March 18, 1941. H. V. McCORMICK 2,235,380

ELEVATOR DOOR OPERATOR

Filed Feb. 17, 1938 2 Sheets-Sheet 1

Fig. 1.

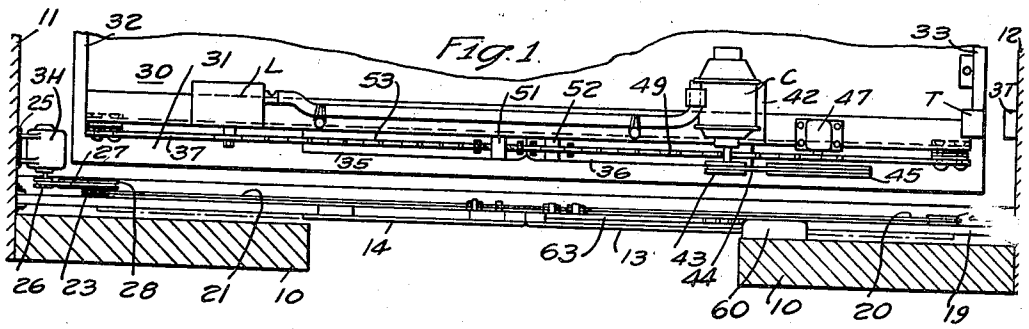



Fig. 2.

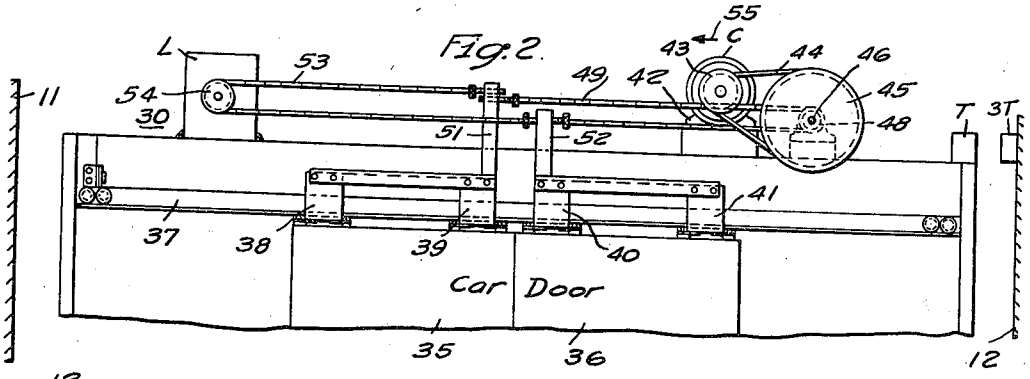



Fig. 3.

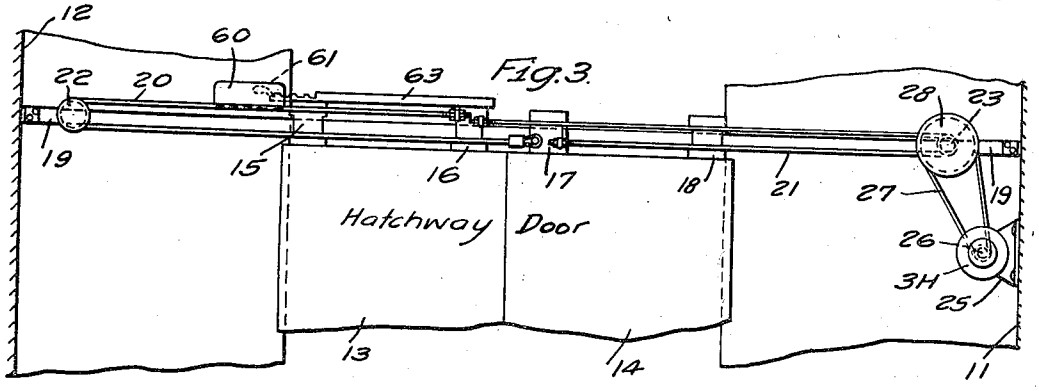
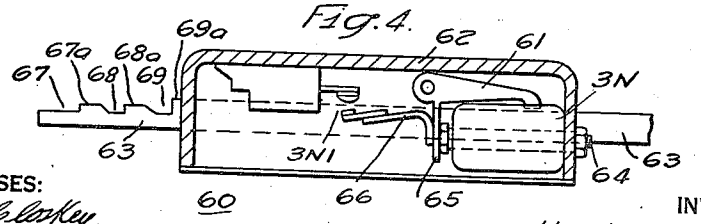



Fig. 4.



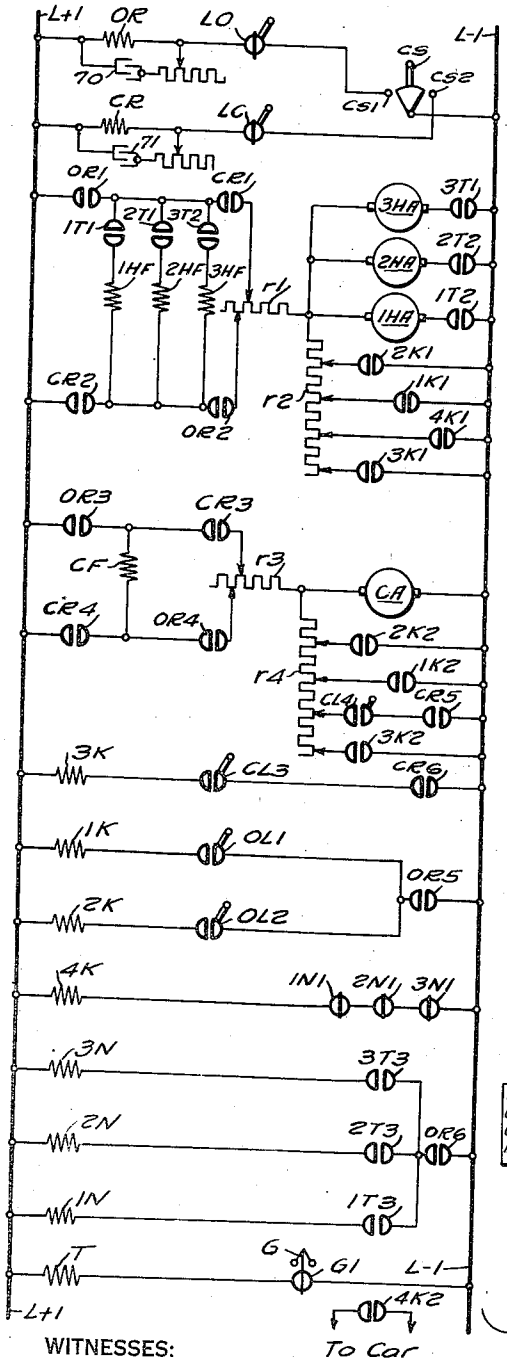

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Filed Feb. 17, 1938 2 Sheets-Sheet 2




To Car Control System

Fig. 5.

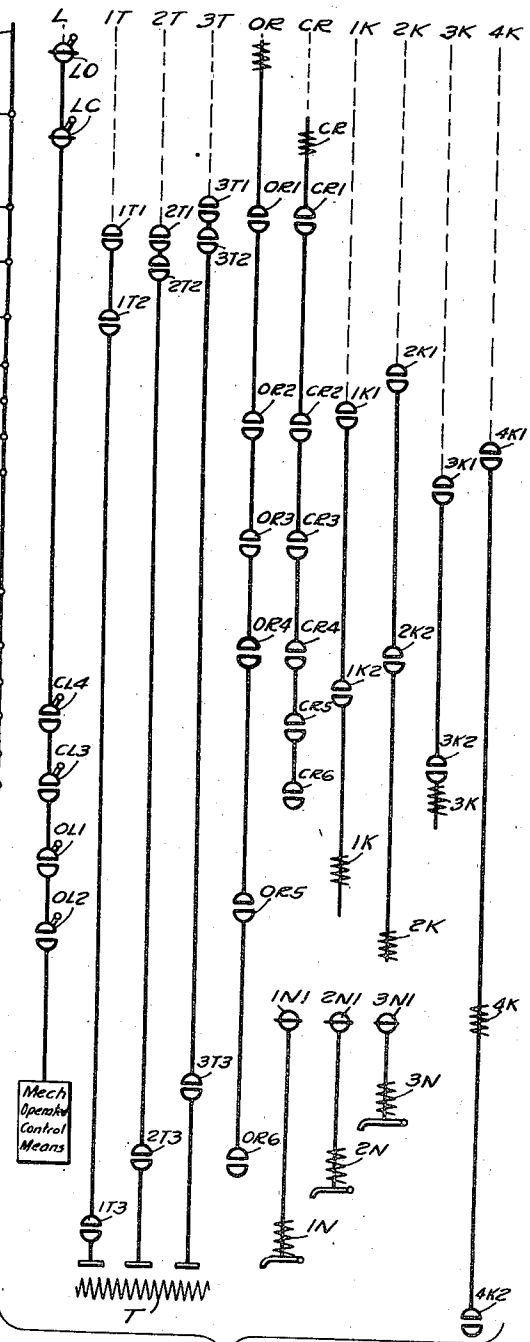



Fig. 5A.

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# UNITED STATES PATENT OFFICE

2,235,380

## ELEVATOR DOOR OPERATOR

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Application February 17, 1938, Serial No. 190,990

9 Claims. (Cl. 187—52)

My invention relates to elevator door operators and more particularly to the arrangement of the door operative mechanism and the systems of control therefor whereby the hatchway doors and the car doors are operated by individual electric motors.

One object of the invention is to provide the most effective elevator door systems with simple and inexpensive electric door operators.

Another object is to provide an electrically operated door system by means of which the car may be started away from a floor as soon as the hatchway door at that floor is almost but not quite closed, with assurance that that door is locked against being reopened and that it will finish its closing travel.

A further object is to provide interlocking mechanism and control which will effect the locking of the hatchway door as soon as it approaches within a predetermined distance of its closed position, but which will move the door to its final closed position while maintaining it in its locked condition.

A further object is to provide a system comprising an individual motor and control for each door and gate which may be readily and easily adjusted to suit the characteristics of the door or gate with which it is associated.

It is also an obbject to provide a common checking means for the car door and the adjacent hatch door while they are in midway operation, but to have each door itself operate its own final check to insure the final checking of each door at a predetermined distance from its closed position when it is being closed.

Other objects will be obvious in the following description taken in conjunction with the accompanying drawings in which:

Figure 1 is a top plan view of a portion of an elevator hatchway and a car, with the walls broken away to show the car door or gate and the hatchway door at one of the floor landings;

Fig. 2 is a front elevation of the upper portion of the car and the car door shown in Fig. 1;

Fig. 3 is a view in front elevation, from the interior of the hatchway, of the upper portion of the hatchway door shown in Fig. 1;

Fig. 4 is an enlarged view, in side elevation, with the cover broken away, of the hatchway door lock and interlock shown in Fig. 1;

Fig. 5 is a straight-line diagrammatic representation of the motors and the control system for operating the doors shown in Fig. 1; and

Fig. 5A is an explanatory representation of the connections between the relays and contact members operated thereby in Fig. 5.

*List of relays, etc. in drawings*

OR=door opening relay
CR=door closing relay
CS=car switch
1H=1st floor hatchway motor
2H=2nd floor hatchway motor
3H=3rd floor hatchway motor
C=car door motor
1T=1st floor hatchway door motor switch
2T=2nd floor hatchway door motor switch
3T=3rd floor hatchway door motor switch
1K=first opening resistor relay
2K=second opening resistor relay
3K=first closing resistor relay
4K=second closing resistor relay on door only
1N=interlock coil at 1st floor
2N=interlock coil at 2nd floor
3N=interlock coil at 3rd floor
LO=limit switch on opening (operated by controller)
LC=limit switch on closing (operated by controller)
OL1=1st opening cam on door and gate (operated by controller)
OL2=2nd opening cam on door and gate (operated by controller)
CL3=1st closing cam (operated by controller)
CL4=2nd closing cam on gate only (operated by controller)

Referring more particularly to the drawings, I have illustrated a section of an elevator hatchway having a front wall 10 and side walls 11 and 12. The section of the hatchway is taken at a floor landing, and any suitable door, such as a single door, a two-speed door, or center opening doors, may be provided at the landing.

For convenience, I have illustrated the landing as provided with a pair of horizontally sliding center opening doors 13 and 14. The other landings (not shown) may be provided with doors of the same style or any other suitable style. The doors are provided with suitable hangers 15, 16, 17 and 18 by which they may be suspended on an overhead track rail 19 in the usual manner so that they may slide toward the center in closing and away from it in opening.

The means for operating these doors comprises a pair of door operating cables 20 and 21 mounted upon and passing around a pair of sheaves 22 and 23 attached to the track rail construction. The under ends of the cables are attached to the

hanger 17 and the upper ends are attached to the hanger 16, so that rotation of the sheaves will pull the cables to open or to close the doors. The cables may be constructed of iron covered with rubber as described in Patent No. 1,966,182, issued July 10, 1934.

The means for operating the sheaves comprises an electric motor 3H mounted by means of a bracket 25 upon the sidewall 11 of the hatchway and provided with a pinion 26 for operating a belt 27 to rotate a pulley 28 mounted on the shaft of the sheave 23. With this construction, rotation of the motor 3H in one direction will cause the sheave 28 to operate the cables to open the hatchway doors and operation of the motor in the opposite direction will cause the cables to close the hatchway doors.

A car 30, of which only the front wall 31 and the side walls 32 and 33 are shown, is disposed in the hatchway in position opposite the hatchway doors 13 and 14. The car is provided with a pair of horizontally sliding center opening doors 35 and 36 which are suspended from an overhead track rail 37 by a plurality of hangers 38, 39, 40 and 41.

The means for moving the car doors to their open or to their closed position includes an electric motor C provided with a foot plate 42 by means of which it is secured to the roof of the car 30. The motor is provided with a driving pulley or wheel 43 over which a driving belt 44 passes to a driven pulley or sheave 45, mounted upon the outer end of a shaft 46, the inner end of which is mounted in a suitable bearing 47 bolted or otherwise secured to the roof of the car. On the shaft 46, between the bearing 47 and the sheave 45, is mounted a sprocket wheel 48, over which passes a sprocket chain 49. The sprocket wheel 48 is connected to the driven sheave so that rotation of the sheave effects a corresponding rotation of the sprocket wheel. The upper end of the sprocket chain is attached to a bracket 51 attached to the hangers 38 and 39 of the car door 35 and its under end is secured to a bracket 52 mounted on the hangers 40 and 41 of the door 36. A second sprocket chain 53 is supported on a sprocket wheel 54 and has its upper end connected to the bracket 51 on the door 35 and its under end connected to the bracket 52 on the door 36.

As may be seen in Fig. 2, if the motor C rotates in the direction of the arrow 55, it causes the operating mechanism, comprising the pulley 43, belt 44, sheave 45, sprocket wheel 48 and the chain 49, to pull on the bracket 52 to move the door 36 to its open position. At the same time, the operation of the door 36 causes its bracket 52 to pull on the lower end of the chain 53 and thereby causes its upper end to pull on the bracket 51 and thus cause the door 35 to move to its open position simultaneously with the opening motion of the door 36. It will also be apparent that when the motor is reversed, the chain will be operated by the sprocket wheel 48 to move the doors 35 and 36 to their center closing position.

The door operating mechanism may be used in an elevator system serving any desired number of floors. However, in the present case, I have assumed, for the sake of simplicity, that illustrating it in connection with the first, second and third floors will enable any one to clearly understand the system. In the drawings, the car is shown at the third floor, where the motor 3H has been provided for operating the hatchway doors at that floor. The hatchway doors at the other floors will be similar to the pair of hatchway doors for the third floor and each pair of doors will be provided with similar door operating mechanism. In the control circuit shown in Fig. 5, the armatures of the hatchway door motors are indicated as 3HA for the third floor motor, 2HA for the second floor motor, and 1HA for the first floor motor. Similarly, the field windings for these motors are indicated as 3HF for the third floor, 2HF for the second floor, and 1HF for the first floor. The armature for the car door motor is indicated as CA and the field winding for that motor as CF.

The operation of the motors to open or to close the doors may be controlled by operating a car switch CS. When the switch is moved to the left, a door opening relay OR is disposed to be energized to connect the car door motor and the hatchway door motor at the hatchway floor at which the car is standing to operate to open the doors. When the switch is moved to the right, a door closing relay CR is disposed to be energized to connect the car door motor and the hatchway door motor at which the car is standing to close the doors.

The hatchway door motors and the car door motor are preferably of the series wound direct-current type. The armatures and field windings of the hatchway door motors are connected in series, with the armatures in parallel with each other and with the field windings in parallel with each other, but each hatchway landing is provided with a switch disposed to be operated by an inductor relay on the car when it stops at that landing for connecting only the field winding and the armature winding for the door motor at that landing for energization by the opening or the closing relay.

The floor switch for the first floor is designated as 1T, that for the second floor as 2T, and that for the third floor as 3T. The inductor relay on the car is indicated as T and is connected to be controlled by a speed governor, for instance, such as indicated by the ball governor G. While the car is operating, the ball governor prevents energization of the inductor relay T, but, when the car comes to a stop at a floor, the ball governor closes its contact members to energize the inductor relay so that it will operate the inductor switch at the floor at which the stop is made.

An adjustable resistor $r1$ is disposed between the armatures and the field windings of the hatchway door motors whereby the amount of effective resistance in the resistor may be selected to cause the armature and field windings to operate in their most efficient manner.

A resistor $r2$ is provided for controlling the amount of current through the armatures of the hatchway door motors so that the speed of the motors in starting and stopping may be controlled as desired.

The armature CA and the field winding CF of the car door motor are connected in series, and a resistor $r3$ is provided for adjusting the current therein as desired. A resistor $r4$ is provided for controlling the amount of current through the armature of the car door motor so that its speed may be controlled in starting and stopping the car door.

In order to control the amount of the resistors $r2$ and $r4$ in the circuits for the armatures of the car door and the hatchway door motors and also to deenergize the starting and stopping relays at the right time, the system is provided with a controller L for connecting the resistors in the

motor circuits in accordance with the position of the car doors and the hatchway doors at which the car is standing. The controller is mounted upon the top of the car and is operated by the sprocket wheel **54**. The use of the sprocket wheel for operating the controller and also for supporting the chain **53** affords a simple construction whereby the controller is operated in accordance with the movement of the car doors. A chain is used instead of a cable so that the position of the controller will always correspond exactly with the position of the doors.

The controller is provided with cam operated switches OL1, OL2, CL3, CL4, LO and LC.

The switches OL1 and OL2 control the energization of a first opening resistor relay 1K and a second opening resistor relay 2K for controlling value of the resistors *r*2 and *r*4 in the circuits of the armatures of the car door motor and the hatchway door motor at the floor at which the car is stopped while the doors are being opened. The switch CL3 controls the first closing resistor relay 3K in the resistor circuits *r*2 and *r*4 during the closing operation of the doors. The cam switch CL4 controls, in conjunction with a switch on the closing relay, a circuit through the resistor *r*4 in the circuit of the car door motor in order to place a positive check on the movement of the car door when it closes to within a predetermined distance of its completely closed position. A second closing resistor relay 4K is provided for controlling the amount of the resistor *r*2 in the circuit of the hatchway door armature when the hatchway door closes to within a predetermined distance of its closed position.

The opening relay OR is provided with a time delay device such as a condenser **70** arranged to discharge through the relay coil when it is deenergized by the opening of the limit switch LO. The discharge of the condenser through the relay coil provides approximately one-half second delay in the opening of the relay thus giving the doors time to complete their opening movement after the limit switch opens and also causes the doors to be held momentarily against their bumpers to absorb their rebound. The closing relay CR is provided with a time delay means such as a condenser **71** to control the last closing action of the doors in the same manner. If desired, any other time delay means instead of condensers may be employed.

In order to prevent the opening of any of the hatchway doors while the car is not standing thereat and also to prevent operation of the car while a hatchway door is open, each hatchway door is provided with a pawl and ratchet locking mechanism **60**. The mechanism comprises a pawl or latch **61** pivotally mounted in a lock casing **62** secured to the hatchway wall in such position that the pawl will fall into the notched portion of a bar **63** mounted on the top portions of the hangers **15** and **16** on the door **13** when the door is completing its closing movement. An electromagnetic coil **3N** is mounted, by means of a bolt **64**, on the inside of the lock casing to attract, when energized, an armature **65** attached to the pawl. When the coil is energized, the armature **65** is attracted thereto and thus raises the pawl out of the notched portion of the bar and holds it above the bar so that the door may be readily moved to its open position. The pawl **61** is weighted sufficiently to fall into its locking position in the notched or ratchet portion of the bar when the door is in or near its closed position and the coil **3N** is deenergized. The pawl and armature are provided with an arm **66** for operating a pair of contact members **3N1** disposed in the circuit for the second closing resistor relay **4K**. By this it will be apparent that the relay **4K** will be energized only when the lock at a hatchway door is unlocked to permit the opening of the hatchway door.

In accordance with my invention, the locking bar **63** is provided with a plurality of notches **67**, **68** and **69** of different sizes to receive the pawl **61** when the door is being locked. The ledges or teeth **67***a* and **68***a* of the notches **67** and **68** are made lower than the ledge **69***a* for the notch **69**, so that the pawl will close the contact members **3N1** when it slips off the ledge **69***a* into the notch **69** but will not open those contact members when it moves over the ledges **68***a* and **67***a* on moving from the notch **69** to either the notch **68** or **67** as the door completes its movement into its fully closed position.

It is to be understood that an interlocking switch is associated with each lock at each hatchway door opening, the interlocking switch for the first floor being indicated as **1N1**, that for the second floor as **2N1**, and that for the third floor as **3N1**.

The second closing resistor relay 4K is also provided with a pair of contact members **4K2** which may be disposed in the car control circuit to prevent operation of the car while the hatchway door is unlocked and also to permit the car to proceed on its trip as soon as the pawl **61** is disposed in the locking notch **69**.

The operation of the system is as follows: It will be assumed that the car is in operation and is slowing down to a stop at the third floor. Under these conditions the interlock **60** on the corridor door is closed, with its latch **61** in the notch **67** and the switch **3N1** closed, thus energizing the second closing resistor relay **4K** which, in turn, has its contact members **4K2** closed in the car to permit the operation of the car. The controller switches **CL4**, **CL3** and **LO** are closed by reason of the position of the controller L.

The slowing down of the car causes its governor G to close its contact members G1 thus energizing the inductor relay coil T on the car to operate the inductor plate **3T** at the third floor to close its switches **3T1**, **3T2** and **3T3**. The closing of the switches **3T1** and **3T2** prepares the circuits of the hatchway door motor **3H** at the third floor for operation when the door is to be opened. The closing of the contact members **3T3** prepares a circuit for energizing the hatch door inductor coil **3N** to unlock the corridor doors when they are to be opened.

As the car comes into the third floor, it is assumed that the attendant throws the car switch CS to open the car doors **35** and **36** to unlock and open the hatchway doors **13** and **14** at the third floor. The closing of the contact members CS1 energizes the door opening relay OR by the circuit *L*+1, *OR*, *LO*, *CS1*, *L*—1. The energized relay OR closes contact members OR6 and thereby completes the circuit for energizing the hatch door interlock coil **3N** at the third floor which causes it to lift the pawl **61** out of the locking notch **67**, thus unlocking the corridor doors. The unlocking movement of the pawl also opens the contact members **3N1** at the third floor which deenergizes the relay **4K** to open its contact members **4K1** to eliminate the resistor *r*2 from the circuit for the armature **3HA** and opens its contact members **4K2** to prevent operation of the

car control circuit to move the car while the hatchway doors are open.

The closing of the contact members OR1 and OR2 energizes the field winding 3HF and the armature 3HA of the door motor at the third floor to cause that motor to move the hatchway doors at the third floor to their open position. The motor circuit extends

*L+1, OR1, 3T2, 3HF, OR2, r1, 3HA, 3T1, L—1*

The closing of the contact members OR3 and OR4 energizes the field winding CF and the armature CA of the car door motor to move the car doors to their open position, through the circuit

*L+1, OR3, CF, OR4, r3, CA, L—1*

The energized motor moves the chains 49 and 53 to open the car doors and the action of the chains rotates the controller L to restore its limit switch contact members LC to their closed position. By the time the doors are approximately one inch open, the chains rotate the controller to restore its contact members CL4 to their open position. When the doors are, say, four inches open, the controller restores its contact members CL3 to their open position. As the car doors continue their travel toward their open position and are, say, four inches from their full open position, the controller L closes its first decelerating contact members OL1, thereby energizing the first opening resistor relay 1K which, in turn, closes its contact members 1K1 and 1K2. The closing of the contact members 1K1 inserts a predetermined portion of the resistor *r2* in parallel with the armature 3HA of the hatch door motor to decelerate that motor to slow down the hatchway doors as they near their open position. The closing of the contact members 1K2 inserts a predetermined portion of the resistor *r4* in parallel with the armature CA of the car door motor to decelerate that motor to slow down the car door as it nears its full open position. As the doors arrive at, say, one inch from their full open position, the controller L is operated to close its second decelerating switch OL2, thereby energizing the second opening resistor relay 2K to close its contact members 2K1 and 2K2 by the circuit

*L+1, 2K, OL2, OR5, L—1*

The closing of the contact members 2K1 inserts a predetermined portion of the resistor *r2* in parallel with the armature 3HA to decrease the speed of the hatchway door motor so that the hatchway doors will slow down softly at the end of their opening travel. The closing of the contact members 2K2 inserts a predetermined portion of the resistor *r4* in parallel with the armature CA of the car door motor to decelerate that motor to slow down the car doors so that they move softly into their full open position.

In the diagram of Fig. 5, the resistors *r2* and *r4* are shown as connected at various points by adjustable arrows controlled by opening and closing switches. It should be understood that in actual practice the circuits controlled by the opening and closing switches may be connected to these resistors at any point or points selected by the elevator engineer and that it is common practice to make these connections when the elevator is installed and to change or modify them in any manner desired to secure smooth operation of the hatch door motors and the car door motors in opening and closing the doors with which they are associated.

As the car doors reach their open position, the controller L is operated to open its limit switch LO to deenergize the opening relay OR. However, inasmuch as this relay is associated with its condenser 70, it stays energized for a very short time to give the door motors time to complete their opening movement after the limit switch opens and also causes the doors to be held in their full open position momentarily against their bumpers to absorb their rebound. The opening of the contact members OR1 and OR2 of the deenergized relay OR deenergizes the field winding 3HF and the armature winding 3HA of the hatch door motor, thereby stopping that motor. The opening of the contact members OR3 and OR4 deenergizes the field winding CF and the armature CA of the car door motor, thereby stopping that motor. The opening of the contact members OR5 deenergizes the first opening and the second opening resistor relays 1K and 2K to open their contact members for disconnecting the resistor *r2* and *r4* from the circuits for the armature CA and armature 3HA.

The opening of the contact members OR6 deenergizes the hatch door interlock coil 3N which causes the pawl 61 to drop down on the ledge 69*a* of the bar 63. This ledge, however, prevents the door from being locked and also prevents the closing of the contact members 3N1 to move the car. It will be obvious that the pawl 61 cannot move into locking position until the hatchway door is moved sufficiently toward its closing position to permit the pawl to drop off the ledge or upper surface 69*a* of the bar and into one of the notches 67, 68 or 69.

It will be assumed now that the passengers have entered or left the car and that the car attendant moves the car switch CS in a clockwise direction to effect the closing of the car doors and the hatchway doors. The movement of the switch closes its contact members CS2, thereby energizing the door closing relay CR through the circuit *L+1, CR, LC, CS2, L—1*. The closing of the contact members CR1 and CR2 reverses the energization of the hatch door motor to close the hatch doors, by the circuit

*L+1, CR2, 3HF, 3T2, CR1, r1, 3HA, 3T1*

The energization of the hatch door motor 3H causes the hatch doors to move toward their closed position.

The closing of the contact members CR3 and CR4 energizes the car door motor C through the circuit

*L+1, CR4, CF, CR3, r3, CA, L—1*

The energized car door motor moves the car doors toward their closed position and in doing so causes the chains 49 and 53 to rotate the controller L so that it restores the limit switch LO to its closed position. As the car door moves, say, one inch away from its open position, the controller restores its switch OL2 to its open position, and, as the car door moves, say, four inches away from its open position, the controller restores the switch OL1 to its open position, to prepare them for closing at the proper time in the opening sequence of the doors.

As the doors arrive at, say, four inches from their closed position, the controller L closes its switch CL3, thereby completing the circuit for energizing the first closing resistor relay 3K to close its contact members 3K1 and 3K2. The closing of the contact members 3K1 inserts a predetermined portion of the resistor *r2* in parallel with the armature 3HA of the hatch door motor to check its speed so that the door will slow down

as it nears its fully closed position. The closing of the contact members 3K2 inserts a predetermined portion of the resistor *r*4 in parallel with the armature CA of the car door motor to cause that motor to decelerate and thus slow down the movement of the car door as its nears its fully closed position.

As the car door gets within, say, one inch of its closed position, the controller L closes its switch CL4, thereby inserting a predetermined portion of the resistor *r*4 in parallel circuit with the armature CA to positively check the car door motor as the car door reaches the desired predetermined distance from its full closed position. It is to be noted that this last checking of the car door motor is controlled by the car doors reaching a predetermined point on closing and that it is independent of the final checking of the hatchway door motor.

As the hatch doors reach a predetermined distance from their fully closed position, the pawl 61 drops off the ledge 69*a* and into the notch 69, thereby locking the hatch doors against being opened until the interlocking coil 3N is again energized. The movement of the pawl 61 into the notch effects the closing of the contact members 3N1, thereby energizing the second closing resistor relay 4K to close its contact members 4K1 and 4K2. The closing of the contact members 4K1 inserts a predetermined amount of the resistor *r*2 in parallel with the armature 3HA of the hatch door motor to decelerate that motor to cause the hatch doors to close softly. Hence, it is seen that this final checking of the hatch door motor is effected by the hatch doors reaching a predetermined closing position and that it is independent of the final checking of the car door motor.

The car doors and the hatch doors are now almost closed and the hatch door is locked against being reopened. Hence, there is no reason why the car should not be permitted to depart and not have to wait until the doors are tightly closed. It is for this reason that the contact members 4K2 of the relay 4K are disposed to close in the car controlled circuit when the pawl 61 falls into the notch 69 and locks the door against opening but permits it to finish its closing movement.

When the doors are about one-half inch from their fully closed position, the controller opens its limit switch LC, thereby opening the circuit for the door closing relay CR but the condenser 71 on this relay maintains it in its energized condition for a time sufficient for the motors to move the doors to their fully closed position and also causes the motors to hold the doors momentarily against their bumpers to absorb the rebound therefrom. When the relay CR becomes deenergized, it opens its contact members. The opening of the contact members CR1 and CR2 deenergizes the hatch door motor. The opening of the contact members CR3 and CR4 deenergizes the car door motor. The opening of the contact members CR5 removes a predetermined portion of the resistor *r*4 from the circuit of the armature CA of the car door motor. The opening of the contact members CR6 deenergizes the first closing resistor relay 3K which restores its contact members 3K1 and 3K2 to their open position.

As the hatch doors move from their closing position where the latch 61 dropped into the notch 69 to their completely closed position, the latch slides over the ledge 68*a* into the notch 68 and then over the ledge 67*a* into the final notch 67 which locks the doors in their completely closed position. However, the ledges 68*a* and 67*a* are not high enough to cause the pawl, as it slips over them from notch to notch, to open the contact members 3N1. Inasmuch as these contact members stay closed, the relay 4K remains energized and thus the car is able to leave the third floor.

It will be assumed that car started to leave the floor as the doors closed to the point where the latch fell into the notch 69, as the car increased its speed, the governor G opened its contact members G1, thereby deenergizing the inductor relay T to open the switches 3T1, 3T2 and 3T3 to prevent any operation of the hatchway door circuit at the third floor.

The car doors and the hatchway doors are now in their completely closed position and the door-operating system will be ready for its next operation when the car slows down at the next floor at which a stop is to be made.

By the foregoing description it will be appreciated that I have provided a door operating system requiring very simple apparatus arranged in a simple and inexpensive manner; that the motors are provided with individual control systems which may be adjusted to meet the various conditions under which such systems are installed; that a special lock and interlock switch permits the locking of the doors before they are fully closed and permits the car to be moved away from a floor before the hatch doors at that floor are tightly closed but when they are safely closed and that the operating relays are provided with means which cause the doors to be held momentarily against their bumpers in their closed or open position at the end of their movement at least for a sufficient time to permit them to absorb the rebound effect of the bumpers.

Although I have illustrated and described only one specific embodiment of my invention, it is to be understood that changes therein and modifications thereof may be made without departing from its spirit and scope.

I claim as my invention:

1. In an elevator door operating system for operating a hatchway door at a landing and a door on the car in the elevator, an electric motor for moving the hatchway door, an electric motor for moving the car door, switches for starting, stopping and reversing the motors, means responsive to operation of one of the doors for decelerating both motors at predetermined points in their movements and responsive to movement of said one door to within a predetermined distance of its completely closed position for further decelerating the motor of said one door for its final closing movement, and means responsive to a closing movement of the other of said doors to within a predetermined distance of its completely closed position for further decelerating the motor of said other door in its final closing movement, whereby both doors are checked by common means at one stage of their travel and each door is checked by its own means when it is a predetermined distance from its final position.

2. In an elevator door operating system for operating a hatchway door at a landing and a door on the car in the elevator, an electric motor for moving the hatchway door, an electric motor for moving the car door, switches for starting, stopping and reversing the motors, a resistor for each motor, means responsive to operation of one of the doors for controlling the resistors of both motors to decelerate their speed at prede-

termined points and responsive to movement of said one door to within a predetermined distance of its completely closed position for controlling the resistor of the motor for that said one door to decelerate that motor for its final closing movement, and means responsive to a closing movement of the other of said doors to within a predetermined distance of its completely closed position for controlling the resistor of the motor of said other door to decelerate that motor for its final closing movement, whereby both doors are checked by a common means at one stage of their travel and each door is checked by its own means when it is a predetermined distance from its final position.

3. In an elevator door operating system, for operating a door at a corridor opening and a door on a car in the elevator, an electric motor for moving the corridor door, an electric motor for moving the car door, switches for starting and stopping the motors, a resistor for each motor, means responsive to a predetermined operation of the car door for controlling the resistors of each motor to decelerate the motors and responsive to movement of the car door to within a predetermined distance of its completely closed position for controlling the resistor of the car door motor to decelerate that motor for its final door closing movement, and means responsive to a closing movement of the corridor door to within a predetermined distance of its completely closed position for controlling the resistor of the corridor motor to decelerate that motor for its final closing movement, whereby both motors are checked by a common means at one stage of their movement and by individual means at their final closing movement.

4. In an elevator door operating system, a motor for moving the door, an opening relay, means for connecting the opening relay for energization, means responsive to energization of the opening relay to cause energization of the motor to move the door to its open position, a limit switch for controlling the energization of the opening relay, means responsive to a predetermined opening movement of the door for operating the limit switch to disconnect the opening relay from its source of energization, and a time delay means associated with the opening relay for preventing that relay from deenergizing the motor for a predetermined time after the opening of its limit switch whereby the door motor will complete its opening movement after the limit switch opens and will hold the door momentarily against its bumpers to absorb their rebound.

5. In an elevator door operating system for operating a sliding door at a corridor opening and a door on the car in the elevator, a motor for moving the corridor door, a motor for moving the car door, an opening relay and a closing relay for connecting and disconnecting the motors with a source of energy and for reversing their direction of operation, a limit switch for each relay, means responsive to a predetermined opening movement of the car door for operating the limit switch associated with the opening relay to disconnect that relay from its source of energization, means responsive to a predetermined closing movement of the car door for operating the limit switch associated with the closing relay to disconnect that relay from its source of energy, a time delay means associated with each relay for preventing deenergization of the motors for a predetermined time after the opening of the relay to cause the motors to complete the opening movement or the closing movement of the doors after the opening of a limit switch and to hold them momentarily against their bumpers to absorb their rebound.

6. In a door operating system for a door on a car in an elevator hatchway and a door in the hatchway, a motor for the car door, a motor for the hatchway door, an opening relay and a closing relay for connecting and disconnecting the motors with respect to a source of energy and for reversing their direction of operation, means responsive to a closing movement of the car door to a predetermined point for decelerating both motors and responsive to a further closing movement of the car door for further decelerating the car door motor, a lock comprising a notched bar and a pawl responsive to a closing movement of the hatchway door to nearly its closed position for locking that door, means responsive to the locking operation of the lock for further decelerating the hatchway door motor, a limit switch for the closing relay responsive to a still further closing movement of the car door for disconnecting the closing relay from its source of energy, a time-delay means associated with said closing relay for preventing deenergization of that relay for a predetermined time after it is disconnected to cause the motors to complete the closing movement of the doors after the opening of the limit switch and to hold them momentarily against their bumpers to absorb their rebound.

7. In a door operating system for a door on a car in an elevator hatchway and a door in the hatchway, a motor for operating the hatchway door, a motor for operating the car door, an opening relay and a closing relay for connecting and disconnecting the motors with respect to a source of energy and for reversing their direction of operation, a pawl and ratchet lock for locking the hatchway door comprising a notched bar mounted on the hatchway door and a pawl pivotally mounted on the hatchway walls in position to engage one of the notches when the hatchway door is nearly closed and to engage another notch when the door is completely closed for locking the door, means responsive to operation of the car door to a predetermined point for decelerating both motors and responsive to movement of said car door to within a predetermined distance of its final position for decelerating the motor of said car door for its final movement, means responsive to a locking operation of the lock when the hatchway door is nearly closed for decelerating the motor of the hatchway door for its final movement and for preparing for operation a control system of the car, a limit switch for each relay, means responsive to a predetermined movement of the car door for operating the limit switch associated with the opening relay to disconnect that relay from its source of deenergization, means responsive to a predetermined closing movement of the car door for operating the limit switch associated with the closing relay to disconnect that relay from its source of energy, a time delay means associated with each relay for preventing deenergization of that relay for a predetermined time after it is disconnected to cause the motors to complete the opening or closing movement of the doors after the opening of the limit switch and to hold them momentarily against their bumpers to absorb their rebound.

8. In a door operating system for an elevator,

a door, an electric motor for opening and closing the door, switches for starting, stopping and reversing the motor, a lock for the door, and means responsive to a locking operation of the lock when the door nears its closed position for decelerating the motor during the latter part of the movement of the door to its closed position.

9. In an elevator door operating system for operating a hatchway door at a landing and a door on the car in the elevator, an electric motor for moving the hatchway door, an electric motor for moving the car door, switches for starting, stopping and reversing the motors, means responsive to operation of one of the doors for decelerating both motors at predetermined points in their movements and responsive to movement of said one door to within a predetermined distance of its completely closed position for further decelerating the motor of said one door for its final closing movement, a lock for the other of said doors disposed to be locked by the closing movement of said other door, and means responsive to the locking operation of said lock for further decelerating the motor of said other door in its final closing movement, whereby both doors are checked by common means at one stage of their travel and each door is checked by its own means when it is a predetermined distance from its final position.

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