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DOOR OPERATING MECHANISM

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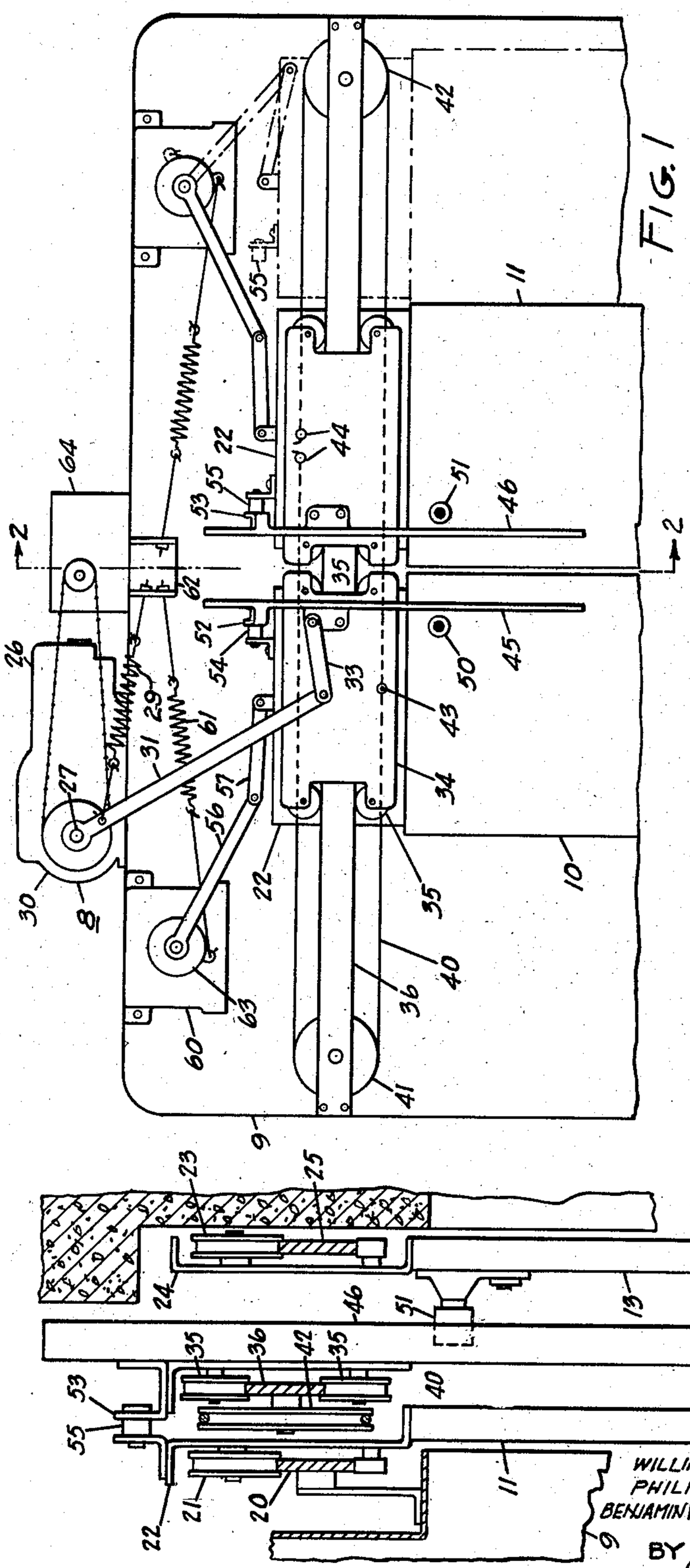

FIG. 1

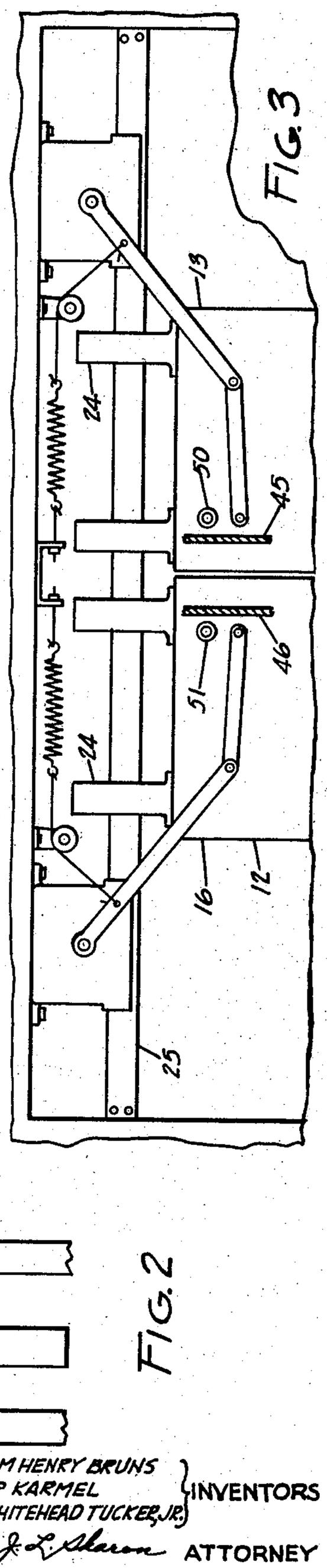

FIG. 3

FIG. 2

WILLIAM HENRY BRUNS
PHILIP KARMEL
BENJAMIN WHITEHEAD TUCKER, JR.
} INVENTORS

BY J. L. Sharon ATTORNEY

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DOOR OPERATING MECHANISM

William Henry Bruns, Lincolndale, and Philip Karmel, New York, N. Y., and Benjamin Whitehead Tucker, Jr., South Orange, N. J., assignors to Otis Elevator Company, New York, N. Y., a corporation of New Jersey

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This invention relates to elevator door operating mechanism.

In elevator installations in which the elevators are operated without attendants it is customary to provide power operated doors which open and close automatically. To minimize the possibility of persons being struck by the closing doors, the doors are provided with various mechanisms to stop the closing of the doors when a person enters into the path thereof or when a person is in the path of and proximate to the doors. With such mechanisms there is the possibility that a person will step into the path of the doors immediately in front of the door so that there is not sufficient time to completely stop movement of the doors and consequently be struck by the door. In the past the door closing speed has been made comparatively low so that if a person is struck by the door the impact is kept low to minimize the possibility of real injury. However, with the advent of high speed elevator installations this door operating time became an appreciable portion of the over-all elevator operating time.

It is, therefore, the object of this invention to provide a door operating mechanism which will enable the door closing operation to be effected at a high speed without danger of real injury from the impact when a person is struck by the door.

The invention involves a door mechanism in which the masses by which the person may be struck are minimized. More specifically, the invention involves the provision of center opening doors for both the car and hoistway entrances and arranging each door to be closed independently of all the others.

In carrying out the invention there is provided a pair of oppositely movable carriages on the elevator car for operating the center opening car doors and hoistway doors. In opening, the carriages are driven in opposite directions by a door operating motor, the carriages in turn engaging the center opening car doors and hoistway doors and pushing them in opposite directions to their open positions. When the door motor is energized to initiate a door closing operation only the carriages are moved thereby to door closed position. Each of the car doors and each of the hoistway doors is closed independently by a separate spring. Thus, if a person is struck by a door only the mass of the door by which he is struck is involved in the impact. This enables the door closing speed to be increased without danger of real injury from the impact.

Features and advantages of this invention will be apparent from the foregoing and the description which follows.

In the drawings:

Figure 1 is an elevational view schematically showing the door mechanism car equipment;

Figure 2 is a view in detail taken along line 2—2 of Figure 1; and

Figure 3 is a view similar to Figure 1 but showing the hoistway door equipment.

Reference will be made to the figures conjointly for a description of a preferred arrangement of the present invention. Although the doors illustrated are of the center opening single speed type, it is to be understood that this invention may be employed for example with center opening two speed type doors.

A door engine 8 mounted on the elevator car 9 operates to move both the car doors 10 and 11 and the hoistway doors 12 and 13 in synchronism to an open position. The car doors are supported on track 20 by means of rollers 21 and door hangers 22. Hoistway doors 12 and 13 are similarly supported by rollers 23 and door hangers 24 to run on track 25. Locking mechanism for the hoistway door is not shown insofar as it will not aid in an understanding of this invention.

Door motor 26 drives a shaft 27 through a gear reducing unit 30 to rotate arm 31. Arm 31 is pivotally connected at 32 to link 33 which in turn is pivotally connected to carriage 34. Spring 29 is mounted between arm 31 and a fixed portion of the elevator car in position to be tensioned as the arm is rotated to a door open position. The spring insures the return of the carriage to its closed position in the event of failure of the door motor to do so. Rotatably fastened to the carriage are a plurality of rollers 35 which guide the carriage along track 36. Thus as arm 31 is rotated clockwise, carriage 34 is moved toward the left. Motion of carriage 34 is transmitted to carriage 37 by means of wire cord 40. The cord, which passes over pulleys 41 and 42 is securely fastened to the respective carriages at points 43 and 44. Hence as carriage 34 moves toward the left, carriage 37 moves toward the right.

Fastened to carriages 34 and 37 are cams 45 and 46 which engage rollers 50 and 51 on the hoistway doors 12 and 13 to move the doors to open limiting positions. Cams 45 and 46 are also provided with extensions 52 and 53 which engage rubber bumpers 54 and 55 respectively on doors 10 and 11 to move the car doors to open limiting positions.

Army 56 and link 57 connect door 10 to door check mechanism 60. Spring 61 which extends between fixed angle bracket 62 and rotatable disk 63 of the door check mechanism is tensioned as door 10 is moved to an open position. The other car door 11 and the hoistway doors 12 and 13 are similarly arranged with springs and door check mechanisms as is shown in the drawing.

Having in mind the details above described, a better understanding of the invention will be had from a description of the door mechanism in operation. It will be assumed that the car has arrived at a floor at which a call is to be answered. As the car levels into the floor, door motor 26 is energized to open the doors. Operation of the motor causes arm 31 to rotate clockwise, thus moving carriage 34 towards its open limiting position. Carriage 37 is at the same time moved toward an open limiting position through the agency of wire cord 40. Control of the motor, and consequently the carriages, in accelerating, decelerating and stopping is accomplished through the use of limit switches located in box 64. The limit switches, which are operated in accordance with the position of the carriages, control the insertion of series and parallel resistance in the motor armature circuit in a manner known in the prior art.

As the carriages are moved to a full open position by the motor, extensions 52 and 53 of cams 45 and 46 engage bumpers on car doors 10 and 11 respectively to move the doors to their open positions, the open position of door 11 and its associated mechanism being indicated in dot-dash lines in Figure 1. Cams 45 and 46 also engage rollers 50 and 51 on the hoistway doors to move these doors to open positions. As each of the doors

is thus moved, the springs associated therewith are tensioned e. g., spring **61**.

After the doors have been open for a period of time which is determined by the established operating conditions, motor **26** is energized to move carriages **34** and **37** to closed positions. As is clear from the drawing, during a closing operation there is no connection between the carriages and the doors. Thus, the sole means of closing the doors are the tensioned springs. The springs may be adjusted to cause rollers **50** and **51** on the hoistway doors to bear against cams **45** and **46** respectively and bumpers **54** and **55** on the car doors to bear against extensions **52** and **53** respectively to permit the car and the hoistway doors to close in synchronism provided that one of the doors is not obstructed in closing. A door check is provided for each door to prevent the doors from slamming shut. Switch mechanism (not shown on the drawing) is also provided for each panel for indicating whether or not the door is in a closed position.

It is clear that if an obstruction is placed in front of any one of the doors only that door will be prevented from closing; the other doors closing in a normal manner. Thus, if during a normal closing operation a person should enter the path of the doors immediately in front of the doors so that any mechanism provided on the doors to arrest door motion under such circumstances (such as that shown in Patent 2,601,250) would not have time to fully stop the closing doors, the person would only have to absorb the energy of the one door by which he was struck. If arranged to do so, the mechanism would then act to reopen the doors, after which the doors would close in synchronism as above described. On the other hand, if a person is in a position where he will be struck by a door but will not actuate a mechanism to arrest door motion or under circumstances where such a mechanism is not provided, when the person is struck by one door the other doors will continue to close and only the one door will be impeded. After the obstruction is removed, the door will continue to close. The door check associated therewith will prevent the door from slamming shut even though the carriages and the other doors have already reached closed positions. By so reducing the mass it is possible to increase the closing speed of the doors without exceeding the kinetic energy which experience has shown will minimize the possibility of real injury.

Although the invention is particularly suitable for high speed elevators operated without an attendant, it is, of course, applicable for other type elevator installations using attendants or for slow speed duties. Likewise, although the description is directed to center opening doors, certain features of the invention are applicable to side opening doors. Also two speed doors, of either the center opening or side opening type, may similarly incorporate the invention. The invention may also be utilized for door control apparatus in which separate power means control the opening of the car and the hoistway doors. Also, the invention may be used with any of the so-called door safety devices.

Thus, as many changes could be made in the above construction and many apparently widely different embodiments of this invention could be made without departing from the scope thereof, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

What is claimed is:

1. In an elevator installation in which an elevator car is provided with center opening doors and in which center opening hoistway doors are provided at a landing served by the car, door operating apparatus comprising, power mechanism carried by the elevator car for moving said car doors and said hoistway doors at said landing to open positions, and means for moving each of said car doors and each of said hoistway doors at said landing from open

position to closed position independently of all the other of said car doors and said hoistway doors at said landing.

2. In an elevator installation in which an elevator car is provided with center opening doors and in which center opening hoistway doors are provided at a landing served by the car, door operating apparatus comprising, a pair of members corresponding to said car doors and said hoistway doors, said members being guided on the car for opposite movement between door open and door closed positions, power mechanism carried by said elevator car for moving said members to said positions, each of said car doors and each of said hoistway doors being provided with means adapted to be engaged by the corresponding one of said members upon movement thereof to said open position to open said door, and biasing means for each of said doors for returning it to closed position independently of all the other of said doors upon return of said members to closed position.

3. In an elevator installation in which an elevator car having a door serves a plurality of landings each having a door for controlling access to said elevator car, door operating apparatus comprising, a carriage guided on said car for movement between an open position and a closed position, power mechanism for moving said carriage, a member on the car door and on each landing door, said carriage engaging said members on said car door and on a landing door at a landing at which said elevator car is stopped to move said doors to an open position, and additional means for moving said doors to a closed position independent of each other.

4. In an elevator installation in which an elevator car serves a plurality of landings and in which center opening doors on the car and at each landing control access to said car, door operating apparatus comprising, power mechanism carried by said elevator car, a first carriage operated by said power mechanism and guided on said elevator car for movement between an open and a closed position, a second carriage guided on said elevator car for movement between an open and a closed position, means connecting said second carriage to said first carriage for causing said second carriage to travel in a direction opposite to that of said first carriage, a member on each car door and on each hoistway door, each of said carriages engaging said member on a car door and on a hoistway door at a landing at which the car is stopped to move said doors to an open position, and a plurality of energy storing means, one for each door, for moving such doors independently to closed positions.

5. In an elevator installation in which an elevator car serves a plurality of landings, a power unit carried by said car, a first carirage mounted on said car and guided for movement between two limiting positions, means linking said carriage to said power unit, a second carriage mounted on said car and guided for movement between two limiting positions, a wire cord connecting said carriages for moving said second carriage when said first carriage is moved by said power unit, said carriages moving in opposite directions when actuated, a car door and a hoistway door at a landing, each having means engageable by said first carriage to move said doors to an open position, a second car door and a second hoistway door at a landing, each having means engageable by said second carriage to move said doors to an open position, a plurality of closers, one for each door, for independently closing that door, and a plurality of door check means, one for each door.

6. In an elevator installation in which an elevator car serves a plurality of landings, power mechanism carried by said car, a right hand carriage guided on said elevator car for movement between two limiting positions, a left hand carriage guided on said elevator car for movement opposite to that of said right hand carriage, between two limiting positions, a right hand car door and a right hand hoistway door, each of said doors having a member engageable by said right hand carriage for moving said

doors to an open position, a left hand car door and a left hand hoistway door, each of said doors having a member engageable by said left hand carriage for moving said doors to an open position, a plurality of springs, one for each of said doors, for independently closing each of said doors, and a plurality of door checks, one for each door.

7. In an elevator installation in which an elevator car is provided with center opening doors and in which center opening hoistway doors are provided at a landing served by the car, door operating apparatus comprising, power mechanism carried by the elevator car operable in one direction for opening said car doors and said hoistway doors at said landing and operable in another direction to permit the closing of said car doors and said hoistway doors at said landing, and means adapted upon operation of said power mechanism in said other direction to move each of said center opening car doors from open position to closed position independently of the other car door and of each of said center opening hoistway doors at said

landing at a speed determined by said power mechanism and to move each of said center opening hoistway doors at said landing independently of the other hoistway door and of each of the center opening car doors at a speed determined by said power mechanism.

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