No. 715,299. Patented Dec. 9, 1902.

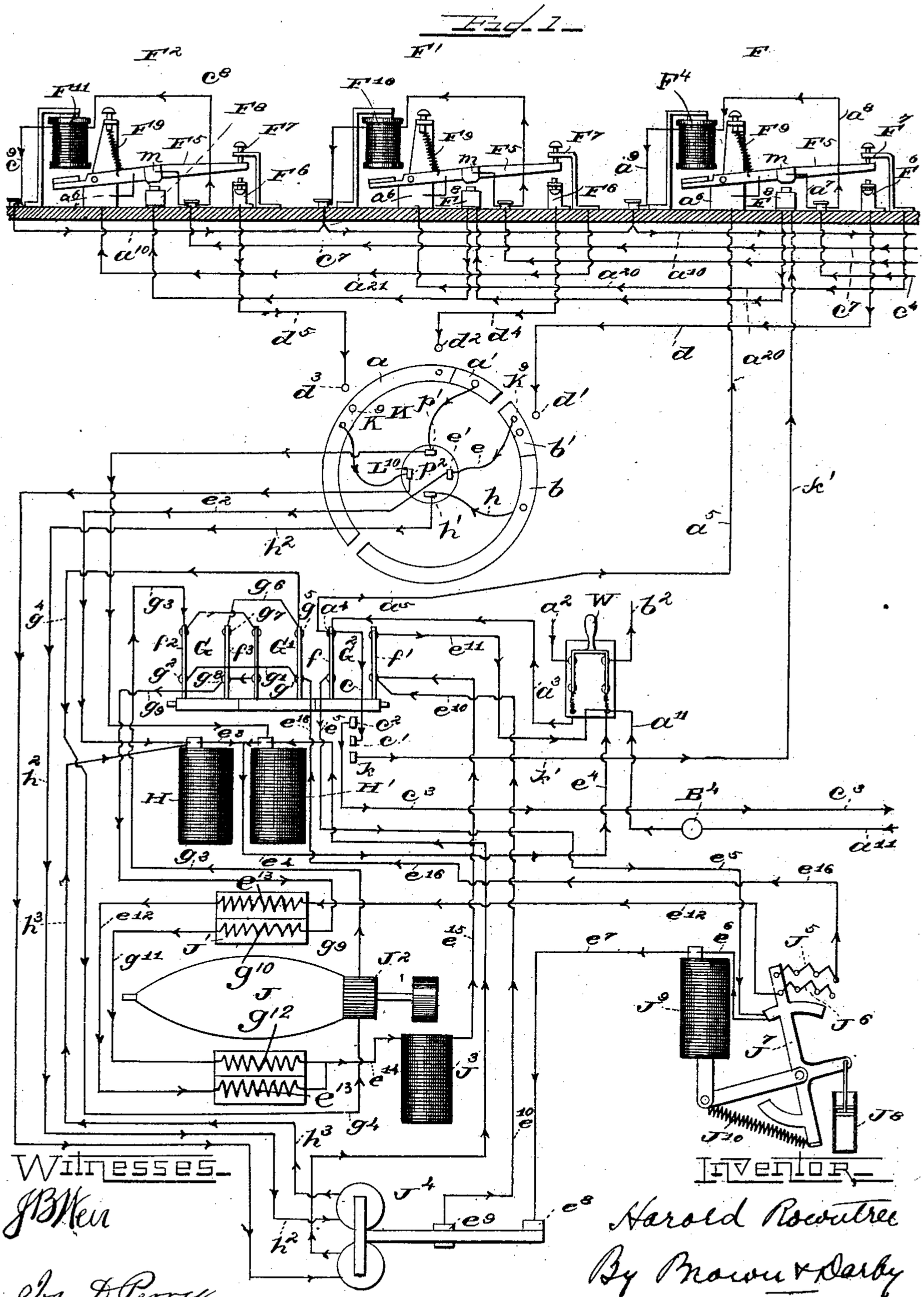
H. ROWNTREE.

ELECTRIC ELEVATOR.

(Application filed Nov. 29, 1899.)

(No Model.) 4 Sheets—Sheet 1.

Fig. 1.



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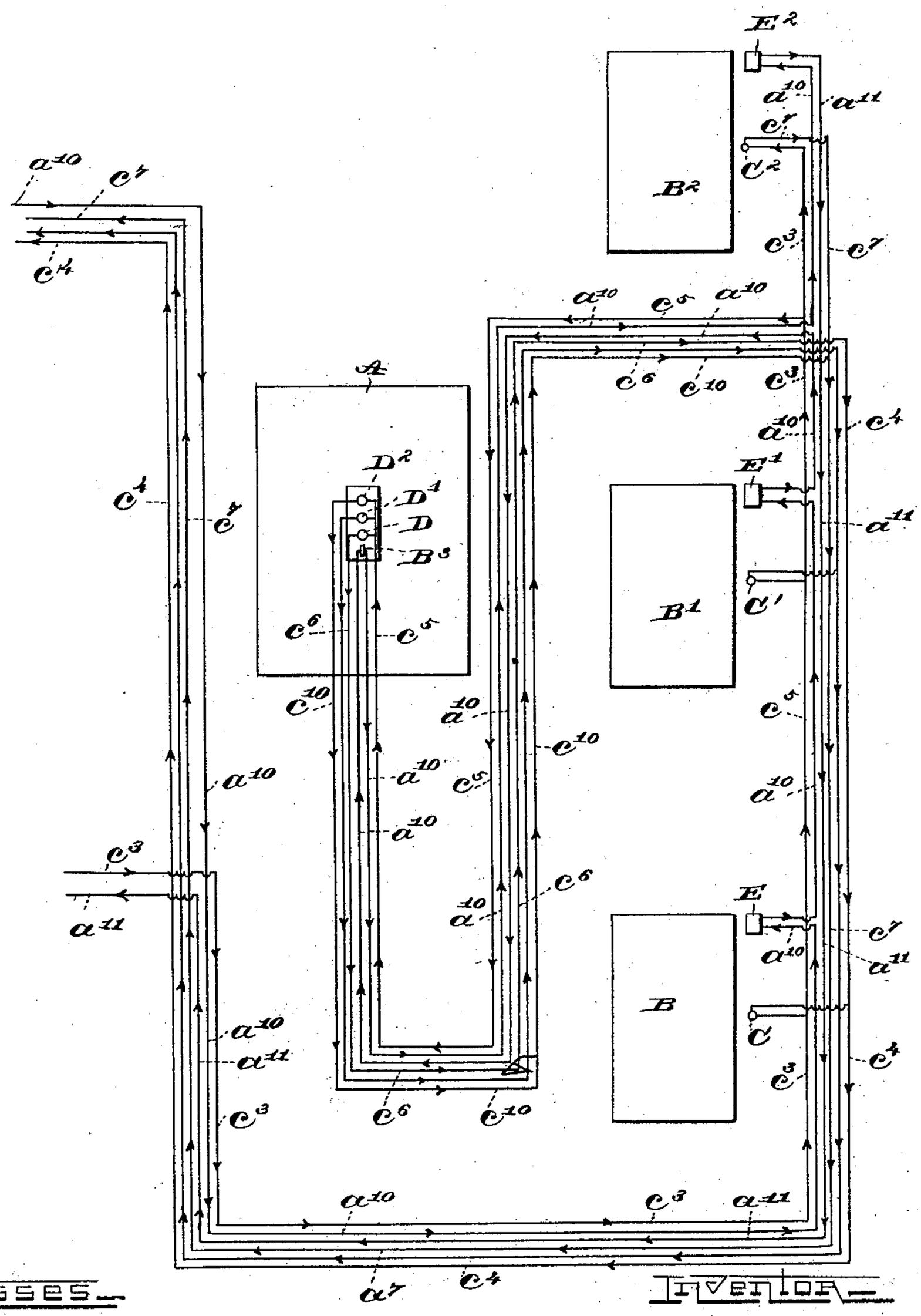
(No Model.) 4 Sheets—Sheet 2.

Fig. 2.



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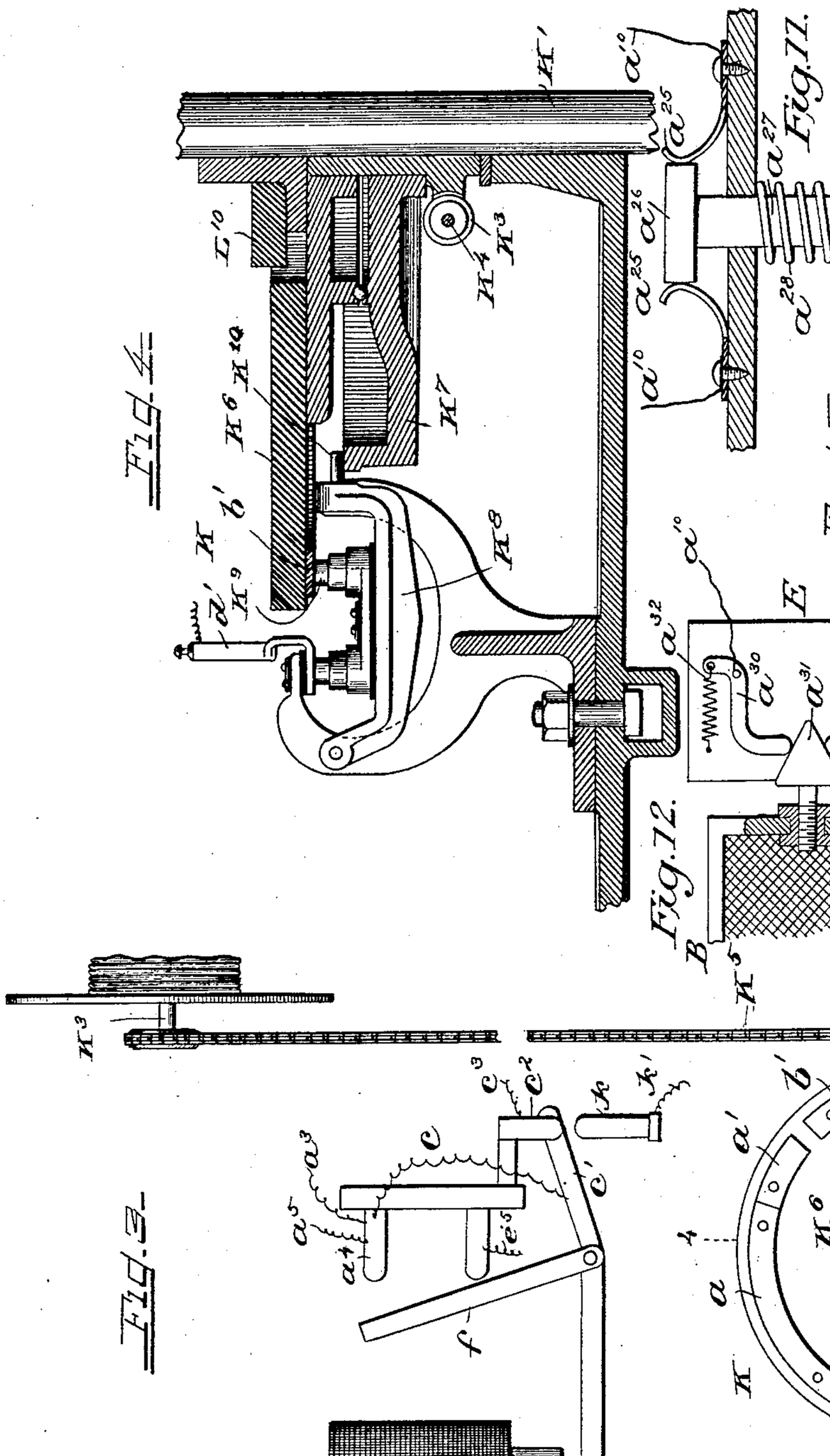
(No Model.) 4 Sheets—Sheet 3.



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(Application filed Nov. 29, 1899.)

(No Model.) 4 Sheets—Sheet 4.

Fig. 7.

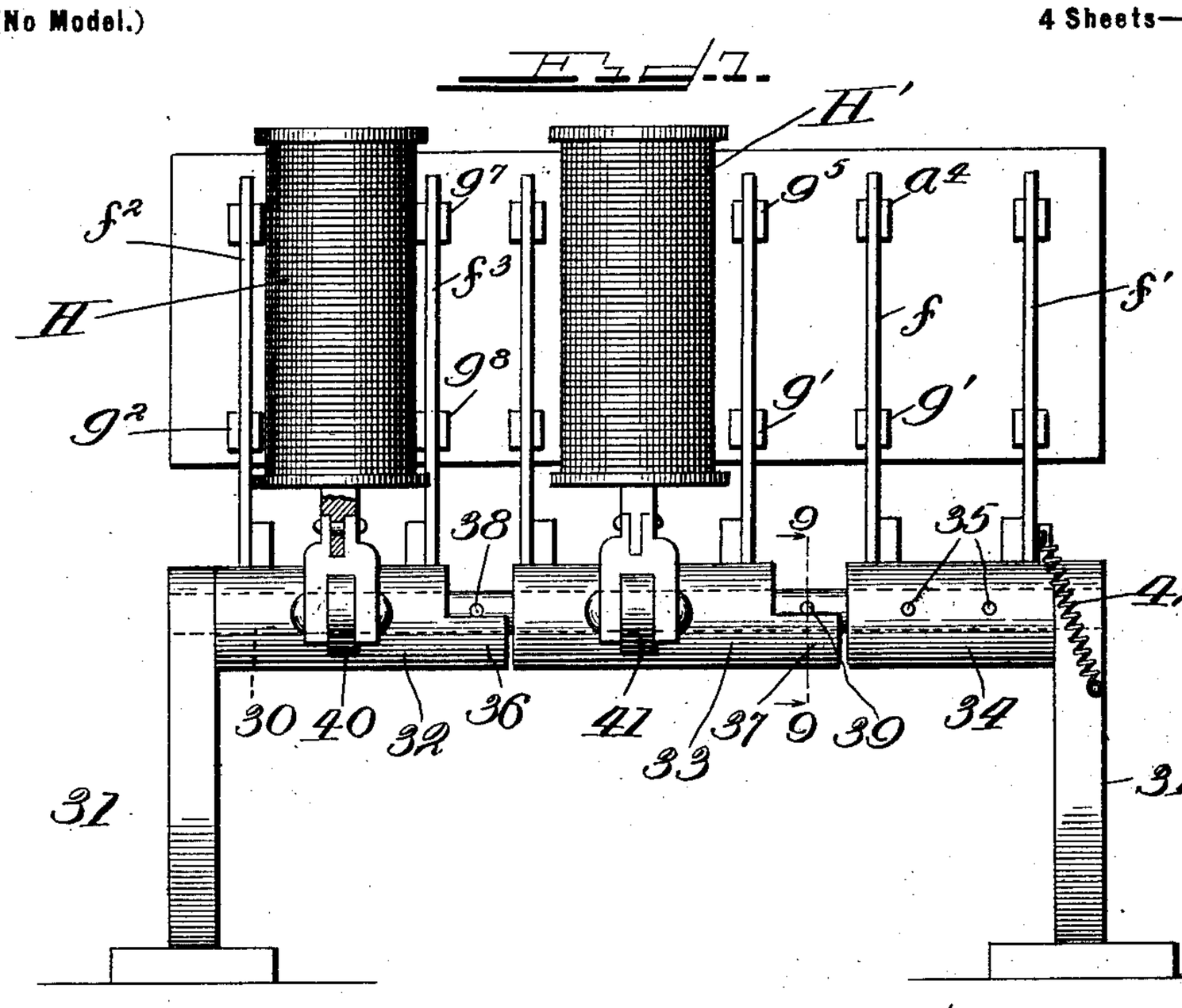


Fig. 10.

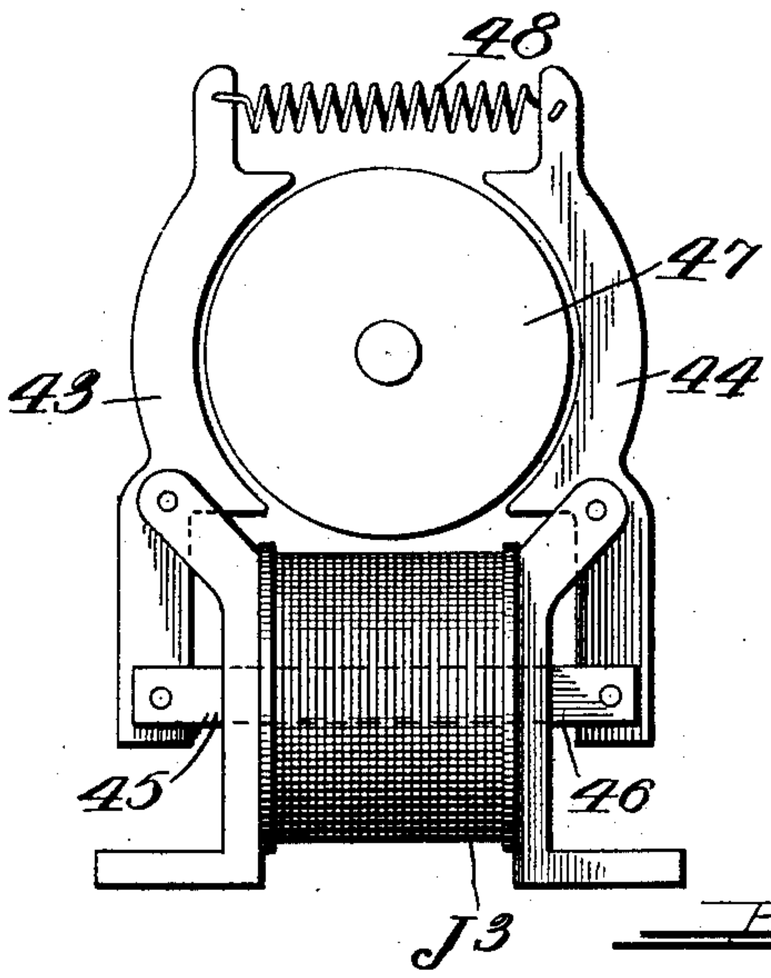


Fig. 8.

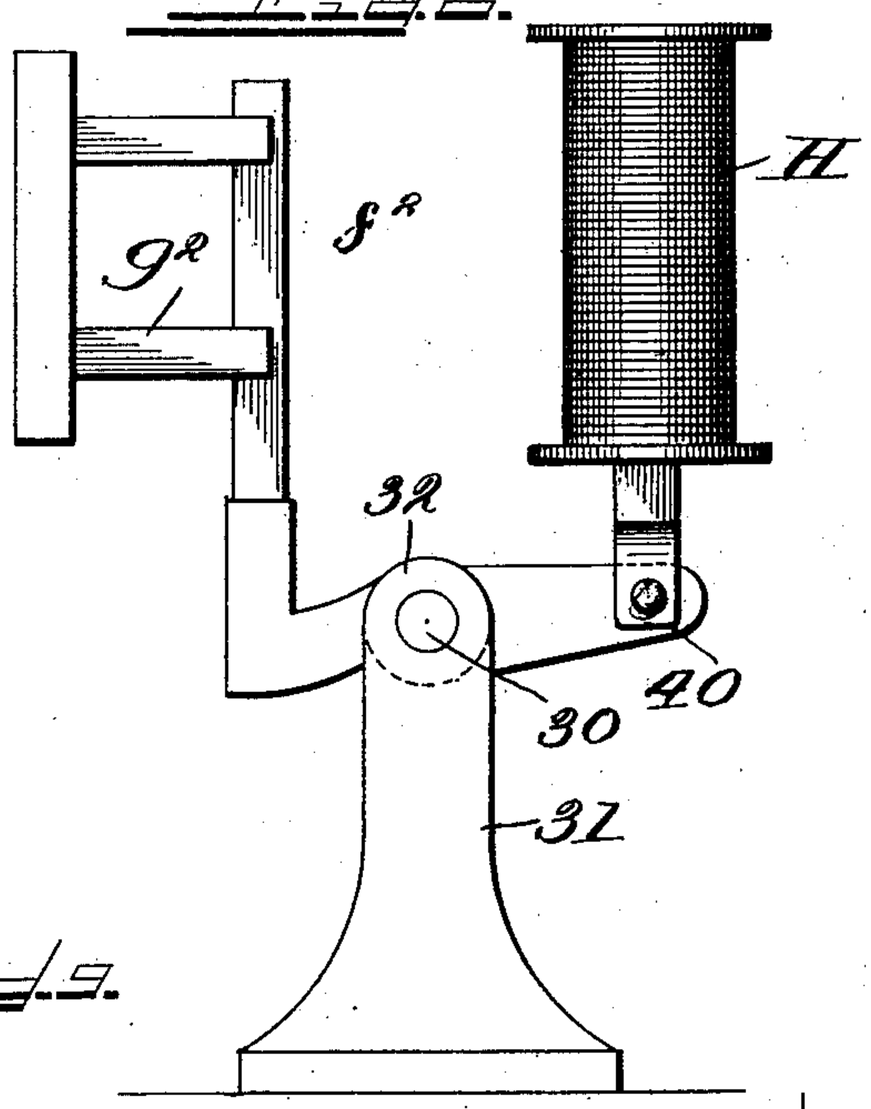
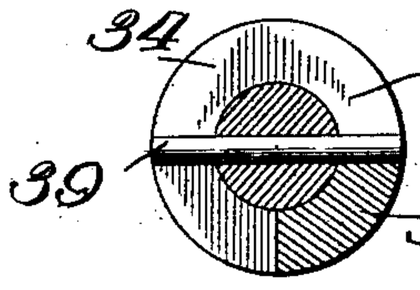


Fig. 9.



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ELECTRIC ELEVATOR.

SPECIFICATION forming part of Letters Patent No. 715,299, dated December 9, 1902.

Application filed November 29, 1899. Serial No. 738,746. (No model.)

To all whom it may concern:

Be it known that I, HAROLD ROWNTREE, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a new and useful Improvement in Electric Elevators, of which the following is a specification.

This invention relates to electric elevators.

The object of the invention is to provide a push-button-control system for elevators whereby the movement of the car may be effected and controlled from any landing or from the car by means of push-buttons.

A further object of the invention is to provide means of simple construction and arrangement whereby by merely manipulating an ordinary push-button at any landing the car-hoisting mechanism will be set in motion to move the car and will be arrested automatically only when the car reaches the particular floor at which the push-button was manipulated.

A further object of the invention is to provide a control system wherein by manipulating any one of a series of ordinary push-buttons arranged on the car and corresponding to the various landings at which the car stops the hoisting mechanism will be put in action to move the car and will be arrested only when the car reaches the particular floor corresponding to the particular push-button which has been manipulated.

A further object of the invention is the provision of means in a push-button-control system whereby the hoisting mechanism is rendered inoperative whenever a shaft or well door is open at any landing or floor.

A further object of the invention is the provision of means in a push-button-control system whereby when one push-button is manipulated, whether at any landing or on the car, to cause the car to move to a particular landing or floor the operation or manipulation of any other push-button will be ineffective until the cycle of operation set in motion by the manipulation of the first push-button is completed.

Other objects of the invention will be more fully set forth hereinafter.

The invention consists, substantially, in the construction, combination, location, and arrangement, all as will be more fully hereinafter set forth, as shown in the accompanying drawings, and finally pointed out in the appended claims.

Referring to the accompanying drawings, and to the various views and reference-signs appearing thereon, Figure 1 is a diagram showing the various motor and controlling circuits and switches. Fig. 2 is a similar view showing the arrangement of the push-button circuits at the various landings and through the car. Fig. 3 is a broken detail view showing a form of automatic switch for controlling the various circuits. Fig. 4 is a broken detail view in section on the line 4 4, Fig. 3. Fig. 5 is a broken detail view of a portion of the switch device shown in Figs. 3 and 4. Fig. 6 is a detail view illustrating the coöperative relation of the main and auxiliary switches. Fig. 7 is an enlarged detail view of the main motor-switches and the means for operating the same. Fig. 8 is an end view of the construction shown in Fig. 7. Fig. 9 is a detail sectional view on the line 9 9, Fig. 7. Fig. 10 is an enlarged detail view of the motor-brake mechanism. Fig. 11 is a detail view of the safety-switch on the car. Fig. 12 is a similar view of a door-switch through which a circuit is completed when the door is closed and circuit is broken when the door is opened.

Referring to the drawings, A designates the car; B B′ B^2, the doors of the elevator shaft or well at the various landings at which the car is to stop; C C′ C^2, push-buttons, one located at each landing or floor, and D D′ D^2 push-buttons on the car corresponding, respectively, to the push-buttons C C′ C^2. A circuit-closure switch or device E E′ E^2 is arranged at each floor to be opened or closed by the opening or closing of the door at the same landing therewith. The wall-switch is indicated at W.

Reference-signs F F′ F^2 designate magnet-switches corresponding to the various floors or landings and the circuits of which are controlled by the respective and corresponding push-buttons on the car or at the landings, as will be more fully explained hereinafter.

B³ designates a safety-switch on the car, the purpose and function of which will be explained more fully hereinafter.

G G′ G² designate double switches for controlling the main motor-circuit, the double switch G² controlling the main return-circuit and being actuated when either one of the other two double switches are actuated, and said switches G G′, both of which cannot be actuated at the same time, determining the direction of the current through the motor, one of said switches actuating the motor in one direction and the other actuating said motor in the opposite direction.

H H′ are solenoids for actuating the switches G G′, respectively. In Figs. 7, 8, and 9 are shown in detail the construction and arrangement of these double switches and a means for operating the same and wherein 30 designates a shaft suitably journaled to rock in bearing-posts 31. The arms of double switch G are connected to a sleeve 32, loosely mounted on shaft 30. Similarly, the arms of double switch G′ are connected to a sleeve 33, also loosely mounted on said shaft, while the sleeve 34, which carries the arms of switch G², is mounted and connected to rotate with said shaft, as by means of pins 35. Each of the sleeves 32 and 33 is provided with an extension or lug 36 37, respectively, and suitably connected to the shaft 30 is a pin or stud 38 39, said pins or studs being respectively arranged in the path of said lugs or extensions 36 37. Connected to each of the sleeves 32 33 is a crank-arm 40 41, said arms being pivotally connected, respectively, to the armatures of the solenoids H H′. From this construction it will be readily seen that when the solenoid H is energized the sleeve 32 will be rocked, thereby actuating the double switch G and also rocking shaft 30, through the engagement of lug 36 with pin 38, and with it the sleeve 34, which carries the double switch G², but without actuating the double switch G′. Similarly, when solenoid H′ is energized the switches G′ and G² are actuated. A spring 42 may be arranged to oppose the rocking movement of shaft 30 and operates to return said shaft and the double switches to normal position when the solenoids H H′ are cut out of circuit.

J is the motor-armature; J′, the motor-field; J², the commutator.

J³ is a brake-solenoid. The construction of the brake mechanism actuated by said solenoid is shown more in detail in Fig. 10 and comprises arms or levers 43 44, pivotally mounted intermediate their ends. To one end of each is connected pieces 45 46, forming core-pieces of the solenoid J³. The other ends of said levers are arranged to embrace between them the periphery of the brake-wheel 47, carried by the motor-shaft. A spring 48 exerts its tension to apply the levers 43 44 with braking effect to the brake-wheel 47, and by energizing the solenoid the tension of this spring is overcome and the brake is released.

J⁴ is an automatic electric switch operated by the current passing through the switch-solenoids and in turn controlling the circuit of a controlling device through which the motor field and armature currents are controlled. This controlling device consists of a rheostat J⁵, through which the motor-armature current is increased or decreased, and a rheostat J⁶, through which the motor-field current is increased or decreased, these rheostats being so relatively arranged that when the motor-armature current is increased the field-current is decreased, and when the armature-current is decreased the field-current is increased, thus effecting a speed regulation of the motor. The rheostats J⁵ J⁶ are controlled by an arm J⁷ and dash-pot J⁸, the said arm being operated by a solenoid J⁹ against the tension of a spring J¹⁰, the circuits of the said solenoid J⁹ being controlled, as above explained, by the automatic electric-switch device J⁴. Each of the magnet-switches F F′ F² consists of a magnet F⁴ F¹⁰ F¹¹ and an armature-lever F⁵, each armature-lever playing between a pair of contacts F⁶ F⁷ and also arranged to make contact with a contact-point F⁸, the action of the several magnets F⁴ F¹⁰ F¹¹ upon their respective armature-levers F⁵ being opposed by a spring F⁹. The circuits of the solenoids H H′ are controlled by means of a switch device, (indicated generally by reference-sign K.) This comprises a shaft K′, suitably journaled and driven from the hoisting-drum shaft K² or other suitable or convenient rotating part of the apparatus in any suitable manner—as, for instance, through a worm K³, shaft K⁴, and driving-sprocket K⁵. The rotation thus imparted through worm K³ effects a partial rotation of an insulation-disk K⁶ and a cam-wheel or track K⁷. Upon the insulation-disk are mounted contact strips or segments. These segments or strips are arranged in two separated sets, one set consisting of a long strip *a* and a short strip *a′* and the other set consisting of a long strip *b* and a short strip *b′*, the two sets of strips being separated from each other. Supported upon the lever K⁸ is a contact K⁹, arranged to coöperate with the contact-strips *a a′ b′ b*. The lever K⁸ is pivotally supported at one end and at the other end is supported in position for the contact K⁹ to make electrical connection with the strips carried by disk K⁶ by means of a projection K¹⁰, arranged to rest upon the edge of cam-disk K⁷. At a suitable point the periphery of said disk K⁷ is recessed, as at K¹¹, and when the projection K¹⁰ reaches recess K¹¹ the supporting end of the lever K⁸ will be lowered by said projection dropping into said recess, thereby breaking circuit between the strips or segments and the contact K⁹. In order to enable the projection K¹⁰ to again ride up upon the periphery of the cam-disk, I provide the inclined ways K¹² on each side of the recess K¹¹, said ways being covered by pivoted track-sections K¹³ in a well-known manner.

Upon shaft K′ is supported a disk L^{10}, of insulating material, upon which are mounted the binding-posts or other suitable contact or circuit completing means (indicated at h' e' p' p^2) through which the circuits are completed from the strips or segments a a' b' b.

It will be understood that the periphery of cam-disk K^7 is provided with only one recess K^{11}, and this recess is arranged opposite or adjacent to the space between the ends of the strips a' and b', and hence whenever the car arrives at its predetermined stopping-point the recess K^{11} will be opposite the pin or projection K^{10} on lever K^8 corresponding to that floor at which the car is to stop, and said disks K^6 and K^7 rotate in one direction or the other, according as the car ascends or descends. It will also be understood and will be more fully explained hereinafter that as the car approaches its stopping-point the contact-carrying disk K^6 will move, so as to carry strip b or a, as the case may be, out of contact with the operative contact K^9 and to bring strip a' or b', as the case may be, into contact therewith.

The specific mechanical construction of many of the parts above referred to is of no particular consequence so far as the present invention is concerned, and they are more fully shown and described in my companion application filed on November 15, 1899, Serial No. 737,095, and hence are not shown herein, except diagrammatically, to illustrate the electrical action of my push-button system, which forms the essential feature of my present invention.

I will now describe the electrical action of the several devices above referred to and their mutual and coöperative action and relation.

Suppose the parts to be in the relative positions shown and the push-button C to be manipulated. Thereupon the following circuit will be completed: from the main supply-wire a^2 through wall-switch W, wire a^3 to a point a^4, thence through wire c to contact-point c', thence to contact-point c^2, these contacts being bridged, as will be presently explained, thence through wire c^3 to push-button C to wire c^4, wire a^8, (see Fig. 1,) magnet F^4, wire a^9, wire a^{10}, thence (referring again to the diagram Fig. 2,) through contact device E, which ends the circuit at that point in case the door B is open. If the door B is closed, the circuit continues from contact device E through wire a^{10} to contact device E′ and in case the door B′ is closed on through wire a^{10} through the safety-switch B^3 on the car. Thence the circuit a^{10} continues through contact device E^2 in case the door B^2 is closed and on through wire a^{11} (see Fig. 1) to the wall-switch W and to the main return-wire b^2. If desired, a lamp or other suitable device (indicated at B^4) may be arranged in this circuit to reduce the current flowing therethrough. It will be noted that the current as above traced leads through all the contact devices E E′ E^2 throughout the system and also through the safety-switch B^3 on the car. In Fig. 11 I have shown a construction suitable for the car-switch B^3, wherein the circuit through wire a^{10} is completed between the contact-springs a^{25} by a conducting-plug a^{26}, carried by a pin a^{27} and held by a spring a^{28} in normal engagement with the contact-springs a^{25}. The circuit is broken by means of the push-button a^{29}, through which the plug a^{26} may be moved out of contact with the springs a^{25}. In Fig. 12 I have shown a simple and convenient form of door-switch, and as the construction of all the switches is identical a description of door-switch E will be sufficient. The circuit through wire a^{10} is completed between the contact-levers a^{30} by means of a contact-plug a^{31}, carried by the door B, the levers being yieldingly held in proper position by means of the springs a^{32}, the arrangement being such that when the door is in closed position the plug a^{31} enters the space between the contact-levers a^{30} and completes the circuit therethrough, and when the door is moved to open position the plug a^{31} is withdrawn from between the levers a^{30} and the circuit therethrough is broken. Therefore if any door of the system be open or if the safety-switch on the car be open no current can flow through this circuit. Commencing at point a^4 a shunt-circuit is established therefrom through wire a^5, post a^6, lever F^5, point F^7, wire a^{20} to the post a^6 of magnet-switch F′ through its lever F^5, contact F^7, wire a^{21} to post a^6 of magnet-switch F^2, its lever F^5 to post F^7. The purpose and function of this shunt-circuit will be explained more fully hereinafter. The points c' c^2 are bridged by means of an auxiliary switch when the main switch device G^2 is open. (See Fig. 6.)

From the foregoing it will be seen that pushing the button C will close a circuit, including magnet F^4, of magnet-switch F, thereby effecting an energization of said magnet.

Now suppose instead of pushing button C the button D on the car is pushed. Thereupon the following circuit is established: from main or wall switch W to wire c^3, Figs. 1 and 2, as above described, wire c^5, Fig. 2, push-button D, wire c^6, wire c^4, and thence on, as above described, through wire a^8, Fig. 1, magnet F^4, wire a^{10}, through all the door-switches E E′ E^2, the safety-switch B^3 on the car, wire a^{11} to the main return-wire b^2. Thus it will be seen that whether push-button C at the landing is manipulated or the push-button D on the car corresponding thereto the magnet-switch F will be actuated. Similarly suppose the push-button C^2 to be manipulated. Thereupon the following circuit will be closed: from main wall-switch W, Fig. 1, as above explained, to wire c^3, (see Fig. 2,) through push-button C^2, wire c^7, wire c^8, magnet F^{11}, wire c^9, wire a^{10}, and on, as before, through the door-switches E E′ E^2, the safety-car switch B^3, and return through wire a^{11} to wall-switch W. If instead of push-button C^2 suppose

the corresponding push-button D^2 on the car to be manipulated, thereupon the following circuit will be established: from the wall-switch to wire c^3, wire c^5, push-button D^2 on the car, wire c^{10} to wire c^7, and thence on, as before described, through wire c^8, magnet F^{11} to wire a^{10}, and thence after passing through the door-switch and the safety-switch on the car to the main return-wire b^2, as before described. In the same manner the circuits controlled by any other floor or landing push-button or its corresponding car-button can be traced, and it will be found that when any floor-button or its corresponding car-button is manipulated a circuit is completed which includes the corresponding magnet-switch F F′ F^2.

The energization of magnet F^4 causes the armature-lever F^5 to rock into contact with point F^6, thereby completing the shunt-circuit from the wall-switch, and which includes wire a^5, to said point F^6 through wire d to contact-point d'. Similarly the rocking of the armature-lever F^5 of any other magnet-switch closes a circuit to one or the other of the contact-points d^2 d^3, as the case may be, the contact-points F^6 being respectively connected to said contacts d^2 d^3 through wires d^4 d^5. Thus whenever any one of the floor or landing push-buttons or the corresponding car push-button is manipulated the corresponding magnet-switch F F′ F^2 is actuated to complete a circuit to one or the other of the contact-points d', d^2, or d^3. The contact-points d' d^2 d^3 are coöperatively arranged to be placed in communication with the contacts a a' b b'. In Fig. 4 is shown a construction for completing the communication between contact d' and strip b. It will be observed that as many points d' d^2 d^3 and levers K^8 are employed as there are floors or landings for the car. One set of contact-strips a a' or b b' are employed for the up movement of the car and the other set are employed for the down movement of the car.

I will now trace the circuit from point d', reference being had to Figs. 1 and 4, it being understood that a similar arrangement is employed in connection with each of the other contacts d^2 d^3. Supposing the lever K^8 is in position to contact with strip b, then the circuit is completed from point d', through point K^9, strip b, wire h, point h', wire h^2, electric-switch device J^4, wire h^3, the coils of solenoid H, wire e^3, wire e^4 to the wall-switch W. The completion of this circuit energizes the solenoid H, and hence causes the closing of main motor-switch G and also the switch G^2. The closing of these switches completes the circuit through the motor-field, also a circuit which includes the auxiliary shunt field-windings, and also the motor armature-circuits. These various circuits will now be traced. From the wall-switch W, through wire a^3, point a^4, switch-arm f, wire e^5 to rheostat-arm J^7. At this point the current divides, one part passing through wire e^6, solenoid J^9, wire e^7, points e^8 and e^9, these points being bridged by the actuation of the automatic switch J^4, to wire e^{10}, arm f' of switch G^2, and wire e^{11} to the wall-switch W. Another portion of the current passes through arm J^7, rheostat J^6, wire e^{12}, the field-windings e^{13}, wire e^{14}, brake-solenoid J^3, wire e^{15} to arm f', and thence to the wall-switch W, and the third portion passes from arm J^7, rheostat J^5, wire e^{16}, point g, wire g', point g^2, arm f^2, wire g^3, commutator J^2, armature J, wire g^4, point g^5, wire g^6, point g^7, arm f^3, point g^8, wire g^9, field-winding g^{10}, wire g^{11}, field-winding g^{12} to wire e^{14}, solenoid J^3, and thence onto the wall-switch W, as before explained. The completion of these circuits starts up the motor and moves the car in the desired direction. The energization of the solenoid J^9 by the completion of the circuit therethrough, as above explained, causes arm J^7 to rock against the action of spring J^{10}, thereby causing said arm to move over the rheostats J^5 J^6. The result of this is to gradually increase the current passing through the motor-armature and to correspondingly decrease the current passing through the field, thus attaining an increasing speed of travel of the car. The starting up of the motor also sets in rotation the insulation-disk K^6, carrying the contact-segments a a' b b', and in a direction corresponding to the direction of travel of the car as determined by the position of the car when the push-button is manipulated. The rotative movement of this disk causes the contact-point d' to be eventually brought into contact with strip b'. This occurs when the car approaches the landing at which it is to stop. When this contact is made, the circuit through strip b, wire h, and on, as above described, is broken and the following circuit is completed: from point d' to strip b', wire e, point e', wire e^2, solenoid H, and on to the wall-switch, as above described. The completion of this circuit and the breaking of circuit between point d' and strip b cuts the switch J^4 out of circuit, thereby breaking the circuit of solenoid J^9, thereby causing the rheostat-arm J^7 to return to its normal or retracted position, which movement of said arm controlling the rheostats J^5 J^6 decreases the armature-current and increases the field-current, thereby slowing down the car, and when the car arrives at the desired landing or stopping-point the projection K^{10} of lever K^8 corresponding to such floor will attain that point of the periphery of cam-disk K^7 at which is located the recess K^{11} and the said projection will drop into said recess, thereby breaking the circuit between point d' and the strip or segment b', thereby causing the motor-switches G G^2 to return to their normal positions, thereby breaking the motor-circuits and arresting the motor.

It will be understood that the recess K^{11} in the periphery of cam-disk K^7 arrives opposite any one of the levers K^8 when the car is opposite the corresponding floor and that said

recess is so relatively arranged that when the projection K^{10} of one lever drops into said recess—that is, when the car is at one stopping-place—the other levers K^8 are held up to cause their contact-points K^9 to contact with their coöperating segments or strips $a\ a'\ b\ b'$, as the case may be, so that the apparatus is in condition to be again set in motion when another push-button at some other floor or a corresponding button on the car is manipulated. It will be observed, however, that only two switch-actuating solenoids H H′ are employed, one effecting an actuation of switches G and G^2 and the other effecting an actuation of switches G′ and G^2, the switch G^2 being actuated coincidently with the actuation of either switches G or G′.

Now suppose the push-button C^2 or its corresponding car-button D^2 to be manipulated. The corresponding magnet-switch F^2 will be thereby caused to operate as above explained, thus completing the circuit of solenoid H′ when the relative position of contact device K is that shown in the drawings, and hence actuating switches G′ G^2. The actuation of these switches effects a reversal of the current through the motor-armature, thereby causing the car to move in the opposite direction to that above described. In other respects the operation is the same as that above described, the car starting up and having its speed accelerated until it approaches the particular predetermined landing at which it is to stop, and then the motor is automatically slowed down and the motor-circuit is finally broken when the car reaches its stopping-point.

It is above explained that when neither of the switches G G′ is snapped in—that is, when they are in their normal retracted position—an auxiliary switch actuated thereby operates to close the circuit between points $c'\ c^2$, which are included in the circuit of all the landing push-buttons throughout the system. When, however, either of the switches G G′ is actuated, thereby in either case, as explained, actuating switch G^2, this circuit is broken between the points $c'\ c^2$, (see Fig. 6,) and as the circuits of the various magnet-switches are completed through these points by breaking this circuit between points $c'\ c^2$ the particular magnet-switch which is actuated by pushing a button would be broken, thereby breaking the circuit which controls the motor-switch actuating solenoids H H′. To avoid this, I arrange another circuit adapted to be closed through contact-points c' and k when the switch G^2 is actuated by means of said auxiliary switch. This completes the following circuit: from main wall-switch W through wire a^3, point a^4, wire c, point c', point k, wire k', post F^8, and since under the previous conditions, as above explained, the magnet-switch has been actuated by the manipulation of a push-button the lever F^5 has been rocked to cause point m, which is insulated from lever F^5, to contact with said post F^8, and hence said auxiliary circuit is completed from said lever through wire a^7, wire a^8, and on through magnet F^4, as above explained. The several posts F^8 are in electrical connection with each other, and hence whichever magnet-switch has been operated will remain in the operative relation in which it is put when a push-button has been manipulated, notwithstanding the fact that the push-button circuits have been broken and all the push-buttons are inoperative. The practical and advantageous effect of this arrangement is to prevent any action taking place when any other push-button is manipulated while the car is in motion through the manipulation of a particular button.

From the foregoing description it will be seen that a push-button is arranged at each landing and a push-button is arranged on the car to correspond to each floor. Each floor push-button and its corresponding car-button controls a circuit which includes a magnet-switch. Each magnet-switch controls a circuit which includes one or the other of two solenoids. Each solenoid-circuit includes a contact-making arrangement adapted to be broken automatically when the car has reached the particular floor corresponding to the button which has been manipulated and also adapted to automatically effect a slowing down of the motor as the car approaches the landing at which it is to stop. Each solenoid actuates sets of switches through which the motor-circuits are controlled. It will also be seen that the push-button circuits are all inoperative if any shaft or well-door is open and that all the push-buttons are inoperative when the car is in motion.

I have referred to the fact that both sets of switches G G′ cannot be actuated at the same time. It will be observed that two solenoids H H′ are employed for actuating these switches, the solenoid H actuating switch G and the solenoid H′ actuating switch G′. Now in order that both switches G G′ may not be actuated at the same time I provide means whereby it is impossible to simultaneously energize the coils of both solenoids H H′. This is the special function and purpose of the shunt-circuit which includes wire a^5. By tracing this circuit it will be seen to extend to post a^6, lever F^5, point F^7, wire a^{20}, post a^6 of magnet-switch F′, its lever F^5, point F^7, wire a^{21}, post a^6 of magnet-switch F^2, its lever F^6, point F^7—that is, supposing that all the magnet-switches are inoperative or out of action. Now the circuits for energizing the solenoids H H′ are completed by actuating a magnet-switch so that a lever F^5 may contact with point F^6, the several points F^6 being wired to points $d'\ d^2\ d^3$, as shown. Now suppose magnet-switch F to be actuated, thereby rocking lever F^5, to complete a solenoid-circuit to d', the rocking of said lever effects a break in the circuit above traced, which includes point F^7 and the le-

vers F^5 of the other magnet-switches. Therefore only that solenoid H or H′ which is fed or energized through the circuit which includes point *d*′ will be energized, all the other solenoid-circuits being automatically cut out or broken by the actuation of one motor-magnet lever.

From the foregoing description it will be seen that I provide a simple and efficient push-button system for controlling the movements of the car as to destination from any landing or from the car.

I do not desire to include herein claims of sufficient scope to cover mechanical devices or appliances for controlling the speed of engines, as my invention resides in an electrical hoisting mechanism with electrical devices for controlling the direction and speed thereof; nor do I claim specifically a hand-controlled cut-out switch in the motor-circuit with mechanism connected thereto and operated by the movement of the motor for automatically breaking the main circuit; nor do I claim specifically the use of push-buttons at each floor for effecting the electrical control of the car-hoisting mechanism; nor do I claim, broadly, the idea of rendering inoperative, when the motor is in operation, the electrically-controlled means which set the motor in operation.

Having now set forth the object and nature of my invention and a construction embodying the principles thereof, what I claim as new and useful and of my own invention, and desire to secure by Letters Patent, is—

1. In an electric elevator, a hoisting-motor, circuits for said motor, an electrically-operated main switch, means for controlling the same including a series of push-buttons, one arranged at each floor or landing, and a corresponding series of push-buttons arranged on the car and each push-button adapted to close the circuit of said switch-operating means, and an auxiliary switch actuated coincidently with the main switch for breaking all the push-button circuits as the motor-circuit is completed, as and for the purpose set forth.

2. In an electric elevator, a hoisting-motor, circuits therefor, an electrically-operated main switch, means for controlling the same including a series of push-buttons, one arranged at each floor or landing, a corresponding series of push-buttons arranged on the car, each push-button adapted to close the circuit of said switch-operating means, and circuit-closure devices also arranged in said circuit and adapted to be opened and closed by the opening and closing of the elevator-shaft or well-door, and an auxiliary switch actuated coincidently with the main switch to break the push-button circuit as long as the motor-circuit remains closed, as and for the purpose set forth.

3. In an electric elevator, a hoisting-motor, circuits therefor, means for controlling said circuits, a magnet-switch for controlling said circuit-controlling means, a push-button arranged on the car for controlling the circuit of said magnet-switch, an auxiliary switch actuated coincidently with the actuation of said circuit-controlling means for breaking said push-button circuit, and an auxiliary energizing-circuit for said magnet-switch, and means for closing said auxiliary circuit coincidently with the breaking of the push-button circuit, as and for the purpose set forth.

4. In an electric elevator, a hoisting-motor, circuits therefor, switches for controlling said circuits, electrical devices for actuating said switches, a series of push-buttons, one arranged at each floor or landing and each adapted to close the circuit of said electrical devices, an auxiliary switch arranged in the push-button circuits, and connections between said auxiliary switch and said main switch whereby when the latter is operated said auxiliary switch is opened to break the push-button circuits, as and for the purpose set forth.

5. In an electric elevator, a hoisting-motor, circuits therefor, means for controlling said circuits, a series of magnet-switches corresponding in number to the various landings at which the car is to stop, and each adapted when actuated to operate said circuit-controlling means, and a push-button arranged at each landing for controlling the circuit of its corresponding magnet-switch, an auxiliary switch arranged in the push-button circuit, connections between the motor-circuit-controlling means and said auxiliary switch, whereby the actuation of the former opens the latter, and an auxiliary energizing-circuit for said magnet-switches arranged to be closed when the push-button circuit is opened, as and for the purpose set forth.

6. In an electric elevator, a hoisting-motor, circuits therefor, a series of magnet-switches corresponding to the various landings at which the car is to stop, and each adapted when actuated to effect the control of the hoisting-motor circuits, a main circuit and an auxiliary circuit for said magnet-switch, a switch for controlling said auxiliary circuit, means for closing said auxiliary-circuit switch when said main circuit is broken, and a push-button arranged at each landing for controlling the main circuit of its corresponding magnet-switch, as and for the purpose set forth.

7. In an electric elevator, a hoisting-motor, circuits therefor, a series of magnet-switches corresponding to the various landings at which the car is to stop, each adapted when actuated to effect the control of the hoisting-motor circuits, a main circuit and an auxiliary circuit for each magnet-switch, a switch for controlling said auxiliary circuits, means for closing said switch when said main circuit is broken, and a series of push-buttons on the car corresponding to the various mag-

net-switches for controlling the main circuits of said magnet-switches, as and for the purpose set forth.

8. In an electric elevator, a hoisting-motor, a series of magnet-switches, corresponding to the various landings at which the car is to stop, each adapted when actuated to effect the control of the hoisting-motor circuits, a main and an auxiliary circuit for each magnet-switch, means for closing the auxiliary circuit when the main circuit is open, each main circuit including a push-button at the landing corresponding to said magnet-switch, and an auxiliary energizing-circuit for said magnet-switch, and means for closing said auxiliary circuit, as and for the purpose set forth.

9. In an electric elevator, a hoisting-motor, a series of magnet-switches, corresponding to the various landings at which the car is to stop, and each adapted when actuated to effect the control of the hoisting-motor circuits, a main and an auxiliary circuit for each magnet-switch, each of said main circuits including a push-button arranged at the landing corresponding to its own magnet-switch, and a closure device arranged in said main magnet-switch circuits at each landing, to be controlled by the opening and closing of the elevator-shaft or well-door, electrically-controlled means for rendering all the push-button circuits inoperative while the motor-circuits are closed, an auxiliary energizing-circuit for said magnet-switches, and means for closing said auxiliary circuit, as and for the purpose set forth.

10. In an electric elevator, a hoisting-motor, a series of magnet-switches, corresponding to the various landings at which the car is to stop, and each adapted when actuated to effect the control of the hoisting-motor circuits, a main and an auxiliary circuit for each magnet-switch, each main circuit including a push-button on the car and a push-button at the particular landing corresponding to said magnet-switch, and an auxiliary energizing-circuit for said magnet-switch, and means for closing said auxiliary circuit, as and for the purpose set forth.

11. In an electric elevator, a hoisting-motor, a magnet-switch for effecting the control of the circuit of said motor, a main and an auxiliary circuit for said magnet-switch, the main circuit including a push-button, and means actuated coincidently with the actuation of the motor for breaking said push-button circuit, and an auxiliary energizing-circuit for said magnet-switch, and means for closing said auxiliary circuit, as and for the purpose set forth.

12. In an electric elevator, a hoisting-motor, a switch for controlling the circuits of said motor, electrical devices for actuating said switch, means arranged at each landing for completing the circuit of said electrical devices, and an auxiliary switch actuated by the operation of said switch for breaking said landing-circuits, as and for the purpose set forth.

13. In an electric elevator, a hoisting-motor, a switch for controlling the circuits of said motor, electrical devices for actuating said switch, magnet-switches for controlling the circuits of said electrical devices, said magnet-switches corresponding in number to the various landings at which the car is to stop, a main circuit and an auxiliary circuit, means whereby when said main circuit is opened the auxiliary circuit is closed, and a push-button arranged at each landing for completing the main circuit of its corresponding magnet-switch, and electrically-controlled means for rendering all the push-button circuits inoperative while the car is in motion, as and for the purpose set forth.

14. In an electric elevator, a hoisting-motor, a switch for controlling the circuits of said motor, electrical devices for actuating said switch, magnet-switches corresponding in number to the various landings at which the car is to stop, for controlling the circuits of said electrical devices, a push-button arranged at each landing, for completing the circuit of its corresponding magnet-switch, and means actuated by said motor-switch for breaking said push-button circuits, coincidently with the completion of the motor-circuit, as and for the purpose set forth.

15. In an electric elevator, a hoisting-motor, a switch for controlling the circuits of said motor, electrical devices for actuating said switch, a magnet-switch, corresponding to each landing at which the car is to stop, for controlling the circuit of said electrical devices, a circuit for each magnet-switch, each magnet-switch circuit including a push-button on the car and a push-button at the floor or landing corresponding to said magnet-switch, and an auxiliary switch actuated by said motor-switch for making or breaking all of said push-button circuits, coincidently with the breaking or making, respectively, of the motor-circuit, as and for the purpose set forth.

16. In an electric elevator, a hoisting-motor, a switch for controlling the circuits of said motor, electrical devices for actuating said switch, a series of magnet-switches, a main circuit therefor controllable from the respective landings at which the car is to stop, for controlling the circuits of said electrical devices, and an auxiliary energizing-circuit for said magnet-switch, and means for closing said auxiliary circuit, and means arranged in the circuits of said electrical devices for automatically breaking said circuits when the car arrives at the floor or landing corresponding to the magnet-switch which is operated, as and for the purpose set forth.

17. In an electric elevator, a hoisting-motor, a switch for controlling the circuits of said motor, electrical devices for actuating said switch, circuits for said electrical devices, magnet-switches controllable from the respec-

tive landings at which the car is to stop, for completing the circuits of said electrical devices, and an auxiliary energizing-circuit for said magnet-switch, and means for closing said auxiliary circuit, means for opening said landing-circuits when said auxiliary circuit is closed, and means arranged in the circuits of said electrical devices and actuated by the hoisting-motor for automatically breaking said circuits when the car arrives at the particular landing at which it is to stop, as and for the purpose set forth.

18. In an electric elevator, a hoisting-motor, a switch for controlling said motor, electrical devices for actuating said switch, circuits for said electrical devices including an automatic contact device, magnet-switches, main circuits therefor controllable from the respective floors or landings at which the car is to stop for completing the circuit of said electrical devices to said automatic contact device, and an auxiliary energizing-circuit for said magnet-switch, and means for closing said auxiliary circuit, and means actuated by said motor for operating said contact device, as and for the purpose set forth.

19. In an electric elevator, a hoisting-motor, and means for controlling said motor, including a series of magnet-switches corresponding to the various landings at which the car is to stop, each adapted to be controlled from its corresponding landing, and means whereby when one magnet-switch is actuated the landing-controlling circuits of all the magnet-switches are broken, and an auxiliary energizing-circuit for said magnet-switches adapted to be closed when said landing-circuits are broken, as and for the purpose set forth.

20. In an electric elevator, a hoisting-motor, and means for controlling said motor, including a series of magnet-switches, a main circuit for each magnet-switch, each of said main circuits including a push-button on the car and a push-button at the corresponding landing, means whereby when one magnet-switch is operated the main or push-button circuits of all the magnet-switches are broken until the cycle of operation set in motion by that magnet-switch which has been operated is completed, an auxiliary energizing-circuit for said magnet-switches, a controlling-switch for said auxiliary circuit, and means for closing said auxiliary-circuit switch when said push-button circuits are broken, as and for the purpose set forth.

21. In an electric elevator, a hoisting-motor, means for controlling the circuits of said motor, including a series of magnet-switches, a circuit for each magnet-switch, each circuit including a push-button on the car and a push-button at the corresponding landing at which the car is to stop, an auxiliary energizing-circuit for said magnet-switches, and means actuated coincidently with the completion of the motor-circuit for breaking said push-button circuit and completing said auxiliary energizing-circuit, as and for the purpose set forth.

22. In an electric elevator, a hoisting-motor, a switch for completing the circuit of said motor, an auxiliary switch actuated by said motor-switch, means for controlling said motor-switch, including a series of magnet-switches corresponding to the various landings at which the car is to stop, a circuit for each magnet-switch, including a push-button on the car and a push-button at the corresponding landing, an auxiliary energizing-circuit for said magnet-switches, said auxiliary switch adapted to control the push-button and auxiliary circuits of said magnet-switches, as and for the purpose set forth.

23. In an electric elevator, a hoisting-motor, means for controlling the circuits of said motor, including a series of magnet-switches, a circuit for each magnet-switch, each circuit including a push-button, an auxiliary energizing-circuit for said magnet-switches, said auxiliary energizing-circuit including a closure device at each landing, adapted to be opened and closed by the opening and closing of the shaft or well door at that landing, and means actuated coincidently with the completion of the motor-circuit, for breaking said push-button circuit and completing said auxiliary energizing-circuit, as and for the purpose set forth.

24. In an electric elevator, a hoisting-motor, a circuit therefor, make-and-break and direction-controlling switches for said circuit, said make-and-break switch adapted to be actuated when any one of the direction-controlling switches is actuated, and electrical means for controlling said switches from any landing or from the car, said electrical means having a main circuit extending to the car and to each landing, and an auxiliary circuit, and means whereby when the former is opened the latter is closed, as and for the purpose set forth.

25. In an electric elevator, a hoisting-motor, a circuit therefor, a make-and-break and direction-controlling switches for said circuit, said make-and-break switch adapted to be actuated when any one of the direction-controlling switches is actuated, electrical devices for controlling said switches, main and auxiliary circuits for said electrical devices, said main circuits including a push-button on the car and a push-button at each floor or landing, and means for breaking the push-button circuits when the make-and-break switch is closed, as and for the purpose set forth.

26. In an electric elevator, a hoisting-motor, a circuit therefor, a make-and-break and direction-controlling switches for said circuit, means whereby when either one of said direction-controlling switches is actuated said make-and-break switch is also actuated, a solenoid for actuating each direction-controlling switch, a circuit for each solenoid,

and electrical means, main and auxiliary circuits therefor, the former including push-buttons arranged at each landing, for controlling the circuits of said solenoids, and means for breaking the circuit of said electric means when the make-and-break switch is closed, as and for the purpose set forth.

27. In an electric elevator, a hoisting-motor, a circuit therefor, a make-and-break and direction-controlling switches for said circuit, a solenoid for operating each direction-controlling switch, and means whereby the completion of the circuit of one solenoid prevents the completion of the circuit of the other solenoid, as and for the purpose set forth.

28. In an electric elevator, a hoisting-motor, a circuit therefor, a make-and-break and two sets of direction-controlling switches for said circuit, a solenoid for operating each set of direction-controlling switches, electrical means for controlling the circuits of said solenoids from each landing or from the car, and means for breaking the circuit of said electrical means when the make-and-break switch is closed, as and for the purpose set forth.

29. In an electric elevator, a hoisting-motor, a circuit therefor, a make-and-break and independent direction-controlling switches, a solenoid for operating each direction-controlling switch, circuits for said solenoids, controlling devices for said circuits, including a magnet-switch, a circuit for said magnet-switch, said circuit including a push-button, and an auxiliary energizing-circuit for said magnet-switch, and means for closing said auxiliary circuit, as and for the purpose set forth.

30. In an electric elevator, a hoisting-motor, a circuit therefor, a make-and-break and independent sets of direction-controlling switches for said circuit, a solenoid for operating each set of direction-controlling switches, means for controlling said solenoids, including a series of magnet-switches corresponding to the various landings at which the car is to stop, and a push-button arranged at each landing for controlling the corresponding magnet-switch, and an auxiliary energizing-circuit for said magnet-switch, and means for closing said auxiliary circuit, as and for the purpose set forth.

31. In an electric elevator, a hoisting-motor, circuits therefor, a series of magnet-switches, a main and an auxiliary circuit for each of said magnet-switches, a switch for said auxiliary circuits, means for closing said switch when said main circuits are broken, a push-button arranged at each landing and corresponding push-buttons on the car, each push-button adapted to control the main circuit of a magnet-switch, electrically-controlled means for rendering all the push-button circuits inoperative while the car is in motion, circuits controlled by said magnet-switches, means arranged in said circuits for controlling the motor-circuits, and means also arranged in said circuits for causing the arrest of the motor when the car reaches any predetermined landing, as and for the purpose set forth.

32. In an electric elevator, a hoisting-motor, a series of magnet-switches, main and auxiliary circuits for said switches, a push-button arranged at each landing, and a corresponding push-button arranged on the car, each push-button adapted when manipulated to close the main circuit of a magnet-switch, circuits controlled by said magnet-switches, means arranged in said circuits for controlling the main motor-circuits, and means also arranged in said circuits for causing the motor to slow down as the car approaches any predetermined floor, as and for the purpose set forth.

33. In an electric elevator, a hoisting-motor, a series of magnet-switches, main and auxiliary circuits for said magnet-switches, a push-button arranged at each landing and a corresponding push-button arranged on the car, each push-button adapted when manipulated to close the main circuit of a magnet-switch, and electrically-controlled means for rendering all the push-button circuits inoperative while the car is in motion, circuits controlled by said magnet-switches, means arranged in said circuits for controlling the main motor-circuits, and means also arranged in said circuits and operated by the motor for automatically breaking said circuits when the car reaches a particular predetermined landing, as and for the purpose set forth.

34. In an electric elevator, a hoisting-motor, a series of magnet-switches, main and auxiliary circuits for said magnet-switches, a push-button arranged at each landing, and a corresponding push-button arranged on the car, each push-button adapted when manipulated to close the main circuit of a magnet-switch, and electrically-controlled means for rendering all the push-button circuits inoperative while the car is in motion, a control-circuit adapted to be closed when a magnet-switch is operated, an automatic switch arranged in said control-circuit, and devices controlled by said control-circuit for varying the speed of the motor, as and for the purpose set forth.

35. In an electric elevator, a hoisting-motor, circuits therefor, a main switch for controlling said circuits, a rheostat for varying the speed of said motor, devices for actuating said rheostat, a circuit for said devices, means actuated by the motor for breaking said circuit in advance of the breaking of the main switch as the car approaches any particular predetermined floor, and a push-button arranged at each floor for controlling the motor-circuit, as and for the purpose set forth.

36. In an electric elevator, a hoisting-motor, a rheostat for varying the speed of said motor, a solenoid for actuating said rheostat, an automatic switch for controlling the circuit of said solenoid, a circuit for said automatic switch, and means actuated by the motor for breaking the circuit of said automatic switch

as the car approaches a particular predetermined landing, as and for the purpose set forth.

37. In an electric elevator, a hoisting-motor, a rheostat for varying the speed of said motor, a solenoid for actuating said rheostat, an automatic switch for controlling the circuit of said solenoid, a contact device arranged in the circuit of said automatic switch for making and breaking said circuit, and means controllable from the car and from each floor or landing for completing said circuit to said contact device, as and for the purpose set forth.

38. In an electric elevator, a hoisting-motor, a rheostat for varying the speed of the motor, an automatic switch for controlling said rheostat, a contact device arranged in the circuit of said automatic switch, and actuated by the motor, for making and breaking said circuit, and means controllable from the car and from each landing for completing said circuit to said contact device, as and for the purpose set forth.

39. In an electric elevator, a hoisting-motor, a rheostat for varying the speed of the motor, an automatic switch for controlling said rheostat, a contact device arranged in the circuit of said automatic switch, and actuated by the motor, for making and breaking said circuit, a series of magnet-switches, each when actuated adapted to complete an operating-circuit to said contact device, and means controllable from the car and from each landing for actuating said magnet-switches, as and for the purpose set forth.

40. In an electric elevator, a hoisting-motor, a rheostat for varying the speed of the motor, an automatic switch for controlling said rheostat, a contact device arranged in the circuit of said automatic switch, and actuated by the motor, for making and breaking said circuit, a series of magnet-switches corresponding to the various landings at which the car is to stop, each when actuated adapted to close an operating-circuit to said contact device, a circuit for each magnet-switch, a push-button on the car, and a push-button at the corresponding landing, for completing said motor-magnet circuits, as and for the purpose set forth.

41. In an electric elevator, a hoisting-motor, a field-circuit, and an armature-circuit therefor, a rheostat for varying the current in said circuits, an automatic switch for controlling the circuit of said rheostat, a contact device actuated by the motor for making and breaking the circuit of said automatic switch, whereby as the motor starts up its speed is accelerated, and as the car approaches its predetermined stopping-point its speed is decreased, and means controllable from the various landings for completing circuit to said contact device, as and for the purpose set forth.

42. In an electric elevator, a hoisting-motor, a switch device for controlling the circuits of said motor, electrical devices for actuating said switch device, a contact device arranged in the circuit of said electrical devices and adapted to be actuated by the motor to make and break said circuit, a series of magnet-switches, each adapted to close a circuit to said contact device, a main circuit for each magnet-switch; each magnet-switch main circuit including a push-button on the car and a push-button at a floor or landing at which the car is to stop, and an auxiliary energizing-circuit for said magnet-switches, and means whereby when the push-button circuit is broken said auxiliary circuit is closed, as and for the purpose set forth.

43. In an apparatus for controlling elevators, the combination with a motor for operating the car in either direction, of a floor-controller, push-buttons controlling the floor-controller, and means controlled by the floor-controller for reducing the speed of the motor before it is stopped.

44. The combination of an elevator and a motor therefor, of a mechanism including a rotary disk driven in unison with the motor, and lever, arms by which the electrical circuit of the motor is kept closed by the arms contacting with the disk, said circuit controlled by said mechanism to arrest the motor and cage when the latter has reached its destination.

45. The combination with an electric elevator or hoist, of mechanism actuated by the movement of the hoist, and arranged to automatically cut in resistance so as to slow down the motor as the car or hoist nears the end of its travel.

46. In an electric hoist, a series of resistances in the motor-circuit, a contact movable over the resistances, and actuating connections between the contact and the hoisting-drum, arranged to move the contact over the resistances and to cut in resistance as the car or hoist nears the end of its travel.

47. In an electric hoist, a reversing-controller and a cut-out switch included in the circuit, and a mechanism connected with the cut-out switch operated by the movement of the hoist and arranged to automatically break the main circuit when the car has reached the limit of its travel.

48. In a hoisting mechanism, the combination of a car, mechanism for moving said car, means for stopping said car at any predetermined intermediate landing in its travel, and automatic means for changing the rate of movement of the car as it approaches its predetermined stopping-point, as and for the purpose set forth.

49. In a hoisting mechanism, the combination of a car, mechanism for moving said car, means for automatically stopping the car at any predetermined landing or floor, and means for reducing the rate of movement of the car as it approaches the predetermined landing or floor at which it is to stop, as and for the purpose set forth.

50. In a hoisting mechanism, the combination of a car, mechanism for moving said car,

automatic means for changing the rate of movement of the car from fast to slow as it approaches certain predetermined landing-points, and means for automatically stopping the car when it arrives at the predetermined stopping-point, as and for the purpose set forth.

51. In a hoisting mechanism, the combination of a car, mechanism for moving the same, and automatic means for changing the rate of movement of the car from fast to slow as it approaches certain predetermined landing or stopping points, as and for the purpose set forth.

52. The combination with a car, an electric hoisting-motor and a circuit therefor, of mechanism geared to and actuated by said motor for automatically cutting in resistance in the motor-circuit to slow down the motor as the car approaches any predetermined landing or stopping point, as and for the purpose set forth.

53. In a hoisting apparatus, the combination with an electric motor for operating the car in either direction, of a switch device operating to control the motor-circuits and also the particular floor or landing at which the car is to stop, and means for controlling said switch device, as and for the purpose set forth.

54. In a hoisting apparatus, a hoisting-motor, a combined motor and floor controller, and means controllable from each floor or landing at which the car is to stop for controlling said controller, as and for the purpose set forth.

In witness whereof I have hereunto set my hand, this 17th day of November, 1899, in the presence of the subscribing witnesses.

HAROLD ROWNTREE.

Witnesses:
FRANK T. BROWN,
S. E. DARBY.