No. 722,756. PATENTED MAR. 17, 1903.

J. H. ROBERTS.

ELECTRICAL APPLIANCE FOR ELEVATORS.

APPLICATION FILED JAN. 13, 1903.

NO MODEL. 4 SHEETS—SHEET 1.

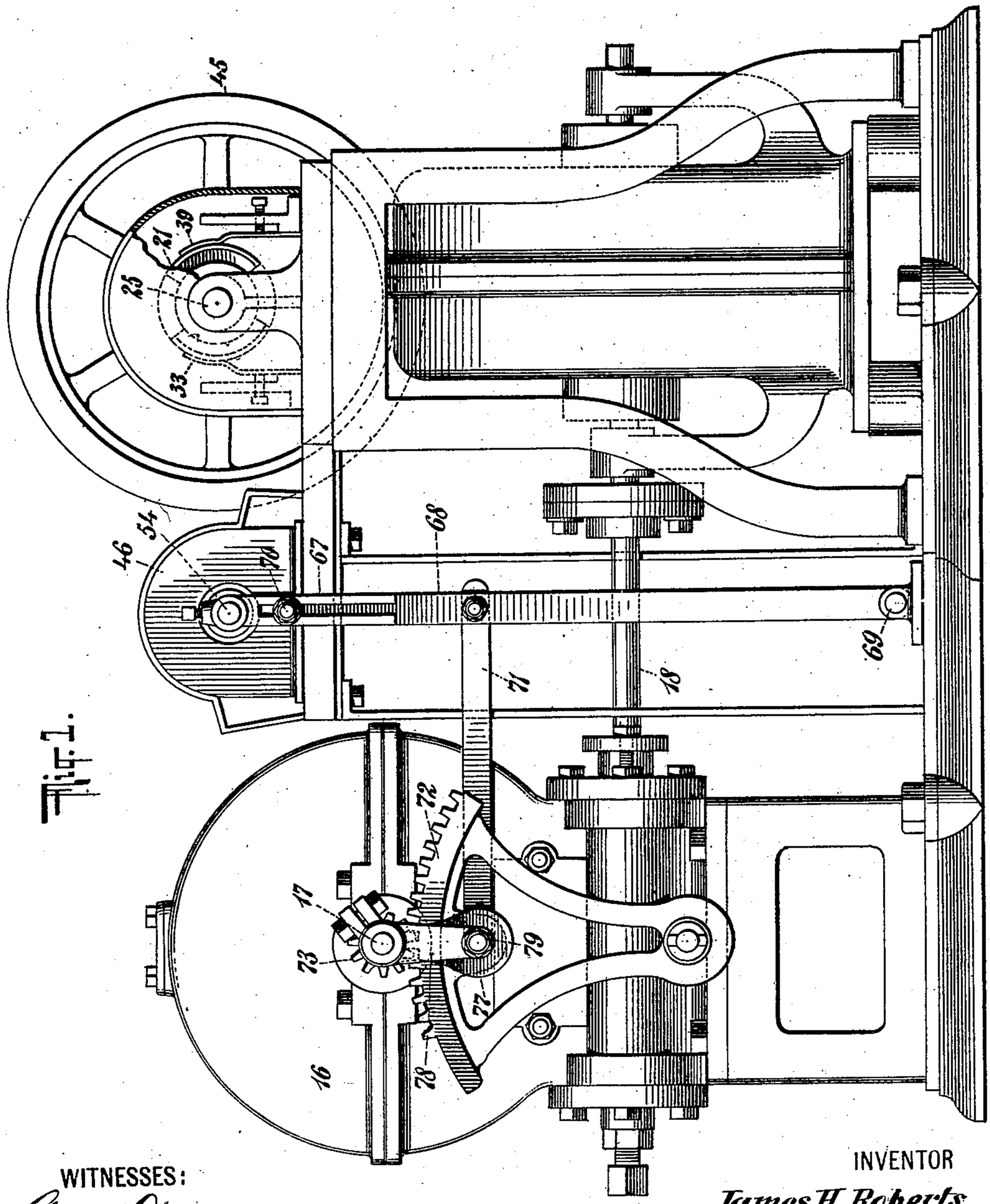

Fig. 1.

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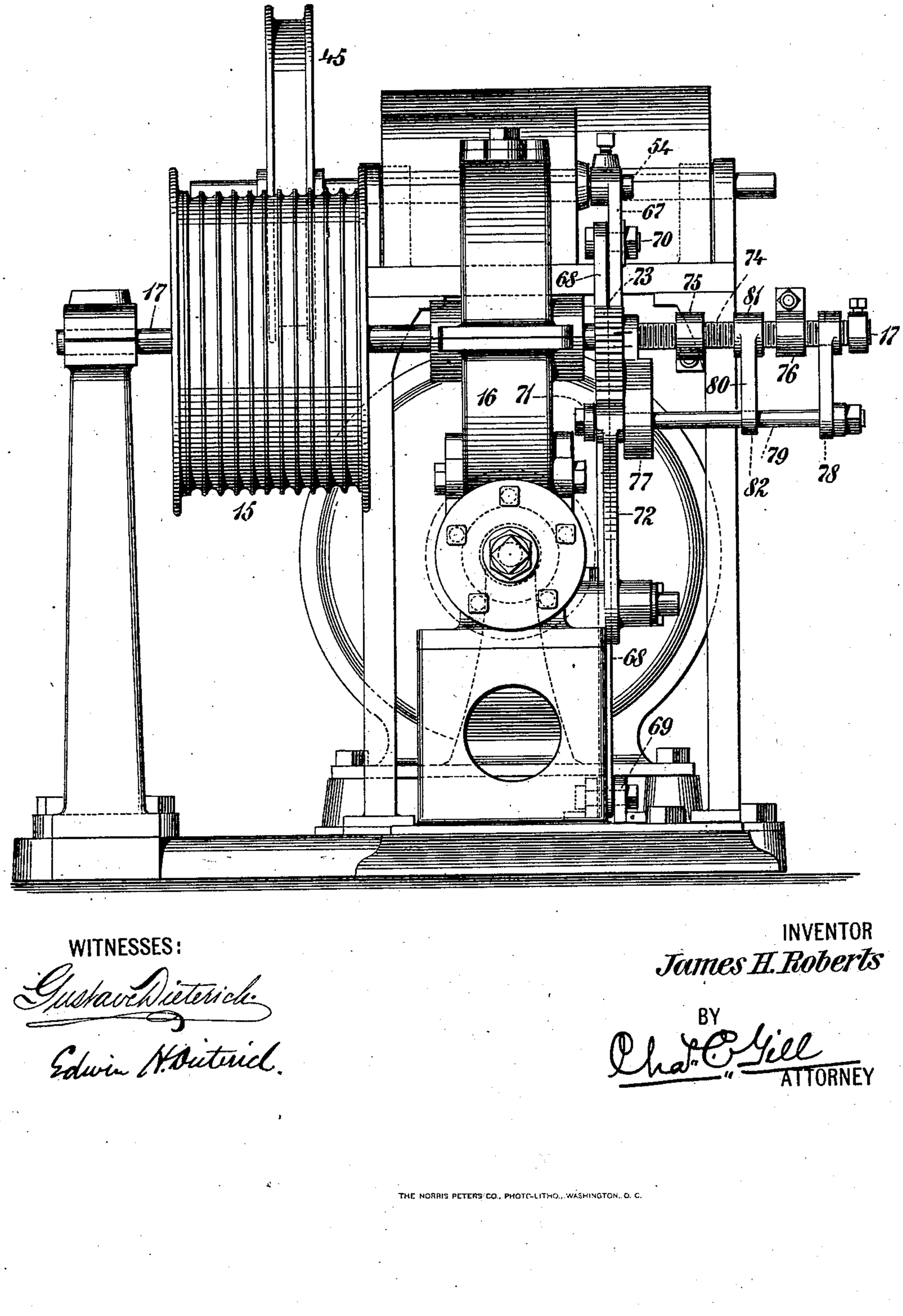
NO MODEL. 4 SHEETS—SHEET 2.

Fig. 2.



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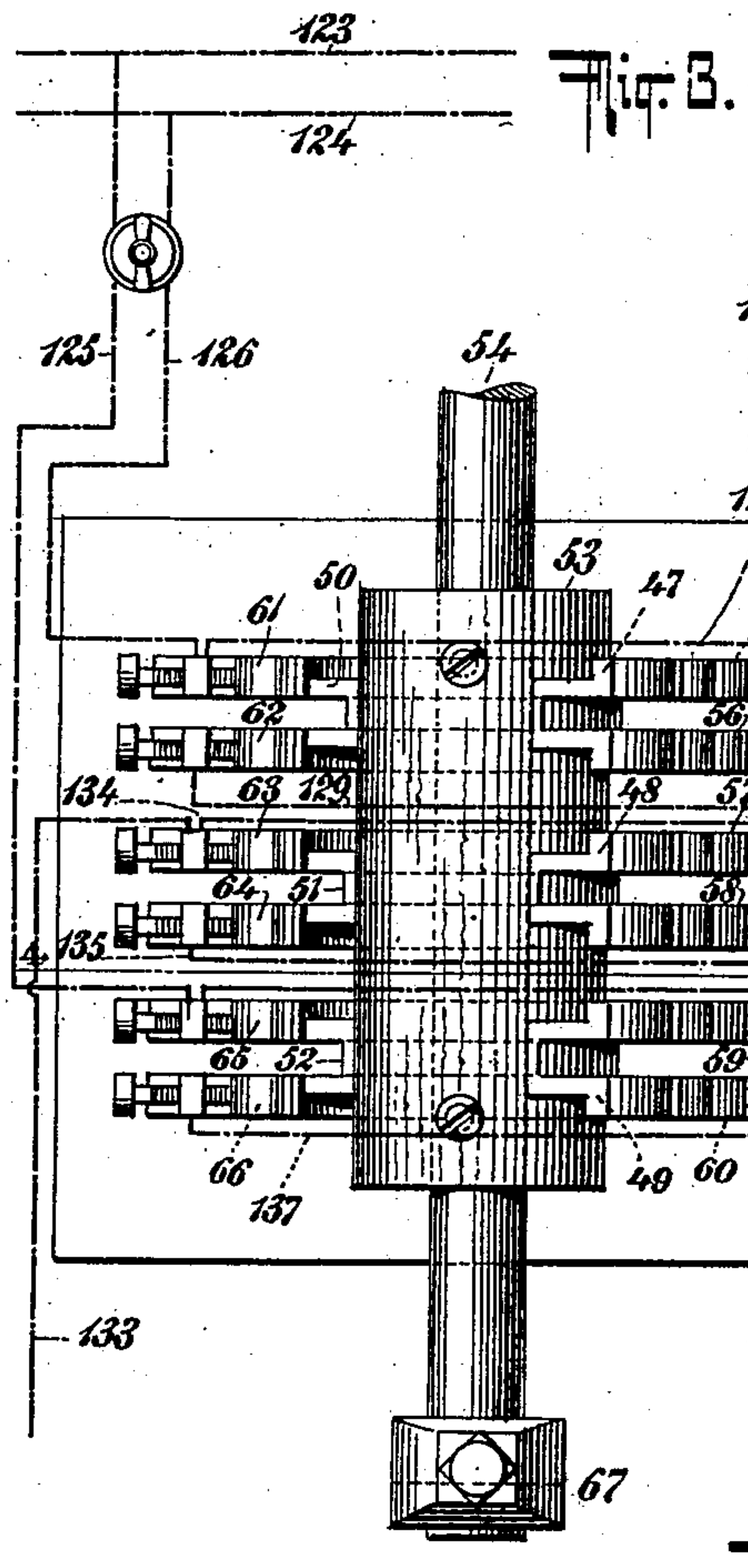
NO MODEL. 4 SHEETS—SHEET 3.

Fig. 3.



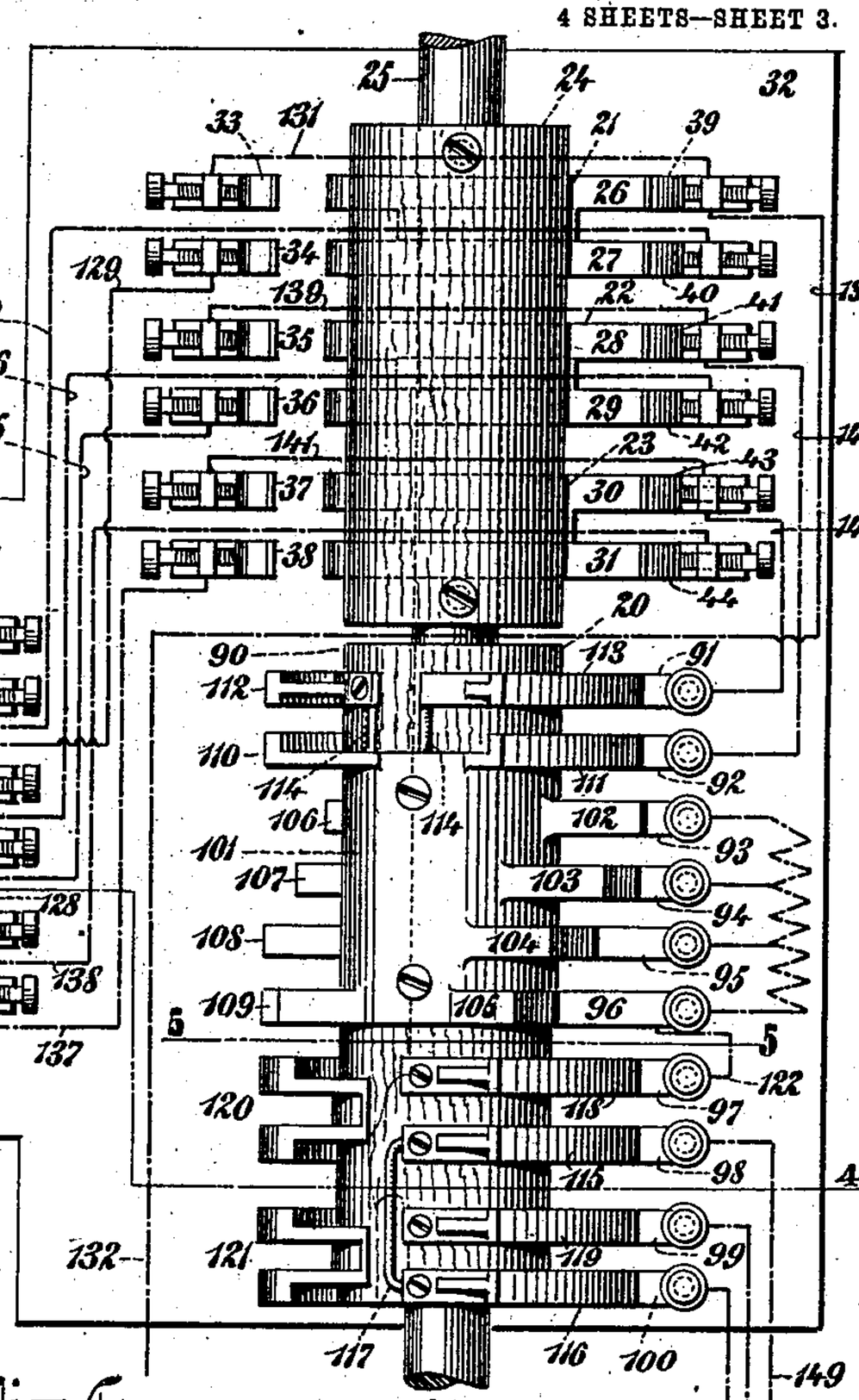
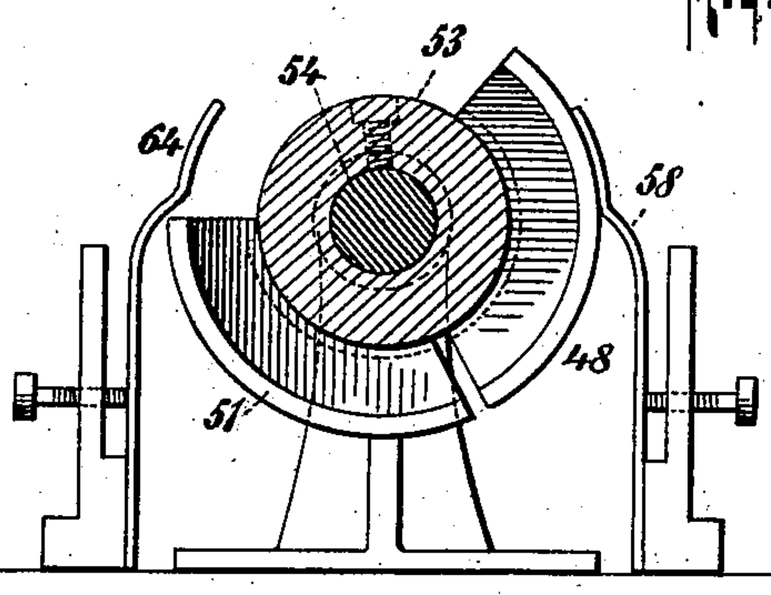


Fig. 4.



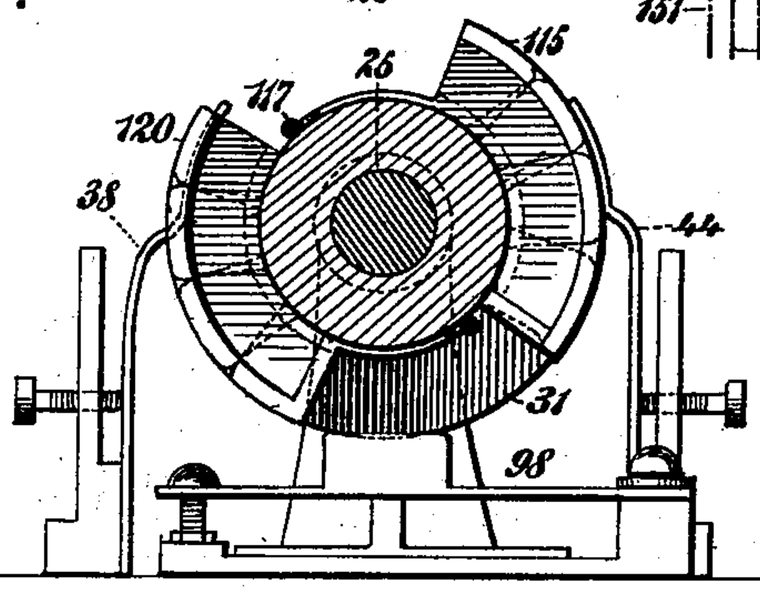
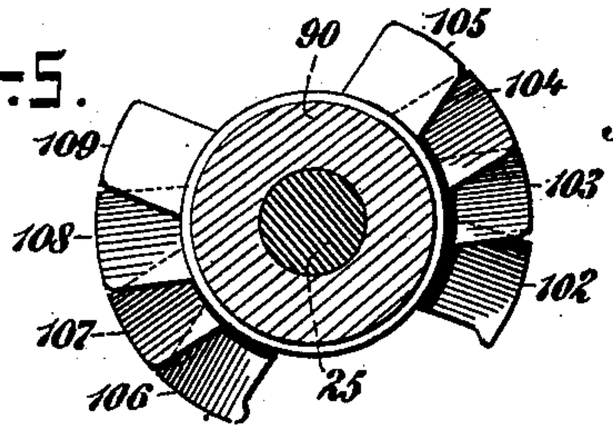


Fig. 5.



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NO MODEL. 4 SHEETS—SHEET 4.

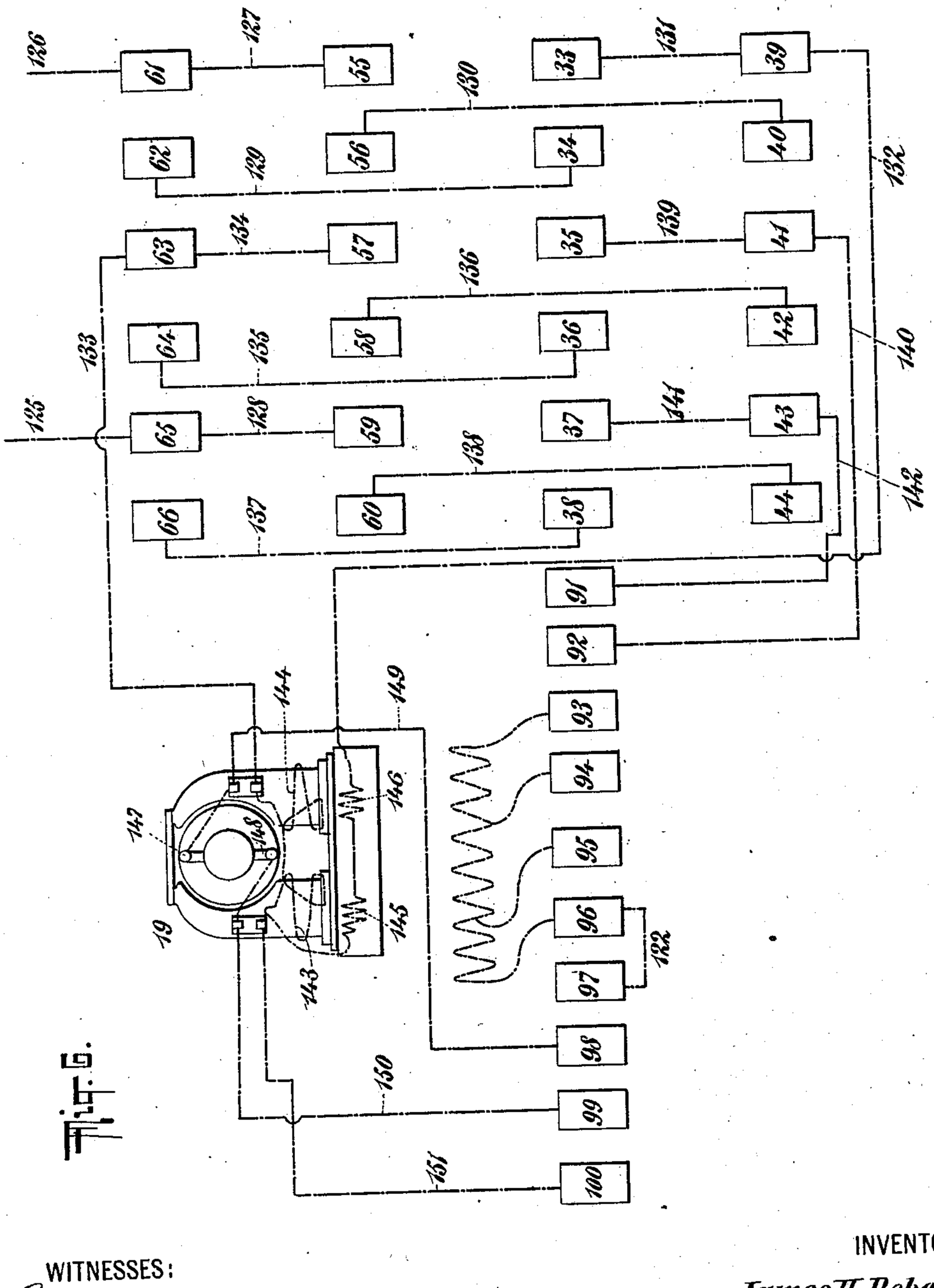

Fig. 5.

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UNITED STATES PATENT OFFICE.

JAMES H. ROBERTS, OF NEW YORK, N. Y.

ELECTRICAL APPLIANCE FOR ELEVATORS.

SPECIFICATION forming part of Letters Patent No. 722,756, dated March 17, 1903.

Application filed January 13, 1903. Serial No. 138,803. (No model.)

To all whom it may concern:

Be it known that I, JAMES H. ROBERTS, a citizen of the United States, and a resident of New York, in the county of New York and State of New York, have invented certain new and useful Improvements in Electrical Appliances for Elevators, of which the following is a specification.

The invention relates to improvements in electrical appliances for elevators or other forms of hoisting or elevating apparatus; and it consists in the novel switches and operating mechanism therefor hereinafter described, one set of said switches being timed with the shaft of the winding drum or gearing operating the same or other movable parts of the apparatus and operable, preferably, by said part to break the electric circuit at such time as the elevator shall have reached the end of its line of travel, and thus automatically arrest the movement of the elevator at the terminus of its proper travel either on its ascent or descent, and the other set of switches hereinafter described being operable by the attendant in the elevator-carriage through the usual hand-rope or stopping and starting cable, whereby the elevator may be started and stopped at will by the attendant at any time. The starting and stopping switches are connected with a "controller" or rheostat, and the controller proper in the combination presented performs its usual functions of offering resistance and affording a convenient means of controlling the current and determining the direction of movement of the elevator, and it and the said starting and stopping switches connected therewith are operated simultaneously from the usual stopping and starting cable.

The switches for automatically stopping the car at the ends of its line of travel are mounted upon a rock-shaft, which is adapted to be actuated by a segment-gear and lever, which at the proper time are moved to turn said rock-shaft by a traveler whose motion is derived from some part of the hoisting mechanism, preferably the shaft of the drum or gearing, which causes said drum to rotate, the said traveler being timed with the hoisting mechanism, so that when the elevator reaches the upper end of its line of travel the said rock-shaft will be turned in one direction to break the circuit, and when the elevator reaches the lower end of its line of travel said shaft will be turned in the opposite direction to break the electric circuit, while when said rock-shaft is in a neutral position, relieved from the action of said traveler, (as while the carriage is in motion in either direction,) the said shaft and limit-switches carried thereby remain idle.

The invention will be fully understood from the detailed description hereinafter presented, reference being had to the accompanying drawings, in which—

Figure 1 is a side elevation of apparatus for elevators constructed in accordance with and embodying the invention. Fig. 2 is an end view of same looking at the left-hand end of Fig. 1. Fig. 3 is an enlarged top view, with the exterior casings removed, of the controller, the starting and stopping switches connected therewith, and the limit-switches for automatically arresting the car at the terminus of its line of travel. Fig. 4 is a vertical section of same on the dotted line 4 4 of Fig. 3. Fig. 5 is a vertical section transversely through the controller on the dotted line 5 5 of Fig. 3, and Fig. 6 is a diagrammatic view of the motor and circuits.

In the drawings, 15 indicates the usual winding-drum; 16, the customary worm and pinion gearing for operating said drum; 17, the shaft for said drum, and 18 the shaft to which power is applied for actuating said gearing from the compound-wound motor, (denoted by the numeral 19.)

The controller is indicated by the numeral 20 and is of well-known construction, being a Crocker-Wheeler railroad-controller of the form and construction employed in connection with the Crocker-Wheeler compound-wound brake-motor, which is the motor denoted by the numeral 19.

The controller 20 and the stopping and starting switches operable in connection therewith by the attendant in the carriage are illustrated in Fig. 3 and are numbered 21, 22, and 23, all corresponding with one another and carried by a non-conducting sleeve 24, rigidly mounted upon the shaft 25 of the controller 20. The switches 21 22 23 are of metal and of segmental outline, and each of said switches is formed of two connected segments,

the segments of the switch 21 being numbered 26 27, those of the switch 22 being numbered 28 29, and those of the switch 23 being numbered 30 31. Each of these switches is in one integral piece of metal, and the two segments of each switch are connected together by the metal of the switch, so that each switch, though comprising the two segments, is in one integral casting or piece of metal, the two segments of each switch being thus in electrical connection with each other. Each of the switches 21 22 23 is, however, independent, there being no electrical connection through the sleeve 24, upon which said switches are secured. Upon the switchboard 32 below the controller 20 and switches 21 22 23 are mounted for said switches at the opposite sides of the sleeve 24 the series of spring-contacts numbered 33 to 44, inclusive, the contacts 33 to 38, inclusive, being at one side of the sleeve 24 and the contacts 39 to 44, inclusive, being at the other side of said sleeve, as shown in Fig. 3. The form and construction of the contacts 33 to 44, inclusive, are sufficiently represented at the right-hand side of Fig. 4. The series of contacts at one side of the sleeve 24 are sufficiently separated from the like contacts at the other side of the sleeve 24 to permit the switches 21, 22, and 23, with which they coöperate, to remain clear of all of said contacts when said switches are, through the shaft 25, turned downwardly into a neutral position, this being the position of said switches, free of all of said contacts, when the car is at rest. It is intended, however, that the switches 21, 22, and 23 may be moved into engagement with the contacts 39 to 44, inclusive, when the shaft 25 is turned in one direction and with the contacts 33 to 38, inclusive, when turned in the reverse direction.

In Fig. 3 for purposes of illustration I illustrate the shaft 25 as having been turned to move the switches 21, 22, and 23 into engagement with the contacts 39 to 44, inclusive, and it may be assumed that the shaft 25 has been thus turned by the attendant in the car for the purpose of starting the latter in an upward direction. When the switches 21, 22, and 23 are in the position in which they are shown in Fig. 3, they are entirely free of the contacts 33 to 38, inclusive, and their segmental members are respectively in engagement with the contacts 39 to 44, inclusive. When it is desired that the elevator-car shall descend, the shaft 25, which is a rock-shaft, will be given by the attendant in the car a reverse motion, so as to carry the switches 21, 22, and 23 from engagement with the contacts 39 to 44, inclusive, and into engagement with the contacts 33 to 38, inclusive. Upon one end of the shaft 25 is secured the usual stopping and starting wheel 45, operable in the customary manner by the attendant in the elevator-car. When the wheel 45 is turned in one direction, the switches 21, 22, and 23 will be moved into engagement with the contacts 39 to 44, inclusive, and when the wheel 45 is moved in a reverse direction the said switches 21, 22, and 23 will be carried into engagement with the contacts 33 to 38, inclusive.

The switches for breaking the electric circuit and which arrest the car at the ends of its line of travel are more clearly illustrated in Figs. 3 and 4, and in Fig. 1, 46 denotes the casing covering these switches, which switches are respectively designated by the numerals 47 to 52, inclusive, and are carried by a non-conducting sleeve 53, rigidly mounted upon a rock-shaft 54. The switches 47 to 52, inclusive, correspond with one another, and each is of segmental outline, as more clearly illustrated in Fig. 4. The switches 47, 48, and 49 are secured at one side of the sleeve 53, and the switches 50 51 52 are secured at the other side of said sleeve, and at the opposite sides of said sleeve and switches are mounted upon the switchboard 32 the series of spring-contacts 55 to 66, inclusive, there being two of the contacts for each of said switches, and said switches, like the switches 21, 22, and 23, being each formed of two connected segments, so that each switch may engage two adjoining contacts. The switches 47, 48, and 49 are independent of the switches 50, 51, and 52, there being, as shown in Fig. 4, a space between the adjoining edges of said switches. In Figs. 3 and 4 the shaft 54 is represented as having been turned to lower the switches 50, 51, and 52 from their spring-contacts and to turn the switches 47, 48, and 49 upwardly along their spring-contacts; but when the switches 47 to 52, inclusive, are in a neutral or normal position the switches 47 to 49, inclusive, will be in engagement with their respective contacts 55 to 60, inclusive, and the switches 50 to 52, inclusive, will be in engagement with their respective contacts 61 to 66, inclusive; but when the elevator or car has reached the end of its line of travel in one direction the shaft 54 will be turned to disengage one set of said switches from its contacts, and when the car reaches the terminus of its travel in the opposite direction the shaft 54 will be given a reverse movement and the other set of said switches will be moved from engagement with their respective contacts. The switches 47 to 52, inclusive, are used solely for breaking the circuit, and thereby arresting the car at the terminus of its lines of travel. These switches are rotary switches and receive their motion from the shaft 54, which is automatically actuated by the mechanism shown in Figs. 1 and 2, in which it will be seen that upon one end of the shaft 54 is secured a bifurcated crank-arm 67, connected with a vertical lever 68, pivoted at its lower end, as denoted at 69, and carrying at its upper end a bolt, which is adapted to play within the slot of the crank-arm 67. The vertical oscillatory lever 68 is by means of a link 71 pivotally connected with the segment-gear 72, pivotally mounted at its lower end and hav-

ing its teeth in engagement with the pinion-wheel 73, free on the shaft 17 of the winding-drum 15. The outer portion of the shaft 17 has a threaded section 74, Fig. 2, which passes through stationary stops 75 76 and has loosely hung from it the arms 77 78, which carry in their lower ends the rod 79, and the former of which is weighted or made considerably heavier at its lower end than at its upper end. Connecting the threaded section 74 with the rod 79 is a traveler 80, which has a threaded sleeve 81 at its upper end to engage and travel upon the threaded section 74, while at its lower end said traveler 80 is provided with a free eye or loop 82 to engage but slide freely upon the rod 79. The rod 79 passes through the arm 78 and into the arm 77, and the arm 77 and pinion-wheel 73 are connected together as one piece, said pinion-wheel 73, arm 77, rod 79, and arm 78 constituting a swinging frame to be actuated at the proper time by the traveler 80 for moving the segment-gear 72 and through said gear and the link 71, lever 68, and crank-arm 67 turning the rock-shaft 54 in accordance with the direction of motion said traveler may impart to said frame. During the rotation of the winding-drum 15 and shaft 17 the traveler 80 by reason of the engagement of its threaded sleeve 82 with the threaded section 74 will have a traveling movement intermediate the stops 75 and 76, said traveler 80 then maintaining its due vertical position, and the segment-gear 82, link 71, lever 68, and crank-arm 67 then remaining stationary in the position in which they are shown in Fig. 1. When the traveler 80 is moving outwardly toward the stop 76, the car will be performing its usual movement; but when the sleeve 81 of said traveler contacts with the stop 76 the traveler will be arrested and will then be compelled to turn outwardly from its vertical toward a horizontal position by reason of the continued motion of the shaft 17. When the traveler 80 thus is turned outwardly, it will move with it the rod 79 and arms 77 78, and this movement of the arm 77 will cause the pinion 73 to perform a partial rotation, with the result that said pinion-wheel 73 will move the segment-gear 72 and cause it to move, through the link 71, the lever 68, the latter turning on its pivot 69 and through the bolt 70 at its upper end turning the crank-arm 67 to impart a partial rotary motion to the shaft 54 of the limit-switches 47 to 52, inclusive, moving said switches from their neutral position in engagement with both sets of spring-contacts 55 to 66, inclusive, and turning one set of said switches from engagement with one set of said spring-contacts, this resulting in the breaking of the electric circuit and the stopping of the car at the end of its line of travel. When the car is thereafter started in the usual manner in the opposite direction, the motion of the shaft 17 and threaded section 74 will be reversed and at once relieve the traveler 80 from its contact with the stop 76, whereupon the traveler 80, arms 77 78, rod 79, and pinion-wheel 73 will return to their former normal position, (shown in Fig. 1,) and the rotation of the pinion 73 at this time will restore the segment-gear 72, link 71, and lever 68 to their former normal position, with the result that the bolt 70 at the upper end of said lever 68 will act through the crank-arm 67 to reverse the motion of the shaft 54 and restore the switches 47 to 52, inclusive, to their initial position in engagement with all of the contacts 55 to 66, inclusive. The purpose of weighting the arm 77 is to assure the return of the traveler and parts connected therewith to their normal position (shown in Fig. 1) as soon as on the reverse motion of the shaft 17 the said traveler is released from the stops 76 and 75. During the travel of the car in its reverse direction the traveler 80 will move along the threaded section 74 of the shaft 17 toward the stationary stop 75, and said traveler will reach said stop at about the time the car is reaching the end of its line of travel, and the contact of said traveler with said stop 75 will result in the traveler being arrested and in being compelled by the continued motion of the shaft 17 to swing outwardly in a reverse direction to its former outward movement and carry with it the rod 79 and arms 77 78, said arm 77 causing the pinion-wheel 73 to perform a partial rotation and actuate the segment-gear 72, the latter then moving the link 71 and lever 68 and causing the latter through the crank-arm 67 to turn the shaft 54 in a reverse direction and move one set of the switches thereon from engagement with one set of the contacts provided for said switches, thereby breaking the electric circuit and stopping the car. As soon as the car is again started the reversal of the shaft 17 will relieve the traveler from the stop 75 and allow said traveler, with the arms 77 78 and rod 79, to descend to their former normal position, this, as above, resulting in the pinion-wheel 73 setting in motion the segment-gear 72 and restoring the lever 68, crank-arm 67, shaft 54, and switches 47 to 52, inclusive, to their former initial position, said switches then engaging their respective contacts 55 to 66, inclusive. It will thus be seen that the purpose of the traveler 80 is, through the mechanism shown, to turn the shaft 54 for breaking the electric circuit and stopping the car when the latter has reached the end of its proper movement and that the traveler 80 will be swung outwardly in one direction when it reaches the stop 76 and in the opposite direction when it reaches the stop 75. The bolt 70 at the upper end of the lever 68 forms a sliding connection with the slotted crank-arm 67, and hence said lever when turned on its pivot 69 may, through said crank 67, turn the shaft 54 to the right or left in accordance with the direction of motion imparted from

the segment-gear 72 and link 71 to said lever 68. It will be understood that the bolt 70 does not rigidly clamp the upper end of the lever 68 to the crank-arm 67, but that said bolt is carried by the lever 68 and during the movement of the latter is enabled to slide along the walls of the slot in the crank-arm 67, said bolt 70 moving outwardly along said slot as the lever 68 is carried from its vertical position and approaching the inner end of said slot as the lever 68 is gradually returned to its vertical position.

The features desired to be protected by the present application are more particularly the switches carried by the rotary shaft 54 for breaking the circuit at the terminus of the lines of travel of the car, the mechanism operable from the hoisting means for actuating said shaft and its switches, and the starting and stopping switches mounted upon the shaft 25 of the controller and operable therefrom by the attendant in the car. As above described, the controller 20 is a well-known form of railroad-controller.

The switches 49 52, with their connections, are unnecessary in some instances and are employed in the present apparatus because of the fact that the apparatus shown is adapted for use in connection with the well-known Crocker-Wheeler compound-wound brake-motor, the connections from the switches 49 52 serving when said switches are in their normal position to establish the circuit which renders active the magnet which holds the brake and when in their operative or shifted position (as when moved by the lever 68 and crank-arm 67) to break the circuit which includes said magnet, and thereby effect the release of the brake from the magnet and its application by the usual spring or weight to the motor to stop the latter. I do not, therefore, in every instance limit the present invention to the use of any special number of the switches on the rotary shaft 54.

The stopping and starting switches on the shaft 25 have been hereinbefore described and are shown as being in the form of three pairs of segmental disks, and these are essential in instances where the apparatus is to be used with the well-known Crocker-Wheeler compound-wound brake-motor; but the invention is not in every instance limited to the special number shown of switches 21, 22, and 23, since if these starting and stopping switches were employed in connection with the rheostat illustrated in the Letters Patent granted to me April 23, 1895, No. 537,885, it would be unnecessary to employ more than two pairs of the said segmental-disk switches, with the appropriate contacts therefor.

The controller 20 is of ordinary construction and for ordinary uses and in itself is not separately claimed herein. This controller is on the same shaft with the switches 21, 22, and 23, as shown in Fig. 3, and comprises a non-conducting sleeve 90, secured on said shaft and carrying the various segmental switches, these switches being adapted, respectively, on the turning of the shaft 25 to pass into engagement with the series of horizontal spring-contacts numbered, respectively, 91 to 100, inclusive, which are suitably mounted upon the switchboard 32 below the said sleeve 90 and require no special description. Upon the sleeve 90 of the controller is secured a metallic or conducting sleeve 101, and integral with this sleeve are the two sets of switches numbered, respectively, 102 to 105, inclusive, for one side of said sleeve and 106 to 109, inclusive, for the other side of said sleeve, these switches forming resistances and adapted on the turning of the shaft 25 in one direction or the other for engagement with the contacts 93, 94, 95, and 96. Upon the upper end of the sleeve 101 (looking at Fig. 3) are the segment-switches 110 and 111, respectively, and adjacent to these switches 110 and 111 similar switches 112 and 113 are secured to the non-conducting sleeve 90, which switches 112 and 113 are separated from each other at their adjoining ends and are respectively, by means of a conducting-wire 114 above and below the sleeve 90, electrically connected with the conducting-sleeve 101. At the right-hand side of the lower end of the sleeve 90 (looking at Fig. 3) are the segment-switches 115 and 116, and these switches are connected by a wire 117, and at said side of the said sleeve 90 are also the corresponding segment-switches 118 and 119, and these two switches below the sleeve 90 are in electrical connection by means of a wire corresponding with the wire 117. At the left-hand side of the lower end of the sleeve 90 are the pairs of segment-switches 120 and 121, the switches of each pair being integral, and therefore in electrical connection with each other. When the shaft 25 and sleeve 90 are turned in one direction—as, for instance, that represented in Fig. 3—the switches 112, 110, 120, and 121 will pass into engagement with the contacts 91, 92, 97, 98, 99, and 100, and at the same time and in accordance with the extent of movement imparted to the sleeve 90 some of the resistance-switches 106, 107, 108, and 109 will pass into engagement with the contacts 93, 94, 95, and 96. When the shaft 25 and sleeve 90 are reversed and turned to their operative position in the opposite direction, the switches 113, 111, 118, 115, 119, and 116 will pass into engagement with their respective contacts 91, 92, 97, 98, 99, and 100, and some of the resistance-switches 102, 103, 104, and 105, in accordance with the extent of motion, will engage their contacts 93, 94, 95, and 96. The contacts 96 and 97 are in electrical connection through the wire 122. When the shaft 25 and non-conducting sleeves 24 and 90 are turned to a neutral position, none of the switches on said sleeves will engage any of the contacts provided for them on the switchboard 32.

The wiring of the apparatus illustrated is not intended to be specially claimed herein, but is illustrated diagrammatically in Figs. 3 and 6, the illustration of the circuits being that employed when the apparatus is used in connection with the well-known Crocker-Wheeler railroad-controller and with the Crocker-Wheeler compound-wound brake-motor. The main-line conductors are denoted by the numerals 123 124, and to these are connected the auxiliary main-line conductors 125 and 126, the latter of which passes to the contact 61 for the limit-switch, and this contact 61 is by means of a conductor 127 connected with the contact 55. The auxiliary main-line conductor 125 passes directly to the contact 65, and this contact 65 is by means of a conductor 128 connected with the contact 59. From the contact 62 the conductor 129 passes to the contact 34, and from the contact 56 a conductor 130 passes to the contact 40. The contacts 33 and 39 are connected by a conductor 131, and from the contact 39 a conductor 132 passes to the series field of the motor 19. The shunt-wire conductor 133 is connected with the contact 63, and this contact 63 is by a conductor 134 connected with the contact 57. The contact 64 is by means of a conductor 135 connected with the contact 36, and the contact 58 is by means of a conductor 136 connected with the contact 42. The contact 66 is by means of a conductor 137 connected with the contact 38, and the contact 60 is by means of a conductor 138 connected with the contact 44. The contact 35 is by a conductor 139 connected with the contact 41, and this contact 41 is by a conductor 140 connected with the contact 92 of the controller. The contact 37 is by means of a conductor 141 connected with the contact 43, and this contact 43 is by means of a conductor 142 connected with the contact 91 of the controller.

It is not deemed necessary to specifically refer to the wiring of the controller and motor, because this is the ordinary wiring well understood and because the present invention pertains to the rotary switches hereinbefore described and the mechanism for automatically actuating the limit-switches for breaking the circuit at the terminus of the travel of the car. It may be said, however, in respect of the motor 19 that the shunt-fields are respectively designated by the numerals 143 and 144, that the series fields are designated by the numerals 145 146, and that the upper and lower brushes of the commutator are designated by the numerals 147 148. The upper brush 147 is by means of a conductor 149 connected with the contact 98 for the controller, and the lower brush 148 is by a conductor 150 connected with the contact 99 for the controller. The contact 100 for the controller is by a conductor 151 connected with the shunt-field 145 of the motor, and this shunt-field 145 is connected with the other shunt-field 146, as usual.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. In electrical apparatus of the character described, the compound-wound brake-motor, the controller, the starting and stopping switches, and means for operating said switches and controller from the elevator-carriage, said switches being mounted on the shaft of said controller and operable therefrom and having the several sets of contacts for forming the circuits at the ends of the movements of said switches, combined with the shaft carrying the limit-switches at opposite sides thereof and operable from the hoisting mechanism, the contacts at the opposite sides of said shaft for engagement with said switches respectively at the terminus of the travel of the elevator-carriage, and suitable conductors; substantially as and for the purposes set forth.

2. In electrical apparatus of the character described, the compound-wound brake-motor, the controller, the starting and stopping switches, and means for operating said switches and controller from the elevator-carriage, said switches being mounted on the shaft of said controller so as to be moved therewith and having the several sets of contacts for forming the circuits at the ends of the movements of said switches, combined with the shaft carrying the limit-switches 47, 48 and 49 at one side thereof, and 50, 51 and 52 at the opposite side thereof, means for actuating said shaft from the hoisting mechanism for moving said switches to break the electric circuits at the proper time, the contacts 55 to 60 inclusive for said switches 47, 48 and 49, the contacts 61 to 66 inclusive for said switches 50, 51 and 52, and suitable conductors; substantially as and for the purposes set forth.

3. In electrical apparatus of the character described, the compound-wound brake-motor, the controller, the starting and stopping switches 21, 22 and 23 carried by the shaft of said controller and comprising the segments in pairs, the contacts 39 to 44 inclusive at one side of said shaft for said switches, the contacts 33 to 38 inclusive at the other side of said shaft for said switches, and means for operating said switches and controller from the elevator-carriage, combined with the limit-switches operable from the hoisting mechanism for breaking the circuits at the ends of the travel of the elevator-carriage, and suitable conductors; substantially as and for the purposes set forth.

4. In electrical apparatus of the character described, the compound-wound brake-motor, the controller, the starting and stopping switches, and means for operating said switches and controller from the elevator-carriage, combined with the shaft carrying at

the opposite sides thereof the limit-switches 47, 48, 49, and 50, 51, 52, respectively, and each being in the form of a connected pair of segments, the contacts 55 to 60 inclusive for the segments of the switches 47, 48 and 49, the contacts 61 to 66 inclusive for the segments of the switches 50, 51 and 52, means operable from the hoisting mechanism for turning said shaft to move said switches at the terminus of the travel of the elevator-carriage to break the circuits, and suitable conductors; substantially as set forth.

5. In electrical apparatus of the character described, the shaft 54 carrying the switches 47, 48, 49, and 50, 51, 52, respectively, at opposite sides thereof, and each being in the form of a pair of connected segments, combined with the contacts 55 to 60 inclusive for the segments of the switches 47, 48 and 49, the contacts 61 to 66 inclusive for the segments of the switches 50, 51, 52, means for turning said shaft and switches in one direction at one end of the travel of the elevator-carriage to break the circuits, and in the opposite direction at the other end of the travel of the elevator-carriage to break the circuits, and to a neutral position for restoring the circuits, and suitable conductors forming the circuits; substantially as set forth.

6. In electrical apparatus of the character described, the shaft carrying the limit-switches for arresting the car at the ends of its line of travel, the contacts for said switches, a crank connected with said shaft for turning the same to its several positions, a segment-gear operatively connected with said crank, and means operable from the hoisting mechanism and timed therewith to actuate said segment for turning said shaft in one direction at one end of the travel of the car to break the circuit, then to a neutral position when the car is started in an opposite direction, and then to a reverse position when the car reaches the end of its line of travel; substantially as set forth.

7. In electrical apparatus of the character described, the shaft carrying the limit-switches for arresting the car at the ends of its line of travel, the contacts for said switches, the segment-gear operatively connected with said shaft for turning the same, and means operable from the hoisting mechanism and timed therewith to actuate said segment for turning said shaft in one direction, at one end of the travel of the car to break the circuit, then to a neutral position when the car is started in an opposite direction, and then to a reverse position when the car reaches the opposite end of its line of travel; substantially as and for the purposes set forth.

8. In electrical apparatus of the character described, the shaft carrying the limit-switches for arresting the car at the ends of its line of travel, the contacts for said switches, the crank connected with said shaft for turning the same to its several positions, the lever by a loose connection engaging said crank, the pivoted segment-gear, and the link connecting said gear and said lever, combined with the loose pinion on the hoisting-shaft in engagement with said segment-gear, the swinging frame connected with said pinion for turning the same, the traveler engaging a threaded portion of said shaft and connected with said frame, and the stops for arresting said traveler at the opposite ends of its line of movement, whereby said segment-gear is enabled to turn said limit-switches in one direction at one end of the travel of the car to break the circuit, then to a neutral position when the car is started in an opposite direction, and then to a reverse position when the car reaches the opposite end of its line of travel; substantially as and for the purposes set forth.

9. In electrical apparatus of the character described, the shaft carrying the limit-switches for arresting the car at the ends of its line of travel, the contacts for said switches, the crank connected with said shaft for turning the same to its several positions, the lever by a loose connection engaging said crank, the pivoted segment-gear, and the link connecting said gear and said lever, combined with the loose pinion on the hoisting-shaft in engagement with said segment-gear, the swinging arms 77, 78, and rod 79 connected with said pinion for turning the same, the traveler 80 engaging the threaded portion of said shaft and connected with said rod 79 by a sliding engagement, and the stops 75, 76 for arresting said traveler at the opposite ends of its line of movement, whereby said segment-gear is enabled to turn said limit-switches in one direction at one end of the travel of the car to break the circuit, then to a neutral position when the car is started in an opposite direction, and then to a reverse position when the car reaches the opposite end of its line of travel; substantially as and for the purposes set forth.

10. In electrical apparatus of the character described, the shaft 54 carrying at opposite sides thereof the limit-switches for breaking the circuit at the terminus of the line of travel of the elevator-carriage, and the contacts for said switches, combined with means operable from the hoisting mechanism and timed therewith to turn said shaft and switches in one direction at one end of the travel of the elevator-carriage to break the circuits, and in the opposite direction at the other end of the travel of the carriage to break the circuits, and to a neutral position for restoring the circuits upon the starting of the carriage in either direction, and suitable conductors forming the circuits; substantially as and for the purposes set forth.

11. In electrical apparatus of the character described, the motor, the controller, the start-

ing and stopping switches carried by the shaft of said controller and operable therewith, and the contacts at opposite sides of said shaft for said switches, combined with means for operating said switches and controller from the elevator-carriage, limit-switches for breaking the circuit at the ends of the travel of the elevator-carriage for arresting the latter, means operable from the hoisting mechanism for actuating said limit-switches, and suitable conductors; substantially as and for the purposes set forth.

Signed at New York, in the county of New York and State of New York, this 12th day of January, A. D. 1903.

JAMES H. ROBERTS.

Witnesses:
CHAS. C. GILL,
ARTHUR MARION.