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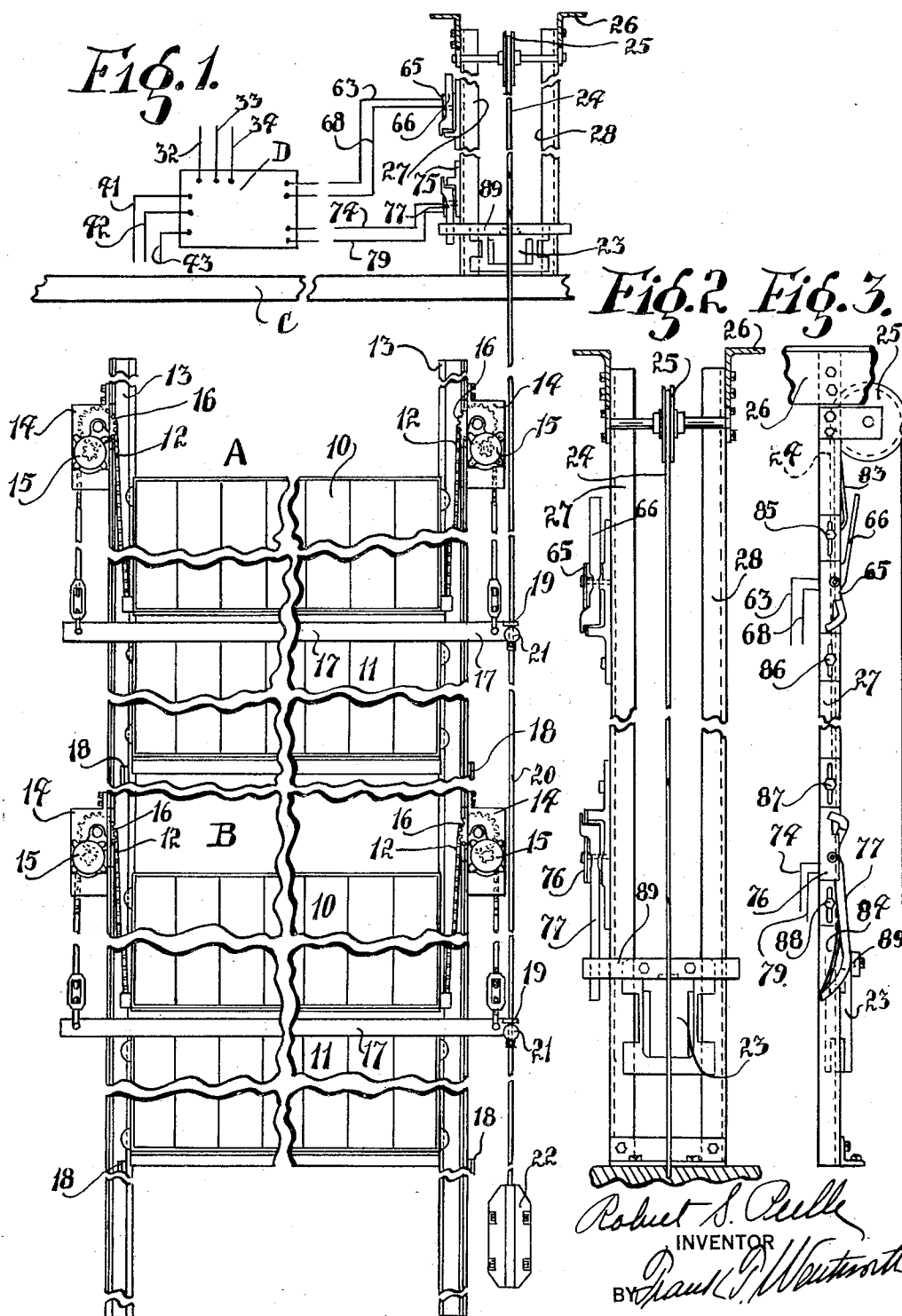
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OPERATOR FOR COUNTERBALANCED ELEVATOR DOORS

Filed April 10, 1931

2 Sheets-Sheet 1



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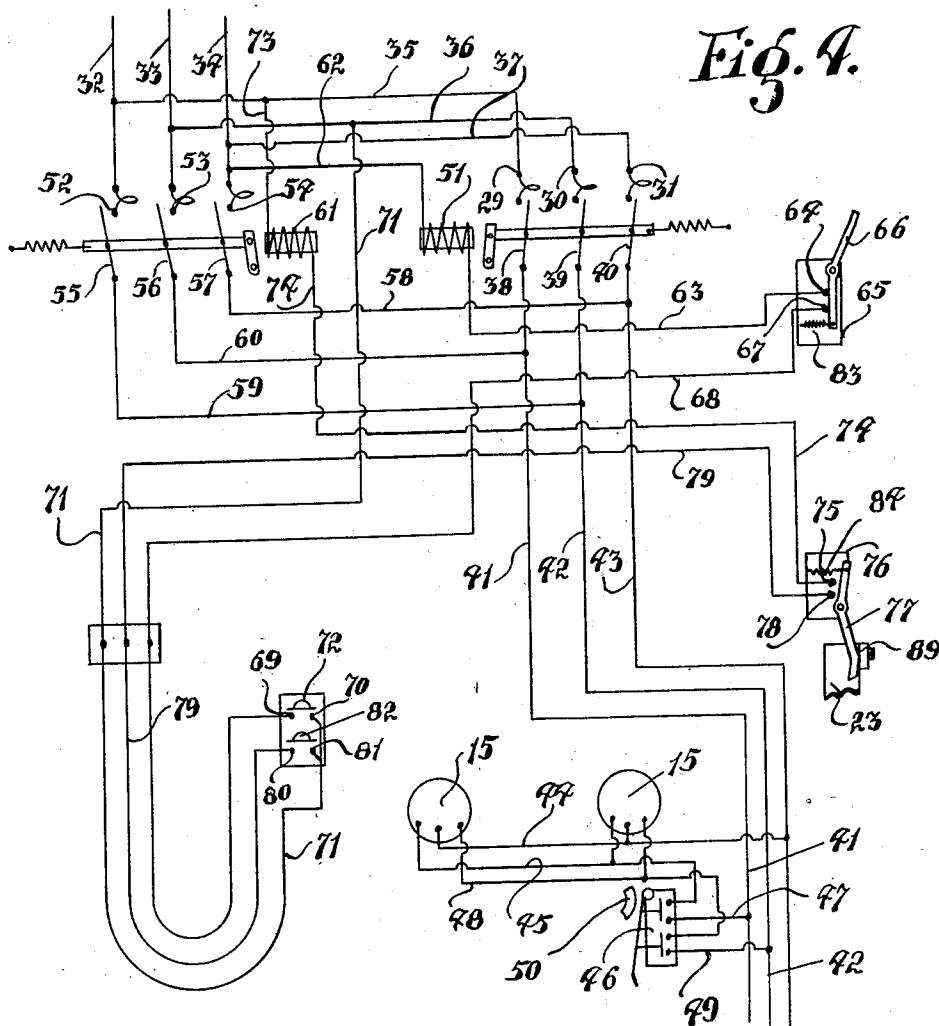
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Fig. 4.



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OPERATOR FOR COUNTERBALANCED ELEVATOR DOORS

Application filed April 10, 1931. Serial No. 529,263.

My invention relates to operators for counterbalanced elevator doors, and more particularly to improvements in electric motor actuated operators wherein each door in a shaft is acted upon by an electric motor or motors located adjacent the door.

In an operator of the type to which the invention relates, means are provided, by which power from a single source may be selectively applied to the motors associated with any door in a shaft for imparting movement thereto. The power from the source is in part controlled by a switch mechanism in the elevator car, or in the hall with certain types of elevators, through a single pole changing switch mechanism arranged in the penthouse, and by switch mechanism actuated by the elevator car in the shaft adjacent the several door openings, which latter ensures the application of power to the motor or motors for imparting movement to the door at an opening only when an elevator car is at the opening adjacent which a shaft switch is located.

While continued application of power to the motors operative upon any door, beyond the interval required to fully open or fully close the door, will have no injurious effect either upon the motors or the doors, it is desirable to provide mechanisms by which the power to the motors will be automatically interrupted substantially simultaneously with the completion of the opening or closing movement of any door in a shaft.

With the above conditions in mind, I provide an operator wherein the circuit controlled by the car, or the hall switch has included therein a single switch mechanism normally so set as to permit the application of power for either opening or closing the door, according to the position of the door, said switch mechanisms being mechanically actuated as a result of the movement of any door in the shaft so as to establish the desired electrical conditions with different positions of the door.

By providing mechanical means common to all of the doors in the shaft and actuated by any door, the circuit controlling means may be differentially adjusted to the different

doors in the shaft and may be a simple, inexpensive and dependable mechanism which will ensure an accurate timing of the application of power to any door, irrespective of slight varying opening and closing movements of different doors.

The mechanism is operative solely for the purpose of controlling the operative effect of the car, or the hall, switch as determined by the movements of a door, and may be so set as to secure any desired timing of the duration of the application of power to a door. It is sometimes desirable to complete such opening or such closing movement by the moving inertia of parts, rather than by a continued application of motor power thereto.

No particular construction of the penthouse switch mechanism is required, although the invention is particularly applicable to a constant pressure car, or hall, switch wherein there is a tendency for a car attendant, or the user of the car, to actuate the switch in a manner to keep the circuit closed for a period in excess of that required for a complete opening or closing movement. In fact, an interruption of the circuit to the car motors just prior to the completion of the full opening or the full closing movement is desirable as tending to cut down the speed of the doors at the conclusion of such movement.

The invention consists primarily in an operator for counterbalanced elevator doors of the type in which each door in a shaft is actuated by a motor operative upon said door only, and power for operating the several motors is controlled by a pole changing magnetic switch mechanism, a shaft switch adjacent each door, and an opening and a closing switch included respectively in the circuits to the windings of the magnets of said pole changing switch, embodying therein self-closing switches arranged respectively in the circuits including said opening and said closing switch, a snake extending throughout the shaft, means carried thereby engageable by the respective doors in a shaft, and a reciprocating member carrying an impact co-operating with said self-closing switches, whereby the circuits controlled by said opening and closing

switches will be automatically interrupted substantially simultaneously with the completion of the opening or the closing movement of any door in a shaft; and in such other novel features of construction and combination of parts as are hereinafter set forth and described, and more particularly pointed out in the claims hereto appended.

Referring to the drawings,

Fig. 1 is a view of two counterbalanced elevator doors in an elevator shaft from the shaft side, said doors being vertically and laterally condensed;

Fig. 2 is an enlarged view of the penthouse limit switch mechanism;

Fig. 3 is a side view of Fig. 2; and

Fig. 4 is a view showing diagrammatically the electrical conditions as to one door in a shaft.

Like numerals refer to like parts throughout the several views.

Counterbalanced elevator doors are extensively used for closing the openings in elevator shafts of warehouses, garages and buildings devoted to manufacturing purposes. The elevator shafts extend throughout the height of a building, and the openings in each shaft may at times number twenty, or even more, these openings being vertically alined. Upon opposite sides and adjacent the jamb of each opening is a track or guide structure extending continuously throughout the entire height of the shaft, the portions of the structure between the lintel of one opening and the sill of the other opening serving to guide the movements of a section of the door at each of said openings.

With this construction, it is essential that a door at one opening be closed before a door at either adjacent opening can be opened or closed. Under normal conditions, when the elevator car has movement, all of the doors in the shaft will be closed.

Several types of operators for counterbalanced elevator doors are employed. One type of operator, utilizes cables or rods extending vertically upon opposite sides of the doors and adapted to be connected to any door in a shaft by means of a clutch mechanism carried by the door. These cables or rods extend to the penthouse. Flexible portions thereof pass about the drum of a winch actuated by an electric motor, the application of power to which is controlled by either a car, or hall opening and closing switch. With this type of operator, a single motor is utilized for operating any door in a shaft as determined by the setting of the clutch mechanism associated with such door.

This type of operator has been largely superseded by a construction in which similar cables or rods are used upon opposite sides of all of the doors in a shaft, each of these rods, however, being made operative

as to any door in the shaft by means of adjustable balls or stops secured to the cables or rods and engaging the under side of the truck bar of the lower door section.

Both types of operators above referred to possess limitations which precluded their use with an elevator door installation wherein a shaft has a large number of door openings requiring heavy doors. The penthouse mechanism is fairly large and heavy and requires various electrically actuated appliances to avoid overrunning of the motor and damage to the doors resulting therefrom.

At the time of my present invention, the two types of operators for counterbalanced doors above referred to had been largely superseded by an operator in which each door in a shaft has associated therewith a motor or motors, operative only upon that door with which it, or they, are associated. With this operation, the penthouse motor and all of the penthouse operating mechanisms, excepting a pole changing switch mechanism, the operation of which is controlled by opening and closing switches in an elevator car, or with some types of elevator equipment, in the halls of a building are dispensed with. While the construction of this type of operator is such as to preclude possibility of damage to the doors as a result of overrunning of the motor, and avoids the necessity for a complicated brake mechanism to check the motor when it has been operated to an extent to fully open or to fully close the door, it has been found desirable to provide means which will permit the application of power to any motor only when the position of the door is such as to permit the power from the motor to be applied to the door for imparting movement thereto, and which will interrupt the application of power to any motor substantially simultaneously with the completion of either the opening or the closing movement of the door.

The sole function of the mechanism immediately above referred to, is to control the operative effect of the car or the hall switches, so far as actuation of the main control switch thereby is concerned, and the various parts have no function so far as imparting or permitting any movement of the door is concerned. Consequently, the mechanism may be made fairly light in construction, may be applied at only one side of a door and is subjected to stresses which are so small as to avoid likelihood of any loss of adjustment. It is actuated solely as a result of movement of the door, and the power required to actuate same is so small as to have no effect whatever upon the movements of the door.

The mechanism above referred to will be described in detail hereafter.

In Fig. 1 of the drawings, I have shown the invention in connection with two doors of

a shaft, it being understood that the mechanisms shown may be duplicated throughout a shaft having any number of door openings in vertical alinement, irrespective of the size of such doors, since each door is provided with its own motive power for opening and closing same, and the motors for actuating the various doors may be selectively operated. The upper door is indicated at A and the lower door at B. The penthouse grating is shown at C, and the main pole changing switch panel at D.

As shown, each of the doors A—B is composed of an upper section 10 and a lower section 11, these sections being connected by means of the usual flexible connections 12 at opposite edges of the door. The doors have movement along guide rail structures 13 of the usual construction extending throughout the entire height of the shaft at opposite sides of each door opening and adjacent the jambs thereof. The guide rail structures 13 are continuous.

Mounted adjacent the lintel of each door opening, upon the guide rail structures 13, are operator fittings 14, each embodying therein a motor 15 geared directly to a sheave 16 over which the connections 12 pass. The lower door section 11 is provided with the usual truck bar 17 projecting across the guide rail structure in the usual manner. This truck bar is adapted to engage truck bar stops 18 for arresting downward movement of the lower door section when the truck bar 17, as to the upper surface thereof, is substantially flush with the sill of a door opening.

All of the foregoing structural details are characteristic of the type of operator to which the invention is applicable.

Each of the truck bars 17 is provided with a bracket 19 having an opening therethrough. Extending throughout the height of the shaft adjacent all of the doors therein is a cable or rod 20 passing through each of the brackets 19. This cable or rod is known in the art as a "snake". Secured to the snake adjacent each bracket 19 is an impact member or ball 21, such as is commonly used with a shipper cable, and like the ball of the shipper cable, the impact member or ball 21 may be adjusted along the snake and in relation to the bracket 19. The lower end of the snake is provided with a weight 22. But one snake 20 is used in each shaft.

Positioned in the penthouse is a weight 23 which is relatively heavier than the weight 22. When rods are used in the snake 20, the upper portion of these rods is connected to a section of flexible cable or chain 24, the other end of which is attached to the weight 23. The flexible portion of the snake passes about a guide sheave 25 mounted toward the top of a frame 26 supporting tracks or guides 27 and 28 for the weight 23.

By the above construction it will be noted that when the lower section 11 of any door in a shaft is permitted to descend by the actuation of the motor 15 associated therewith, the truck bar 17, during its downward movement, through the impact or ball 21, causes a downward movement of the snake 20, and thus raises the weight 23 along the guides 27 and 28. With the upward movement of the lower door section by the motor actuated sheave 16 and motor 15, the weight 23 is permitted to descend, the impact or ball 21 following the truck bar 17.

The snake 20 and the parts associated therewith serve merely as a control mechanism by which the application of power to any motor in the shaft may be restricted to that required by the position of the door upon which that motor is operative. It affords means common to all of the doors in a shaft for controlling the operative effects of the opening or closing switch for setting the pole changing switch mechanism, but has no direct control over other mechanisms for controlling the circuit to the motor operative upon any door, or for imparting movement to the door itself.

If a door to be opened is in the fully closed position, the snake and its appurtenances will limit the effect of the car or the hall switch to that required to cause the application of power to a motor so as to impart only an opening movement to the door. If the door be fully opened, it will act to cause the application of power to the motor in a manner to cause only a closing movement to the door. If a door be partially open, it will permit application of the power to either open or close the door.

Whatever the direction of movement of the door as a result of the application of power to the motor, as the door approaches the limit of its movement, the snake under the control of the door itself will cause this interruption of the power to the motor, notwithstanding that the attendant or user may still be maintaining a closed circuit at the opening or the closing switch in the car, or in a hall of the building. As heretofore stated, the snake does not apply any power whatever to the door, but is actuated by the door.

The operative effect of the snake can be better understood by reference to the electrical conditions present in an operator of the invention as shown in Fig. 4.

The switch panel D, which, for convenience of access, is usually located in the penthouse, although this is immaterial, carries the main pole changing switch mechanism. This mechanism comprises an electro-magnetically operated opening switch consisting of three fixed contacts 29, 30 and 31, connected respectively with the three lines 32, 33 and 34 of an electrical main by the leads 35, 36 and 37. Associated with the fixed contacts

29, 30 and 31 are three movable contacts 38, 39 and 40 which are connected with a line extending throughout the height of the shaft adjacent all of the doors, containing the conductors 41, 42 and 43.

The motors 15 are a special type of three-phase inductive motor. A lead 44 from the conductor 43 of the shaft line is connected with the corresponding terminal of both motors. A lead 45 connects other corresponding terminals of both said motors with one contact of a shaft switch 46, another contact of this switch being connected by a lead 47 with the conductor 41 of the shaft line. The remaining terminal of each motor is connected by a lead 48 with one contact of the switch 46, the other contact of which is connected by a lead 49 with the conductor 42.

At 50 is shown conventionally a shoe carried by and movable with an elevator car and adapted to close the switch mechanism 46.

The motors at each floor opening are connected with the shaft line in the manner immediately above described, a shaft switch 46 being positioned adjacent each door opening so that the motors 15 operative upon the door closing that opening will be connected with the shaft line only when an elevator car is in a position to permit the opening of such doors.

The movable contacts 38, 39 and 40 are actuated by means of an electro-magnet 51 which, when energized in a manner to be hereinafter described, will close the circuits to the various conductors of the shaft line. This switch is an opening switch.

Also connected with the lines 32, 33 and 34 of the electric main are fixed contacts 52, 53 and 54. The movable contact 57 is in electrical connection with the conductor 43 of the shaft line, through a lead 58. The movable contact 55 is in electrical connection with the conductor 42 of the shaft line by a lead 59, and the movable contact 56 is in electrical connection with the conductor 41 of the shaft line through a lead 60. The contacts 52, 53, 54, 55, 56 and 57 constitute a closing switch which is actuated by an electro-magnet 61 operative upon the movable contacts.

It will be noted that the polarity of two of the three lines will differ according to whether the opening switch of the pole changing mechanism, or the closing switch of said mechanism is closed, thus reversing the rotation of the field of said motors.

The shaft switch 46 prevents the closing of the circuits to the motors at any door unless the elevator car is located at the opening closed by said door.

The winding of the electro-magnet 51 has one terminal thereof connected by the lead 62 with the main 34, and the other terminal thereof connected by a lead 63 with a fixed contact 64 of an opening limit switch 65 hav-

ing a movable contact 66. Another fixed terminal 67 of said limit switch is connected by a lead 68 with one of the contacts 69 of a manually operative opening switch which may be located in an elevator car or in a hallway. The other fixed contact 70 of said opening switch is connected by the lead 71 through the lead 36 with the main 33. The fixed contacts 69 and 70 of the opening switch are connected by means of a manually operative movable bridge contact 72.

One terminal of the winding of the magnet 61 is connected by the leads 73 and 35 with the line 32 of the main, and the other terminal of this magnet is connected by a lead 74 with the fixed contact 75 of a closing limit switch 76 having a movable contact member 77. The other fixed contact 78 of the closing limit switch 76 is connected by the lead 79 with one fixed terminal 80 of the car or hall closing switch, the other fixed contact 81 of which is connected to the lead 71.

A manually operative movable bridge contact 82 co-operates with the fixed contacts 80 and 81.

The movable contact member 66 of the closing limit switch is acted upon by a spring 83, see Fig. 3, having a normal tendency to engage said contact member with the fixed contacts 64 and 67. The movable contact member 77 of the closing time limit switch is acted upon by a spring 84 having a normal tendency to engage said contact 77 with the co-operating fixed contacts 75 and 78. The movable contacts 66 and 77 are bridge contacts. The springs 83 and 84 are shown conventionally in Fig. 4.

The opening limit switch 65 is mounted upon the frame 26 by means of bolts 85 and 86 passing through elongated slots in the base of said switch mechanism so as to permit limited adjustment vertically of said frame. The closing limit switch 76 is mounted adjacent the bottom of said frame by means of bolts 87 and 88 passing through elongated openings in the base of the switch for permitting the adjustment of said switch in the same manner.

The adjustment of said limit switches is for the purpose of permitting the setting of these limit switches in a manner to ensure the interruption of the application of power to the motors 15 after a desired movement of the door in either direction. It also admits of the adaptation of the same parts to doors, the sections of which vary in height.

The springs 83 and 84 have a normal tendency to close the circuit controlled by the switches 65 and 76 respectively.

Carried by and movable with the weight 23 is an impact member 89 projecting laterally of the frame 26 to an extent to engage the movable contact members 66 and 77 as a result of movement of the weight 23 by the

snake 20 in one direction, or the return movement of said snake, due to the overbalancing of the weight 22 by the weight 23. The weight 23 must be sufficiently heavy to overcome the load of the snake 20 and the weight 22, in the form of the invention shown, since while the downward movement of the snake, resulting in the upward movement of the weight, is caused by the force developed by the downward movement of a door section, the return movement of the weight is not the result of the application of any force applied to the snake. This condition, however, is not essential to the invention, which merely requires that the snake 20 be free to have movement in both directions as the result of movement of the door.

When the snake is actuated by the downward movement of the lower door section, the weight 23 must overbalance the weight 22. On the other hand, if the snake 20 be actuated by the upward movement of the upper door section, then the weight 22 must overbalance the weight 23. The extent of overbalancing is merely that required to assure movement of the weight 23 simultaneously with opening or closing movement of the door so as to cause it to engage either the movable contact member 66 or 77 as the door approaches the limit of its movements as a result of the actuation of the motors 15.

The operation of the herein described operator is substantially as follows:—

The detailed construction of the counter-balanced doors themselves is immaterial to the invention, and in the accompanying drawings, I have not shown such details which may vary widely.

In describing the operation of the invention, reference will be had to the embodiment thereof shown in the drawings, it being understood that other mechanisms for securing the same operative effect may be employed.

When all of the doors in a shaft are closed, the relation of parts will be as shown in Fig. 1 of the drawings, and the electrical conditions will be as shown diagrammatically in Fig. 4. The weight 23 will be in the lowermost position, with the impact member 89 carried thereby engaged with the lever 77 in a manner to open the circuit controlled by the closing limit switch 76. The spring 83 will maintain the movable contact member 66 in a position to close the circuit controlled by the opening limit switch 65.

Assuming that the manually operative opening and closing switches are carried by an elevator car, the attendant, as the car reaches or is approaching a floor at which a stop is to be made, presses the bridge contact 72 so that when the shoe 50 upon the car engages the movable contact of the shaft switch 46, power will be applied to the motors 15 at that floor to cause the rotation of such motors in a direction to open the doors.

The circuit established as a result of the manual actuation of the opening switch in the car, and the automatic closing of the shaft switch 46 will be as follows:—

From the main 34, through the lead 62, the winding of the electro-magnet 51, lead 63, the contacts 64, 66 and 67 of the opening limit switch, the lead 68 to the contacts 69, 72 and 70 of the car opening switch, and the lead 71 from the contact 70 to the lead 36 and line 33 of the main. The closing of this circuit causes the electro-magnet 51 to actuate the movable contacts 38—39—40 thus connecting the main lines 32—33—34 with the conductors 41, 42 and 43 of the shaft line and therethrough with the motors 15 through the leads 44, 47 and 49 the contacts of the shaft switch 46 and the leads 45 and 48 from said contact to two of the motor terminals.

With the downward movement of the lower door section 11, the bracket 19 on the truck bar 17 of that door, by engagement with the ball 21, will draw the snake 20 downwardly, the weight 22, opposed to that of the weight 23, avoiding any material resistance to this movement, or any such resistance as might tend to interfere with the smooth operation of the door.

As the weight 23 is raised, as a result of the downward movement of the snake within the shaft, the impact member 89 passes from engagement with the movable contact member 77 of the closing limit switch, the spring 75 of this switch immediately closing the switch. During the opening movement of the door therefore, after a short initial travel of the weight 23, both limit switches will be closed. Consequently, the attendant may, at any time, interrupt the application of power for causing a continuing opening movement, either allowing the doors to remain partially opened, or, by applying closing power to the motors 15, re-shut the doors. The attendant may also again apply opening power to the motors. The closing circuits under this condition will be the same as when a full closing movement of the door is required, which will be hereinafter described.

Assuming that a continuing opening power is applied to the motors, as the doors approach the limit of this movement, the impact member 89, by engagement with the movable contact 66 of the opening limit switch 65, will oscillate this contact against the tension of the spring 83 in a manner to open the circuit at the switch and thus interrupt the application of power to the motors 15 as a result of the de-energizing of the electro-magnet 51. Immediately that this magnet is de-energized, the movable contacts 38, 39 and 40 are disengaged from the fixed contacts 29, 30 and 31 to interrupt the circuit to the motors 15.

The present invention has nothing to do

with the control of the circuits to the motor for moving the elevator car.

When the doors are fully open, the circuit controlled in part by the opening switch mechanism 69, 70 and 72 is interrupted at the opening limit switch 65, so that it is impossible to apply power to the motors 15 to cause further opening movement of the door.

Upon the completion of the opening movement of the door, the truck bar 17, by engagement with the stops 18 carried by the guide rail structure, not only has the usual function of bringing the lower section 11 of the door to a position where the top of the truck bar is substantially flush with the sill of a door opening, but prevents possibility of overrunning of the weight 23 in a manner to release the contact 66 of the opening limit switch 65 and permit a re-closing of the circuit having therein this switch.

When the door is in the fully open position, the opening limit switch 65 is therefore open, the closing limit switch 76 is closed and the electro-magnet 51 is de-energized. The switch 46, however, remains closed, the circuit to the motors 15 being interrupted as a result of the de-energizing of the magnet 51.

When the attendant desires to close the door, it is merely necessary for him to depress the movable contact 82 of the closing switch. With the closing of this switch, a circuit is set up from the line 32, through the leads 35 and 73, the winding of the electro-magnet 61, the lead 74, the contacts 75, 77 and 78 of the closing limit switch 76, the lead 79 from the contact 78, the contacts 80, 82 and 81 of the car closing switch, and the leads 71 and 36 to the line 33 of the main.

With the closing of this circuit, the electro-magnet 61 is energized to move the movable contacts 55, 56 and 57 into engagement with the fixed contacts 52, 53 and 54 of the pole changing switch mechanism. The closing of these switches places the lines 32, 33 and 34 in electrical connection through the leads 59, 60 and 58 with the conductors 42, 41 and 43 of the shaft line, the circuit to the motors being closed through the shaft switch 46 in the manner heretofore described, with the exception that the polarity of two of the lines 41-42 will be reversed in a manner to cause the field of the motors 15 to rotate in the opposite direction and thus impart a reverse rotation to the armatures of said motors, in a manner to impart a lifting movement to the lower door section 11 and to permit the descent of the upper door section 10.

With the upward movement of the door section 11, the ball 21 follows the bracket 19 as a result of the action of the weight 23 upon the snake 20. With the initial closing movement of the door, the impact member 89 moves out of operative engagement with the movable contact member 66, and the spring 83, operative upon this contact, engages it

with the fixed contacts 64 and 67, thus closing the switch 65 so that opening power may, if desired, be applied to the motors. This condition continues until the doors approach the limit of their closing movement, at which time the impact member 89, by engagement with the movable contact member 77, opens the closing limit switch 65 and thus interrupts the circuit to the winding of the magnet 61, the movable contacts 55, 56 and 57 being moved by their spring out of engagement with the fixed contacts co-operating therewith respectively, to interrupt the circuit to the conductors 41, 42 and 43 of the shaft line. This restores the condition by which only opening power can be applied to a door. When the door is in the fully open position, only closing power can be applied thereto. At an intermediate stage of the movement of the door, either opening or closing power may be applied thereto. No power may be applied to any door in a shaft unless a switch 46 adjacent that door is closed as a result of the presence of a car at the opening closed by that door.

The magnets 51 and 61 are commonly called "holding" magnets, and in the drawings the construction of the pole changing switches is such as to require the application of constant pressure to either the opening or the closing switch to ensure continuity in the operation of the motors.

By properly setting the limit switches 65 and 76, the power applied to the motors 15 operating any door may be interrupted before the door has reached the fully opened or the fully closed position. With the operator of the invention, a rapid opening and closing movement is secured, and since the two sections of the door 10 and 11 are approximately balanced, the sections may gather sufficient momentum or moving inertia to ensure a continued movement thereof after the interruption of power to the motors. This is desirable. The motors 15 are small, light motors with a free-running armature, so that the motors will turn freely after the interruption of power to permit this practice. In fact, the conditions in the operator are such that the doors may be manually opened and closed entirely independently of the operator, so that if the moving inertia of the door should be insufficient to either fully open or close same, the attendant may manually complete either movement.

It will be noted that the snake 20 and the parts actuated therethrough have no function beyond the control of the circuits in the manner above described, and that the working conditions are such as to place very little stress upon said snake. Hence there is little or no probability of a loss of adjustment due to elongation of the snake.

By the adjustment of any ball 21 in relation to the truck bar with which it co-operates,

the operator may be adjusted to meet the conditions resulting from small variation in the height or setting of different doors in the shaft. With some doors, the ball 21 co-operating therewith may be set close to the truck bar, while with other doors the ball may be spaced from the truck bar. With the latter adjustment, moving inertia of the door must be relied upon particularly to effect the closing movement. A leeway of several inches as to the quantity of opening movement of different doors may be thus secured. In fact, by reason of the operation peculiar to counterbalanced doors, doors varying in height to the extent of a foot or more may be satisfactorily operated by the same mechanism.

In the operator of the invention, the power from the mains may be selectively applied to any door of a shaft through a single mechanism, and the interruption of this power, toward the limit of the opening and closing movement, may be secured by a single mechanism. Nevertheless, each door in a shaft is equipped with its own motors.

It is not my intention to limit the invention to the precise details of construction, or to the electrical conditions shown in the accompanying drawings, it being apparent that such may be varied without departing from the spirit and scope of the invention.

Having described the invention, what I claim as new and desire to have protected by Letters Patent, is:—

1. An operator for counterbalanced elevator doors of the type in which each door in a shaft is actuated by a motor operative upon said door only, and power for operating the several motors is controlled by a pole changing magnetic switch mechanism, a shaft switch adjacent each door, and an opening and a closing switch included respectively in the circuits to the windings of the magnets of said pole changing switch, embodying therein self-closing switches arranged respectively in the circuits including said opening and said closing switch, a snake extending throughout the shaft, means carried thereby engageable by the respective doors in a shaft, and a reciprocatory member carrying an impact co-operating with said self-closing switches, whereby the circuits controlled by said opening and closing switches will be automatically interrupted substantially simultaneously with the completion of the opening or the closing movement of any door in a shaft.

2. An operator for counterbalanced elevator doors of the type in which each door in a shaft is actuated by a motor operative upon said door only, and power for operating the several motors is controlled by a pole changing magnetic switch mechanism, a shaft switch adjacent each door, and an opening and a closing switch included respectively in

the circuits to the windings of the magnets of said pole changing switch, embodying therein a frame carrying vertically extending guides, a sheave idly mounted adjacent the top of said frame, self-closing switches arranged respectively in the circuits including said opening and said closing switch, and carried by said frame adjacent the top and bottom thereof, a weight slidably mounted in said guides, a snake extending throughout the shaft and having a flexible portion passing about said sheave and connected with said weight, means carried by said snake engageable by the respective doors in a shaft, and an impact member carried by said weight co-operating with said self-closing switches, whereby the circuits controlled by said opening and closing switches will be automatically interrupted substantially simultaneously with the completion of the opening or the closing movement of any door in a shaft.

3. An operator for counterbalanced elevator doors of the type in which each door in a shaft is actuated by a motor operative upon said door only, and power for operating the several motors is controlled by a pole changing magnetic switch mechanism, a shaft switch adjacent each door, and an opening and a closing switch included respectively in the circuits to the windings of the magnets of said pole changing switch, embodying therein a frame carrying vertically extending guides, a sheave idly mounted adjacent the top of said frame, self-closing switches arranged respectively in the circuits including said opening and said closing switch, and carried by said frame adjacent the top and bottom thereof, a weight slidably mounted in said guides, a snake extending throughout the shaft and having a flexible portion passing about said sheave and connected with said weight, means adjustably mounted upon said snake engageable by the respective doors in a shaft, whereby varying movement of different doors in a shaft may be compensated for, and an impact member carried by said weight co-operating with said self-closing switches, whereby the circuits controlled by said opening and closing switches will be automatically interrupted substantially simultaneously with the completion of the opening or the closing movement of any door in a shaft.

4. An operator for counterbalanced elevator doors of the type in which each door in a shaft is actuated by a motor operative upon said door only, and power for operating the several motors is controlled by a pole changing magnetic switch mechanism, a shaft switch adjacent each door, and an opening and a closing switch included respectively in the circuits to the windings of the magnets of said pole changing switch, embodying therein a frame carrying vertically extending guides, a sheave idly mounted adjacent

the top of said frame, self-closing switches arranged respectively in the circuits including said opening and said closing switch, and carried by said frame adjacent the top and bottom thereof, a weight slidably mounted in said guides, means whereby said self-closing switches may be vertically adjusted upon said frame to vary the moment of the interruption of the circuit controlled thereby, a snake extending throughout the shaft and having a flexible portion passing about said sheave and connected with said weight, means carried by said snake engageable by the respective doors in a shaft, and an impact member carried by said weight co-operating with said self-closing switches, whereby the circuits controlled by said opening and closing switches will be automatically interrupted substantially simultaneously with the completion of the opening or the closing movement of any door in a shaft.

5. An operator for counterbalanced elevator doors of the type in which each door in a shaft is actuated by a motor operative upon said door only, and power for operating the several motors is controlled by a pole changing magnetic switch mechanism, a shaft switch adjacent each door, and an opening and a closing switch included respectively in the circuits to the windings of the magnets of said pole changing switch, embodying therein a frame carrying vertically extending guides, a sheave idly mounted adjacent the top of said frame, self-closing switches arranged respectively in the circuits including said opening and said closing switch, and carried by said frame adjacent the top and bottom thereof, a weight slidably mounted in said guides, means whereby said self-closing switches may be vertically adjusted upon said frame to vary the moment of the interruption of the circuit controlled thereby, a snake extending throughout the shaft and having a flexible portion passing about said sheave and connected with said weight, means adjustably mounted upon said snake engageable by the respective doors in a shaft, whereby varying movement of different doors in a shaft may be compensated for, and an impact member carried by said weight co-operating with said self-closing switches, whereby the circuits controlled by said opening and closing switches will be automatically interrupted substantially simultaneously with the completion of the opening or the closing movement of any door in a shaft.

6. An operator for counterbalanced elevator doors of the type in which each door in a shaft is actuated by a motor operative upon said door only, and power for operating the several motors is controlled by a pole changing magnetic switch mechanism, a shaft switch adjacent each door, and an opening and a closing switch included respectively in the circuits to the windings of the mag-

nets of said pole changing switch, embodying therein self-closing switches arranged respectively in the circuits including said opening and said closing switch, a snake extending throughout the shaft, means carried thereby engageable by the respective doors in a shaft, a reciprocatory member carrying an impact co-operating with said self-closing switches, whereby the circuits controlled by said opening and closing switches will be automatically interrupted substantially simultaneously with the completion of the opening or the closing movement of any door in a shaft, and means limiting the opening movement of the sections of the counterbalanced door.

7. An operator for counterbalanced elevator doors of the type in which each door in a shaft is actuated by a motor operative upon said door only, and power for operating the several motors is controlled by a pole changing magnetic switch mechanism, a shaft switch adjacent each door, and an opening and a closing switch included respectively in the circuits to the windings of the magnets of said pole changing switch, embodying therein a frame carrying vertically extending guides, a sheave idly mounted adjacent the top of said frame, self-closing switches arranged respectively in the circuits including said opening and said closing switch, and carried by said frame adjacent the top and bottom thereof, a weight slidably mounted in said guides, means whereby said self-closing switches may be vertically adjusted upon said frame to vary the moment of the interruption of the circuit controlled thereby, a snake extending throughout the shaft and having a flexible portion passing about said sheave and connected with said weight, means carried by said snake engageable by the respective doors in a shaft, an impact member carried by said weight co-operating with said self-closing switches, whereby the circuits controlled by said opening and closing switches will be automatically interrupted substantially simultaneously with the completion of the opening or the closing movement of any door in a shaft, and means limiting the opening movement of the sections of the counterbalanced door.

8. An operator for counterbalanced elevator doors of the type in which each door in a shaft is actuated by a motor operative upon said door only, and power for operating the several motors is controlled by a pole changing magnetic switch mechanism, a shaft switch adjacent each door, and an opening and a closing switch included respectively in the circuits to the windings of the magnets of said pole changing switch, embodying therein a frame carrying vertically extending guides, a sheave idly mounted adjacent the top of said frame, self-closing switches arranged respectively in the circuits including

said opening and said closing switch, and carried by said frame adjacent the top and bottom thereof, a weight slidably mounted in said guides, means whereby said self-closing
5 switches may be vertically adjusted upon said frame to vary the moment of the interruption of the circuit controlled thereby, a snake extending throughout the shaft and having a flexible portion passing about said sheave
10 and connected with said weight, means adjustably mounted upon said snake engageable by the respective doors in a shaft, whereby varying movement of different doors in a shaft may be compensated for, an impact
15 member carried by said weight co-operating with said self-closing switches, whereby the circuits controlled by said opening and closing switches will be automatically interrupted substantially simultaneously with the completion of the opening or the closing move-
20 ment of any door in a shaft, and means limiting the opening movement of the sections of the counterbalanced door.

In witness whereof I have hereunto affixed
25 my signature this 7th day of April, 1931.

ROBERT S. PEELLE.

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