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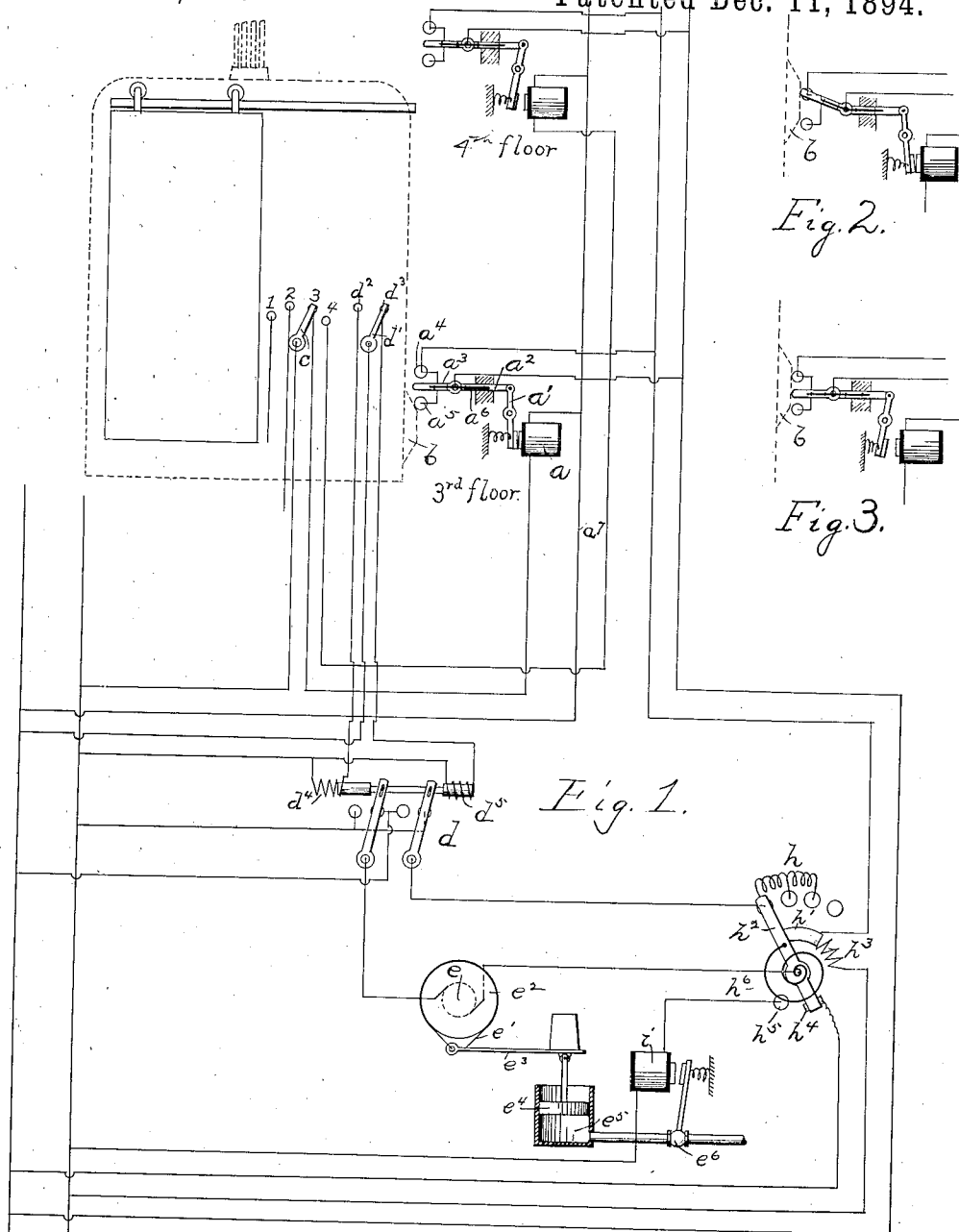
2 Sheets—Sheet 1.

L. S. BUFFINGTON & W. C. JONES.

ELECTRIC ELEVATOR CONTROLLER.

No. 530,578.

Patented Dec. 11, 1894.



Witnesses:
George L. Cragg.
George S. Buell.

Inventors:
Leroy S. Buffington,
Walter Clyde Jones.
By Barton Brown
Attys.

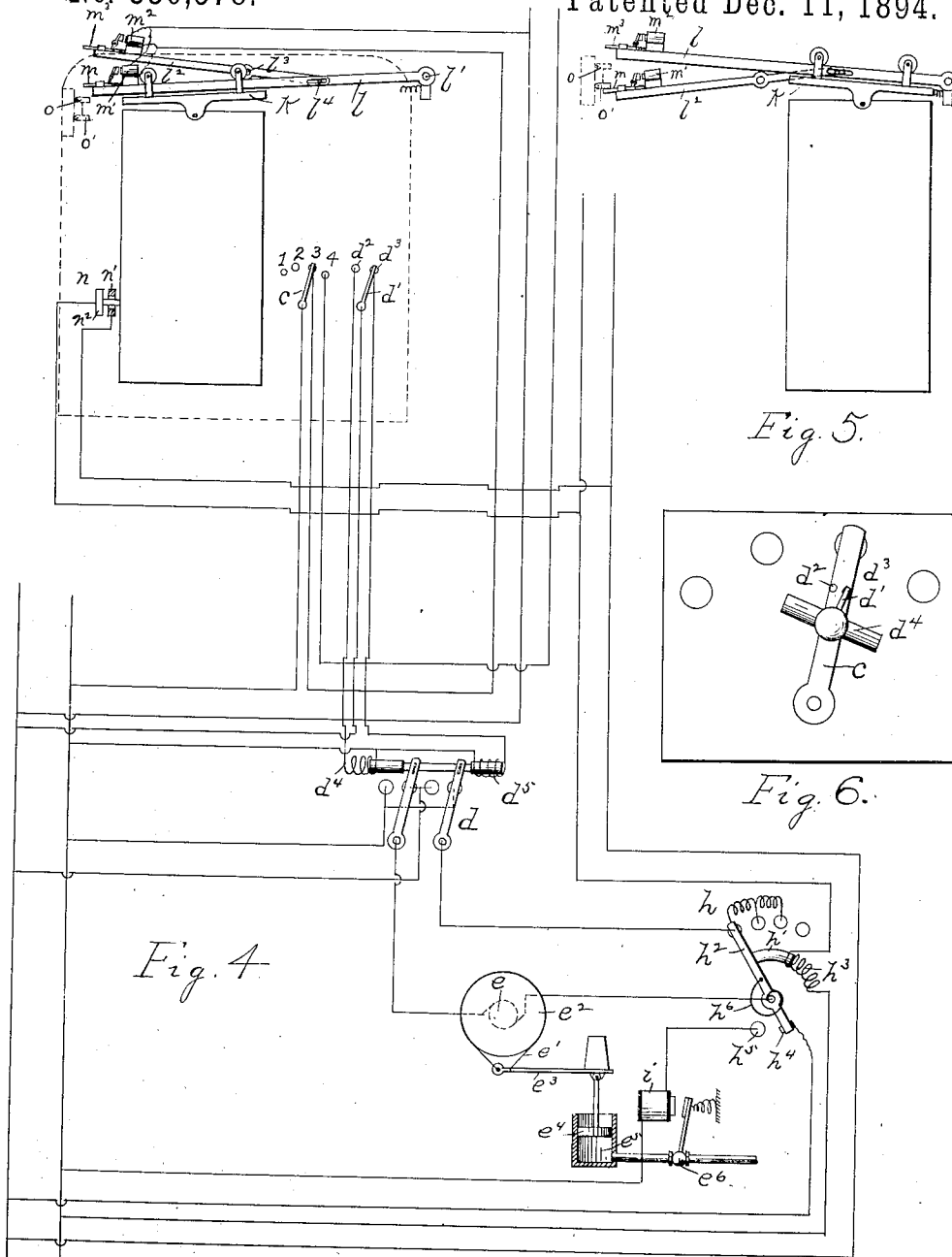
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No. 530,578.

Patented Dec. 11, 1894.



Witnesses:
George L. Bragg.
George S. Bull.

Inventors:
Leroy S. Buffington
Walter Clyde Jones.
By Barton Brown
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UNITED STATES PATENT OFFICE.

LEROY S. BUFFINGTON, OF MINNEAPOLIS, MINNESOTA, AND WALTER
CLYDE JONES, OF CHICAGO, ILLINOIS.

ELECTRIC ELEVATOR-CONTROLLER.

SPECIFICATION forming part of Letters Patent No. 530,578, dated December 11, 1894.

Application filed February 23, 1894. Serial No. 501,116. (No model.)

To all whom it may concern:

Be it known that we, LEROY S. BUFFINGTON, residing at Minneapolis, county of Hennepin, and State of Minnesota, and WALTER CLYDE JONES, residing at Chicago, county of Cook, and State of Illinois, citizens of the United States, have invented a certain new and useful Improvement in Electric Elevator-Controllers, (Case No. 1) of which the following is a full, clear, concise, and exact description, reference being had to the accompanying Drawings, forming a part of this specification.

Our invention relates to electric elevator controllers, and more particularly to means for automatically controlling the elevator car and the elevator doors.

The object of our invention is, first, to provide means for automatically bringing the elevator car to rest opposite any floor; second, to provide means for automatically opening and closing the elevator doors without positively connecting the same with the moving elevator car at any time; and, third, to provide an elevator system which will be more automatic in its operation than systems heretofore in use.

Our invention consists, first, in an elevator system comprising an electro-magnetic device for controlling the motive power, switches at the several floors, which may be designated floor switches, which are adapted to be actuated to control the circuit through the controlling electro-magnetic device; electro-magnetic devices adapted to control the position of the floor switches, whereby the same may or may not be engaged by the moving elevator car, and switching apparatus carried upon the elevator car and adapted to control the electro-magnetic devices that control the floor switches.

Our invention consists, second, in an elevator door suspended from and adapted to slide upon a pivoted bar serving as a track, the bar normally resting with its free end at a less elevation than the pivoted end, an inclination being thereby imparted to the bar to maintain the door closed, means being provided for raising the free end of the pivoted bar by engagement with the moving elevator car, the bar being thereby inclined in a reverse direction, whereby the door is caused

to slide open, means being also provided whereby the operator may release the pivoted bar permitting the same to return to its normal position to cause the door to close.

Our invention consists, third, in an elevator system comprising an electro-magnetic device for controlling the motive power, switches at the several floors, adapted to be actuated by the movement of the several doors to control the circuit through the power controlling electro-magnetic device, elevator doors adapted to operate in their movement the several floor switches, and switching apparatus carried upon the elevator car and under the control of the operator for placing the elevator doors in condition to be actuated by the moving elevator car.

Our invention consists, fourth, in such other constructions as will be hereinafter described.

We believe that it has not heretofore been proposed to automatically bring the elevator car to rest at any predetermined floor through the agency of apparatus controlled by the operator in the car.

In the system of our invention, as hereinafter illustrated, the operator is provided with switching apparatus placed in the car, which may comprise a lever moving over a series of contact points, by means of which he may close circuit through any one of a number of electro-magnets placed upon the wall of the elevator shaft at the respective floors. The closing of the circuit through one of the electro-magnets serves to place the circuit closing element of a floor switch in the path of a projection upon the elevator car. The movement of the elevator car serves to actuate the floor switch an instant before the car reaches the level of the floor where it is desired to stop, and the actuation of the floor switch closes circuit through an electro-magnetic device, which, when excited, cuts off the motive power and brings the car to rest. In an electric elevator system the motive power is derived from the motor, and the excitation of the electro-magnetic device may serve first to open the armature circuit, and then to throw on a brake. In starting the car again it is only necessary to open the circuit through the magnet controlling the floor switch, by

means of the switching apparatus on the car when the floor switch will, through the resiliency of a spring, or otherwise, open the circuit through the electro-magnetic device controlling the motive power. The armature switch may be adapted to be closed through the resiliency of a spring, or otherwise, and the brake may be thrown off through the agency of compressed air in a well known manner.

To secure automatic operation of the elevator doors each is suspended from and adapted to slide upon a bar, serving as a track, said bar being pivoted at one end and normally resting with its free end at a less elevation than its pivoted end, an inclination being thereby imparted to the bar which serves to maintain the door in a closed position. Upon the end of said bar, as well as upon a bar adapted to be engaged by the car in its downward travel, is provided a tongue adapted to be moved into or out of the path of a projection on the elevator car, through the agency of an electro-magnet carried upon the end of said bar. The circuit of the electro-magnet extends to the elevator car, whereby the operator may close or open circuit through the same to cause the tongue to move into or out of the path of the projection, as desired. When the tongue is moved into the path of the projection on the car, the movement of the car raises the free end of the pivoted bar, thus imparting to it an inclination in a reverse direction, thereby causing the door to open by sliding down the inclined track thus produced. The door being thus opened, the tongue may be withdrawn from engagement with the projection on the car, thus permitting the free end of the pivoted bar to descend, imparting to the same an inclination in a direction to cause the door to close.

We are enabled to produce an entirely automatic elevator system by so placing the floor switches that they will be operated by the opening of the elevator door, circuit being preferably maintained open through the electro-magnetic device that controls the motive power, so long as the door remains closed, and closed so long as the door remains opened. By this construction the operator is able at will to place any door in position to be opened by the car, and the door at the instant of starting operates the means provided for bringing the car to rest. When it is desired to start the car the operator can withdraw the tongue, thereby permitting the door to close. The door at the instant of closing operates the means provided for starting the car. The only attention requisite on the part of the operator is to properly manipulate the switching apparatus upon the car.

Our invention will be more readily understood by reference to the accompanying drawings, in which—

Figure 1 is a diagrammatic representation of an elevator system equipped after our invention, the elevator car being shown in dotted lines.

Fig. 2 is a view showing the floor switch in a position to close circuit through the electro-magnetic device controlling the motive power. Fig. 3 is a similar view showing the position assumed by the switch when the electro-magnet is de-energized, the circuit being thereby opened. Fig. 4 is a diagrammatic view of a system equipped after our invention, the door being adapted to be automatically opened and closed, and the car being adapted to be brought to rest opposite any desired floor automatically; the elevator car being shown in dotted lines. Fig. 5 is a view showing the door in its opened position, the projection on the elevator car being shown in dotted lines. Fig. 6 is a view of the operator's switching apparatus.

Like letters and numerals refer to like parts throughout the several figures.

In Fig. 1 we have illustrated that part of our invention which relates to the automatic stopping of the elevator car opposite the desired floor. At each floor is provided an electro-magnetic device and a switch. The electro-magnetic device may be in the form of an electro-magnet a acting upon an armature carried upon the end of a pivoted lever a' . The other end of the lever a' is connected with the longitudinally movable rod a^2 supported in a bearing and carrying upon its end the switch lever a^3 pivoted thereto and adapted to make contact with contact points a^4 or a^5 . To the rod a^2 and the switch lever a^3 is attached a spring a^6 which tends to maintain said rod and lever in a straight line and to return the lever to this position when displaced to either side.

Upon the elevator car is provided a projection b which is adapted to impinge against the lever a^3 when in its outer position to cause the same to make contact with one or the other of the contact points. When the electro-magnet is excited the lever is brought in position to be engaged by the projection on the car, and when not excited the lever is not in position to be so engaged.

Upon the elevator car is provided a contact arm c provided with a handle whereby the same may be easily manipulated by the operator, said arm being adapted to be moved over a series of contact points 1, 2, 3, 4. The contact arm is electrically connected with one side of an electric circuit, while each of the contact points is connected with one terminal of one of the electro-magnets placed at the several floors. Thus contact point 3 is connected with electro-magnet a at the third floor, and contact point 4 is connected with the electro-magnet at the fourth floor. We have not illustrated the switching apparatus at the first and second floors but such apparatus may be the same as that illustrated at the third and fourth floors. The other terminal of each of the electro-magnets is connected with a common wire a^7 extending to the other side of the source of electricity. When the contact arm c rests upon a contact

point, as, for instance, contact point 3, one of the electro-magnets will be excited and the switch will be placed in position to be engaged by the elevator car. Thus, as illustrated, the contact arm *c* is on contact point 3 and the switch at the third floor is in position to be engaged by the car. In the car is provided also means for operating a reversing switch *d*. This may consist of an arm *d'* connected with one side of an electric circuit and adapted to make contact with terminal points *d²* *d³* connected respectively through solenoids *d⁴* *d⁵* to the other side of the circuit. When the arm rests on one contact point one of the solenoids is excited and acts upon its core to place the switch in one position, and when it rests upon the other the position of the switch is reversed.

The reversing switch is included in circuit with the armature of the motor *e*, as is also a rheostat *h* comprising terminal points between which are included resistance coils, and an arm *h²* adapted to be moved over the terminal points. To the arm is secured the core *h'* of a solenoid *h³* in such manner that when the solenoid is excited the arm will be caused to traverse the terminal points. The solenoid *h³* is included in circuit with the floor switches, the latter being placed in multiple with one another.

We have shown the motor as provided with a friction band brake, comprising a band *e'* encircling a pulley *e²* on the armature shaft. The band is connected with a weighted lever *e³* in a well known manner, the end of the lever being maintained in an elevated position by compressed air acting on a piston *e⁴* provided in the cylinder *e⁵*. A valve *e⁶* is provided in the pipe leading to the compressed air supply adapted to maintain the cylinder *e⁵* in communication with the compressed air supply until the magnet *i* is energized, when the valve is operated to open the cylinder to the external air and to cut off the compressed air supply. The compressed air being removed from beneath the piston *e⁴* the latter descends, due to the weight on the end of the lever, thus causing the friction band to grip the pulley and bring the motor armature to rest.

The operation of the system, as thus described, is as follows: Suppose the car in the act of ascending and the operator desirous of stopping at the third floor. The contact arm *c* is moved to make contact with terminal point 3, thereby closing circuit through electro-magnet *a*, which, being excited, attracts its armature to thrust the lever *a³* into the path of the projection *b* on the elevator car. The projection *b* on the car in its ascent impinges against lever *a³*, causing the same to make contact with contact point *a⁴* thereby closing circuit through solenoid *h³*. Solenoid *h³* being excited attracts its core *h'*, thereby causing contact arm *h²* to move over the terminal points to gradually cut resistance out of and finally open the armature circuit. At the in-

stant the armature circuit is opened the brush *h⁴*, carried on the extended end of arm *h²*, makes contact with terminal *h⁵*, thereby closing circuit through magnet *i* which attracts its armature to cut off the supply of compressed air and open the cylinder *e⁵* to the external air, thereby permitting the setting of the brake which brings the motor armature, and, consequently, the elevator car, to rest. When it is desired to start again the contact arm *c* is moved to some other position, magnet *a* being thereby de-energized to permit the spring attached to lever *a⁴* to draw back the lever *a³* out of the path of the projection *b*, the spring *a⁶* then acting upon lever *a³* to cause it to break contact with terminal *a⁴*. Circuit being thus opened through solenoid *h³*, the spring *h⁶* causes arm *h²* to move to break circuit through magnet *i*, thereby releasing the brake, and to close circuit through the motor armature and then to cut resistance from the armature circuit, thus starting the elevator car. The car is automatically stopped at the floor corresponding to the terminal with which the arm *c* makes contact, and during the travel the arm *c* may be moved slightly in advance of the car so that the car may be stopped at any floor that may be called without reversing the motion of the arm *c*. When it is desired to descend the arm *d'* is moved to operate the reversing switch and change the direction of the current through the armature.

In Fig. 4 we have illustrated the above described system of automatically stopping the elevator car in connection with means for automatically opening and closing the elevator doors. The door is pivotally suspended from a bar *k* provided with rollers running upon the inclined bar *l* as a track. The bar *l* is pivoted at *l'*. A lever *l²* pivoted at *l²* is provided with a pin *l⁴* in its end adapted to work in a slot in said bar *l*, so that when the end of lever *l²* is depressed the free end of bar *l* is raised. Upon the end of bar *l* is provided a tongue *m* adapted to slide back and forth so that the end thereof may in one position extend beyond the end of the bar *l*. To the tongue is connected a pivoted lever carrying upon one end the armature of a magnet *m'*, which, when excited, attracts said armature to cause said tongue to extend beyond the end of the bar. A similar tongue is provided upon the end of lever *l²* and is similarly operated by a magnet *m²*. The elevator is provided with switching apparatus similar to that described in connection with Fig. 1, and the motor connections and the brake are similar. Instead of floor switches adapted to be acted upon directly by the moving car, a switch *n* is provided adapted to be actuated by the door. Such a switch is provided at each floor and they are connected with the solenoid *h³* in the same manner as heretofore described. When the door is opened the switch is adapted to close the circuit through the solenoid *h³*, and to main-

tain the circuit open so long as the door is closed. The switch may be of any well known form, as for instance, a contact plate n' forming one terminal of the circuit and a plate n^2 forming the other terminal, the plate n^2 being held out of contact with plate n' while the door is closed, but being adapted to close against the same when the door is opened. Upon the elevator car are provided projections o o' , one in the path of tongue m , and the other in the path of tongue m^3 , projection o being so pivoted that it will permit the passage of lip m on the downward travel of the car, but will engage therewith on the upward travel. Likewise projection o' engages with tongue m^3 on the downward travel, but not on the upward travel.

The operation of the system, as above described, is as follows: The car being in its upward travel and it being desired to stop at, say, the third floor, the operator moves arm c to terminal 3. Circuit is thus closed through the magnets m' , m^2 , causing the tongues m and m^3 to be thrust forward. As the car continues the projection o impinges against tongue m , thereby raising the end of bar l , imparting to the same an inclination such that the door is caused to open by sliding down the inclined track thus produced. As the door opens the switch n closes the circuit through the solenoid h^3 . The latter is excited to attract its core, causing the arm h^2 to move over the terminal points and open the armature circuit and throw on the brake, in a manner heretofore described. When it is desired to again start the car, the contact arm c is moved from terminal 3, thereby opening the circuit through magnet m' to de-energize the same and permit the tongue m to be withdrawn from engagement with the projection o , due to the reaction of a spring. The end of bar l being thus unsupported the same descends and imparts to the bar an inclination such that the opened door is caused to close by sliding down the inclined track. When the door completes its travel the switch n is opened, thus de-energizing the solenoid h^3 and starting the elevator car in a manner heretofore described. When it is desired to descend, the arm d' is moved to operate the reversing switch to change the direction of the current through the armature, and, consequently, the direction of travel of the elevator car.

The arm d' may be preferably mounted upon the arm c , as illustrated in Fig. 6, in which the arm d' is connected with the handle d^4 which is adapted to be given a slight rotary motion whereby said arm d' may make contact alternately with contact points d^2 d^3 carried upon the arm c . When the handle is at one or the other end of its stroke circuit will be closed through one of the solenoids of the reversing switch. The operator becoming accustomed to the positions of the handles in ascending and descending, will be en-

abled to control the car with the use of but one hand.

It is evident that many of the operations of the system as herein described may be accomplished by other means and in a different manner without departing from our invention. We desire, therefore, to claim broadly the features specified in the several clauses of claim.

Having described our invention, what we claim as new, and desire to secure by Letters Patent, is—

1. In an elevator system, the combination with an electro-magnetic device adapted to control the motive power, of a switch adapted to control the operation of said electro-magnetic device, an electro-magnetic device adapted to place an element in position to be engaged by the moving elevator car and thereby to cause the actuation of said switch, and switching apparatus provided upon the elevator car in electrical connection with said second mentioned electro-magnetic device and adapted to control the same, substantially as described.

2. In an elevator system, the combination with an electro-magnetic device adapted to control the motive power, of a switch adapted to control the operation of said electro-magnetic device, an electro-magnetic device, an element adapted to be placed thereby in position to be engaged by the moving elevator car and thereby to cause the opening of the elevator door, said door being adapted in its movement to actuate said switch, and switching apparatus provided upon the elevator car and adapted to control said second mentioned electro-magnetic device, substantially as described.

3. In an elevator system, the combination with an electro-magnetic device adapted to control the motive power, of a switch adapted to control the operation of said electro-magnetic device, a pivoted bar, an elevator door suspended therefrom, an electro-magnetic device, an element adapted to be placed thereby in position to be engaged by the moving elevator car, and thereby to raise the end of said pivoted bar to cause said door to open, said door being adapted in its movement to actuate said switch, and switching apparatus upon the elevator car and adapted to control said second mentioned electro-magnetic device; whereby the door is automatically opened and closed and the car is automatically brought to rest opposite a predetermined floor, substantially as described.

4. In an elevator system, the combination with a pivoted bar, of an elevator door suspended therefrom, and means for raising and lowering the free end of said pivoted bar to effect the opening and closing of the elevator door, substantially as described.

5. In an elevator system, the combination with a pivoted bar, of an elevator door suspended therefrom, an electro-magnetic device

adapted to place an element in position to be engaged by the moving elevator car, and thereby to raise the end of said pivoted bar to cause said door to open, and switching apparatus provided in the elevator car adapted to control said electro-magnetic device, substantially as described.

6. In an elevator system, the combination with switches provided at the several floors, of motor mechanism controlled by said switches, said switches being adapted to be actuated through the agency of the moving elevator car, and electro-magnetic devices controlled from the car for predetermining the switch to be actuated; whereby the car may be brought to rest opposite any floor, substantially as described.

7. In an elevator system, the combination with a contact arm adapted to be moved over a series of contact points, of circuit connections through said arm and contact points for controlling the movement of the elevator car, a lever pivoted upon said arm, a pair of contact points carried upon the said arm and adapted to be alternately engaged by said lever, and circuit connections through the lever and the pair of contact points adapted to control the direction of movement of the car, substantially as described.

8. The combination with a laterally sliding elevator door, of door opening mechanism for opening and closing the same through the agency of the weight of the door.

9. The combination with a laterally sliding elevator door, of means for opening the same through the agency of the weight of the door.

10. The combination with a laterally sliding elevator door, of means for raising the center of gravity of the same by the movement of the elevator car, and means for opening the door by the descent of the center of gravity of the door.

11. The combination with a laterally sliding elevator door, of means for raising the center of gravity of the same by the movement of the elevator car, mechanism for opening the door by the descent of the center of gravity, and means for closing the door by the descent of the center of gravity.

12. The combination with an elevator door, of means for opening the same through the agency of the moving elevator car, and a device for automatically stopping the car by the opening of the door, substantially as described.

13. The combination with an elevator door, of means for opening the same through the agency of the moving elevator car, and a device for automatically starting the car from rest by the closing of the door.

14. The combination with an elevator door, of means for opening the same through the agency of the moving elevator car, a device for automatically stopping the car by the opening of the door, and means for automatically starting the car from rest by the closing of the door, substantially as described.

15. The combination with an elevator door, of a moving elevator car, mechanism independent of the motion of the car for automatically opening said door, a device actuated by the moving elevator car adapted to place said mechanism in condition to open the door, and means for automatically stopping the car by the opening of the door.

16. The combination with an elevator door, of the elevator car, an electric switch thereon, an electro-magnetic device controlled thereby and means for opening the door through the agency of the moving car, said means being placed in operative condition by said electro-magnetic device.

17. The combination with an elevator door, of the elevator car, an electric switch thereon, an electro-magnetic device controlled thereby and means for opening the door through the agency of the moving car, said means being placed in operative condition by said electro-magnetic device, and means for automatically stopping the car by the opening of the door.

18. The combination with an elevator door, of the elevator car, an electric switch thereon, an electro-magnetic device controlled thereby, means for opening the door through the agency of the moving car, said means being placed in operative condition by said electro-magnetic device, and means for automatically starting the car from rest by the closing of the door.

19. The combination with an elevator door, of the elevator car, an electric switch thereon, an electro-magnetic device controlled thereby, means for opening the door through the agency of the moving car, said means being placed in operative condition by said electro-magnetic device, means for automatically stopping the car by the opening of the door, and means for automatically starting the car from rest by the closing of the door.

20. The combination with an elevator car, of an elevator door, mechanism independent of the motion of the elevator car for opening the door, said means being controlled in its time of operation by the movement of the car, a device actuated by the opening of the door for bringing the car to rest, and mechanism for starting the car from rest by the closing of the door, substantially as described.

21. The combination with an elevator car, of an elevator door, mechanism independent of the motion of the car for opening the same, an electro-magnetic device, a switch upon the car for operating the same, a movable element adapted to be moved into the path of the car by said electro-magnetic device, said car being adapted to engage the same to throw said door opening mechanism into operation, substantially as described.

22. The combination with an elevator car, of an elevator door, mechanism independent of the motion of the car for opening the same, an electro-magnetic device, a switch upon the car for operating the same, a movable element adapted to be moved into the path of the car

by said electro-magnetic device, said car being adapted to engage the same to throw said door opening mechanism into operation, and a switch controlled by said door for throwing on and off the motive power.

23. The combination with an elevator car, of an elevator door adapted to be opened through the agency of the moving car, an electric switch controlled by said door, an electro-magnetic device controlled by said switch, and motive mechanism adapted to move said car, controlled by said electro-magnetic device.

24. The combination with an elevator car of a series of contact terminals located thereon and connected respectively through electro-

magnetic devices located at the several floors, a contact arm adapted to make contact with any one of said terminals to close circuit through the respective electro-magnetic devices, and mechanism controlled by said electro-magnetic devices for bringing the elevator car to rest opposite the respective floors.

In witness whereof we hereunto subscribe our names this 27th day of October, A. D. 1893.

LEROY S. BUFFINGTON.
WALTER CLYDE JONES.

Witnesses:

GEORGE L. CRAGG,
GEO. S. BUELL.