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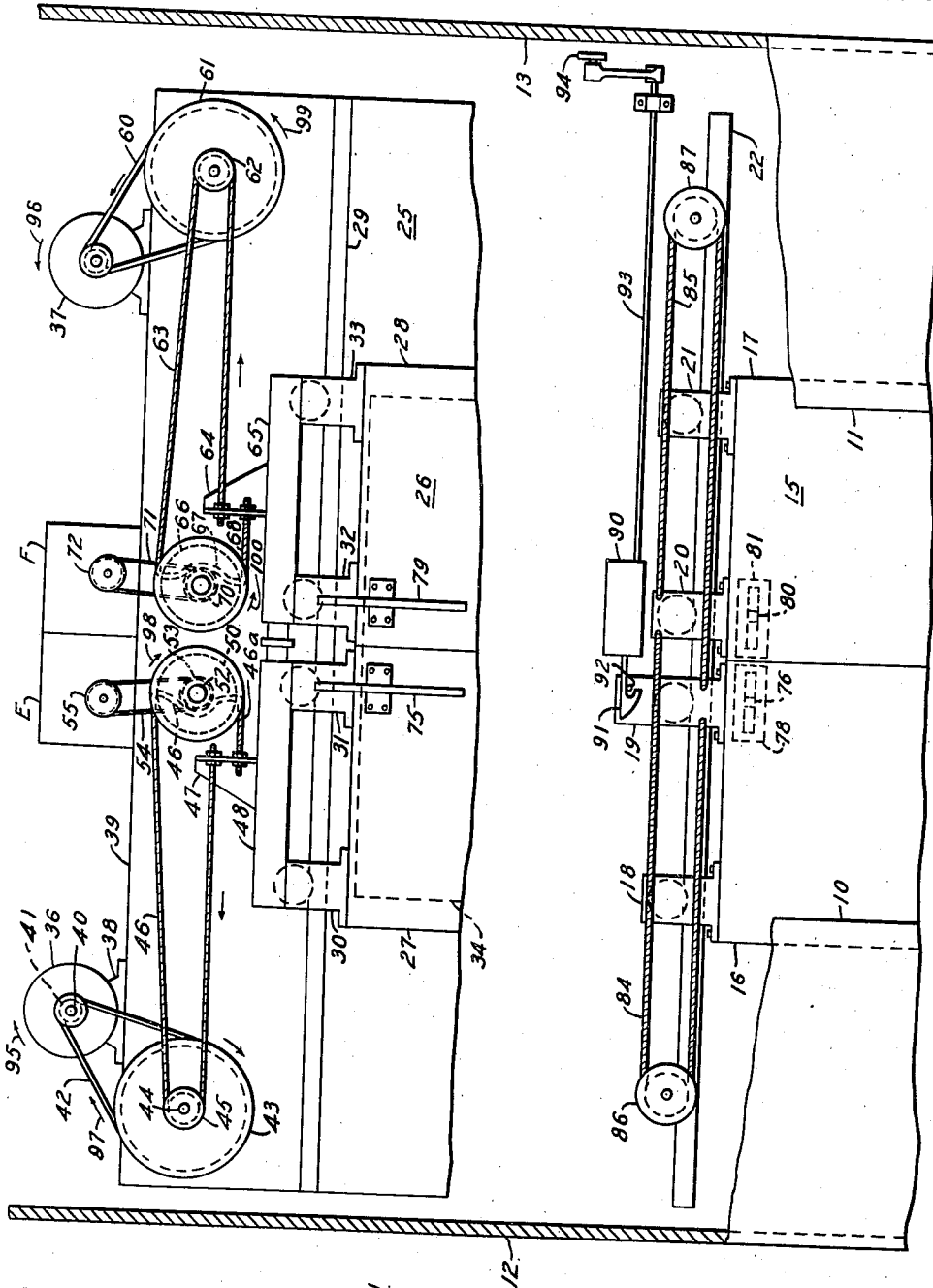
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DOOR OPERATING SYSTEM FOR ELEVATORS

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2 Sheets-Sheet 1



WITNESSES:

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Fig. 1.

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DOOR OPERATING SYSTEM FOR ELEVATORS

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15 Claims. (Cl. 187—52)

My invention relates to elevator door operating systems, and more particularly to high speed master door operators for center opening doors in which a motor mounted on the car is used for operating both the car door and the hatchway door at any floor at which the car makes a stop.

Heretofore, master door operating systems have usually included a door driving motor on the car, means for driving the car door by the motor, a clutch connected to the car door for engaging and driving one of the hatchway door sections, and chains so connecting the hatchway door sections that operation of one section causes operation of both sections. These systems require a very strong rigid clutch and even where a strong clutch is used, they often break down because of the force transmitted at high speed. Furthermore, in these systems, the movement of the clutch to push the hatchway door open in one direction exerts a force on the car tending to move it in the opposite direction, thereby pushing the car to one side of the shaft when the hatchway door is opened and pushing it back again to the other side of the shaft when the hatchway door is closed, thus causing the car to sway objectionably during the opening and closing operation of the hatchway door.

Therefore, it is an object of my invention to provide a master door operating mechanism or system which will permit the use of light resilient clutching devices which will not go to pieces in operation and which will so balance the forces exerted by the motive means on the car that the operation of the hatchway doors will have no tendency to move the car in any direction, thus permitting it to remain in its normally suspended position during operation of the doors.

Another object is to provide a master door operating system in which the operating force will be so applied, tied together, and controlled that all of the parts will work harmoniously together thereby absorbing any minor unbalance of any of the parts and assuring that each part of the system completes its motion simultaneously with the other parts.

A further object is to provide a master door operator which may be easily and inexpensively constructed, installed and maintained in operation.

For a better understanding of the invention, reference may be had to the accompanying drawings in which:

Figure 1 is a view in front elevation of a portion of an elevator hatchway and a car disposed therein, with the hatchway walls broken away to

show the car and also the hatchway door at one of the floor landings, the car being positioned slightly above the landing indicated:

Fig. 2 is a top plan view of the hatchway door and car door embodied in Fig. 1;

Fig. 3 is a diagrammatic representation in "straight-line" style of a control system for the door operating motors; and

Fig. 4 is an explanatory representation of the position of the coils and contact members of the relays embodied in Fig. 3.

Referring more particularly to the drawings, I have illustrated a section of an elevator hatchway having front wall sections 10 and 11 and side walls 12 and 13. The section of the hatchway is taken at a floor landing provided with a corridor opening between the wall sections 10 and 11, served by a hatchway door 15 comprising a pair of horizontally slidable center opening center door sections 16 and 17. The door sections are provided with suitable hangers 18, 19, 20, and 21 by means of which they are suspended from an overhead door track rail 22 in the usual manner, so that the door sections may slide toward or away from the center in closing and opening.

A car 25 is illustrated as disposed in the hatchway in a position somewhat above the door opening. The car is provided with a car door or gate 26 comprising a pair of center-opening, horizontal, slidable door sections 27 and 28 suspended from an overhead track rail 29 by a plurality of hangers 30, 31, 32, and 33 to cover a doorway in the car represented by the dotted line 34.

Inasmuch as door hangers are old and well-known in the art, no further description thereof will be given. It will also be apparent that the track rails for the hangers may be supported in any suitable manner.

The means for moving the doors to their open position and to their closed position comprises a pair of electric motors 36 and 37, one for each car door section, mounted by means of plates 38 on the upper frame member 39 of the car. The motor 36 is provided with a shaft 40 on which is mounted a pulley 41 over which a driving belt 42, preferably of the V type, passes to a driven pulley or wheel 43. The driven pulley is mounted on the outer end of the shaft 44, the other end of which may be supported in any suitable manner on the car frame member 39. On the outer end of the shaft 44 is mounted a pulley 45 which operates the door section 27 through a V shaped belt 46 and a rubber covered steel cable 46^a. The belt 46 passes around the pulley 45 and has its one end securely fixed to an arm 47 mounted on a

horizontal bar 48 secured to the upper portions of the hangers 30 and 31 on the hatchway door section 27. The other end of the belt 46 is seated in an individual groove in a sheave 50 and extends through a passage in the bottom of the groove to a point near the hub of the sheave where it is firmly secured. The sheave 50 is fixed on a shaft 52 rotatably mounted on the frame 39. One end of the cable 46^a is secured to the arm 47 and its other end is wrapped around a second individual groove in the sheave 50 to a point where it leads through a hole in the bottom of the groove and is secured to the side of the sheave. When the motor 36 is operated in one direction, it causes the wheel 43 to drive the belt 46 to pull the door section 27 to its open position. When the motor is operated in the other direction, the belt rotates the sheave 50 to cause the cable 46^a to pull the door section 27 to its closed position.

A small sprocket wheel 53 is fixed to the shaft 52 for driving a sprocket chain 54 which passes over a sprocket wheel 55 mounted on a controller E.

The V belt 46 insures good driving characteristics and the rubber covered steel cable 46^a, with its one end fastened to the arm 47 and its other end secured to the sheave 50, provides a positive drive for operating the controller in accordance with the movement of the door section. This double groove sheave drive mechanism is illustrated, described and claimed in my copending application Serial No. 315,695, filed January 26, 1940.

The motor 37 is mounted on the right-hand side of the car in position to drive a V belt 60 which passes over a sheave 61. A small pulley 62 is mounted on the shaft of the sheave 61 for driving a V belt 63, one end of which is secured to the upright arm 64 on the bar 65 on the hangers 32 and 33. The other end of the belt 63 is wrapped around a peripheral groove in a sheave 66 from which it passes through a hole to a center fastening 67. A rubber covered steel cable 68 is wrapped around a second groove in the sheave 66 with one end secured at the fastening 67 and the other end secured to the arm 64. A sprocket wheel 70 is mounted on the sheave of the wheel 66 in position to operate a chain 71 which extends over a sprocket wheel 72, mounted on a controller F. When the motor 37 is operated, it will effect rotation of the sheave 66 to pull the car door section 28 from its closed position to its open position or from its open position to its closed position.

The motors 36 and 37 should be so connected to the control system that they will rotate in opposite directions when the control system is operated to open or to close the doors, so that both door sections will move toward each other in closing and away from each other in opening.

The controllers E and F are provided with contact members or switches disposed in the control circuit of Fig. 3 for controlling the deceleration of the motors in accordance with the position and direction of operation of the doors.

A pair of clutches 73 and 74 are provided to cause the hatchway doors at the floor landing where the car makes a stop to open and close with operation of the car door (Fig. 2). The clutch 73 comprises an operating vane 75 mounted on the car door section 27 in position to enter a slot 76 in a rubber block 78 mounted on the hatchway door section 16. The clutch 74 comprises an operating vane 79 mounted on the car door section 28 in position to enter a slot 80 in a rubber block 81 mounted on the hatchway door 17

when the car makes a stop at the landing. Hence, it will be apparent that when the car is at the landing and its doors are moved horizontally to their open or to their closed position, the vanes 75 and 79 in the slots will engage the walls of the blocks 78 and 81 and cause the hatchway door sections 16 and 17 to open and shut with the car doors. The individual clutch construction is disclosed in Patent No. 2,094,385 issued September 28, 1937, and assigned to Westinghouse Electric Elevator Company.

It is desirable to have the motor driving systems tied together so that they will absorb any minor unbalance in their operation and assure that each part of the system competes its motion simultaneously with the other parts. In order to accomplish this, a pair of rubber covered steel tie cables 84 and 85 are mounted on a pair of sheaves 86 and 87 mounted above the hatchway door sections 16 and 17. The cable 84 passes around the sheave 86 and has its upper end attached to the hanger 20 of the door section 17 and its lower end attached to the hanger 19 of the door section 16. The cable 85 passes around the sheave 87 and has its upper end attached to the hanger 20 of the door section 17 and its lower end attached to the hanger 19 of the door section 16. Therefore, when the door section 16 is moved from its center position to the left toward its open position, the hanger 19 pulls the lower end of the cable 85 around the sheave 87 and thereby causes the upper end of the cable 85 to pull the hanger 20 and the door section 17 open. When the door section 16 is moved to its closed position, it pulls the cable 84 to cause the door section 17 to move towards its closed position at the same time and at the same rate of speed as the door section 16. Hence, it is seen that the rubber covered steel cables 84 and 85 will cause the hatchway doors to operate simultaneously in co-operative relation and when the car is at the landing with the operating vanes 75 and 79 in the slots 76 and 80 of the rubber blocks 78 and 81, the whole door operating system will be tied together and operate as a unit.

In actual operation, it is practically impossible to make the two motors 36 and 37 divide their load exactly equally. Also, as the car assumes various positions sideways in the shaft by reason of guide wear, etc., one of the clutches may engage sooner than the other, at times. The hatchway doors are synchronized by the cable tie (84 and 85) between them and this automatically causes a proper division of load between the motors as far as it is possible to do so; that is, if one motor draws a greater share of the load than it should, due to engaging its clutch first, it slows down and the other motor speeds up, but in so doing it tries to drive its clutch faster and thereby takes more of the load until the total load is properly divided. There will be momentary exchanges of energy through the shaft door cable tie just sufficient to keep the system moving and the load divided.

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 an interlock 90. The interlock comprises a locking latch 91 disposed to engage and hold a pin 92 mounted in the upper part of the hanger 19 when the door is closed. The latch 91 is provided with a cam surface which will cause it to operate over the pin 92 when the door is brought to a closed position so that the

door section 16 will be automatically locked in its closed position. An arm 93 having a cam wheel 94 is provided for unlocking the interlock when the car makes a stop at a floor. The cam wheel 94 is positioned to be engaged by an operating cam or lever (not shown) which may be mounted on the car in any suitable position to be operated by the attendant or it may be connected for automatic control by the control system when the car makes a stop at a floor.

Referring now to the diagrammatic representation of the control system given in Figs. 3 and 4, the motor 36 is provided with an armature 36A and a field winding 36F. The motor 37 is provided with an armature 37A and a field winding 37F. The armatures are disposed in parallel circuits connected to a pair of supply conductors L+ and L-. The field windings 36F and 37F are also connected in parallel in the same circuit but in series with the armatures of the motors. A resistor M is connected in shunt with the armatures for controlling the dynamic braking and deceleration of armatures 36A and 37A. It should be noted that the portion of the resistor M bearing the reference numeral r1 remains in shunt relation to the armatures at all times and that the dynamic braking and deceleration of the armatures is controlled by including and excluding other portions of the resistor M in the shunt circuit around the armature.

Two pairs of contact members SC and SO which may be connected to any suitable part of the car control system (not shown) are provided for controlling the energization of the door opening relay and the door closing relay.

A series resistor K and a resistor relay RS for controlling it are provided for the motor circuit so that the motors remain energized with a small torque to keep the car doors tightly closed while the car is moving until it arrives at a landing.

A door opening relay OR and a door closing relay CR are provided for controlling the circuit to the motors 36 and 37.

An operation of the door operating system may be assumed as follows: It will be assumed that the car 25 has moved into and stopped at the floor landing served by the hatchway door 15 and that the car door and hatchway door are in their closed position. It will be assumed now that the "open-door" contact members SO are closed to effect the opening of the car door and the hatchway door. The closing of the contact members SO energizes the door opening relay OR by the circuit L+, SO, OR, EOL, or FOL to L-. The energized relay OR closes its contact members OR1 and OR2 and opens its contact members OR3 and OR4. The opening of OR3 and OR4 prevents the contact members controlled by the closing of the door from being effective while the door is opening. The closing of the contact members OR1 and OR2 energizes the armatures and field windings of the motors 36 and 37 by the following circuit: L+ in parallel through 36A and 37A, through OR2, through field windings 36F and 37F in parallel, through OR1 to L-. The motors 36 and 37 are so wound that this energization causes the motor 36 to rotate in the direction of the arrow 95 and the motor 37 to rotate in the direction of the arrow 96.

The rotation of the motor 36 in the direction indicated causes the belt 42 to rotate the sheave 43 in the direction of the arrow 97 which in turn causes the V belt 46 and the cable 46a to rotate the sheave 50 in the direction of the arrow 98 and at the same time to pull the car door section 27

from its closed position toward its open position. The rotation of the sheave 50 causes the sprocket wheel 53 to operate the chain 54 for rotating the controller E to operate its contact members EO1 and EO2 when the door section reaches certain predetermined points. The rotation of the motor 37 in the direction of the arrow 96 causes the sheave 61 to rotate in the direction of the arrow 99, thereby driving the V belt 63 and the cable 68 to move the car door section 28 from its closed position to its open position. The operation of the V belt 63 and the cable 68 also rotate the sheave 66 in the direction of the arrow 100, thereby rotating the sprocket wheel 70 to operate the sprocket chain 71 and thus in turn, the controller F to operate its contact members FO1 and FO2 when the door section reaches certain predetermined points.

Inasmuch as the operating vanes 75 and 79 are disposed in the notches 76 and 80 in the blocks 78 and 81 on the hatchway door sections, the opening movement of the car door sections effects a similar opening of the hatchway door sections, and it will be observed that the forces utilized in opening the hatchway doors are applied in opposite directions so that the forces are balanced against each other on the car and the car is not subjected to any side motion or side sway, as would be the case in a door operating mechanism pushing against only one door section.

It will be assumed now that the car door section 27 reaches the predetermined slowdown point for decelerating the door sections in their opening movement slightly ahead of the other car door section 28. This operation of the car door section 27 causes its controller E to close its contact members EO1 thereby short circuiting the resistor sections r3, r4 and r5 in shunt with the motor armatures 36A and 37A so as to provide a shunt path from the supply conductor L+ through the resistor sections r1 and r2. This action causes the motors 36 and 37 to decelerate both doors to the desired predetermined slowdown speed. As both doors continue toward their full open position, it will be assumed that the car door section 28 arrives at the next deceleration point ahead of its cooperating door section 27, thus causing its controller F to close its contact members FO2, thereby eliminating the resistor section r2 from the shunt circuit around the armatures 36A and 37A. This action decreases the speed of both motors 36 and 37 still further to their stopping speed. Inasmuch as the hatchway door sections 16 and 17 are coupled to the car door sections by the clutches 73 and 74, they will be decelerated to the same rate of speed at the same point.

It will be assumed now that the doors are moving into their full open position and that car door 27 slightly precedes its cooperative car door section 28. At the stopping point, the car door 27 operates the controller E to open its contact members EOL in the circuit of the door operating relay OR, but nothing happens because that circuit may still extend through the remaining closed contact members FOL controlled by the controller F, actuated by the door section 28. It will be assumed now that the door section 28 follows the arrival of the door section 27 in its full open position and thereby operates its controller F to open its contact members FOL. The opening of these contact members deenergizes the relay OR which opens its contact members OR1 and OR2, thereby deenergizing and stopping the motors 36 and 37.

It will be assumed now that, after a short stay

at the floor, the attendant on the car causes the contact members SO to be opened and then causes the contact members SC to be closed, to effect the closing of the door. The closing of the contact members SC energizes the door closing relay CR by the circuit L+, SC, CR, and L- and also energizes the resistor relay RS by the circuit L+, SC, RS, and either ECL or FCL to L-. The energized relay RS closes its contact members RSI to short circuit the resistor K in the door closing circuit of the motors 36 and 37. The energization of the relay CR closes its contact members CR1 and CR3 and opens its contact members CR2 and CR4. The opening of the contact members CR2 and CR4 prevents the contact members controlled by the opening of the door from being effective while the door is closing. The closing of the contact members CR1 and CR3 energizes the armatures 36A and 37A and the field windings 36F and 37F of the motors 36 and 37, thus causing those motors to rotate opposite to the direction of the arrows 95 and 96.

The rotation of the motor 36 in a direction opposite to the arrow 95 rotates the sheave 43 opposite to the direction arrow 97, thus causing the V belt 46 and the cable 46A to pull the car door section 27 toward its closed position. The rotation of the motor 37 in the direction opposite to the direction of the arrow 96 causes sheave 61 to rotate opposite to the arrow 99 and thus cause the V belt 63 and the cable 68 to pull the door section 28 toward its closed position. The closing operation of the doors causes the sheaves 50 and 66 to rotate the controllers E and F for the closing control operation. It will be assumed that the car door section 28 arrives at its predetermined slowdown point ahead of the door section 27, thus causing the controller F to close its contact members FCI, thereby eliminating the resistor section r5 from the shunt circuit around the armatures 36A and 37A, thereby decelerating both motors 36 and 37. It will be assumed that the doors travel at a decreased speed and that door section 27 arrives at the next slowdown point slightly ahead of the door section 28. This action causes the controller E to be operated to the point where it closes its contact members EC2, thus eliminating resistor section r4 from the shunt circuit around the armatures 36A and 37A. This action causes both motors to decelerate to their final door closing speed.

It will be assumed now that the car door section 28 arrives at its full closed position ahead of the car door 27. This causes the controller F to open its contact members FCL, but the relays CR and SR still remain energized because of the parallel contact members ECL. It will be assumed now that the car door section 27 reaches its full closed position. This operates the controller E to open its contact members ECL, thereby deenergizing the resistor relay RS which opens its contact members RSI, thereby inserting the resistor K in series with the door closing circuit of the motors 36 and 37. The contact members SC will not be opened until the car makes the next stop and the door is to be opened. Inasmuch as the door closing relay CR remains energized until the contact members SC are opened, the car door sections 27 and 28 will be maintained in their closed position by the energized motors 36 and 37, but the resistor K will cause a greatly reduced current flow through the motors, thus retaining a small torque in them just sufficient to keep the doors tightly closed so that the vanes 75 and 79 will be in the proper position to engage the hatchway

door driving blocks at the next floor landing at which a stop is made.

It may be observed that usually in normal operation the door sections will reach their decelerating switches and limit switches at the same time, particularly in view of the tie-together cables 84 and 85 on the hatchway door sections. But there may be times when the doors will not operate quite normally because of wear or other inaccuracies in the sheaves, tracks, etc., and will operate as described. In either case the deceleration and stopping of the motors will be effected in the most desirable manner.

However, if the car door sections are operated while the car is between floors, as they will be at times when making operating repairs, inspections, etc., during "maintenance" work, then the car door sections are very likely to arrive at unequal times at their decelerating switches and limit switches. The circuits described for the motors will take care of the inequalities of operation in either case and cause the door sections to be operated smoothly by the two motors at all times.

By the foregoing operation, it will be seen that I have provided a door operating system in which the motive means may be mounted on the car for operating a pair of center opening doors on the car and the center opening doors at any floor landing at which the car may stop in such manner that all the parts of the apparatus involved will be so tied together that they will operate as a unit regardless of any small lost motion or minor application of force which may occur in the system. It will further be obvious that with my improved system the forces applied from the car to open or close the hatchway doors will be applied in opposite directions so as to offset each other and prevent any tendency for the car to sway from one side to another when the doors are being opened or closed.

It will also be apparent that my door operator permits the use of a pair of light weight resilient clutches which will stand up in service much better than the usual strong heavy clutch heretofore required in high speed or medium speed operators.

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 the spirit and scope of my invention.

I claim as my invention:

1. In an elevator system, a car for serving a floor landing in a hatchway, a center opening hatchway door comprising a pair of horizontally slidable door sections mounted at the landing, and power means mounted on the car for individually engaging the hatchway door sections when the car is at the floor and moving them in opposite directions to close or open the door.

2. In an elevator system, a car for serving a floor landing in a hatchway, a center opening hatchway door comprising a pair of horizontally slidable door sections mounted at the landing, a pair of clutches supported on the car, one clutch for each door section, motive means mounted on the car, and means responsive to operation of the motive means for moving the clutches in opposite directions into engagement with the door sections to effect an opening or a closing movement thereof when the car is at the floor landing.

3. In an elevator system, a car for serving a floor landing in a hatchway, a hatchway door

comprising a pair of center opening horizontally slidable door sections, a pair of clutches supported on the car, one for each door section, a pair of motors mounted on the car, one for each clutch, means for connecting both motors to a source of electrical energy to cause them to rotate simultaneously in opposite directions, and means responsive to rotation of the motors in opposite directions when the car is at the landing for causing the clutches to move in opposite directions into engagement with the hatchway door section when the car is at the landing, and thereby opening or closing the hatchway door.

4. In an elevator system, a car for serving a floor landing in a hatchway, a hatchway door comprising a pair of center opening horizontally slidable door sections, a pair of clutches supported on the car, one for each door section, a pair of motors mounted on the car, one for each clutch, means for connecting both motors to a source of electrical energy to cause them to rotate simultaneously in opposite directions, means responsive to rotation of the motors in opposite directions when the car is at the landing for causing the clutches to move in opposite directions into engagement with the hatchway door sections when the car is at the landing, and thereby opening or closing the hatchway door, a pair of sheaves mounted at the hatchway door, flexible means disposed on the sheaves and connected to each of the hatchway door sections to cause each section to move in accordance with the movement of the other section, and a lock responsive to operation of one of the hatchway door sections for locking the hatchway door in its closed position.

5. In an elevator system having a car serving a floor landing in a hatchway, a hatchway door for the landing comprising a pair of center opening horizontally slidable door sections, a door on the car comprising a pair of center opening horizontally slidable door sections, motive means mounted on the car for moving the car door sections in opposite directions in opening or closing them, and a clutch mounted on each car door section for engaging the hatchway door section opposite that car door section and moving it with itself when the car is at the landing and the motive means is energized to move the car door sections in an opening or closing operation.

6. In an elevator, a car for serving a corridor opening, a hatchway door comprising a pair of center opening horizontally slidable door sections mounted at the corridor opening, a car door comprising a pair of center opening horizontally slidable door sections mounted on the car, an individual motor mounted on the car for each car door section, means for operatively connecting each motor to its door section, means for connecting both motors to a source of electrical energy to cause them to rotate simultaneously in opposite directions for moving the car door sections in opposite directions, and a clutch mounted on each car door section for engaging the hatchway door section opposite that car door section and moving it with itself when the car is at the hatchway door and the motors are energized to move the car door sections in an opening or closing operation.

7. In an elevator, a car for serving a corridor opening, a hatchway door comprising a pair of center opening slidable door sections mounted at the corridor opening, a car door comprising a

pair of center opening slidable door sections mounted on the car, an individual motor mounted on the car for each car door section, means for connecting both motors to a source of electrical energy to cause them to rotate simultaneously in opposite directions for moving the car door sections in opposite directions, a pair of limit switches responsive to operation of the car door sections for simultaneously disconnecting both motors from their source of power only when both car door sections arrive at predetermined points in their travel, and a clutch mounted on each car door section for engaging the hatchway door section opposite that car door section and moving it with the car door section in an opening or closing operation when the car is at the hatchway door and the motors are energized to move the car door sections.

8. In an elevator, a car for serving a corridor opening, a hatchway door comprising a pair of center opening horizontally slidable door sections mounted at the corridor opening, a car door comprising a pair of center opening horizontally slidable door sections mounted on the car, an individual motor mounted on the car for each car door section, means for connecting both motors to a source of electrical energy to cause them to rotate simultaneously in opposite directions for moving the car door sections in opposite directions, a pair of limit switches responsive to operation of the car door sections for simultaneously disconnecting both motors from their source of power only when both car door sections arrive at predetermined points in their travel, a clutch mounted on each car door section for engaging the hatchway door section opposite that car door section and moving it with the car door section when the car is at the hatchway door and the motors are energized to move the car door sections, a pair of sheaves mounted at the hatchway door, a flexible connecting means disposed over the sheaves and connected to each hatchway door section for causing the hatchway door sections to travel corresponding distances, and a lock responsive to operation of one of the hatchway door sections for locking the hatchway door.

9. In an elevator, a car for serving a corridor opening, a hatchway door comprising a pair of center opening horizontally slidable door sections mounted at the corridor opening, a car door comprising a pair of center opening horizontally slidable door sections mounted on the car, an individual motor mounted on the car for each car door section, means for connecting each motor to its door section, means for connecting both motors to a source of electrical energy to cause them to rotate simultaneously in opposite directions for moving the car door sections in opposite directions, a clutch mounted on each car door section for engaging the hatchway door section opposite that car door section and moving it with itself when the car is at the hatchway door and the motors are energized to move the car door sections in an opening or closing operation, a pair of sheaves mounted at the hatchway door, and a flexible means disposed on the sheaves and connected to both hatchway door sections to provide a tie between the two motor drives for absorbing any minor unbalance and assuring that each part of the system completes its motion simultaneously with the other parts.

10. In an elevator system, a car for serving a floor landing in a hatchway, a car door comprising

- ing a pair of center opening horizontally slidable door sections, a pair of motors mounted on the car, one for each door section, means for operatively connecting each motor to its door section,
- 5 a circuit for simultaneously connecting both motors to a source of electrical energy to cause them to rotate simultaneously in opposite directions for moving the door sections in opposite directions in a closing or opening operation, and
- 10 means responsive to the first one of either door sections to arrive at its slow down point for decelerating both motors.
11. In an elevator system, a car for serving a floor landing in a hatchway, a car door comprising
- 15 a pair of center opening horizontally slidable door sections, a pair of motors mounted on the car, one for each door section, means for operatively connecting each motor to its door section, a circuit for simultaneously connecting both
- 20 motors to a source of electrical energy to cause them to rotate simultaneously in opposite directions for moving the door sections in opposite directions in an opening operation, and means responsive to that door section which completes
- 25 its opening movement last for disconnecting both motors from their source of energy.
12. In an elevator system, a car for serving a floor landing in a hatchway, a car door comprising
- 30 a pair of center opening horizontally slidable door sections, a pair of motors mounted on the car, one for each door section, means for operatively connecting each motor to its door section, a circuit for simultaneously connecting both
- 35 motors to a source of electrical energy to cause them to rotate simultaneously in opposite directions for moving the door sections in opposite directions in a closing operation, and means responsive to that door section which completes its closing movement last for decreasing the supply
- 40 of energy to both motors.
13. In an elevator system, a car for serving a corridor opening, a car door comprising a pair of center opening slidable door sections mounted
- on the car, an individual motor mounted on the car for each door section, means for operatively connecting each motor to its door section, means for connecting both motors to a source of electrical energy to cause them to operate the door
- 5 sections, means responsive to the first door section to arrive at a predetermined position for decelerating both motors, and means responsive to the last door section to arrive at a second predetermined position for decelerating both
- 10 motors.
14. In a power operated mechanism for opening and closing elevator car and hatchway openings, the combination of a pair of hatchway door
- 15 sections for closing the hatchway opening, said door sections being movable from a center position in opposite directions, gearing for causing said doors to move in synchronism, a pair of
- 20 door sections for closing the car opening, also movable from a center position in opposite directions, an independent power operator for each of said car door sections for moving said door sections independently, and means for engaging said car door sections with said hatchway door sections to thereby cause said car
- 25 door sections to move in synchronism.
15. In a door operating mechanism for center-opening, bi-parting doors for an elevator car entrance and for an associated hatchway entrance, the combination of a pair of doors for
- 30 said car, movable from a center position in opposite directions to open said car entrance, a pair of doors for said hatchway entrance, movable from a center position in opposite direction to open said hatchway entrance, means mounted
- 35 partly on said car doors and partly on said hatchway doors for causing each set of doors comprising one hatchway door and one car door to move substantially in synchronism, and gearing between said hatchway doors to cause said
- 40 hatchway doors to move oppositely in synchronism.

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