No. 638,282. Patented Dec. 5, 1899.

H. ROWNTREE.

AUTOMATIC ELECTRIC ELEVATOR.

(Application filed Feb. 6, 1899.)

(No Model.) 5 Sheets—Sheet 1.

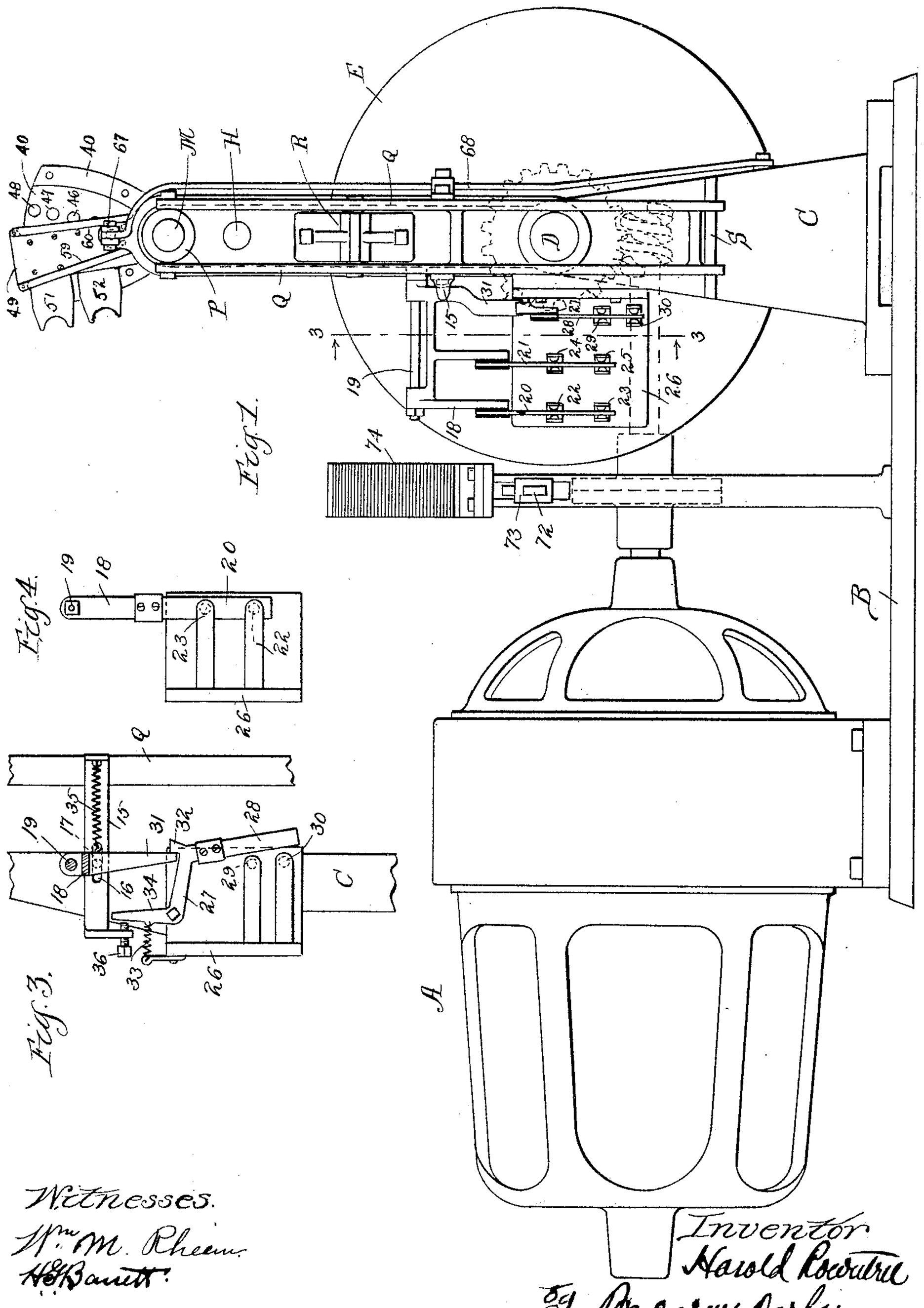

Fig. 1.

Fig. 4.

Fig. 3.

Witnesses.
Wm. M. Rheem.
H. G. Barnett.

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(No Model.) 5 Sheets—Sheet 2.

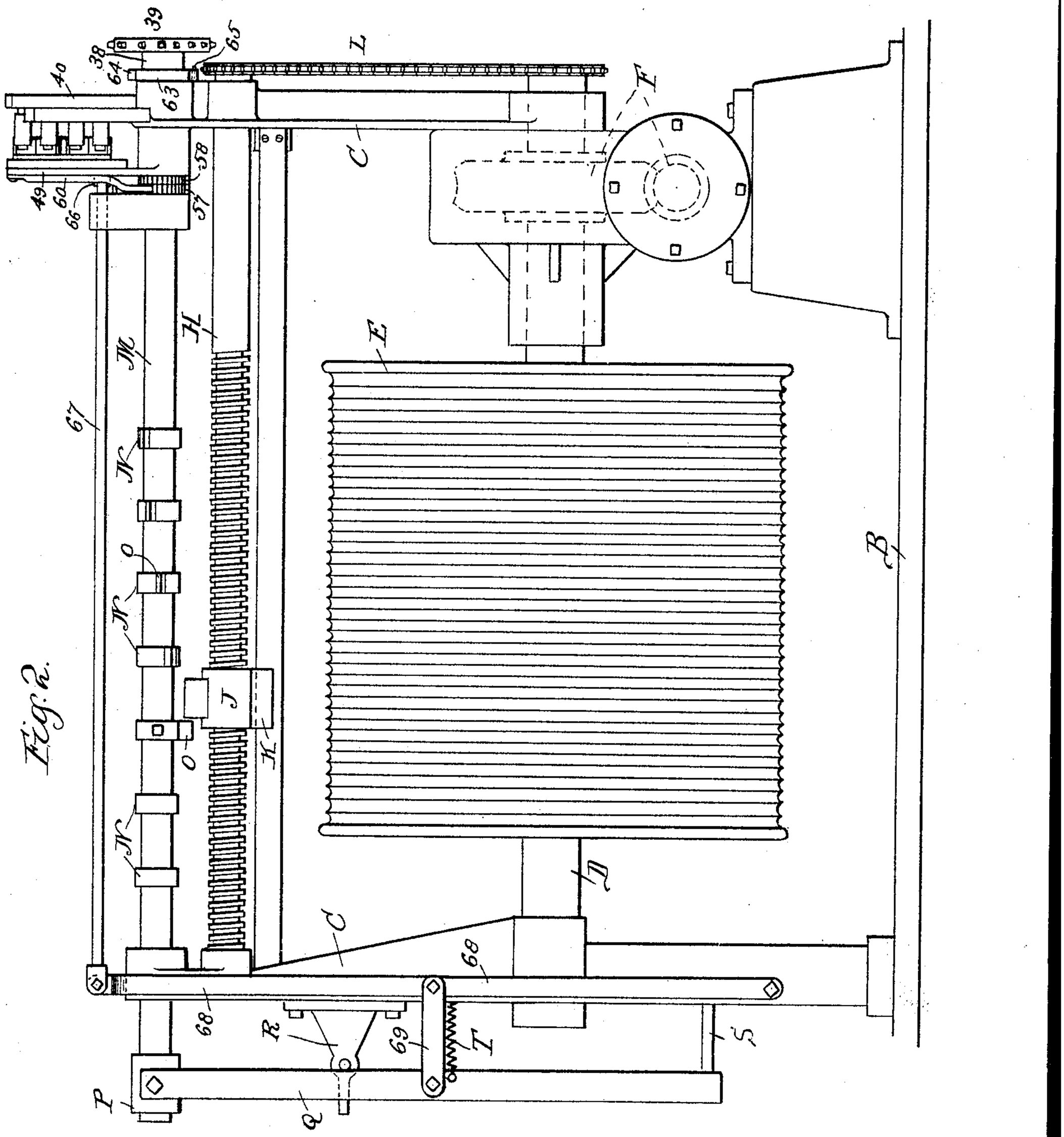

Fig. 2.

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(No Model.) 5 Sheets—Sheet 3.

Fig. 5.

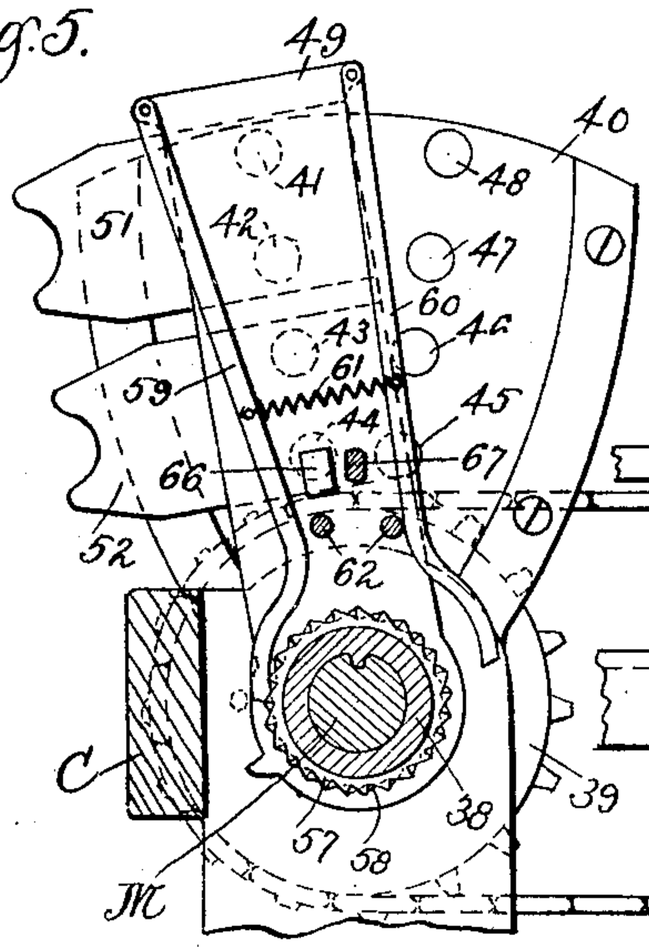

Fig. 6.

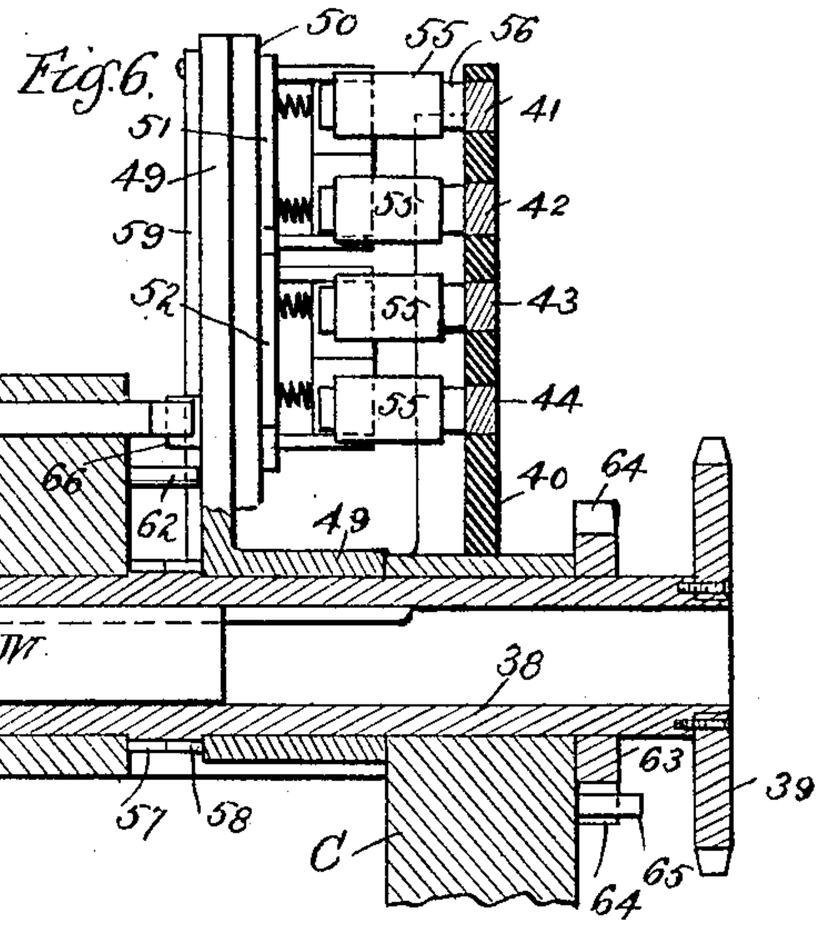

Fig. 7.

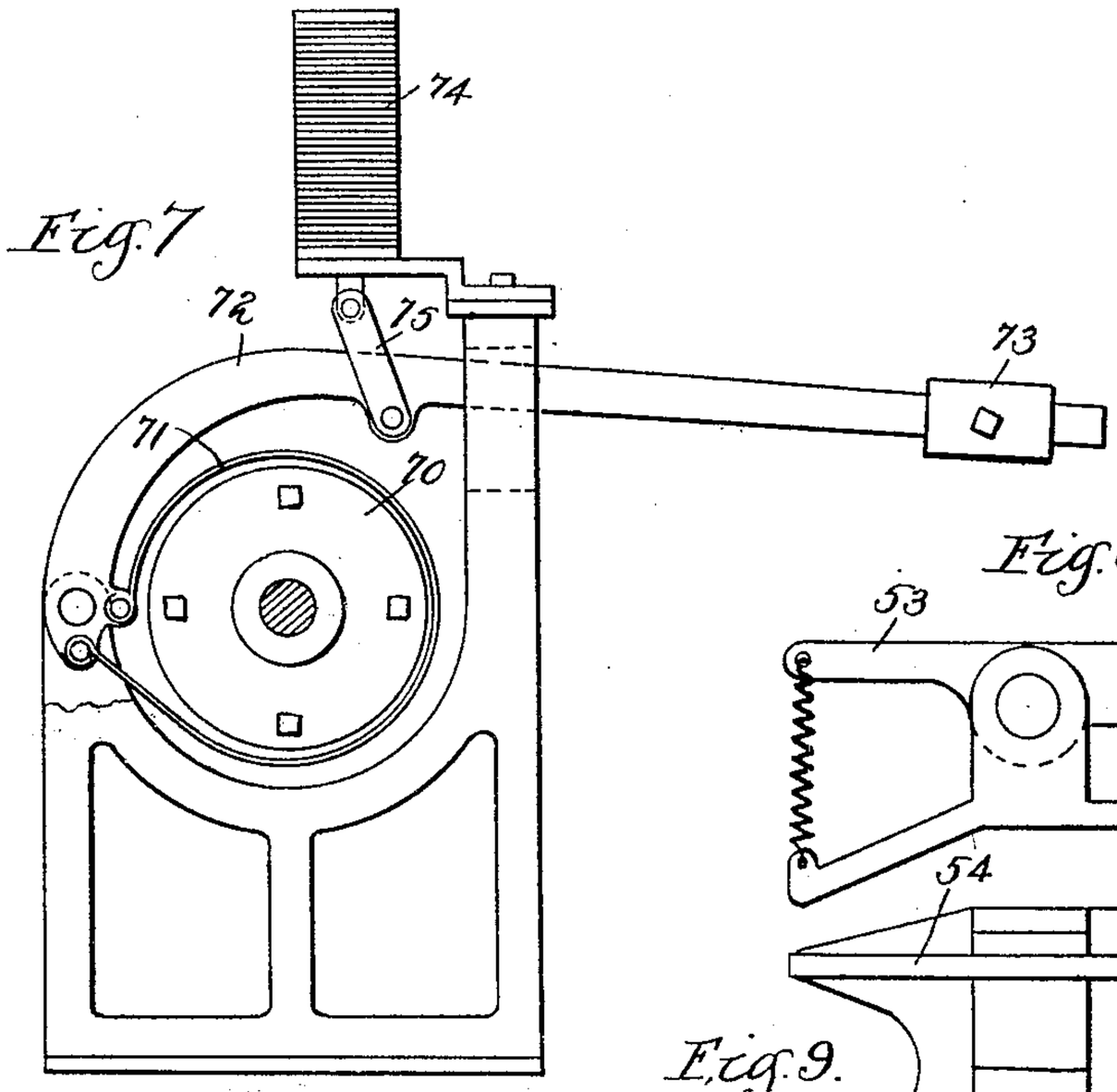

Fig. 8.

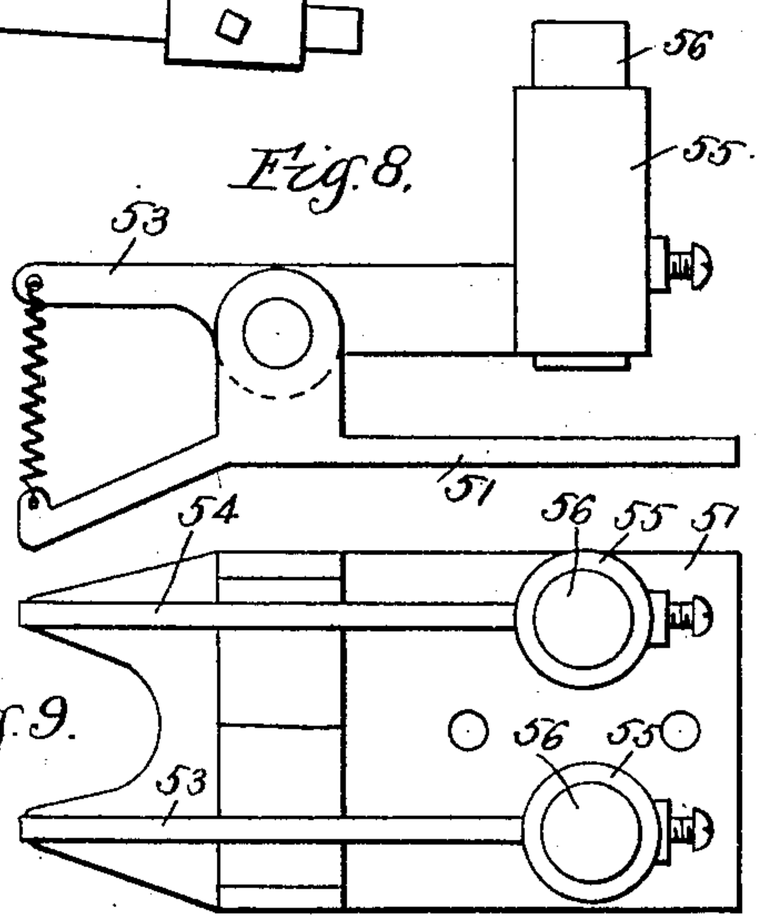

Fig. 9.

Witnesses
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AUTOMATIC ELECTRIC ELEVATOR.

(Application filed Feb. 6, 1899.)

(No Model.) 5 Sheets—Sheet 4.

Fig. 10.

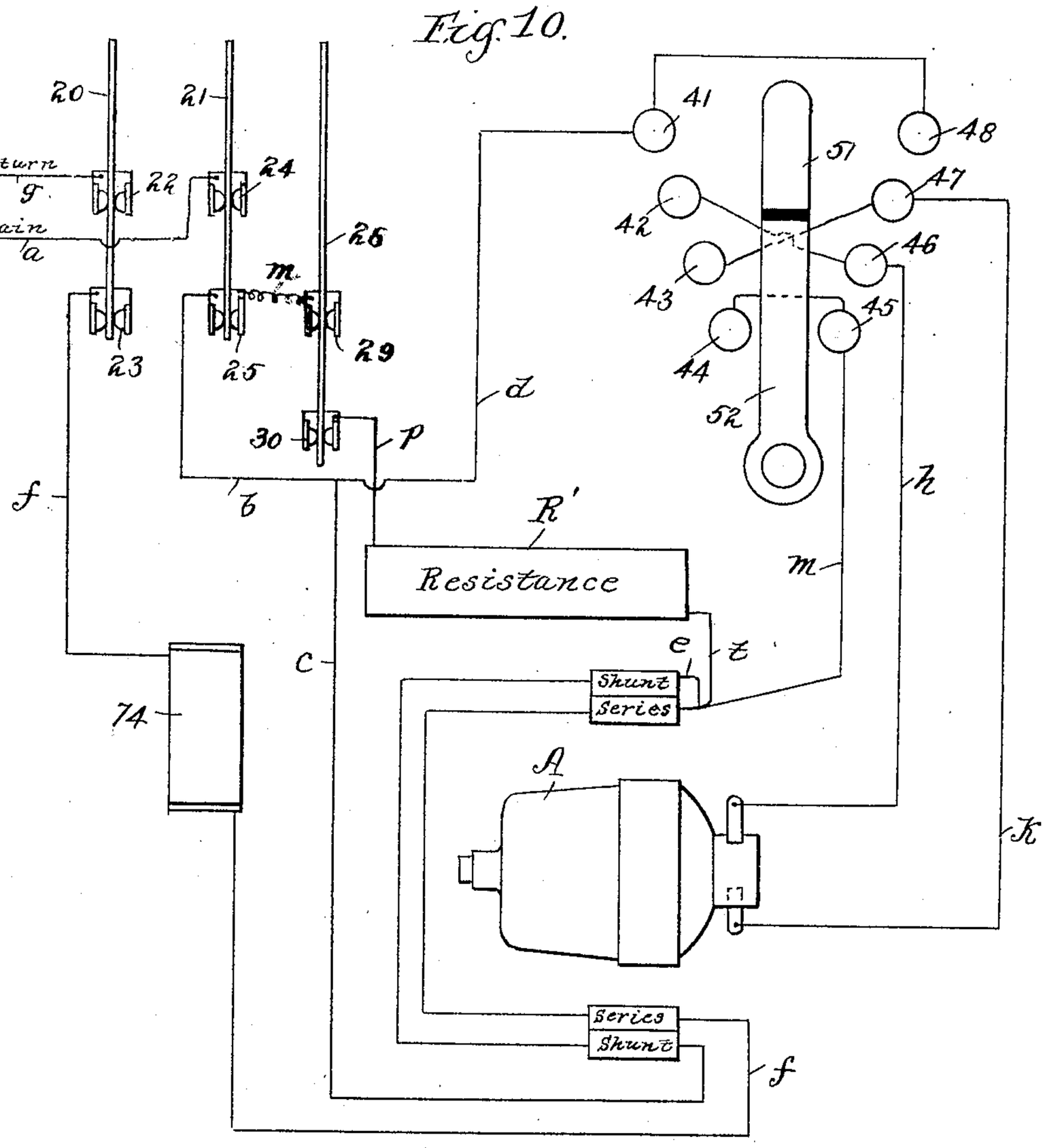
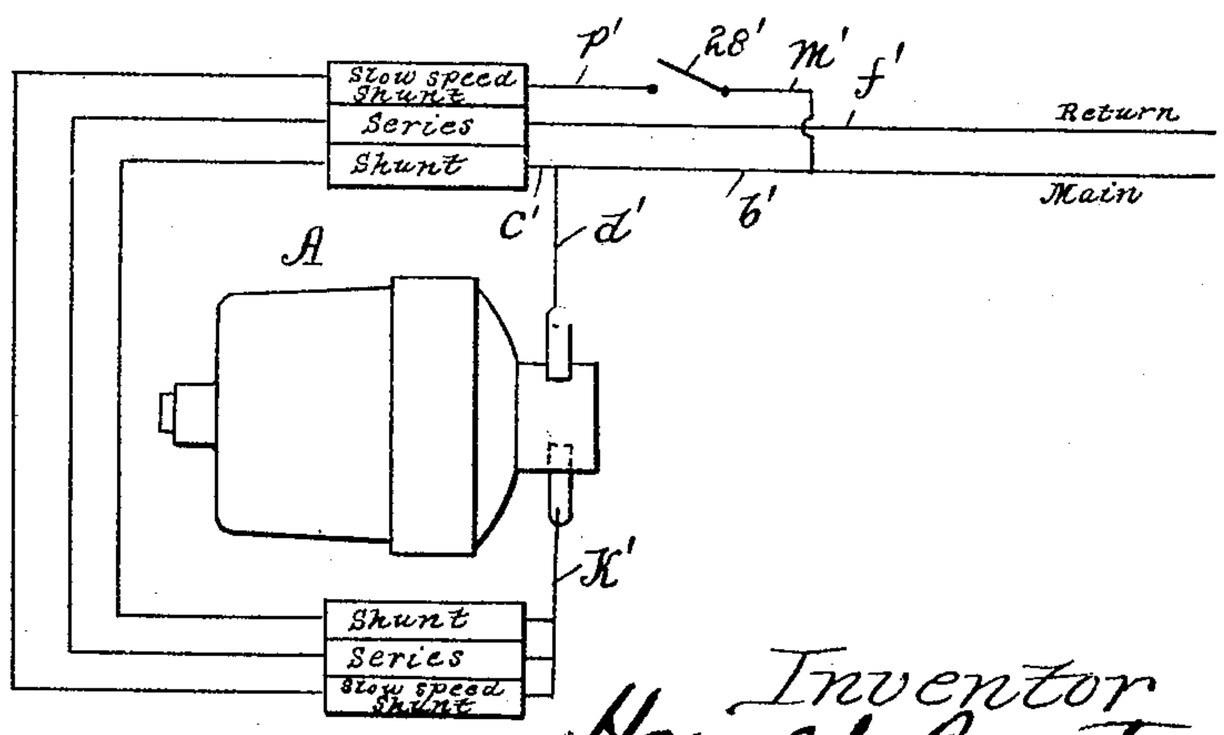


Fig. 11.



Witnesses.
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(Application filed Feb. 6, 1899.)

(No Model.) 5 Sheets—Sheet 5.

Fig. 12.

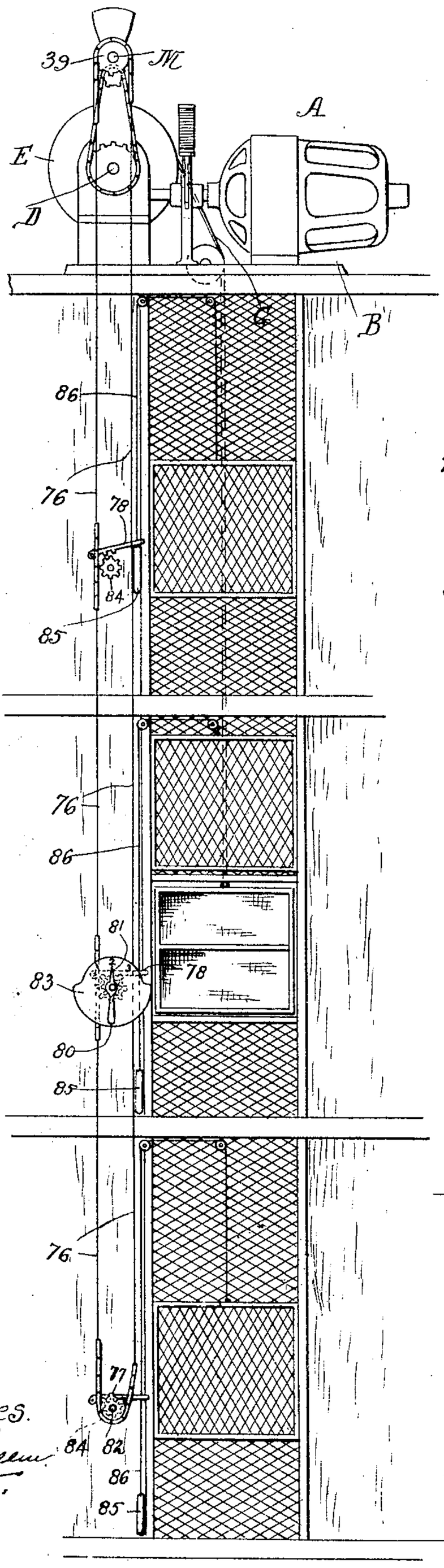


Fig. 13.

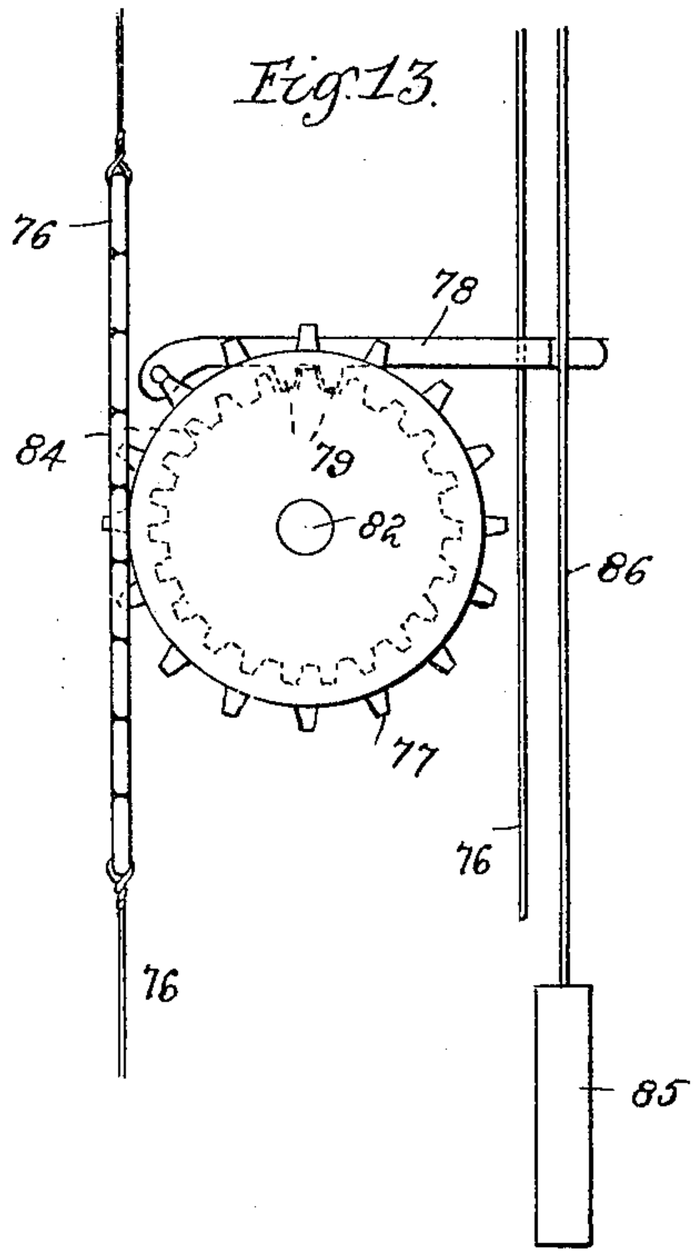
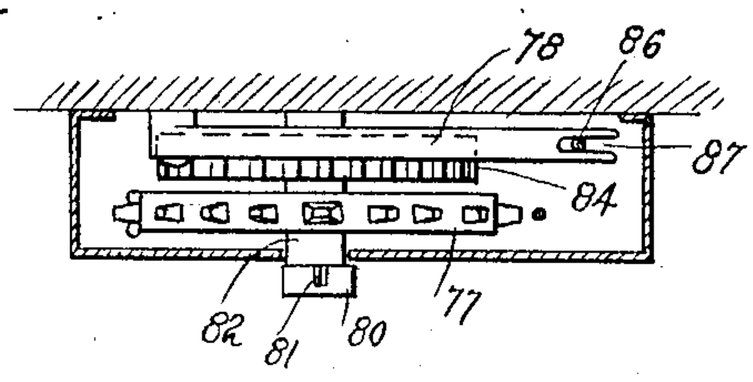


Fig. 14.



Witnesses.
Wm. M. Rheem
H. G. Barnett.

Inventor
Harold Rowntree
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UNITED STATES PATENT OFFICE.

HAROLD ROWNTREE, OF CHICAGO, ILLINOIS, ASSIGNOR TO THE BURDETT-ROWNTREE MANUFACTURING COMPANY, OF SAME PLACE.

AUTOMATIC ELECTRIC ELEVATOR.

SPECIFICATION forming part of Letters Patent No. 638,282, dated December 5, 1899.

Application filed February 6, 1899. Serial No. 704,666. (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 Automatic Electric Elevators, of which the following is a specification.

This invention relates to automatic electric elevators.

The object of the invention is to provide a construction and arrangement which is simple and efficient for automatically controlling the hoisting-motor of electric elevators.

A further object of the invention is to effect the control of the hoisting-motor from any landing or floor at which the car is to stop.

A further object of the invention is to provide means whereby when the motor is once put in action it will continue until the car reaches the landing predetermined upon.

A further object of the invention is to provide means whereby the motor when once put in action cannot be reversed until the car reaches its destination.

A further object of the invention is to provide means whereby the car automatically slows up in advance of stopping, thus coming to rest easily and without shock or jar.

A further object of the invention is to provide means whereby the apparatus is locked against action so long as the door at any one of the landings remains open.

Other objects of the invention will appear more fully hereinafter.

The invention consists, substantially, in the construction, combination, location, and arrangement of parts, all as will be more fully hereinafter set forth, as shown in the accompanying drawings, and finally specifically 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 view in side elevation of an electric-elevator-hoisting motor embodying the principles of my invention. Fig. 2 is an elevation of the same, looking from the right of Fig. 1. Fig. 3 is a broken detail view in section on the line 3 3, Fig. 1, looking in the direction of the arrows and showing the contact-arm for controlling the slow-speed circuit and the lock therefor. Fig. 4 is a detached detail view showing the main-circuit make-and-break switch-arms in closed position. Fig. 5 is a broken detail view of the reversing-switch, parts in transverse section. Fig. 6 is a similar view, in longitudinal section, of the same, showing the means for locking the switch against reverse movement. Fig. 7 is a detail view, the motor-shaft being in transverse section, showing the brake. Figs. 8 and 9 are detail views, respectively in top plan and side elevation, of the reversing-switch contacts. Fig. 10 is a view in diagram illustrating the various electric circuits. Fig. 11 is a similar view showing a slightly-modified arrangement of circuits. Fig. 12 is a general view showing the application of my invention to the operation of dumb-waiters. Fig. 13 is a broken detail view illustrating in side elevation and on an enlarged scale locking means for the motor-control devices. Fig. 14 is a detail view, in top plan, of the construction shown in Fig. 13, parts in transverse section.

The same part is designated throughout the several views by the same reference-sign.

In carrying out my invention I employ a motor, designated generally by reference-sign A, which may be of any suitable, convenient, or well-known construction and arrangement. This motor is mounted in a suitable manner upon a base-plate B, which forms a support for the framework C of the apparatus. In bearings formed in the framework is journaled the shaft D of the hoisting-drum E, said shaft being driven from the motor-shaft through a suitable arrangement of gears F. (Indicated in dotted lines in Fig. 2.) The cable G, which is attached to the car and through which the car is to be raised or lowered in its shaft or well, is designed to be coiled on drum E in the usual or any convenient or well-known manner.

I will first describe the construction and arrangement for automatically controlling the motor so that it will stop only when the car reaches a particular predetermined point. This idea may be carried into practical effect and operation in many specifically different ways. While therefore I have shown and will now describe a particular construction and arrangement for accomplishing the de-

sired object, I desire it to be understood that my invention is not limited or restricted to this specific construction. In the particular form shown I journal a worm or screw shaft H in suitable bearings in the frame, and I mount a threaded nut or block J upon said worm or screw to travel thereon when said shaft is rotated, said block or nut being held against rotation in any convenient way, as by means of a flange K, formed thereon, arranged to engage a suitable part or bar of the frame. Screw-shaft H is rotated coincidently with the drum E and in a coincident direction through any suitable or convenient arrangement of gearing—as, for instance, through a sprocket-chain L, respectively engaging gears on shafts D and H. Arranged parallel and in proximity to screw-shaft H is a shaft M, mounted to rock and also to slide longitudinally in suitable bearings in the framework. A series of sleeves or collars N are mounted on shaft M, each having a lug O. The collars N are adjustable rotarily upon shaft M and are relatively arranged, so as to present the lugs O thereof in spiral relation around said shaft. In practice I employ as many of the stop-collars as there are floors or landings at which the car is intended to stop. The stop-collars are so relatively arranged that when the apparatus is set for the car to stop at the first landing from the bottom, for instance, the shaft M is rocked in its bearings into position for the lug O on the second stop-collar to be brought into line with the traveling nut or block J, whereby as the car approaches the desired stopping-point the traveling nut will engage the lug of the stop-collar, and hence move stop-shaft M longitudinally in its bearings. By arranging the stop-collars so that the lugs O thereon may occupy relative positions spirally around the stop-shaft it will be readily seen that by rotating said stop-shaft the desired extent the stop-collar corresponding to any desired floor will be thus brought into position for the lug O thereon to be in the path of the traveling nut J and that said nut will pass by without engaging any intermediate stop-collar until it reaches the particular one brought into its path. When this point is reached, which, as above explained, occurs when the car is approaching the particular floor or landing at which it is to stop, the traveling nut engages the lug on the stop-collar and effects an endwise movement of the stop-shaft M. This endwise movement is effected in whichever direction the nut travels whenever the stop-shaft is rocked into suitable position to bring a stop-collar into its path. Pivotally supported from a collar P, carried by the end of the stop-shaft, is a lever or frame Q, arranged to freely bear intermediate its ends against a bracket R, carried by the frame, and also at the free end thereof against a bracket or arm S. A stout spring T (see Fig. 2) is connected at one end to lever Q and at the other to the frame C of the machine, said spring being preferably located between the brackets R S and operating to yieldingly maintain said lever Q pressed against said brackets. From this construction it will be seen that when stop-shaft M is moved longitudinally in one direction the lever Q is rocked about one of the brackets as a bearing-point or fulcrum; and when said shaft is moved longitudinally in the other direction said lever rocks about the other of said brackets as a bearing-point or fulcrum and that in either case the rocking movement of said lever is opposed by spring T. For instance, suppose shaft M is moved longitudinally toward the left from the position occupied thereby in Fig. 2 or toward the right in Fig. 3. It will be readily seen that the lever Q will fulcrum at the free end thereof against bracket S as a bearing, and if shaft M is moved longitudinally toward the right said lever will fulcrum about the bracket R, and in either case that portion of said lever lying between the brackets R S will move outwardly or away from the frame of the machine in whichever direction the shaft M is moved longitudinally. Attached to lever Q at a point between the points of contact of said lever with the brackets R S is an arm 15. (See Fig. 3.) This arm is longitudinally slotted, as at 16, to receive a pin or support 17, by which it is held and guided. The guide-pin 17 is carried by a frame 18, suitably pivoted or hinged upon a rod 19, mounted in the framework of the machine, and carries the main switch-arms 20 21, said switch-arms being insulated from said frame 18 and arranged, respectively, to be snapped into and out of contact with the spring-contacts 22, 23, 24, and 25, the contacts 24 and 25 controlling the main supply-circuit and the contacts 22 and 23 controlling the return-circuit. These contacts are suitably mounted upon an insulating base or plate 26, of slate, marble, fiberite, or the like, and are respectively included, as above explained, in the circuit of the main supply and return wires, as seen in the diagram Fig. 10. On the insulating-plate 26 is pivotally mounted an auxiliary switch-lever 27, arranged in the particular form shown, but to which the invention is not limited or restricted, in the form of a bell-crank lever pivotally supported at the angle. Upon one of the arms of such bell-crank lever is mounted a switch-arm 28, which is arranged to cooperate with a pair of contacts 29 30 to control the resistance or auxiliary field-coil circuit through which the motor is slowed down as the car approaches the particular landing or floor at which it is to stop, as will be explained more fully hereinafter. The switch-arm 28 is held normally out of contact with contacts 29 30 by means of a latch 31, arranged to engage a lug 32, formed on lever 27. The latch 31 is carried by or forms part of the frame 18, and the parts are so relatively arranged that when the main switch-arms 20 and 21 are in engagement with their respective contacts 22 23 24 25—that is, when the motor-working circuit is closed—the latch 31 is

in engagement behind lug 32 on lever 27, and hence operates to lock said lever against movement. A spring 33 is connected at one end to arm 34 of lever 27, and the other end thereof is connected to a fixed part of the frame, the tension of said spring being exerted to rock lever 27 in a direction to move the contact-arm 28 away from its coöperating contacts 29 30. A spring 35 is connected at one end to the arm 15 or to lever Q and at the other end is connected to latch 31, said spring exerting a tension upon said latch, and hence also upon frame 18, when lever Q is rocked and in a direction to throw the main contact-arms 20 21 out of engagement with their respective contacts. The arm 15 carries a set-screw 36, arranged to engage the arm 34 of lever 27 and to rock said lever when the arm 15 is moved by the outward swing of lever Q. By providing arm 15 with an elongated slot 16 it will be observed that said arm is permitted considerable travel relative to the frame 18, and this travel, it will be seen, imposes a tension on spring 35, which thus aids spring T (see Fig. 2) in opposing the rocking movement of lever Q and at the same time stores up energy, so to speak, to quickly cause the contact-arms 20 21 to snap out of contact with their respective contacts as soon as latch 31 is freed from lug 32. The same outward movement of arm 15 causes the end of set-screw 36 to engage arm 34, and hence rock lever 27 in a direction to free the lug 32 thereof from the end of latch 31.

The operation of this part of my invention is as follows: Suppose it is desired that the car stop at a particular floor. The stop-shaft M is accordingly set or axially rotated until the stop-collar N corresponding to that particular floor is brought into the path of the traveling nut J. The motor thereupon starts up, as under the conditions shown the main circuits are completed—that is, the switch-arms 20 21 are closed upon their contacts, and, as will be explained more fully hereinafter, the movement of the shaft M to proper position effects also the proper actuation of the reversing-switch to complete the motor-operating circuits and in the proper direction. The car proceeds upon its travel, while the traveling nut J also and correspondingly advances along the screw-shaft H. Finally, this nut engages the stop-collar and in the manner described effects a longitudinal movement of stop-shaft M, and hence a rocking movement of lever Q, which carries with it the arm 15. This movement begins as the car approaches to the point at which it is to stop. The set-screw 36, carried by arm 15, engages arm 34 of lever 27, and hence gradually rocks said lever in a direction to carry contact-arm 28 into contact with the contacts 29 30. This contact is effected before the latch 31 is released and, as will be more fully explained hereinafter, completes a circuit, which causes the motor to slow down. The continued movement of lever Q and arm 15 finally causes bell-crank lever 27 to rock far enough to disengage the end of latch 31 from lug 32. This point is reached when the car reaches the floor or landing at which it is to stop, and immediately the disengagement of said latch and lug is effected the tension of spring 35 causes the frame 18 to swing outwardly upon its support 19, thereby carrying the arms 20 21 out of engagement with contacts 22 23 and 24 25, respectively, thereby breaking the motor-circuits and applying the brake, presently to be described, and hence stopping the car. By returning the stop-shaft M to its initial position the stop-collar, which had been engaged by nut J to effect the operations above described, is freed from said nut, thereby permitting said shaft to be returned or moved longitudinally to its initial position under the influence of spring T acting upon lever Q. The return of said lever Q to its bearing against the brackets R S also causes the arm 15 to move backwardly or toward the left from the position thereof shown in Fig. 3, thus moving set-screw 36 away from arm 34 of lever 27, and hence permitting spring 33 to throw arm 28 out of engagement with contacts 29 30, thus disrupting the slow-speed circuit. It will also be seen that when the pin 17 reaches the limit of slot 16 during such backward movement of arm 15 said pin will be carried along with the arm, and since said pin is connected to or is mounted in swinging frame 18 said frame is swung in a direction to cause arms 20 21 to snap into engagement with their respective coöperating contacts, thus restoring the apparatus to condition to be operated. It is above stated that the stop-shaft M is returned to its initial position in order to restore the apparatus described to condition to be operated. It is obvious, however, that instead of returning said shaft to its initial position it may be moved to position corresponding to any other floor or landing at which it may be desired to stop the car, thus bringing another stop-collar into the path of traveling nut J, whereupon the motor starts up, and as the car approaches the landing determined upon the nut engages the collar, causing the stop-shaft to be moved longitudinally and repeating the operation above described, at first throwing arm 28 into engagement with its coöperating contacts 29 30, and hence completing a circuit, which results in slowing down the motor and finally breaking the motor-circuit when the car reaches its landing. In this manner the car is brought to rest easily and without shock or jar and exactly on a level with the desired landing. By adjusting set-screw 36 it will be seen that the exact point at which the latch 31 is freed from lug 32, and hence the exact moment the main or operating circuit contacts are broken, may be nicely adjusted and regulated.

It will be understood that the operation above described takes place whenever shaft M is moved longitudinally, whether in one

direction or the other, for when said shaft is moved in one direction the lever Q fulcrums about its contact at R, and when said shaft is moved in the other direction said lever fulcrums about its contact at S, and in either case that portion of the lever Q lying between the bearing-points R and S moves in a direction outwardly or away from the machine-frame, and since the arm 15 (see Fig. 1) and spring T (see Fig. 2) are connected to said lever Q at points between its bearing-contacts at R and S it will be seen that in whichever direction shaft M may move when the traveling nut J engages a stop-collar N thereon the arm 15 will always be moved in the same direction, and said arm when so moved causes the stop 36 to engage arm 34 and rock lever 27 to first carry the contact-arm 28 into engaging relation with its contacts 29 30 and then to disengage or release the catch 31 32, all as above explained.

It is important that when the stop-shaft M is rocked in one direction or the other, as above explained, to set the apparatus for a definite and predetermined cycle of operations the direction of current must also be suitably regulated to the end that the motor will operate in the desired direction. Therefore the reversing-switch, by which the direction in which the motor operates is controlled, should bear a definite coöperative relation to the movements of the stop-shaft. I will therefore now describe the construction, arrangement, and coöperative relation of the reversing-switch, it being understood that the particular form shown is designed merely as an illustrative embodiment of operative means and to which the invention is not to be limited or restricted. In the particular form shown I arrange the stop-shaft M to pass longitudinally through a sleeve 38, (see Figs. 2, 5, and 6,) which is suitably journaled in bearings formed in the framework. This sleeve is splined to rotate with the shaft M, but permits said shaft to move longitudinally therethrough. Upon said sleeve 38 is mounted a gear 39, through which in a suitable manner the rocking movements of stop-shaft M are controlled. Suitably mounted on the framework is an insulating-plate 40, carrying a series of contacts 41 42 43 44 45 46 47 48, suitably arranged to control the direction of flow of current through the motor-circuits, as will be more fully hereinafter explained. A casting or plate 49 is loosely mounted to swing upon sleeve 38. Carried by this plate is a sheet 50 of insulating material, upon which is mounted conducting-plates 51 52. Upon each of these conducting-plates is pivotally mounted a pair of arms 53 54, each carrying a socket 55 in the free end thereof, in which is mounted a carbon or other suitable contact-point 56, arranged to coöperate with the series of contacts 41 42 43 44 45 46 47 48, the pair of carbons or points carried by plate 51 serving to bridge the space between contacts 41 and 42 and those carried by plate 52 bridging the space between contacts 43 44 when the casting or plate 49 is swung to its limit in one direction, and the same parts bridging the space between contacts 48 47 and 46 45, respectively, when said casting or plate 49 is swung to its limit in the opposite direction. The several contacts 41, 42, 43, 44, 45, 46, 47, and 48 are suitably connected up in the motor-circuit, as will be more fully explained hereinafter, to control the direction in which the motor is to operate, according to the direction in which the casting or plate 49 is swung.

In order to secure the coöperative action of the reversing-switch and stop-shaft M, to which reference has hereinbefore been made, it is important to provide means whereby when said shaft is rocked in one direction or the other the casting or plate 49 is correspondingly swung or rocked. Many specifically different arrangements may be employed for accomplishing this result. Therefore while I have shown and will now describe a specific arrangement for accomplishing the desired object it is to be understood that my invention is not limited or restricted thereto. In the form shown I provide two sets of ratchet-teeth 57 58 upon the sleeve 38, the ratchet-teeth 57 presenting in the opposite direction with respect to the ratchet-teeth 58, and I pivotally mount upon casting or plate 49 two pawl-arms 59 60, the engaging ends of said arms arranged to straddle the sleeve 38, the one 59 on one side engaging the ratchet-teeth 58 and the one 60 on the other side engaging the ratchet-teeth 57. A spring 61 operates to draw the pawl-arms together. From this construction it will be seen that when sleeve 38, and with it the stop-shaft M, is rocked in one direction—say toward the right or with the hands of the clock, as viewed in Fig. 5—the teeth of ratchet 58 will engage the end of pawl-arm 59 and correspondingly swing plate or casting 49, and with it the contact-points or carbons 56, into coöperative relation with the contacts 48 47 46 45, the pawl-arm 60 riding idly over the teeth of its ratchet 57. Similarly when the sleeve 38, and with it stop-shaft M, is rocked in the opposite direction the teeth of ratchet 57 will engage pawl-arm 60 and swing the plate or casting 49 toward the left or into the position shown in Fig. 5, the pawl-arm 59 riding idly over the teeth of its ratchet 58. When the plate or casting 49 has reached the limit of its swing in one direction or the other—that is, when the apparatus has been set for the car to stop at a certain landing—it is desirable that the apparatus be so arranged that the car after stopping at the desired landing may subsequently proceed upon its travel in the same direction to some other floor or landing. In order to accomplish this result, the stop-shaft M must be rocked or rotated to a further point in the same direction as that in which it has been previously rocked in order to release the stop-collar thereon from engagement with the traveling nut J and to bring another stop-collar

corresponding to the next landing-place at which the car is to stop into the path of the traveling nut. This further rotation of sleeve 38 and shaft M in the same direction, however, must be effected without any further swing of the plate or casting 49, for the reason that said plate or casting has been previously swung to its limit when the stop-shaft was first rocked, and as the car is to proceed in the same direction as before no reversal of the direction of the current is required. In order, therefore, to permit of the further rotation of sleeve 38 without a further swing of the casting or plate 49 under the conditions named, it is necessary to disengage the pawl which effected the initial swing of such plate or casting from its ratchet. Therefore I provide the stop-pins 62 in the frame of the machine and arrange the same to respectively engage the pawls 59 60 when the plate or casting 49 is swung to one of its limits or the other and disengage said pawls. For instance, in the position of the parts as shown in Fig. 5 the pawl 60, through which the plate 49 was swung to its position, is shown thrown out of engagement with its ratchet by said pawl coming into engagement with a pin 62. By this arrangement sleeve 38 and shaft M may be rocked farther and farther in the same direction without carrying the contact-carrying plate 49 beyond the position to which it is swung with said sleeve and shaft at the first operation thereof, while at the same time any reverse rotation or rocking movement of said shaft and sleeve would be at once communicated to the plate 49 to cause the same to be swung to its opposite limit, thus bringing the contacts and points into suitable relation to reverse the motor.

In order to prevent the sleeve 38 and shaft M from being rotated too far—that is, in order to lock said parts against further rotation in the same direction when they have been rotated or rocked to positions corresponding to the extreme limits of travel of the car—I mount a collar 63 on said sleeve and provide the same with flanges 64, arranged to engage at the desired limits a pin or projection 65 on the framework of the machine. (See Figs. 2 and 6.) After the sleeve 38 and shaft M, together with the reversing-switch, have been set in the desired positions to cause the car to stop at any desired point or landing it is desirable and as a matter of safety to provide means whereby the reversing-switch is locked against movement in a direction to reverse the motor until the car arrives at the landing previously determined upon. This locking of the reversing-switch may be effected in many different ways. In the drawings I have shown a simple and efficient construction for accomplishing the desired object; but I do not desire to be limited or restricted thereto, as many variations therefrom and changes therein would readily occur to persons skilled in the art and still fall within the spirit and scope of the invention. In the form shown I provide the reversing-switch plate or casting 49 with a lug or projection 66, and I mount a rod 67 to slide longitudinally through a bearing in the framework of the machine, the free end of said rod arranged when projected endwise to engage on one side or the other of said lug 66 when the reversing-switch plate is thrown to one limit or the other, thereby preventing said switch-plate from being moved in the opposite direction until the rod 67 is withdrawn from its engagement with said lug 66. In order to secure the proper coöperative action of said locking-rod 67 with respect to the other parts of the apparatus, so that when the car stops at any landing said locking-rod is withdrawn automatically from engagement with lug 66, thereby enabling the reversing-switch to be moved as desired, but as soon as the said switch is set in the desired position, which, as above explained, is coincident with the actuation of stop-shaft M, and hence when said stop-shaft returns to its normal position with respect to its endwise movement, then it is important that the locking-rod be again projected into engagement with lug 66 on one side or the other thereof, according to the position occupied by the switching-plate. To accomplish this, I pivotally connect rod 67 to the free end of a lever 68, pivotally mounted at the opposite end upon a convenient part of the framework. This lever 68 is connected by link 69 with lever Q, and hence moves therewith. From this construction it will be seen that so long as lever Q remains in its normal or retracted position, and hence so long as the motor is operating and the car is traveling in either direction, the stop-rod 67 is in locking position with respect to the reversing-switch, and hence said switch cannot be thrown until the car arrives at its destination. When this point is reached, the nut J has engaged the stop-collar on shaft M and has projected said shaft, and hence has rocked lever Q, and therefore through link 69 and lever 68 the locking-rod 67 is withdrawn, thus enabling the reversing-switch to be thrown, if desired or required, for the next movement of the car. The moment the stop-shaft is again rotated to be set for the next stop of the car, whether said shaft is rotated still farther in the same direction or is reversely rocked, the stop-collar thereon, which has just been engaged by the nut J, is released therefrom, hence permitting the lever Q and shaft M to return to their normal positions and causing rod 67 to be again projected into locking relation with respect to the reversing-switch.

Of course it will be understood that the travel of nut J bears a definite relation to the travel of the car, and the stop-collars N are spaced a distance apart corresponding to the distance traveled by the nut J during the travel of the car from one stopping point or landing and the one next adjacent thereto.

In the foregoing description I have referred to the fact that the moment the car arrives

on a level with the floor or landing at which it is to stop the motor-circuit is broken by arms 20 21 snapping out of engagement with their respective contacts, and the brake is applied. In Figs. 1 and 7 I have shown a simple and efficient arrangement of brake of the strap type, wherein I mount a brake wheel or disk 70 upon the motor-shaft, and I arrange a strap 71 around said wheel. The ends of said strap are connected at suitable points on a pivoted lever 72, so that when said lever is rocked in one direction the strap is drawn tight around the wheel, thereby tending to arrest the rotation thereof, and when said lever is rocked in the other direction the strap is loosened upon said wheel. A weight 73, carried upon the end of said lever, operates to normally set or tighten the brake-strap upon the brake-wheel. A solenoid 74 is mounted adjacent to the brake-lever, and the core of said solenoid is connected thereto through a link 75 in such manner that when the coils of said solenoids are energized the core thereof, through its connection with the brake-lever, rocks said lever against the action of weight 73 and in a direction to release the brake-strap. In order that the brake may operate at the required time, I arrange the coils of the solenoid in the main circuit of the motor, as clearly indicated in the diagram in Fig. 10, and therefore as soon as the motor-circuit is broken by arms 20 21 being thrown out of engagement with their coöperating contacts then the core of the solenoid is released and the brake is applied under the influence of the weight 73.

In the foregoing description I have referred to the fact that the various operations mentioned are controlled through the rocking movement of sleeve 38 and stop-shaft M. It is evident that the rocking movement of said sleeve and shaft may be effected from the car or from any desired point, through suitable control-cables or otherwise, in a manner familiar to persons skilled in the art. However, and in order to illustrate the application of the principles of my invention I have shown in Figs. 12, 13, and 14 an arrangement whereby the rocking movements of said sleeve and shaft are controlled from each landing at which the car is designed to stop—as, for instance, in the operation of dumb-waiters, to which the invention is particularly adapted. In this construction I have shown a cable connection 76, preferably, though not necessarily, in the form of an endless sprocket-chain arranged around gear-wheel 39 on sleeve 38 and extending throughout the elevator shaft or well. At each landing I mount a sprocket-wheel 77, around which said chain passes, whereby by suitably turning a control-wheel at any landing not only is the gear 39 rotated, thereby rocking sleeve 38 and shaft M, but also the sprocket-gear at each of the other landings is also and coincidentally rocked. The gears 77 are each mounted on a shaft or support 82, to which is connected a lever 80, having a pointer 81, coöperating with a dial-plate 83, and since the several gears move coincidentally or in unison it will be readily seen that the dial-plate at each landing will indicate the position of the car. Each dial-plate is marked for each landing or stopping-point of the car, and when any one of the pointers is moved to any particular mark on it coöperating dial not only will all the other pointers be moved to a corresponding position, but the sleeve 38, and with it shaft M, will be rocked into position to set the apparatus to move the car to the particular landing indicated by the dial, and when the car reaches that point the motor will be automatically arrested.

In the proper operation of the system and in the interest of safety it is desirable to provide means whereby when the car arrives at any floor or landing and stops the apparatus should be locked while the passengers or freight are being loaded or unloaded. This idea may be carried out in many different ways. For instance, in the form shown, to which, however, the invention is not limited, I provide a lock operated by the movements of the door of the shaft or well and so arranged that when the door is opened the apparatus is locked and when the door is closed the apparatus is free to be operated. In the particular form of apparatus shown embodying these principles, but to which my invention is not limited or restricted, I mount a toothed wheel 84 upon the shaft or support 82 of each sprocket-gear 77, and I pivotally mount a lever 78 upon a convenient part of the framing of the shaft or well in position for the free end thereof to extend over its coöperating toothed gear, and I provide each lever with teeth or lugs 79, arranged to intermesh with and lock the toothed gear 84 whenever said lever is permitted to rest upon its gear. Any desired arrangement may be provided for disengaging said levers from their toothed gears whenever the door adjacent thereto is opened, the particular arrangement employed varying in the details thereof according as the door is a swinging door, a vertical-sliding door, a horizontal-sliding door, or the like. In the form illustrated I have shown vertical-sliding doors employing counterweights 85, connected in the usual way by cords 86 to the door, and I so relatively arrange the counterweight of each door with respect to the locking-lever 78 at the same landing therewith that when the door is closed the counterweight will engage the free end of the locking-lever and lift the same, so as to disengage the lugs or teeth thereon from engagement with its toothed gear, thereby unlocking the apparatus, as shown at the upper portion of Fig. 12, and when the door is raised the downward movement of the counterweight removes the elevating support of the lever, and hence will permit said lever to engage its gear 84, as shown in Fig. 13 and at the bottom of Fig. 12. As shown in Fig.

14, the end of the lever 78 may be slotted, as at 87, to permit the counterweight-cord 86 to pass therethrough. From this description it will be seen that whenever a door at any one of the landings or floors is opened the entire apparatus is locked and cannot be operated from any other point until all the doors are closed, thus efficiently providing against danger or accident.

I will now describe the motor-circuits and their leads and the electrical operation, particular reference being had to the diagrams Figs. 10 and 11. Current is supplied from a main or bus wire *a*, drawing current from any suitable source, and which is connected to contact 24. When contact-arm 21 is closed upon contacts 24 25, the positive circuit is established as follows: from main supply-wire *a* to contact 24, arm 21, contact 25, wire *b*, then dividing, part of the current continuing through wire *c*, the shunt-field coils of the motor, wire *e*, the series-field coils of the motor, wire *f*, contact 23, arm 20, contact 22 to return-wire *g*. The other branch leads from wire *b*, through wire *d*, to contact 41, which is also in electrical connection with contact 48 of the reversing-switch. Now suppose the reversing-switch to be thrown to the left from the position thereof as indicated in Fig. 10—that is, so as to bring the two contacts 56 of the plate 51, (see Figs. 6, 8, and 9,) respectively, into contact with contacts 41 and 42—the space between contacts 41 and 42 is thereby bridged. Contact 42 is electrically connected to contact 46. Therefore the circuit continues to contact 46, thence by wire *h* through the motor-armature, returning by wire *k* to contact 47, which is electrically connected to contact 43. Now under the conditions above stated the reversing-switch is thrown to the left, thereby bridging the space between contacts 43 44 by means of the two contacts carried by the plate 52, and hence completing the circuit to contact 44. This contact is in electrical connection with contact 45, and from thence the circuit continues through wire *m*, the series windings of the motor-field wire *f*, to return-wire *g*, as above described. Similarly if the reversing-switch is thrown to the right from the position thereof, as indicated in Fig. 10, thus bridging the space between contacts 48 47 and between contacts 46 45, the circuit will be as follows: wire *d*, contact 48, contact 47, wire *k*, the motor-armature windings, wire *h*, contact 46, contact 45, wire *m*, and on as before, the only difference being that the direction of the current through the motor-armature is reversed, thereby reversing the action of the motor. It will thus be observed that in the particular form shown, to which the invention is not limited, I employ a combination of shunt and series windings for the motor-field—that is, a portion of the main current is shunted through the motor-field, and a portion after passing through the motor-armature also passes in series through a portion of the field. In addition, that part of the current which is shunted through the field also passes through the series coils of the motor-field. I have found in practice that such arrangement produces a very satisfactory and steady operation of the motor.

In order to secure the slowing down of the motor as the car approaches the particular landing at which it is to stop, the contact-arm 28, actuated, as above described, at the proper point in the operation, closes upon contacts 29 30, thereby establishing a branch circuit as follows: from contact 25, through wire *m*, to contact 29, arm 28, contact 30, wire *p*, resistance R′, wire *l*, through the series-field coils and to return-wire *f*. Thus the completion of this branch circuit, which occurs somewhat in advance of the breaking of the main circuit, divides the operating-current and shunts through the field-coils a portion thereof which has previously been flowing through the armature, thereby strengthening the field and also reducing the armature-current, and hence operating as an electrical retarder or brake to reduce the speed of the motor. This operation takes place, as above explained, just before the car arrives at the point where it is to stop, and therefore when the motor-circuit is completely broken by the arms 20 21 leaving their respective contacts the speed of the motor has been reduced, thus bringing the car to rest at the required point easily and gently and without shock or jar.

In Fig. 11 I have indicated a slight modification, wherein, instead of securing the slowing down of the motor as the car approaches the point at which it is to stop by shunting a portion of the operating-current through an external resistance and thence through the field-coils, I shunt such portion of the current directly through auxiliary field-coils, thus utilizing the current which in the first case expended its energy largely in merely heating up the resistance-coils and without performing useful work, by sending such current through a portion of the field itself, thus largely increasing and building up the field, and hence reducing the speed. This result I secure by passing the current from the main supply-conductor through wire *b′*, whence it divides, part going through wire *c′*, the shunt-field coils, thence back to the series-field coils, wire *f*, and to the return-conductor. The other part of the main current passes through wire *d′*, the motor-armature, wire *k′*, the series-field coils, and on to the return-conductor. So far the operation and arrangement of circuits is the same in all essentials as described with reference to Fig. 10. In order to secure the slowing-down effect of the motor, the switch-arm 28′, which may be identical in construction and operation with that above described with respect to arm 28, is closed, thus completing a branch or shunt circuit as follows: from the main supply-conductor through wire *m′*, switch 28, wire *p′*,

the auxiliary field-coils,(marked "slow-speed shunt" in the diagram Fig. 11,) thence through the series-field coils to the return-conductor, as before described. Thus it will be seen that when the car is at rest the switch-arms 20 21 are out of engagement with their respective contacts and the motor-circuit is broken, and when the car is moving the switch-arms 20 21 are closed and switch-arm 28 is open. As the car approaches the point previously determined upon as its stopping-place the arm 28 is automatically closed, thus establishing the slow-speed shunt-circuit and sending a portion of the operating-current either through an external resistance-coil and thence through the series-field coils to return, as in Fig. 10, or else through auxiliary field-coils and thence through the series-field coils to return, as in Fig. 11, and in both cases reducing the current sent through the armature, thus reducing the speed by increasing the field. Finally, when the car reaches the point at which it is to stop the switch-arms 20 21 are snapped out of contact with their contacts, thereby breaking the motor-circuit, and hence causing the mechanical brake to be applied.

It will be seen that the reversing-switch is so arranged that it can be moved only when the switch-arms 20 21 are out of engagement with their contacts, and hence when no current is flowing through the motor-circuits, therefore avoiding danger and damage resulting from arcs or flashes at the reversing-switch.

It is obvious that the principles of my invention may be embodied in a wide variety of specific forms of apparatus and still fall within the spirit and scope thereof. I do not desire, therefore, to be limited or restricted to the exact details of construction and arrangement shown and described; but,

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

1. In an elevator, a hoisting-motor, circuits therefor, and means actuated by said motor for automatically reducing the current passing through the motor-armature as the car approaches any predetermined stopping-point, and means for controlling the motor-actuated current-reducing means, as and for the purpose set forth.

2. In an elevator, a hoisting-motor, circuits therefor, and means for automatically shunting part of the armature-current around the armature as the car approaches any predetermined stopping-point, as and for the purpose set forth.

3. In an elevator, a hoisting-motor, circuits therefor, switches for controlling said circuits, a shunt-circuit around the motor-armature, an auxiliary switch for controlling said shunt-circuit, and means for automatically operating said auxiliary switch as the car approaches any predetermined landing, as and for the purpose set forth.

4. In an elevator, a hoisting-motor, circuits therefor, main switches for controlling said circuits, a shunt-circuit around the motor-armature, an auxiliary switch for said shunt-circuit, and means for closing said auxiliary switch in advance of the opening of said main switches, as and for the purpose set forth.

5. In an elevator, a hoisting-motor, circuits therefor, and means for automatically shunting a part of the motor-armature current through the motor-field as the car approaches any predetermined stopping-point, whereby the field is strengthened and the speed of the motor is reduced, as and for the purpose set forth.

6. In an elevator, a hoisting-motor, circuits therefor, and means for automatically strengthening the field of the motor as the car approaches any predetermined stopping-point, as and for the purpose set forth.

7. In an elevator, a hoisting-motor, circuits therefor, a shunt-circuit through the motor-field coils, a switch for controlling said shunt-circuit, and means for automatically closing said switch as the car approaches any predetermined stopping-point, as and for the purpose set forth.

8. In an elevator, a hoisting-motor, armature and field circuits for said motor, an auxiliary field-circuit in shunt with the armature-circuit, and means for automatically closing said auxiliary circuit as the car approaches any predetermined stopping-point, as and for the purpose set forth.

9. In an elevator, a hoisting-motor, armature and field circuits therefor, a portion of the field-circuit being in series with the armature, an auxiliary field-circuit in series with the series portion of the field-circuit, but in shunt with the armature, and means for closing said auxiliary circuit as the car approaches any predetermined stopping-place, as and for the purpose set forth.

10. In an electric elevator, a motor, circuits therefor, a shunt-circuit across the armature and through the field, and means for automatically closing said shunt-circuit as the car approaches any predetermined stopping-point, as and for the purpose set forth.

11. In an electric elevator, a motor, circuits therefor, a main switch for controlling said circuits, a slow-speed circuit, for said motor, an auxiliary switch for controlling the same, means operating in unison with the travel of the car for actuating said switches, said means operating to close said auxiliary switch in advance of the opening of said main switch, as and for the purpose set forth.

12. In an electric elevator, a motor, a main switch for controlling the circuits of said motor, a speed-reducing circuit, an auxiliary switch for controlling the same, a trip for maintaining said auxiliary switch open, and means operated in unison with the travel of

the car for releasing said trip as the car approaches a stopping-point, as and for the purpose set forth.

13. In an electric elevator, a motor, circuits therefor, a main switch for controlling said circuits, a speed-reducing circuit in shunt with the motor-armature circuit, an auxiliary switch for controlling said shunt-circuit, a latch arranged to retain said auxiliary switch open, said latch connected to move with said main switch, and means operating as the car approaches a stopping-point for disengaging said latch, as and for the purpose set forth.

14. In an electric elevator, a motor, circuits therefor including a speed-reducing circuit in shunt with the armature-circuit, a switch for controlling the main circuits of said motor, an independently-mounted switch for controlling said shunt-circuit, means whereby when said main switch is closed said independent switch is opened, and means for closing said independent switch in advance of the opening of said main switch, as and for the purpose set forth.

15. In an elevator, a motor, circuits therefor including a speed-reducing circuit, a switch for the main working circuit, an auxiliary switch for the speed-reducing circuit, a nut mounted to travel in unison with the car, and means arranged to be engaged by said nut as the car approaches a stopping-point for closing said auxiliary switch, as and for the purpose set forth.

16. In an elevator, a motor, circuits therefor including a speed-reducing circuit, a switch for the main working circuit, an auxiliary switch for the speed-reducing shaft, a nut mounted to travel in unison with the car, a shaft having stops arranged to be set in the path of said nut, whereby as the car approaches a stopping-point said shaft is moved endwise, and means actuated by the endwise movement of said shaft for closing said auxiliary switch and opening said main switch, as and for the purpose set forth.

17. In an elevator, a motor, circuits therefor including a normally-open speed-reducing circuit, a shaft having stops, a nut mounted to travel in unison with the car, means for setting said stops in the path of said nut, whereby as the car approaches a stopping-point said shaft is moved, and means actuated by the movement of said shaft for closing said slow-speed circuit, as and for the purpose set forth.

18. In an elevator, a motor, circuits therefor, a nut mounted to travel in unison with the car, a series of stops corresponding to the various stopping-places of the car, means whereby any one of said stops may be set at will in the path of said nut to be engaged thereby, and means actuated by the movement of said stop for breaking said motor-circuits, as and for the purpose set forth.

19. In an elevator, a motor, circuits therefor, a nut mounted to travel in unison with the car, a rock-shaft mounted for longitudinal movement and carrying a series of stops, said stops arranged to correspond to the various stopping-places of the car, means for rocking said shaft, whereby any one of said stops may be set in the path of said nut, and means actuated by the longitudinal movement of said shaft for breaking the motor-circuit, as and for the purpose set forth.

20. In an elevator, a motor, circuits therefor including a normally-open speed-reducing circuit, a nut mounted to travel in unison with the car, a rock-shaft having stops corresponding in arrangement with the various stopping-places of the car, means for rocking said shaft into position to set any one of said stops in the path of said nut, whereby as the car approaches the corresponding stopping-point said stop is engaged by said nut and said shaft is moved endwise, and means actuated by the endwise movement of said shaft for closing said speed-reducing circuit, and then as the car reaches its stopping-point, opening the main working circuit, as and for the purpose set forth.

21. In an elevator, a motor, circuits therefor, a series of stops corresponding to the various landings at which the car is to stop, means actuated from each landing for setting any one of said stops into operative position, means actuated in unison with the travel of the car for engaging the stop which occupies operative position and moving the same, and means actuated by the movement of said stop for breaking the motor-circuit, as and for the purpose set forth.

22. In an elevator, a motor, circuits therefor, switches for controlling said circuits, a rock-shaft mounted for longitudinal movement, a series of stops mounted on said shaft and corresponding in relative arrangement to the various landings at which the car is to stop, means whereby said shaft may be rocked to bring any desired stop into operative position, means actuated in unison with the travel of the car for engaging the stop occupying operative position, whereby when the car approaches the landing corresponding to said stop, said shaft is moved longitudinally, and means actuated by the longitudinal movement of said shaft for operating said switches, as and for the purpose set forth.

23. In an elevator, a motor, switches for controlling the circuits of said motor, a series of stops corresponding respectively to the various landings at which the car is to stop, means for setting any one of said stops into operative position, means actuated in unison with the travel of the car for engaging and moving the stop which occupies operative position, as the car approaches the desired landing at which it is to stop, a lever arranged to be rocked by the movement of said stop, and connections between said lever and switches for actuating the latter, as and for the purpose set forth.

24. In an elevator, a hoisting-motor, switches for controlling the circuits of said motor, a le-

ver, means corresponding to each landing at which the car is to stop and operated in unison with the travel of the car for rocking said lever only when the car approaches the particular predetermined landing at which it is to stop, and connections between said lever and switches for operating the latter, as and for the purpose set forth.

25. In an elevator, a hoisting-motor, a switch for controlling the circuits of said motor, a lever, a spring connected at the ends thereof respectively to said switch and lever, whereby when said lever is rocked said spring is placed under tension tending to open said switch, a latch for holding said switch closed, means actuated by said lever for tripping said latch, and means operating in unison with the travel of the car for rocking said lever only as the car approaches the particular landing at which it is to stop, as and for the purpose set forth.

26. In an elevator, a hoisting-motor, a switch for controlling the circuits of said motor, a lever, an arm connected to said lever and having a slot, a pin or projection carried by said switch, operating in said slot, a spring connected at one end to said switch and at the other to said lever, means for locking said switch in closed position during the travel of the car, and means for rocking said lever and releasing said lock when the car arrives at the particular landing at which it is to stop, as and for the purpose set forth.

27. In an elevator, a hoisting-motor, a switch, a lever, an arm connected to said lever and provided with an elongated slot, a pin or projection carried by said switch and operating in said slot, a spring connected at one end to said switch and at the other to said lever, means for locking said switch in closed position during the travel of the car, means actuated by the movement of said arm for releasing said lock, and means operating in unison with the travel of the car for rocking said lever only as the car approaches the particular landing at which it is to stop, as and for the purpose set forth.

28. In an elevator, a hoisting-motor, a switch for the circuits of said motor, means for locking said switch in closed position during the travel of the car, and means actuated in unison with the travel of the car for mechanically releasing said lock only when the car arrives at the particular landing at which it is to stop, as and for the purpose set forth.

29. In an elevator, a hoisting-motor, a controlling-switch therefor, means for locking said switch in closed position during the travel of the car, and means operating in unison with the travel of the car for releasing said lock and opening said switch only when the car arrives at the particular landing at which it is to stop, as and for the purpose set forth.

30. In an elevator, a hoisting-motor, a controlling-switch therefor, means for locking said switch in closed position during the travel of the car, means actuated in unison with the travel of the car for imposing a tension on said switch tending to open the same as the car approaches the particular landing at which it is to stop, and means for releasing said lock when the car arrives at such landing, as and for the purpose set forth.

31. In an elevator, a hoisting-motor having a working circuit and a slow-speed circuit, a main switch for the working circuit, an auxiliary switch for the slow-speed circuit, means for imposing a tension on said main switch tending to open the same, as the car approaches the particular landing at which it is to stop, a latch for holding said main switch closed and said auxiliary switch open during the travel of the car, said latch permitting said auxiliary switch to close before the car arrives at its stopping-point, and means for releasing said latch as the car arrives at its stopping-point, as and for the purpose set forth.

32. In an elevator, a hoisting-motor, a main switch and a slow-speed switch, a lever carrying an arm, said arm when moved arranged to engage and operate said switches, a spring connected at its ends respectively to said main switch and lever, a latch for holding said main switch closed and said slow-speed switch open, and means for rocking said lever only when the car approaches the particular landing at which it is to stop, as and for the purpose set forth.

33. In an elevator, a hoisting-motor, a main switch and a slow-speed switch, a swinging frame carrying said main switch, a lever carrying an arm, said arm when moved arranged to engage and move said frame and said slow-speed switch, a latch for locking said frame in position to hold said main switch closed and said slow-speed switch in open position, and means operating in unison with the travel of the car for rocking said lever only when the car approaches the particular landing at which it is to stop, as and for the purpose set forth.

34. In an elevator, a hoisting-motor, a swinging frame carrying the main switch for starting and stopping said motor, a bell-crank lever carrying an auxiliary switch for controlling the slow-speed circuit of said motor, a lever carrying a slotted arm having a flange arranged in the path of one arm of said bell-crank lever, said bell-crank lever having a lug, a latch carried by said swinging frame and arranged to engage said lug, thereby constituting a lock for said switches, said frame having a pin or projection arranged to operate in the slot in said arm, a spring connected at one end to said frame and at the other to said lever, and means for rocking said lever only when the car approaches the particular landing at which it is to stop, as and for the purpose set forth.

35. In an elevator, a hoisting-motor, a switch for controlling said motor, a lever pivotally mounted at one end and having a loose bearing at two different points in the length thereof, a spring operating to hold said lever in

contact with said bearings, means for moving the pivoted end of said lever whereby it rocks about one or the other of said bearings according to the direction in which the pivoted end of said bearing moves, and connections between said lever and switch for actuating the latter, as and for the purpose set forth.

36. In an elevator, a hoisting-motor, a switch for controlling said motor, a framework having bearing projections, a lever pivotally mounted at one end thereof, a spring normally operating to maintain a bearing of said lever against said bearing projections, one of said projections arranged at the free end of said lever and the other intermediate said ends, means for moving the pivoted end of said lever whereby said lever is rocked about one or the other of said bearing projections, and an arm connected to said lever at a point between said bearing projections, said arm operating to control said switch, as and for the purpose set forth.

37. In an electric elevator, a hoisting-motor, a working circuit therefor, a main switch for opening and closing said circuit, a reversing-switch arranged in said circuit, and means for locking said reversing-switch against reverse movement when said main switch is closed, as and for the purpose set forth.

38. In an electric elevator, a hoisting-motor, a working circuit therefor, a main switch and a reversing-switch, means operated only when the car arrives at the particular landing at which it is to stop for opening said main switch, and means for locking said reversing-switch while said main switch is closed, as and for the purpose set forth.

39. In an electric elevator, a motor, a circuit therefor, a main switch and a reversing-switch, a lever operated only when the car arrives at the particular landing at which it is to stop for opening said main switch, a lock for the reversing-switch, and means operated by the movement of said lever to open the main switch for releasing said lock, as and for the purpose set forth.

40. In an electric elevator, a motor, a working circuit therefor, a main switch and a reversing-switch, a lock for said reversing-switch, a lever for opening said main switch, means actuated only when the car arrives at the particular landing at which it is to stop for rocking said lever, and connections between said lever and lock whereby the latter is released when said main switch is opened, as and for the purpose set forth.

41. In an electric elevator, a motor, a circuit therefor, a main switch and a reversing-switch, a lug formed on said reversing-switch, a rod arranged to engage said lug and lock said reversing-switch, means operated only when the car arrives at a predetermined stopping-point for opening said main switch, and connections between said rod and main switch for releasing said reversing-switch when said main switch is opened, as and for the purpose set forth.

42. In an elevator, a motor, a circuit therefor, a main switch and a reversing-switch, a lug carried by said reversing-switch, a rod arranged to engage said lug, a lever for opening said main switch, means actuated only when the car arrives at a predetermined stopping-point for rocking said lever, and connections between said lever and rod, as and for the purpose set forth.

43. In an elevator, a motor, a controlling-switch therefor, a reversing-switch, a stop-shaft for actuating said controlling-switch, and means operated by said shaft for setting said reversing-switch, as and for the purpose set forth.

44. In an elevator, a motor, a main switch, a reversing-switch, a rock-shaft mounted for longitudinal movement, means actuated by the longitudinal movement of said shaft for opening and closing said main switch, and means actuated by the rocking movement of said shaft for controlling said reversing-switch, as and for the purpose set forth.

45. In an elevator, a motor, a main and a reversing switch therefor, a rock-shaft mounted for longitudinal movement and carrying a series of stops corresponding in arrangement to the various landings at which the car is to stop, means for rocking said shaft to set any one of said stops in operative position, means operated in unison with the movement of the car for engaging the stop which occupies operative position as the car approaches the landing corresponding to said stop, to move said shaft longitudinally, means actuated by the longitudinal movement of said shaft for operating said main switch, and means operated by the rocking movement of said shaft for setting said reversing-switch, as and for the purpose set forth.

46. In an elevator, a motor, a main switch and a reversing-switch, a rock-shaft mounted for longitudinal movement, means actuated by the longitudinal movement of said shaft for opening and closing said main switch, means actuated by the rocking movement of said shaft for setting said reversing-switch, and means for automatically moving said shaft endwise as the car approaches a predetermined landing, as and for the purpose set forth.

47. In an elevator, a motor, a main and a reversing switch, a rock-shaft mounted for longitudinal movement, means actuated by the longitudinal movement of said shaft for opening and closing said main switch, means actuated by the rocking movement of said shaft for setting said reversing-switch, a lock for locking said reversing-switch when set, and means for releasing said lock only when the main switch is opened, as and for the purpose set forth.

48. In an elevator, a hoisting-motor, circuits therefor, a main switch, devices actuated in unison with the travel of the car for automatically opening said switch only when the car arrives at a particular predetermined landing, and means for locking said devices against

derangement while the car is in motion, as and for the purpose set forth.

49. In an elevator, a hoisting-motor, controlling mechanism for starting said motor, means arranged to be actuated in unison with the travel of the car and operating only when the car approaches any particular landing to arrest said motor, and means for locking said motor against reverse movement during the travel of the car to the landing previously determined upon, as and for the purpose set forth.

50. In an elevator, a hoisting-motor, a main switch for starting and stopping said motor, a stop-shaft arranged to be set to correspond to any particular landing at which the car is to stop, whereby when the car approaches the predetermined landing the circuit of the motor at the main switch is broken, ratchets carried by said stop-shaft, a reversing-switch, and pawls carried by said reversing-switch arranged to be engaged by said ratchets for actuating said reversing-switch, as and for the purpose set forth.

51. In an elevator, a hoisting-motor, circuits therefor, a main switch, a stop-shaft for operating said switch, a reversing-switch, ratchets, having oppositely-arranged teeth mounted on said stop-shaft, pawls carried by said reversing-switch and respectively arranged to engage the teeth of said ratchets, as and for the purpose set forth.

52. In an elevator, a hoisting-motor, circuits therefor, a main switch, a stop-shaft, a reversing-switch, ratchets operated in unison with the rotary movements of said stop-shaft, pawls carried by said reversing-switch and arranged to be engaged by said ratchets, and a stop for locking said reversing-switch, as and for the purpose set forth.

53. In an elevator, a framework, a motor, circuits therefor, a main switch, a sleeve journaled in a bearing in said framework, a shaft journaled in said sleeve for rotary movement therewith but capable of longitudinal movement therethrough, means whereby said shaft governs said main switch, a reversing-switch loosely mounted on said sleeve, said sleeve provided with ratchets, and pawls carried by said reversing-switch and arranged to be engaged by said ratchets, as and for the purpose set forth.

54. In an elevator, a hoisting-motor, circuits therefor, a main switch, a shaft arranged to control said main switch, ratchets having teeth presenting in opposite directions and operating in unison with the rotary movements of said shaft, a reversing-switch carrying pawls respectively arranged to engage the teeth of said ratchets, whereby when said shaft is rocked in one direction one of said pawls is engaged to shift the reversing-switch in one direction, and when said shaft is rocked in the other direction the other of said pawls is engaged to shift the reversing-switch in the opposite direction, as and for the purpose set forth.

55. In an elevator, a hoisting-motor, circuits therefor, a main switch, a shaft arranged to control said main switch, ratchets having teeth presenting in opposite directions and operating in unison with the rotary movements of said shaft, a reversing-switch carrying pawls respectively arranged to engage the teeth of said ratchets, whereby when said shaft is rocked in one direction one of said pawls is engaged to shift the reversing-switch in one direction, and when said shaft is rocked in the other direction the other of said pawls is engaged to shift the reversing-switch in the opposite direction, and means whereby when the reversing-switch arrives at the limit of its movement in either direction the operating-pawl is disengaged, thereby permitting the shaft to continue to rotate in the same direction, as and for the purpose set forth.

56. In an elevator, a hoisting-motor, circuits therefor, a main switch for controlling the circuits of the hoisting-motor, means for controlling said main switch from any landing at which the car is to stop, and means for locking said controlling mechanism when any one of the elevator shaft or well doors is in open position, as and for the purpose set forth.

57. In an elevator, a hoisting-motor, circuits therefor, means for controlling the operation of said motor, a gear arranged at each landing at which the car is to stop, each of said gears adapted to actuate said motor-controlling means, and a lock for each gear, said locks arranged to be released only when the adjacent elevator shaft or well door is closed, as and for the purpose set forth.

58. In an elevator, a hoisting-motor, circuits therefor, means for controlling said circuits, a sprocket-chain arranged to extend throughout the elevator shaft or well, a sprocket-gear arranged at each landing or floor at which the car is to stop, all of said gears being simultaneously engaged by said sprocket-chain, whereby when any one of said gears is actuated said motor-circuit-controlling mechanism is operated, a lock for each of said gears, and means operated by the closing of the elevator shaft or well door for disengaging said locks, as and for the purpose set forth.

59. In an elevator, a hoisting-motor, a controller therefor, means for actuating said controller arranged at each landing or floor at which the car is to stop, said means including a rock-shaft, and a dial associated therewith, connections whereby all of said dials operate in unison, and a lock for each dial, said lock arranged to be engaged or released according as the adjacent door of the shaft or well is opened or closed, as and for the purpose set forth.

In witness whereof I have hereunto set my hand, this 31st day of January, 1899, in the presence of the subscribing witnesses.

HAROLD ROWNTREE.

Witnesses:
S. E. DARBY,
E. C. SEMPLE.