(No Model.)

J. H. CLARK.

ELEVATOR.

No. 420,771 Patented Feb. 4, 1890.

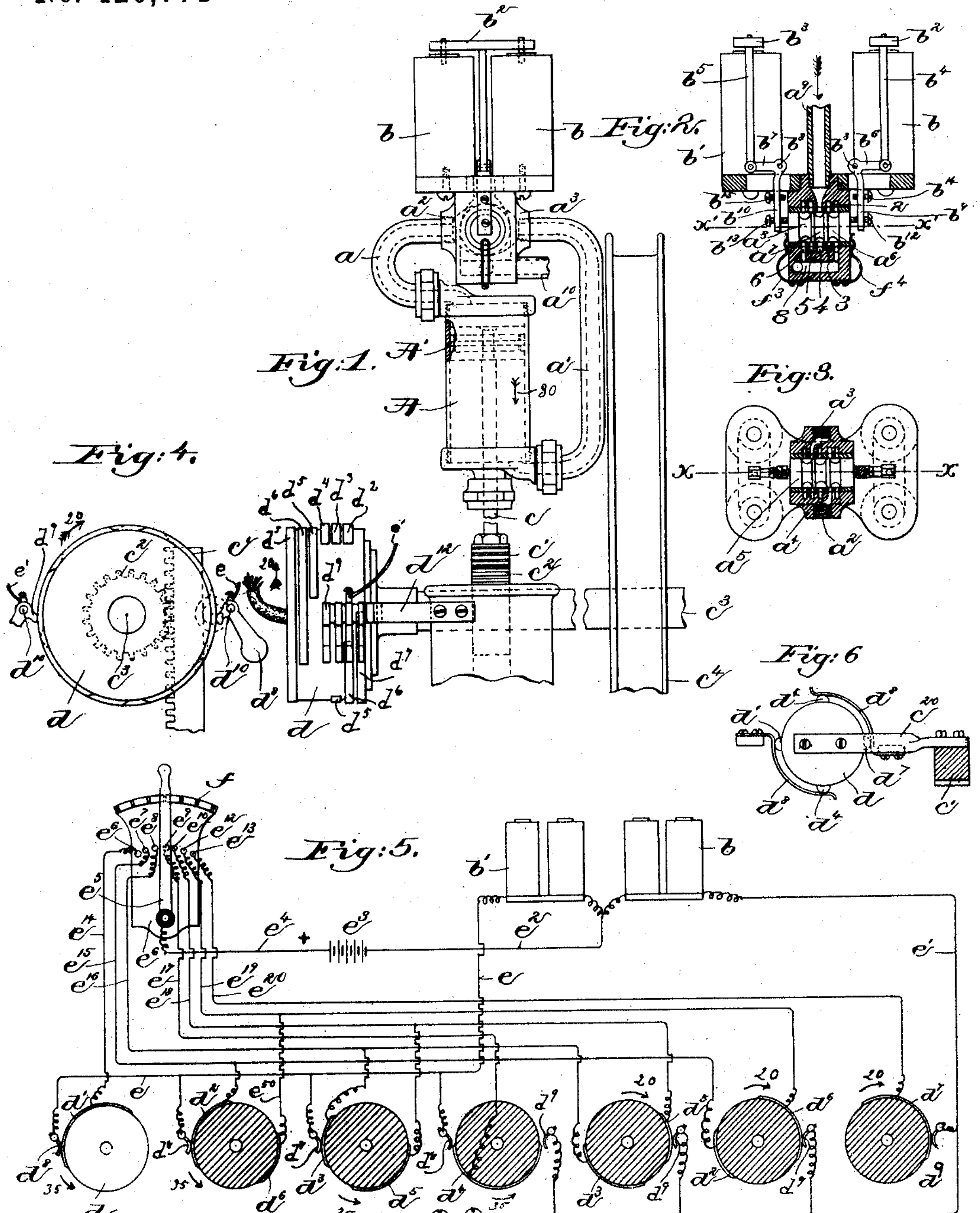
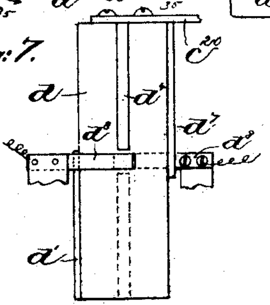


Fig:7.



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UNITED STATES PATENT OFFICE.

JOHN H. CLARK, OF BOSTON, MASSACHUSETTS.

ELEVATOR.

SPECIFICATION forming part of Letters Patent No. 420,771, dated February 4, 1890.

Application filed January 31, 1889. Serial No. 298,230. (No model.)

To all whom it may concern:

Be it known that I, JOHN H. CLARK, of Boston, county of Suffolk, State of Massachusetts, have invented an Improvement in Electrically-Controlled Elevators, of which the following description, in connection with the accompanying drawings, is a specification, like letters on the drawings representing like parts.

This invention relates to elevators of that class in which the motive power is operated by electricity controlled from within or upon the elevator-car.

In elevators of the class referred to the valve controlling the motive power is operated by electro-magnets located in circuits having terminals in circuit-closers upon the elevator-car. The circuit-closers referred to are made principally as push-buttons, which are marked, respectively, "up" and "down," indicative of the direction in which the elevator-car will travel if the said push-buttons are pressed upon; or the said circuit-closers are made as points with which co-operates a lever.

In electric elevators as now commonly constructed the electric circuit is maintained closed at either circuit-closer in the car, according to the direction of travel of the car while the car is in motion. By maintaining the circuits closed while the elevator is in operation the battery is run down in a substantially short period of time, thus rendering the elevator inoperative by the circuit-closers until the battery has been renewed. When the circuit-closers on the car are closed, the valve controlling the operation of the motor is immediately opened to its full capacity—that is, the said valve is wide open—so that the elevator is run at its maximum or full speed, and when the circuit-closers are opened the said valve is immediately closed, thus stopping the elevator substantially in an instant.

With elevators operated by electricity, as described, it has been found in practice that the car cannot be stopped at a landing with any degree of certainty, it being stopped either before or beyond the said landing, thus occasioning delay, which is oftentimes exceedingly annoying.

My invention has for its object to obviate the above-mentioned defects in elevators operated by electricity, and I accomplish my object by means of a circuit-controlling and speed-regulating device, as will be described, electrically connected to the electro-magnets or device operating the valve, whereby the elevator may be run at any desired speed—as, for instance, at full speed, two-thirds, or any other desired part or fraction of the full speed—and the circuit of the battery be automatically broken at the said circuit-controlling device after the valve has been moved a certain or predetermined distance to obtain the desired or predetermined speed.

My improved circuit-controlling and speed-regulating device will preferably be used to control the operation of an auxiliary balanced valve controlling the movement of an auxiliary piston connected to the main valve controlling the operation of the piston or motor employed to move the elevator-car, substantially as shown and described in my application, Serial No. 239,438, filed May 26, 1887.

My invention therefore consists, essentially, in the combination, with an elevator-car and a motor mechanism to move it, of an electric device to control the operation of the said motor mechanism, a switch carried by the car provided with circuit-terminals, and a speed-regulating device connected to the said electric device and to the circuit-terminals on the car, whereby the speed or rate of movement of the elevator-car may be regulated as desired from the car, substantially as will be described.

Other features of my invention will be pointed out in the claims at the end of this specification.

Figure 1 shows in elevation a sufficient portion of an elevator-actuating mechanism provided with a circuit-controlling and speed-regulating mechanism embodying my invention to enable my invention to be understood. Fig. 2 is a detail in elevation and section showing the auxiliary balanced valve in section on line $x\ x$, Fig. 3, the electro-magnets for operating the same being shown in elevation; Fig. 3, a horizontal section through the auxiliary balanced valve on line $x'\ x'$, Fig. 2; Fig. 4, a detail to be referred to; Fig. 5, a diagram of circuits to enable the operation of the circuit-controlling and speed-regulating device to be more readily understood, the said device shown complete in Fig. 1, being divided into seven parts; and Figs. 6 and 7 modifications to be referred to.

The cylinder A, provided with the auxiliary piston A′, and having its opposite ends connected by pipes a a' to the orifices a^2 a^3, respectively, of the valve-chest a^4, containing an auxiliary balanced valve a^5, are and may be substantially such as shown in my application referred to. The valve-chest a^4 is provided, as shown, with annular channels or grooves 2, 3, 4, 5, and 6, (see Figs. 2 and 3,) constituting ports with which co-operate, as shown, annular grooves or channels a^6 a^7 a^8 on the auxiliary valve. The port 4 in the valve-chest constitutes the inlet-port, with which registers the fluid-inlet pipe a^9, and the ports 3 and 5 communicate, respectively, with the orifices a^2 a^3, connected to the pipes a a' leading to the opposite ends of the cylinder A, while the ports 2 and 6 communicate with a common exhaust-passage 8 in the valve-chest a^4, having connected to it the exhaust-pipe a^{10}. (See Fig. 1.) The auxiliary balanced valve a^5 is herein shown as extended through an opening in the valve-chest, and is moved in opposite directions, as will be described, by an electric device. (Shown as two sets b b' of electro-magnets.) Each set b b' of magnets comprises two magnets, and the said magnets have armatures b^2 b^3, respectively, normally held away from the poles of the said magnets, as will be described. The armatures b^2 b^3 are provided with rods b^4 b^5, connected, as shown, to elbow-levers b^6 b^7, (see Fig. 2,) pivoted, as at b^8, to a suitable support, (not shown,) the long arms b^9 b^{10} of the said elbow-levers being provided, as shown, with adjustable projections, (shown as set-screws b^{12} b^{13},) which act upon opposite ends of the valve a^5 when the magnets are energized, as will be described, the movement of the arms b^9 b^{10} of the elbow-levers being limited, as herein shown, by the set-screws b^{14} b^{15}.

The auxiliary balanced valve is operated, through the magnets b b', as will be described, to move the piston A′, and through it the main valve, (not shown,) the said piston having its piston-rod c connected, as shown, to a rack-bar c', in mesh with a pinion c^2, (see Fig. 4,) on a shaft c^3, on which is mounted the sheave c^4, about which is passed the usual shipper-rope, (not shown,) the said rack-bar being connected to the valve-stem of the main valve, (not shown,) but which may be substantially such as shown in the application referred to.

The shipper-shaft c^3 has mounted on it my improved circuit-controlling and speed-regulating device, consisting of a support, which is herein shown as a drum or disk d, to the periphery of which are secured contact-strips, preferably of brass or other metal, the two outside strips d' d^7 and the center strip d^4 being each shown as a single strip, while between the center strip and the outside strips d' d^7 are secured two independent sets of contact-strips d^2 d^3 d^5 d^6, secured to the disk substantially opposite to each other, but in the reverse order—that is, one contact-strip, as d^2, of one set is substantially opposite the contact-strip d^6 of the other set—as clearly shown in Fig. 5, and the contact-strip d^3 is opposite a contact-strip d^5, but the contact-strips having like letters are electrically connected together—as, for instance, the contact-strips d^6 are connected to the wire e^{19}, connected to the contact-point e^{12}, &c., as clearly shown in Fig. 5.

The contact-strips referred to have co-operating with them, as shown, eight contact arms or brushes d^8, divided into sets of four each, located on substantially diametrically-opposite sides of the disk d, (see Fig. 4,) and marked, respectively, d^8 d^9, each set of arms or brushes being mounted on a shaft d^{10}, having bearings in brackets d^{12}, secured to a fixed or stationary part of the apparatus; but any other desired form of brush may be used. One set of contact-arms d^8 is connected, as by wire e, to one set of magnets, as b', while the other set of contact-arms is connected, as by wire e', to the other set b of magnets, the said magnets being joined, as by a common wire e^2, to one pole, herein shown as the negative pole of the battery e^3. (See Fig. 5.) The positive pole of the battery is connected, as by wire e^4, to a switch-lever e^5, which in practice is located in or upon the elevator-car under the control of the operator. The lever e^5, as herein shown, is pivoted to a board e^6, provided, as shown, with seven contact-points, marked, respectively, e^6 e^7 e^8 e^9 e^{10} e^{12} e^{13}, which are respectively connected by wires e^{14} e^{15} e^{16} e^{17} e^{18} e^{19} e^{20} to the contact-strips d' to d^7, inclusive, as shown in Fig. 5. The lever e^5 is preferably provided with a pawl, which in practice will engage one of a series of notches f, by which the said lever is locked in position until positively moved by hand.

The operation of my improved apparatus may be readily comprehended by reference to Fig. 5 in connection with Fig. 2. Let it be supposed, for the purpose of illustration, that the magnet b, when energized, moves the auxiliary valve, so as to produce upward travel of the elevator-car, and the magnet b' moves the said valve in the opposite direction to produce downward movement or travel of the elevator-car. Referring to Fig. 5, it will be noticed that the switch-lever e^5 is in contact with the stud or point e^9, and that the circuit of the battery, which is completed in the car by the lever e^5 and stud e^9, is broken at the circuit-controlling device, the contact-arms d^8 d^9 being out of contact with the strip d^4, which is the only strip connected to the contact-stud, and the remaining contact-arms d^8 are in contact with the strip d' and the two upper strips of the set of strips d^2 d^3, while the remaining contact-arms d^9 are in contact with the strip d^7 and the two upper strips of the set of strips d^6 d^5. The parts mentioned occupy the positions shown in Fig. 5 when the piston A′ is at the center of the cylinder A, the main valve and the auxiliary valve being at such time closed or on their centers and the elevator-car at rest. When the lever e^5 is in contact with the stud e^9, the battery-circuit is broken at the contact-strip d^4, while the said circuit is complete at all the other contact-strips on the disk d and broken on the car. If it is desired to put the elevator-car in motion, the lever e^5 may be moved toward the right to make contact with one of the studs e^{10} e^{12} e^{13}; or it may be moved toward the left to make contact with the studs e^8 e^7 e^6. Let it be supposed it is desired that the car should ascend at full speed. In this case the operator moves the lever e^5 into contact with the stud e^{13}, thus closing the circuit of the battery through the magnets b, the circuit being traced as follows—viz., from the positive pole of the battery to the switch-lever e^5, through contact-stud e^{13}, wire e^{20}, to contact-strip d^7, thence by arm d^9, co-operating therewith, to wire e', through the magnet b, wire e^2, to negative pole of the battery, thus energizing the said magnet. As the magnet b is energized, it attracts its armature b^2 and moves the auxiliary valve a^5, through the arm b^4, lever b^9, and projection b^{12}. As the auxiliary valve is thus moved toward the left in Fig. 2, the inlet-port 4 is uncovered and connected with the port 3, communicating with the pipe a, thus permitting fluid to flow through the ports 4 a^6 of the valve, and 3, through orifice a^2 and pipe a into the cylinder A, above the piston A′, thus moving the said piston downward. The piston on its downward movement rotates the shipper-shaft c^3 and the disk d in the direction indicated by arrow 20, Figs. 1 and 5, through the rack-bar c' and pinion c^2. The piston A′ is moved down in its cylinder in the direction of arrow 30 as long as the auxiliary valve remains open, and the auxiliary valve remains open until the contact-strip d^7, in the rotation of the disk d in the direction of arrow 20, is removed from contact with its co-operating contact-arm d^9, thus breaking the circuit of the magnet b at the said contact-arm, and immediately the auxiliary valve is centered or restored to its closed position. (Shown in Fig. 2.) When the disk, in its rotation in the direction of arrow 20, has moved far enough to disconnect the strip d^7 from its contact-arm d^9, and thus break the circuit of the up-magnet b, the contact-strip b^4 is brought in contact with its co-operating arm d^8, thus closing the circuit of the down-magnet b' at the regulating device. The circuit of the down-magnet still remains broken on the car until the lever e^5 is brought in contact with the stud e^9, at which time the magnet b' is energized and the auxiliary valve moved toward the right in Fig. 2, connecting the inlet-port 4 with the port 5 through the valve-port a^8, thus permitting the water to flow through the orifice a^3 and pipe a' into the cylinder A, below the piston A′, and thus move the said piston toward the center of the cylinder. As the piston A′ is moved toward the center of the cylinder, in a direction opposite to that indicated by arrow 30, the disk d is rotated in the direction indicated by arrow 35, Figs. 1 and 5, until it occupies its normal or starting position, (shown in Fig. 5,) with the strip d^4 out of contact with the arms d^8 d^9. When the disk d is in its normal or starting position, as shown in Fig. 5, the circuit of the magnet b' is broken at the controlling device and the auxiliary valve is centered.

It will be noticed that the circuit of the down-magnet b' is closed at the strips d^3 d^2 d', (shown at the left in Fig. 5,) so that if the lever e^5 is moved into contact with one of the studs e^8 e^7 e^6 the circuit of the said down-magnet will be closed.

If it is desired to descend at full speed, the lever e^5 will be brought in contact with stud e^6, the circuit of the magnet b' being traced as follows: from the positive pole to the lever e^5, thence by contact-stud e^6, wire e^{14}, to contact-strip d', thence by the arm d^8, wire e, to the magnet b', and from the magnet b', by wire e^2, to the negative pole of the battery. When the circuit of the magnet b' is closed at the contact-point e^6, the said magnet attracts its armature b^3, and through the arm b^5, lever b^7, and projection b^{13}, moves the auxiliary valve toward the right to the full extent of its movement—that is, to open wide the said valve. As the auxiliary valve is moved toward the right, the port 5, communicating through the orifice a^3 and pipe a' to the lower end of the cylinder A, is connected to the inlet-pipe a^9 through the port a^8 in the valve. The piston A′ is now forced upward, in a direction opposite to the arrow 30, until, in the revolution of the disk d and the shipper-shaft in the direction indicated by arrow 35, the contact-strip d' is carried away from its co-operating arm d^8, thus breaking the circuit of the battery b' at that point. As soon as the circuit of the battery b' is broken the auxiliary valve is centered by a spring f^4, and the piston A′ becomes stationary until again positively moved either by closing the circuit of the magnet b or by means of the shipper-rope.

If it is desired to have the car move at a speed other than its full speed—as, for instance, at one-third speed or two-thirds speed—the lever e^5 will be brought in contact with the studs e^{10} e^{12} if it is desired to ascend, and with the studs e^8 e^7 if it is desired to descend.

Supposing it is desired to ascend at one-third speed. In this case the lever e^5 will be moved into contact with the stud e^{10}, and the circuit of the battery b will be closed at that point, the said circuit being traced as follows: from the positive pole by the wire e^4, lever e^5, to stud e^{10}, thence by wire e^{18} to contact-strip

d^5, thence by contact-arm co-operating with said strip, and wire e' to the magnet b, through the magnet, and by wire e^2 to the negative pole of the battery. With the circuit of the magnet b closed at the contact-point e^{10} the magnet b attracts its armature, and through the arm b^4 and lever b^6 moves the auxiliary valve to uncover the inlet-port 4 and connect it with the port 3. The piston A′ is thus moved downward and the disk d rotated in the direction of arrow 20 until the contact-strip d^5, co-operating with the contact-arm d^2, is moved out of contact with the said contact-arm.

The contract-strip d^5, it will be noticed, is substantially about one-third of the length of the contact-strip d^7, so that the piston A′ will be moved but substantially one-third of its stroke before the circuit of the magnet b is broken at the contact-arm d^8, and as soon as the said circuit is broken the auxiliary valve is centered, thus cutting off the admission of fluid to the cylinder A and stopping the movement of the piston A′. The piston A′, being moved but one third of its stroke, will move the main valve so as to uncover but one-third of the inlet-port controlled by the said valve, so that but one-third the amount of fluid is admitted to the engine-cylinder to operate the elevator.

The contact-strip d^6, it will be noticed, is substantially two-thirds as long as the strip d^7, so that when the circuit of the magnet b is closed by moving the lever e^5 into contact with the stud e^{12} the piston A′ will be moved but two-thirds the length of its stroke, thereby moving the elevator at two-thirds its full speed, as above described. For instance, let it be supposed that the elevator is ascending at full speed, the lever e^5 being at such time in contact with the stud e^{13}, the auxiliary valve having been wholly opened to move the piston A′ to the full extent of its stroke and open wide the main valve, as above described. If while the elevator is ascending at full speed it is desired to slow down or to continue the ascent at a less speed—as, for instance, at a two-third speed—the lever e^5 will be moved back in contact with the stud e^{12} and the circuit of the magnet b' will be closed, the said circuit being traced as follows, viz., from the positive pole by the wire e^4, lever e^5, to contact-stud e^{12}, thence by wire e^{19} and branch wire e^{50} to the contact-strip d^6, electrically connected to the contact-strip d^6, co-operating with the contact-arm d^9 on the opposite side of the disk d. When in the revolution of the disk d the contact-strip d^6 is removed from contact with the brush d^9, the contact-strip d^6 on the opposite side of the disk d is brought in contact with the brush d^8, so that when the lever e^5 is brought back in contact with the stud e^{12}, the circuit of the magnet b' is completed through the contact-strip d^6 and brush d^8, and said circuit may be traced as follows: from the positive pole by wire e^4, lever e^5, stud e^{12}, wire e^{19}, branch wire e^{50}, brush d^8, and wire e to the magnet b', through the magnet b' and wire e^2 to the negative pole of the battery. The magnet b' attracts its armature and moves the auxiliary valve so as to admit water into the cylinder A below the piston A′ and move the latter back from its full stroke to its two-third position, and thereby move the main valve from its wide-open position to its two-third-open position. As the piston A′ is thus moved to its two-third position, the disk is revolved in the direction of arrow 35, and the contact-strip d^6 is revolved out of contact with the brush d^8, thereby breaking the circuit of the magnet b' at that point and permitting the auxiliary valve to be centered and the piston A′ thus maintained at its two-third position.

The contact-strip d^6 at the right of Fig. 5 may, for convenience, be called the "normally-operating upstrip," and the strip d^6 at the left of said figure designated as the "complementary downstrip" d^6. The normally-operating upstrip d^6 is so placed with relation to the complementary downstrip d^6 that as the former breaks contact with the brush d^9 the latter simultaneously makes contact with the brush d^8. Further movement of the complementary downstrip d^6 being caused by the circuit made through the strip d^7, it will continue to move under the brush d^8 until the circuit is broken at d^7. On the reverse movement of the disks, then the complementary downstrip d^6 will pass from under the brush d^8 in the direction of the arrow 35, and the normally-operating upstrip d^6 will be brought in contact with the arm d^9, and thus complete the circuit of the upmagnet b at that point, so that when the lever is moved in contact with the stud e^{12} the piston A′ will be moved backward one-third of its stroke and the main valve will then be in the two-thirds position.

The contact-strip d^2 is substantially two thirds the length of the strip d', and when the lever e^5 is brought in contact with the stud e^7 the elevator will descend at a two-thirds rate of speed, and the contact-strip d^3 is one-third the length of the contact-strip d', so that when the lever e^5 is brought in contact with the stud e^8 the elevator will descend at one-third speed.

It will thus be seen that by varying the number and size of the contact-strips on the disk d the elevator may be operated at any desired speed.

When the car is in motion in either direction, it may be stopped substantially in an instant, if desired, by bringing the lever e^5 back to its central position in contact with the stud e^9, thus closing the circuit of the strip d^4 through one or the other of the magnets b b', according to the direction of the elevator—that is, if the car is ascending the circuit of the magnet b' will be closed at the stud e^9, and the auxiliary valve will be moved, as described, to admit water into the cylinder A, through the pipe a', to move the piston A′ to the center of the cylinder, thus closing the main valve. As the piston is moved toward the center of the cylinder, the disk d is revolved, and when said piston has reached the center of the said cylinder the contact-strip d^4 is out of contact with the arms or brushes d^8 d^9, and the circuit closed at e^9 is broken at d^4, thus demagnetizing the magnet d' and allowing the spring to center the auxiliary valve. If the car is descending, the circuit of the magnet b will be closed at the said stud e^9 and the piston centered by water admitted through the pipe a.

I do not desire to limit my invention to the particular form of circuit-controlling and speed-regulating device shown in Fig. 1, as other forms may be employed—such, for instance, as shown in Figs. 6 and 7—wherein a vertical cylinder d is secured to the rack-bar c' by the arm c^{20}, the said cylinder having secured to its surface contact-strips similar to those shown in Fig. 1. The contact-strips are secured on substantially diametrically-opposite sides of the said cylinder and extend in the direction of the length of said cylinder.

The arrangement of contact-strips on the vertical cylinder d will correspond to the arrangement shown in Fig. 1, and the said contact-strips will be engaged by the contact-arms d^8, which are stationary.

In order that the drum or disk d may be made conveniently small, some of the contact-strips are located substantially in line with other contact-strips—as, for instance, the contact-strip d^2 is in line with the strip d^6, &c.

It will be noticed that the ports or channels a^6 a^8 in the auxiliary valve are made of sufficient width to lap over two ports in the valve-chest—that is, when the valve is centered, as shown in Fig. 2, the port or channel a^6 connects the port 3, communicating with one end of the cylinder A, to the port 2, communicating with the exhaust, and the port or channel a^8 connects the port 5, communicating with the other end of the cylinder A, to the port 6, leading to the exhaust.

The enlarged ports a^6 a^8 constitute reliefs for the piston A', so that the latter may be moved by operating the shipper-rope, (not shown,) but which is passed about the sheave c^4, in case any accident should happen to the electrical devices for operating the auxiliary valve—for instance, if the battery should run down.

If the elevator is moving in either direction at one speed—as, for instance, at full speed—the speed may be reduced by moving the lever e^5 in contact with a two-thirds or one-third button, thereby placing the magnet controlling the auxiliary valve in circuit with the corresponding strip on the disk d, and, as above described, limiting the movement of the piston A', and consequently the amount or distance to which the main valve is opened.

I claim—

1. The combination, with an elevator-car and a motor mechanism to move it, of a controlling-valve for said mechanism, an electric device to control the operation of said valve, a switch carried by the car provided with circuit-terminals, and a speed-regulating device connected in circuit with said electric device and with the circuit-terminals on the car, said speed-regulating device being actuated by said controlling-valve, substantially as described.

2. The combination, with an elevator-car and a motor mechanism to move it, of a controlling-valve for said mechanism, an electric device to control the operation of the said valve, a switch carried by the car provided with circuit-terminals, and a speed-regulating device actuated by said controlling-valve and consisting of a support, contact-strips secured to said support and connected in circuit with the circuit-terminals, and contact-arms co-operating with the said contact-strips and connected with the electric device, substantially as described.

3. The combination, with an elevator-car and a motor mechanism to move it, including a controlling-valve for said mechanism, of an auxiliary balanced valve, electro-magnets to move said auxiliary balanced valve in either direction, and means, substantially as described, to center the said valve, a switch carried by the car provided with circuit-terminals, and a speed-regulating device actuated by said controlling-valve and connected in circuit with said electro-magnets and with the circuit-terminals on the car, whereby the speed or rate of movement of the elevator-car may be regulated as desired, substantially as described.

4. The combination, with an elevator-car and a motor mechanism to move it, including a controlling-valve for said mechanism, of an auxiliary balanced valve, electro-magnets to move said auxiliary balanced valve in either direction, and means, substantially as described, to center the said valve, a switch carried by the car provided with circuit-terminals, and a speed-regulating device actuated by said controlling-valve and consisting of a support, contact-strips secured to said support and connected in circuit with the circuit-terminals, and contact-arms co-operating with the said contact-strips and connected to the electro-magnets, substantially as described.

5. The combination, with an elevator-car and a motor mechanism to move it, including a main valve, of an auxiliary cylinder and its piston having its piston-rod connected to said main valve and provided with a rack-bar, and an auxiliary balanced valve having its valve-chest connected to opposite ends of the said auxiliary cylinder, electro-magnets to move said auxiliary valve, a switch carried by the car and provided with circuit-terminals, a shipper-shaft having a gear to mesh with the said rack-bar, and a speed-regulating device comprising a disk or drum on the said shipper-shaft, contact-strips on said

drum connected to the said terminals, and contact-arms co-operating with the said contact-strips and connected to the said electro-magnets, substantially as described.

6. The combination, with a cylinder A, provided with a piston having a piston-rod and a controlling-valve for said piston, of an electric device to control the operation of the said valve, a switch provided with circuit-terminals connected to the electric device, and a regulating device connected in circuit with said electric device and with the circuit-terminals to control the movement of the said piston, the regulating device being actuated by the controlling-valve, substantially as described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

JOHN H. CLARK.

Witnesses:
JAS. H. CHURCHILL,
FREDERICK L. EMERY.