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OPERATING AND CONTROL MECHANISM FOR DOOR CLOSURES

Filed June 6, 1927 2 Sheets-Sheet 1

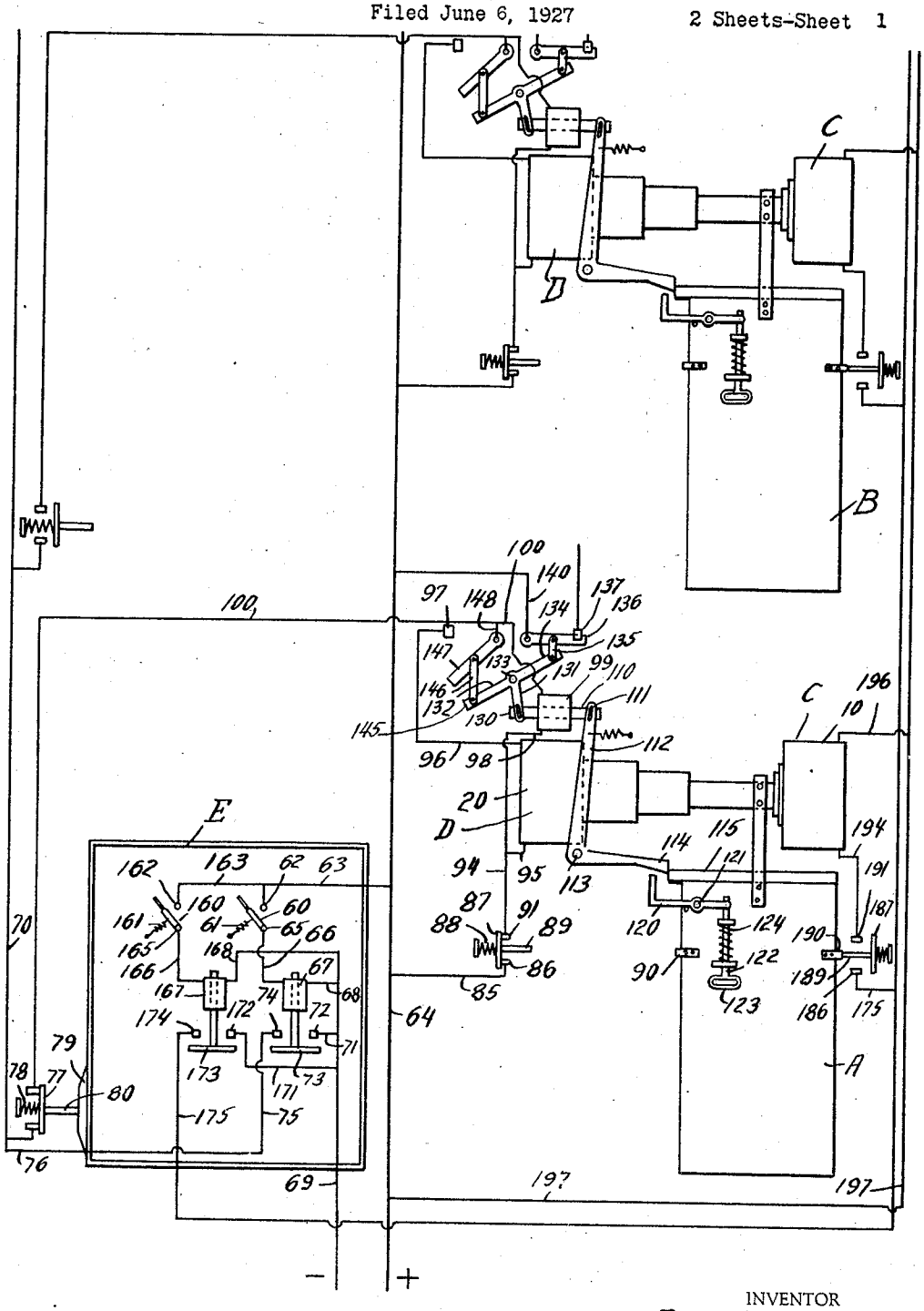


Fig. 1.

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Fig. 2.

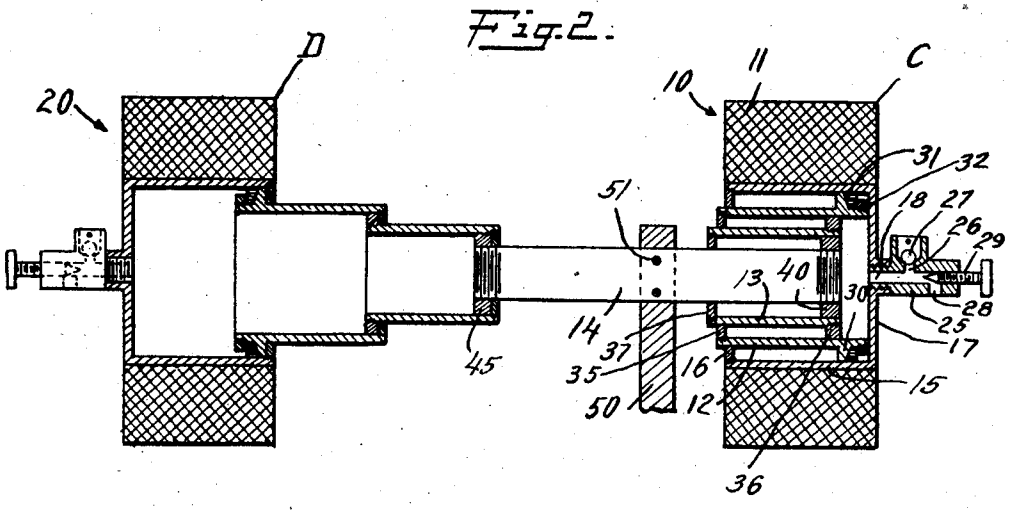
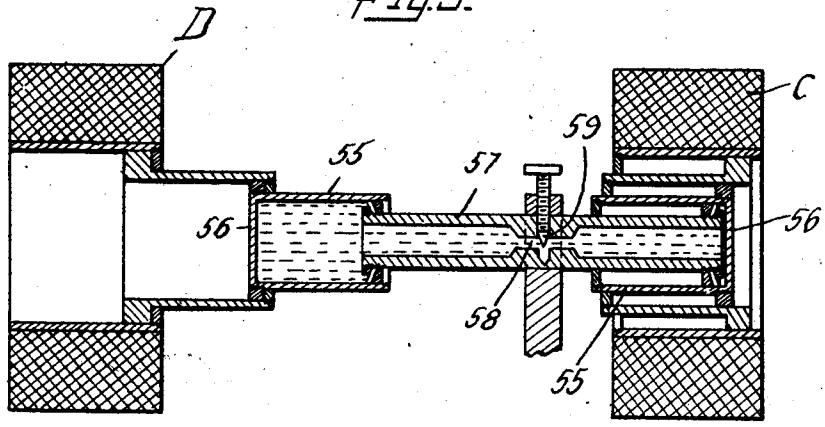


Fig. 3.



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OPERATING AND CONTROL MECHANISM FOR DOOR CLOSURES.

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This invention relates to door closures and particularly to closures for elevator hatchway doors.

It is particularly desirable that elevator hatchway doors be so constructed and controlled that they can be easily and quickly opened and closed. Furthermore, it is desirable that hatchway doors be so controlled that they cannot be opened unless a car is positioned at the floor level and also that the car and doors be so intercontrolled that the car cannot leave a floor level when the door at that level is open. It is also desirable that the doors be so actuated and controlled that they will not open and close with a jar or bang since this tends to rack the doors and also the actuating and control means.

One of the objects of the invention is to provide simple and practical control mechanism for hatchway door closures so constructed and arranged that no door can be opened unless the elevator car is positioned at the floor level at which the door is located.

Another object of the invention is to provide operating and control mechanism for hatchway doors so arranged that the closing of a single switch will effect the opening or closing of the door.

Another object of the invention is to provide operating and control mechanism and hatchway doors so arranged that the closing of a single switch will effect the unlocking and opening or closing and locking of the door.

Another object of the invention is to provide control means whereby the elevator car cannot be operated when a hatchway door is open.

Another object of the invention is to provide simple, practical and efficient door actuating mechanism for moving the door to open and closed position.

Another object of the invention is to provide door opening and closing mechanism so constructed and arranged that the door will be cushioned at both extremes of its movement.

Further objects of the invention will appear from the following specification taken in connection with the drawings, which form a part of this application, and in which

Fig. 1 is a diagrammatic view of a door closure mechanism and control circuits constructed in accordance with the invention;

Fig. 2 is a sectional elevation showing door actuating means for moving the door to open or closed position; and

Fig. 3 is a view similar to Fig. 2 but showing a slightly modified form of the invention.

The invention briefly described consists of actuating mechanism for moving the door to open or closed position, locking means for locking the door in closed position and intercontrol means between the car control circuit and door actuating mechanism whereby a hatchway door cannot be opened unless a car is positioned at the floor level at which the door is located and the car cannot be operated when a hatchway door is opened. In the form of the invention illustrated, the closing of a single switch effects the unlocking of the door and the movement of the door to open position, and the closing of a second switch will effect the closing and locking of the door. The circuits are so arranged that when the door moves to either extreme position, namely, to wide open or closed position, the circuit which has effected the opening of the door or the closing of the door will be opened. Moreover, the door opening circuit is so arranged that this circuit cannot be closed unless a car is disposed at the floor level where the door is located, and also the unlocking of the door will break the car control circuit so that the car cannot be operated until the door is again closed and locked.

The particular door actuating mechanism illustrated consists of oppositely acting telescoping solenoids so arranged that when one of the solenoid circuits is closed the door will be moved in one direction and when the other solenoid circuit is closed the door will be moved in the opposite direction. Further details of the invention will appear from the following description.

In the embodiment of the invention illustrated in Fig. 1 there are shown a pair of elevator hatchway doors A and B positioned at two different floor levels. It will be understood, of course, that the invention is applicable to any desired number of floor levels and the circuits will be the same for each floor level.

The doors A and B are slidably mounted on the usual tracks and are moved by the mechanism and control circuits hereinafter described from the closed position illustrated to open position.

Door actuating mechanism.

In the form of the invention illustrated in the drawings, the door actuating mechanism consists of a pair of oppositely acting solenoids 10 and 20 adapted when energized to move the door to closed and opened position. Each solenoid has the usual solenoid winding 11 and the core of each solenoid consists of a plurality of telescoping sections 12, 13 and 14. The outer section 12, which consists of a cylinder or sleeve of soft iron or steel, is slidably mounted in a casing 15, preferably formed of brass or other non-magnetic material, having a ring 16 of brass or other non-magnetic material at one end and having its other end closed as shown at 17, the closed end having a central opening 18. A valve casing 25 is secured to the central portion of the closed end 17 in casing 15 and the valve casing has a port 26 controlled by an inwardly seating ball check valve 27 and also has a port 28, the size of the port 28 being controlled by an adjustable needle valve 29.

The sleeve 12 has a flange 30 at its inner end slidably mounted in the casing 15 and a backing washer 31 is secured between the flange 30 and a collar 32 threaded on the inner end of the sleeve 12.

The sleeve 12 has a bearing ring 35 formed of brass or other non-magnetic material secured within its outer end and forming a bearing for the sleeve 13. The sleeve 13 has a collar 36 of non-magnetic material secured to its other end and slidably mounted within the sleeve 12.

The sleeve 13 has secured within its outer end a bearing ring 37 of non-magnetic material which forms a bearing for the inner section 14 of the solenoid core. One end of the core section 14 has mounted thereon a non-magnetic collar 40 which is slidably mounted in the sleeve 13.

The other end of the inner section 14 of the core has mounted thereon a collar 45 of non-magnetic material which is slidably mounted in the inner sleeve of the oppositely acting solenoid. Since both of the solenoids are constructed in exactly the same manner, the description of the other solenoid need not be described in detail.

A bar 50 is secured to and extends upwardly from the central portion of the hatchway door and is secured at its other end as shown at 51 to the central portion of the inner section 14 of the solenoid core.

For convenience in referring to the oppositely acting solenoids, they have been indicated on the drawings as C and D. In Figs. 1 and 2 the solenoid C has been energized and the core sections have been telescoped, thus moving the door to the right or to closed position. In order to open the door the solenoid D must be energized, whereupon the telescoping cross sections of solenoid D will be drawn within the solenoid coil, thus effecting the movement of the door to the left or to open position. When the door is moved to the left or is opened, the ball check valve 27 of solenoid C will be closed and air will be admitted to the casing 15 through the restricted inlet port 28 which is controlled as to size by the needle valve 29. As the solenoid sections of the solenoid D move out of the solenoid winding or coil, their movement is controlled by the restricted admission of air to the casing 15 and the door is cushioned in its movement. During the movement of the telescoping sections of one solenoid out of the solenoid winding the sections of the other solenoid core will move into the casing on which the winding is positioned and during this operation the check valve secured to that casing will open and permit the emission of air therefrom.

In Fig. 3 a slightly different form of cushioning mechanism is illustrated. In this form of the invention the solenoid cores are formed in three telescoping sections as in the other embodiment of the invention, but the sleeves or sections 55 have one end closed as shown at 56. The central section 57 of the core consists of a hollow tube having a restricted passage 58 at the longitudinal center thereof and controlled as to size by a needle valve 59. Oil or other suitable viscous material is positioned within the chamber formed in one of the sections 55, as for instance in the chamber formed in the section 55 of the solenoid D. When this solenoid is energized and the cross sections are telescoped, the oil or other material will be forced through the restricted passage 58 of the central core section 57 into the chamber formed in the section 55 of the solenoid C. Thus a cushioning effect is obtained.

Door closure mechanism control circuits.

In Fig. 1 an elevator car is diagrammatically shown at E. The opening and closing of the door is primarily controlled by a pair of switches 60 and 160. These switches may be of the push button type or any other desired form and they are normally held open by springs 61 and 161. Switch 60 has a contact 62 connected by wire 63 to a wire 64 which is connected to the positive side of a power circuit. The other contact 65 of the switch 60 is connected by wire 66 to a relay magnet coil 67 which in turn is connected by a wire 68 to a wire 69, the other end of which is connected to the negative side 70 of a power circuit.

The wire 68 is also connected by a wire 71 to a contact 72 of a relay switch 73 controlled by the relay coil 67. The other contact 74 of

the relay switch is connected by a wire 75 to a switch contact 76 of a switch 77. Switch 77 is normally held open by a spring 78 but is closed when a car is positioned at the landing by a cam 79 which engages a stud 80 secured to and projecting laterally from the switch 77.

The positive main 64 of the power circuit is connected by a conduit or wire 85 to a contact 86 of a switch 87 normally closed by a spring 88. The switch 87 has a stud 89 projecting laterally therefrom adapted to be engaged by a lug 90 carried by the hatchway door when the door reaches its wide open position.

The other contact 91 of switch 87 has secured thereto a wire 94 which is connected by a wire 95 to the solenoid winding of the solenoid D. The other end of the winding of solenoid D is connected by a wire 96 to a switch contact 97.

The wire 94 is also connected as shown at 98 to the winding of a solenoid 99, the other end of the solenoid winding being connected to a wire 100 which in turn is connected to the negative side 70 of the power circuit.

The solenoid 99 has a core 110 to which there is connected by a pin and slot connection 111, one end of a bell crank lever 112 pivoted at 113 and having its other end 114 positioned to lock the door in closed position. A bar 115 is secured to the top of the door and is adapted to be engaged by the lock 114.

In order to manually release the lock in case the electric control circuit is out of order, a bell crank lever 120 is pivoted at 121 to the door and is actuated by a rod 122 having a handle 123 at the lower end thereof. A spring 124 encircles the rod 122 and normally retains the bell crank lever at retracted or inoperative position.

The other end of the core 110 of solenoid 99 is connected by a pin and slot connection 130 to an arm 131 formed on and projecting laterally from a lever 132 mounted on a pivot 133. One end 134 of the lever 132 is connected by a link 135 to a switch blade 136 which is adapted to engage a switch contact 137 connected to the car control switch or in the car control circuit. The switch blade 136 is connected by a wire 140 to the wire 64 or to the positive side of the power main.

The other end 145 of the lever 132 is connected by a link 146 to a switch blade 147 which is adapted to engage the switch contact 97 above referred to. The blade 147 is connected by wire 148 to the wire 100.

The switch 60 and circuits controlled thereby effect the opening of the door. The closing of the door is controlled by the switch 161. The switch 161 is adapted to engage a contact 162 which is connected by wire 163 to the wire 63 which in turn is connected to wire 64 or to the positive power main. The other contact 165 of the switch 160 is connected by wire 166 to a relay magnet coil 167 which in turn is connected by a wire 168 to the wire 68 and, as above stated, wire 68 is connected by wire 69 to the negative side of the power main.

The relay magnet controls a relay switch 173 which is adapted to engage switch contacts 172 and 174. Contact 172 is connected by a wire 171 to the wire 68. Contact 174 is connected by a wire 175 to a switch contact 186 controlled by a switch 187 which is adapted to establish communication between the contact 186 and a contact 191. Switch 187 has a stud 189 projecting laterally therefrom and adapted to be engaged by a lug 190 disposed at the opposite edge of the door from the lug 90.

Switch contact 191 is connected by a wire 194 to the solenoid winding of the solenoid C, the opposite end of the winding being connected by a wire 196 to a wire 197 which in turn is connected to the wire 64 and to the positive side of the power main.

The circuits for controlling the door operating mechanisms for the other floors are exactly the same as those described and, therefore, need not be further explained. From the showing in Fig. 1 it will be clear that the positive and negative mains are extended upwardly to successive floors and the control circuits are connected across these mains in the same manner as that already described.

Operation of control circuits.

In Fig. 1 the solenoid C has been energized and the door has been moved to the right. When the door is open and during the movement of the door to closing position, the end 114 of the door locking lever will ride on the upper edge of the bar 115. When the lever is disposed in this position the solenoid core 110 will be moved to the right, thus swinging the lever 132 in a clockwise direction and opening and maintaining open the switch 136 in the car control circuit. Thus the car cannot be operated when the door is not closed and locked. In order to open the door the operator closes the switch 60. When the switch is closed a circuit is closed from the positive main 64 through conduit 63, switch 60, relay magnet 67, and through wire 68 to wire 69 and to the negative side of the power circuit. A circuit will also be established from wire 64 through wire 85, switch 87, wire 94, solenoid 99, wire 100, switch 77, wire 75, switch 73, wires 71 and 69 to the negative side of the power circuit.

When the solenoid 99 is thus energized, the core 110 will be moved to the left, thus releasing the lock 114 and permitting the door to open. The movement of the core 110 will also swing the lever 132 in a clockwise direction, opening the car control circuit switch 136 and closing the switch 147. When the switch 147 is closed a circuit will pass from the wire 64 through wire 85, switch 87, wires 94 and 95

through the solenoid winding of solenoid D, and thence through the wire 96 and switch 147 to wire 148 and through wire 100, switch 77, wire 75, switch 73, wires 68 and 69 to the negative side of the power circuit.

Thus, in the manner above described, upon the closing of the switch 60 the door will be unlocked and the solenoid D will be energized, causing the core sections of this solenoid to telescope and throw the door to the left or to open position. When the door reaches its wide open position the lug 90 will engage stud 89 and open switch 87, thus opening the solenoid circuit for solenoid D.

In order to close the door the switch 160 is closed and a circuit is then completed through wires 64, 63, 163, switch 160, relay magnet 167, wires 168, 68 and 69 to the negative side of the main. When the relay switch 173 is closed in this manner a circuit will pass from wire 64 through wires 197 and 196 through the winding of solenoid C through wire 194, switch 187, wire 175, switch 173, wire 171 and wire 69 to the negative side of the power main. The energizing of the solenoid C will cause the core sections thereof to telescope, thus moving the door to closed position. Upon reaching this position the lug 190 will engage stud 189 and open switch 187, thus opening the circuit through the winding of solenoid C.

From the foregoing specification it will be evident that simple, practical and efficient means have been provided for actuating and controlling the opening and closing of hatchway doors. Furthermore, it will be clear that the use of the control mechanism described will effectively prevent the opening of a door unless the elevator car is disposed at the level at which the door is located and will also prevent the operation of the car when a hatchway door is open.

Although certain specific embodiments of the invention have been particularly shown and described, it will be understood that the invention is capable of modification and that changes in the construction and in the arrangement of the various cooperating parts may be made without departing from the spirit or scope of the invention, as expressed in the following claims.

What I claim is:

1. Door operating mechanism comprising a door movable to open and closed positions, means including a pair of oppositely acting solenoids for moving said door to open and closed positions, manually operable means for closing said solenoid circuits, and means operable by the door at its two extremes of movement for opening said solenoid circuits.

2. Door operating mechanism comprising a door movable to open and closed positions, and means including a pair of oppositely acting solenoids for moving said door to open and closed positions, said solenoids having non-electrical means controlled by the solenoid core for cushioning the door during its movement in either direction.

3. Door operating mechanism comprising a door movable to open and closed positions, and means including a pair of oppositely acting solenoids for moving said door to open and closed positions, said solenoids having pneumatic means for cushioning the door during its movement in either direction.

4. Door operating mechanism comprising a door movable to open and closed positions, means including a pair of oppositely acting solenoids for moving said door to open and closed positions, each of said solenoids having telescoping cores and cushioning means controlled by said cores for checking and cushioning the opening and closing movements of the door.

5. Door operating mechanism comprising a door movable to open and closed positions, means including a pair of oppositely acting solenoids for moving said door to open and closed positions, each of said solenoids and cushioning means controlled by said cores for checking and cushioning the opening and closing movements of the door having telescoping cores, the central core being common to the two solenoids.

6. Door operating mechanism comprising a door movable to open and closed positions, means including a pair of oppositely acting solenoids for moving said door to open and closed positions, each of said solenoids having telescoping cores, the central core being common to the two solenoids, and a connection between the central core and the door and cushioning means controlled by said cores for checking and cushioning the opening and closing movements of the door.

7. In combination, a door movable to open and closed positions, means for locking the door in closed position, an elevator car, and a switch adapted for connection in the car control circuit, said switch being connected to said locking means and so constructed and arranged that when the door is locked the switch is closed and when the door is unlocked the switch is open and means controlled by the car for controlling said locking means.

8. In combination, a door movable to open and closed positions, a lock releasably engageable with the door for locking the door in closed position, a solenoid for moving the door to open position, and means controlled by said lock for closing the solenoid circuit when the lock moves to unlocking position.

9. In combination, a door movable to open and closed positions, a lock for locking the door in closed position, a solenoid for moving the door to open position, and means controlled by said lock for closing the solenoid

circuit when the lock moves to unlocking position, and electrical operating means for releasing the lock.

10. In combination, a door movable to open and closed positions, a lock for locking the door in closed position, a solenoid for moving the door to open position, and means controlled by said lock for closing the solenoid circuit when the lock moves to unlocking position, and means engageable by the door when it reaches wide open position for opening said solenoid circuit.

11. In combination, a door movable to open and closed positions, a lock for locking the door in closed position, a solenoid for moving the door to open position, and means controlled by said lock for closing the solenoid circuit when the lock moves to unlocking position, electrical operating means for releasing the lock, and manually operable means for releasing the lock.

12. In combination, a door movable to open and closed positions, means for locking the door in closed position, an elevator car, and a switch adapted for connection in the car control circuit, said switch being connected to said locking means and so constructed and arranged that when the door is locked the switch is closed and when the door is unlocked the switch is open, and means on the door for engaging the locking means in all positions of the door except closed position and holding said means in unlocking position unless the door is closed.

13. In combination, a door movable to open and closed positions, a lock for locking the door in closed position, a solenoid for moving the door to open position, a solenoid for moving the lock to unlocking position, and control means for said solenoid circuits so constructed and arranged that the lock control solenoid will be operated prior to the door moving solenoid.

14. In combination, a door movable to open and closed positions, a lock releasably engageable with the door for locking the door in closed position, electrically operated means for moving the door to open and closed position, electric circuits for controlling said means, and means controlled by a lock for closing the circuit of said door moving means to cause said moving means to open the door when the lock is moved to unlocking position.

15. In combination, a door movable to open and closed positions, a lock for locking the door in closed position, electrically operated means for moving the door to open position, an electric circuit for controlling said means, means controlled by the lock for closing the circuit of said door moving means when the lock is moved to unlocking position, and electrical means for releasing the lock.

16. In combination, an elevator car, a car control circuit including a switch, a hatchway door movable to open and closed positions, electrical operating means for opening and closing the door, a control circuit for said door operating means including a switch, a door lock for locking the door in closed position, control means for said lock and means connected to said lock control means and to said switches constructed and arranged to close one circuit when the other circuit is opened and vice versa.

17. In combination, an elevator car, a car control circuit including a switch, a hatchway door movable to open and closed positions, electrical operating means for opening and closing the door, a control circuit for said door operating means including a switch, a door lock for locking the door in closed position, electrically operated control means for said lock and means connected to said lock control means and to said switches constructed and arranged to close one circuit when the other circuit is opened and vice versa.

In witness whereof, I have hereunto set my hand this 1st day of June, 1927.

PETER J. DUGAN.