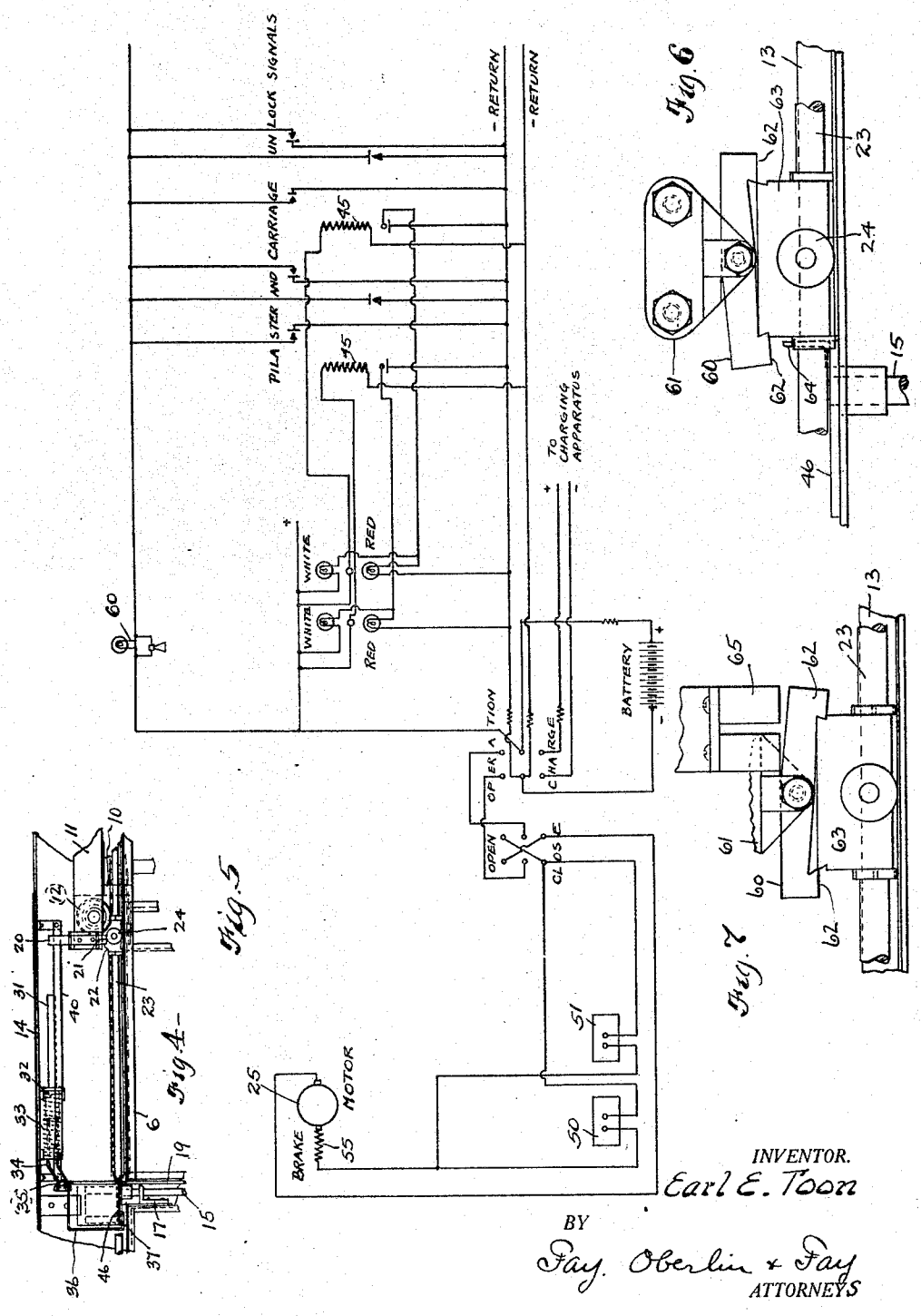
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UNITED STATES PATENT OFFICE.

EARL E. TOON, OF CLEVELAND HEIGHTS, OHIO.

DOOR OPERATING AND LOCKING MECHANISM.

Application filed May 5, 1924. Serial No. 711,105.

To all whom it may concern:

Be it known that I, EARL E. TOON, a citizen of the United States, and a resident of Cleveland Heights, county of Cuyahoga, and State of Ohio, have invented a new and useful Improvement in Door Operating and Locking Mechanism, of which the following is a specification, the principle of the invention being herein explained and the best mode in which I have contemplated applying that principle, so as to distinguish it from other inventions.

The present improvements relate more particularly to mechanism for operating and locking a series of doors, such as the doors to a range of cells in a prison or the like. One principal object of the invention is to provide means whereby all the doors of such a series that may happen to be open at any time may be simultaneously closed and locked in closed position from a remote station. Another object is to provide means whereby any selected door may be individually unlocked and opened from the same station when desired. Still another object is to provide power driven means, specifically consisting of an electric motor, whereby the movement of the doors may be effected. Coupled with the foregoing various devices are incorporated, having as their object the security of the locking mechanism and the prevention of any tampering therewith whether any given door be closed or open. Electrical indicating means are also provided whereby the condition of such doors, i. e. whether closed or open, may be instantly determined form the operating station, without requiring, in other words, any inspection of the doors.

To the accomplishment of the foregoing and related ends, the invention, then, consists of the means hereinafter fully described and particularly pointed out in the claims, the annexed drawings and the following description setting forth in detail certain mechanism embodying the invention, such disclosed means constituting, however, but one of various mechanical forms in which the principle of the invention may be used.

In said annexed drawings:—

Fig. 1 is a front elevation of a series of cells or like compartments provided with doors, one such compartment with door and door operating and locking mechanism being shown complete, such door being in closed position; Fig. 2 is partly a front elevation and partly a section, on a larger scale, of a portion of the door operating and locking mechanism thus appearing in Fig. 1; Fig. 3 is partly a plan view and partly a horizontal section of the mechanism appearing in Fig. 2; Fig. 4 is a broken front elevation of the door operating and locking mechanism with adjacent portions of the cell, such view corresponding to that of Fig. 1, except that the door is shown in open position; Fig. 5 is a wiring diagram of the electrical connections for operating one series or row of doors and of the signal mechanism associated with the latter; and Figs. 6 and 7 are detail views showing a modification in the construction of the door operating and locking mechanism in two different positions respectively.

As explained and described in the drawings, the front of one cell 1 is shown complete in Fig. 1 and to the left thereof is shown a portion of the next adjoining cell 2. Such cells, apart from the door operating and locking mechanism of present interest, will be of usual construction. Each cell is provided with a sliding or longitudinally shiftable door 3, the lower end of such door including a bottom guide track 4, that engages with a guide 5, and the top of the door being similarly provided with a channel 6 that engages a guide 7. The door is supported or hung by means of brackets 10 from a carriage 11, the wheels 12 of which rest on a track-rail or track-way 13 located above and aligned with the front wall of the cell, or in other words, with the guides 5 and 7, wherewith the bottom and top of the door respectively engage. The carriage 11 and the track 13, together with other associated parts presently to be described, are all enclosed in a longitudinally extending box 14 which prevents access thereto even when the door is open.

When closed the door is locked by means of a vertically reciprocable bolt 15 in the pilaster 16, such bolt being suitably guided in two apertured brackets 17 so as to be adapted to enter a correspondingly apertured catch 18 on the door. Except when the door is closed and the catch 18 thus in proper position to receive the bolt 15, the opening in the pilaster through which such catch enters is closed by a vertically movable guard plate 19. The latter, in other words, has to be raised before the door can be completely closed and locked and in the

open position of the door effectually prevents the introduction of any obstruction that might prevent the complete closure of the door or the operation of the bolt.

The door is also designed to be locked in its open position, as shown in Fig. 4. To this end there is mounted in the forward, i. e. left-hand end of carriage 11, a second bolt 20 that is adapted when the door is retracted to full open position to fall into a notch 21 in a plate 22. The front wall of this plate is beveled, as shown, and is lower than the rear or right-hand wall, so that the bolt 20 will ride up such inclined wall and drop into the notch and then be stopped by the rear wall, as will be readily understood. The plate 22 is attached to a bar or rod 23 that extends longitudinally of the entire series of cells and doors, such bar lying adjacent the rails or tracks 13 on which the carriages 11, from which the several doors are hung, are respectively supported. Said rod or bar 23 is furthermore movable back and forth in the direction of its length a distance equal to the width of the doorway, being shown in its extreme right-hand position in Fig. 1 and in its extreme left-hand position in Fig. 4. Attached to plate 22 is a roller 24 that runs on a suitable rail or surface and serves to support said plate and thus support the bar at intervals in the longitudinal movement thereof just referred to.

Any suitable means, either power or manually actuated, may be provided for reciprocating the rod or bar 23, but preferably I employ an electric motor 25 that is suitably intergeared to rotate a large nut 26 on a threaded shaft extension 27 of said rod or bar. Such threaded extension 27 lies entirely beyond the series of cells, being enclosed along with the motor in a suitable housing 28, and the motor is reversible, or else the gearing interposed between the same and the nut permits of the reversible rotation of the latter, so that the screw shaft 27, and thus the bar 23, may be forcibly moved in either direction, as desired. When the door is open, as shown in Fig. 4, and bolt 20 is in engagement with notch 21 in plate 22, the effect of movement of the bar to the left is to move the carriage 11 in the same direction, carrying the door 3 along therewith, until the door is forced into its closed position, as shown in Fig. 1.

In thus moving the door, an upwardly extending projection 30 on carriage 11 is brought into abutting engagement with a plunger 31 that is aligned with the direction of movement of said carriage, being suitably supported independently of the latter in the box 14. This plunger carries a stop 32 that presses against one end of a spring 33, the other end of which is held fixed, as the result of which such spring is compressed, as shown in Fig. 1, whenever the door is moved to closed position. The plunger 31 extends beyond spring 33 to provide an inclined guideway or cam track 34 in which is held a roller 35 attached to the upper end of the guard plate 19. The conformation of such track 34 is such that in the extreme left position of the plunger such plate 19 is raised sufficiently to allow catch 18 on the door to enter the pilaster 16 and thus be positioned for engagement by lock bolt 15. On the contrary, when the plunger 31, under the impulsion of spring 33, is moved to its extreme right position, as shown in Fig. 4, track-way 34 positively pushes the guard plate downwardly to close the opening in the pilaster, as previously described.

Attached to the plunger so as to project to the left of track-way 34 is an arm 36 that carries a horizontally disposed guard plate 37. This plate, when the plunger occupies its extreme right position last referred to (see Fig. 4), underlies the laterally projecting upper end or head of lock bolt 15 and positively prevents any downward movement of such bolt. In other words, the latter can only drop when the plunger is moved to its extreme left position, as shown in Fig. 1, the plate 37 being thereby moved to clear the upper end of said bolt. It should also be noted in this connection that the upper end of bolt 20 rides on a longitudinally extending bar 40, the left-hand end 41 of which is bent upwardly so that when the carriage 11 is moved to its extreme left position, said bolt will be correspondingly raised.

The distance the bolt is thus lifted is just sufficient to clear the same of the corresponding side or wall of notch 21 in plate 22, so that upon the door being closed, the bolt 20 will be disengaged from plate 22 and thus permit the latter to be retracted or moved to the right again when desired. As long, however, as the plate with the bar 23 that carries the same is left in the position to which it was moved incidentally to the closing of the door, the latter will be doubly locked, i. e. by said bolt 20 in addition to bolt 15. Upon retraction of the plate, the door will still remain locked by bolt 15, i. e. it can only be opened upon raising the latter, but the bolt 20 having been raised sufficiently to clear the left-hand wall of notch 21 will not interfere with the retraction of plate 22. Assuming the plate to have been thus retracted, if thereupon the bolt 15 be raised to release catch 18, the spring 33 will immediately expand and push plunger 31 to the right and thereby open the door by virtue of the engagement of the end of said plunger with the projection 30 on carriage 11 from which the door is hung. Incidentally to such movement of the carriage and

door, the bolt 20 rides down from the raised section 41 of bar 40 and so is free again to drop into notch 21 of plate 22. At the same time the trackway 34 forces the guard plate 19 downwardly and the guard plate 37 is brought into operative position over bolt 15.

For the purpose of raising bolt 15, an electro-magnet 45 is mounted in box 14 directly over said bolt or rather over a plate 46, attached to the upper end thereof, that serves as an armature for said electro-magnet. Energization of the latter will attract the armature plate 46 and thus raise the attached bolt, as will be readily understood. In place of an electro-magnet and armature plate, a solenoid with a movable core member may be substituted, if desired.

In order to limit the movement of bar 23, two switches 50 and 51 are mounted in box 14, preferably adjacent the casing 28, such switches being provided with depending levers 52 and 53 that are respectively adapted to be engaged by an arm 54 fixed on the bar 23 when such arm reaches the corresponding limiting position. These switches serve automatically to break the circuit of motor 25 and to stop the motor through an electro-magnetic brake 55.

For a better understanding of the operation of such limiting switches, reference may be had to Fig. 5 where the complete circuit arrangements are shown, not only for the motor 25, but also for the associated signal system. In connection with this diagram (Fig. 5) it should be explained that the battery and charging apparatus will be omitted if D. C. current of the proper voltage is available.

The switch 56, as well as the circuit connections for the signal system, are carried by a panel board 57 that is preferably contained in the same housing 28 in which the motor is contained (see Fig. 1). As shown in the circuit diagram, the signal system includes a series of white and red lights corresponding with the several doors, the former being illuminated when the corresponding doors are safely closed and the latter whenever a door is open. In addition, a signal 60, carried on a separate circuit, may be located wherever desired and is so connected with the signal light circuits as to sound an alarm whenever any of the latter is improperly broken.

The modified construction illustrated in Figs. 6 and 7 relates to the means whereby the carriage 11, from which the door is hung, may be interlocked with the bar 23. In place of the bolt 20, I employ a double lever 60 that is pivotally supported in a bracket 61 that depends from the carriage 11. The under side of said lever is formed at the respective ends of the latter with two inwardly beveled projections 62 disposed to engage with the opposite ends of a plate 63 that otherwise corresponds with plate 22 in the previously described construction. It will be seen that by rocking the lever in a clockwise or counter-clockwise direction, either the right-hand or left-hand end thereof, as the case may be, will be brought into engagement with said plate and so prevent movement of the carriage in a corresponding direction. In Fig. 6, the parts are shown in the position occupied when the door is closed and it will be noted that lever 60 here engages with plate 63 in such manner as to prevent movement of the carriage, and thus of the door, to the right so as to open such door. The armature plate 46, however, on the upper end of lock bolt 15 carries a projection 64 that serves when said bolt is raised to rock lever 60 and cause the opposite end thereof to engage with plate 63, as shown in Fig. 7. The door may accordingly now be opened by movement of the bar 23 to the right. When the door is thus brought open by the carriage 11, it will remain locked open as long as the position of lever 60 is not disturbed. For the purpose of releasing the door when thus locked in its open position, an electro-magnet 65 is provided, this being located so as to occupy a position directly above the right-hand end of the lever in the position just described. Accordingly, by energizing such electro-magnet, the lever will be restored to the position shown in Fig. 6 and the carriage is again connected with the bar 23 so that movement of the latter to the left will serve to close the door. This electro-magnet may be placed either in parallel or series with the electro-magnet 45 so that one button will serve for the operation of both.

Other modes of applying the principle of my invention may be employed instead of the one explained, change being made as regards the mechanism herein disclosed, provided the means stated by any of the following claims or the equivalent of such stated means be employed.

I therefore particularly point out and distinctly claim as my invention:—

1. In mechanism of the character described, the combination with a slidable door; of a catch on said door; a vertically reciprocable bolt adapted normally to interlock with said catch; an electro-magnet adapted when energized to lift said bolt; and a guard operatively interconnected with said door and adapted to prevent dropping of said bolt by moving beneath the same when said door is open.

2. In mechanism of the character described, the combination with a slidable door; of a catch on said door; a vertically reciprocable bolt adapted normally to interlock with said catch; an electro-magnet adapted when energized to lift said bolt; and a guard in the form of a plate slidably mov-

able into engagement with the head of said bolt and adapted in that position to prevent dropping of the latter, said guard being operatively connected with said door, whereby it is slidably moved into such position when said door is open.

3. In mechanism of the character described, the combination with a slidable door; of a catch on said door; a vertically reciprocable bolt adapted normally to interlock with said catch; an electro-magnet adapted when energized to lift said bolt; a guard in the form of a plate slidably movable into engagement with the head of said bolt and adapted in that position to prevent dropping of the latter; a spring tending normally to move said guard into such operative position; and a member carried by said door adapted to move said guard into inoperative position against said spring when said door is closed.

4. In mechanism of the character described, the combination with a slidable door; of a catch on said door; a vertically reciprocable bolt adapted normally to interlock with said catch; a guard controlling access to said bolt; and means operatively interconnected with said door adapted to position said guard.

5. In mechanism of the character described, the combination with a slidable door; of a catch on said door; a vertically reciprocable bolt adapted normally to interlock with said catch; a guard controlling access to said bolt; and means operatively interconnected with said door adapted to position said guard, said means including a reciprocable plunger having a cam engagement with said guard, a spring normally moving said plunger to render said guard operative and a member carried by said door adapted to move said plunger against said spring when said door is closed.

6. In mechanism of the character described, the combination with a slidable door; of a catch on said door; a vertically reciprocable bolt adapted normally to interlock with said catch; a guard controlling access to said bolt; means operatively interconnected with said door adapted to position said guard, said means including a reciprocable plunger having a cam engagement with said guard, a spring normally moving said plunger to render said guard operative and a member carried by said door adapted to move said plunger against said spring when said door is closed; and a second guard in the form of a plate movable into engagement with the head of said bolt and adapted in that position to prevent dropping of the latter, said plate being attached to said plunger so as to be moved into inoperative position simultaneously with said first guard.

7. In mechanism of the character described, the combination with a slidable door; of a carriage from which said door is hung; a spring operated plunger; a member on said carriage adapted to engage said plunger to compress said spring when said door is closed; and means adapted to move and hold said door in closed position.

8. In mechanism of the character described, the combination with a slidable door; of a carriage from which said door is hung; a spring operated plunger; a member on said carriage adapted to engage said plunger to compress said spring when said door is closed; means adapted to move and hold said door in closed position; and independent means for locking said door when thus closed.

9. In mechanism of the character described, the combination with a slidable door; of a carriage from which said door is hung; a spring operated plunger; a member on said carriage adapted to engage said plunger to compress said spring when said door is closed; means adapted to move and hold said door in closed position; and independent means adapted automatically to lock said door when thus closed.

10. In mechanism of the character described, the combination with a slidable door; of a carriage from which said door is hung; a spring operated plunger; a member on said carriage adapted to engage said plunger to compress said spring when said door is closed; means adapted to move and hold said door in closed position; and independent means adapted automatically to lock said door when thus closed, said means including a catch on said door, a vertically reciprocable bolt adapted normally to interlock with said catch, an electro-magnet adapted when energized to lift said bolt, and a guard operatively interconnected with said door and adapted to prevent dropping of said bolt when said door is open.

11. In mechanism of the character described, the combination with a slidable door; of a carriage from which said door is hung; a spring operated plunger; a member on said carriage adapted to engage said plunger to compress said spring when said door is closed; means adapted to move and hold said door in closed position; and independent means adapted automatically to lock said door when thus closed, said means including a catch on said door, a vertically reciprocable bolt adapted normally to interlock with said catch, an electro-magnet adapted when energized to lift said bolt, and a guard in the form of a plate movable into engagement with the head of said bolt and adapted in that position to prevent dropping of the latter, said plate being attached to said plunger so as to be moved into inoperative position when said door is closed.

12. In mechanism of the character described, the combination with a slidable door; of a carriage from which said door is hung; a spring operated plunger; a member on said carriage adapted to engage said plunger to compress said spring when said door is closed; means adapted to move and hold said door in closed position; a catch on said door; a vertically reciprocable bolt adapted to interlock with said catch; a guard controlling access to said bolt; and means operatively connected with said plunger adapted to position said guard.

13. In mechanism of the character described, the combination with a slidable door; of a carriage from which said door is hung; a spring operated plunger; a member on said carriage adapted to engage said plunger to compress said spring when said door is closed; means adapted to move and hold said door in closed position; a catch on said door; a vertically reciprocable bolt adapted to interlock with said catch; a guard controlling access to said bolt; and a cam on said plunger engaging with said guard positively to position same incidentally to movement of said plunger.

14. In mechanism of the character described, the combination with a slidable door; of a carriage from which said door is hung; a spring operated plunger; a member on said carriage adapted to engage said plunger to compress said spring when said door is closed; means adapted to move and hold said door in closed position; a catch on said door; a vertically reciprocable bolt adapted to interlock with said catch; a guard controlling access to said bolt; a cam on said plunger engaging with said guard positively to position same incidentally to movement of said plunger; and a second guard in the form of a plate movable into engagement with said bolt and adapted in that position to prevent dropping of the latter, said plate being attached to said plunger so as to be moved into inoperative position simultaneously with said first guard.

15. In mechanism of the character described, the combination with a slidable door; of a carriage from which said door is hung; a spring operated plunger; a member on said carriage adapted to engage said plunger to compress said spring when said door is closed; and means adapted to move and hold said door in closed position, said means including a bar reciprocable in the direction of movement of said carriage, and a device adapted to lock the latter to said bar.

16. In mechanism of the character described, the combination with a slidable door; of a carriage from which said door is hung; a spring operated plunger; a member on said carriage adapted to engage said plunger to compress said spring when said door is closed; and means adapted to move and hold said door in closed position, said means including a bar reciprocable in the direction of movement of said carriage, and a device adapted to connect the latter with said bar for conjoint movement in one direction or the other as desired.

17. In mechanism of the character described, the combination with a slidable door; of a carriage from which said door is hung; a spring operated plunger; a member on said carriage adapted to engage said plunger to compress said spring when said door is closed; and means adapted to move and hold said door in closed position, said means including a bar reciprocable in the direction of movement of said carriage, a motor geared to said rod whereby the latter may be thus reciprocated, and a device adapted to lock said carriage to said bar.

18. In mechanism of the character described, the combination with a slidable door; of a carriage from which said door is hung; a spring operated plunger; a member on said carriage adapted to engage said plunger to compress said spring when said door is closed; and means adapted to move and hold said door in closed position, said means including a bar reciprocable in the direction of movement of said carriage, an electric motor geared to said rod whereby the latter may be thus reciprocated, limiting switches controlling said motor, a member carried by said bar adapted to operate said switches alternatively, and a device adapted to lock said carriage to said bar.

Signed by me this 2nd day of May, 1924.

EARL E. TOON.