No. 615,365. Patented Dec. 6, 1898.

J. H. ROBERTS.

ELECTRICAL APPLIANCE FOR ELEVATORS.

(Application filed Dec. 27, 1895.)

(No Model.) 4 Sheets—Sheet 1.

Fig. 1.

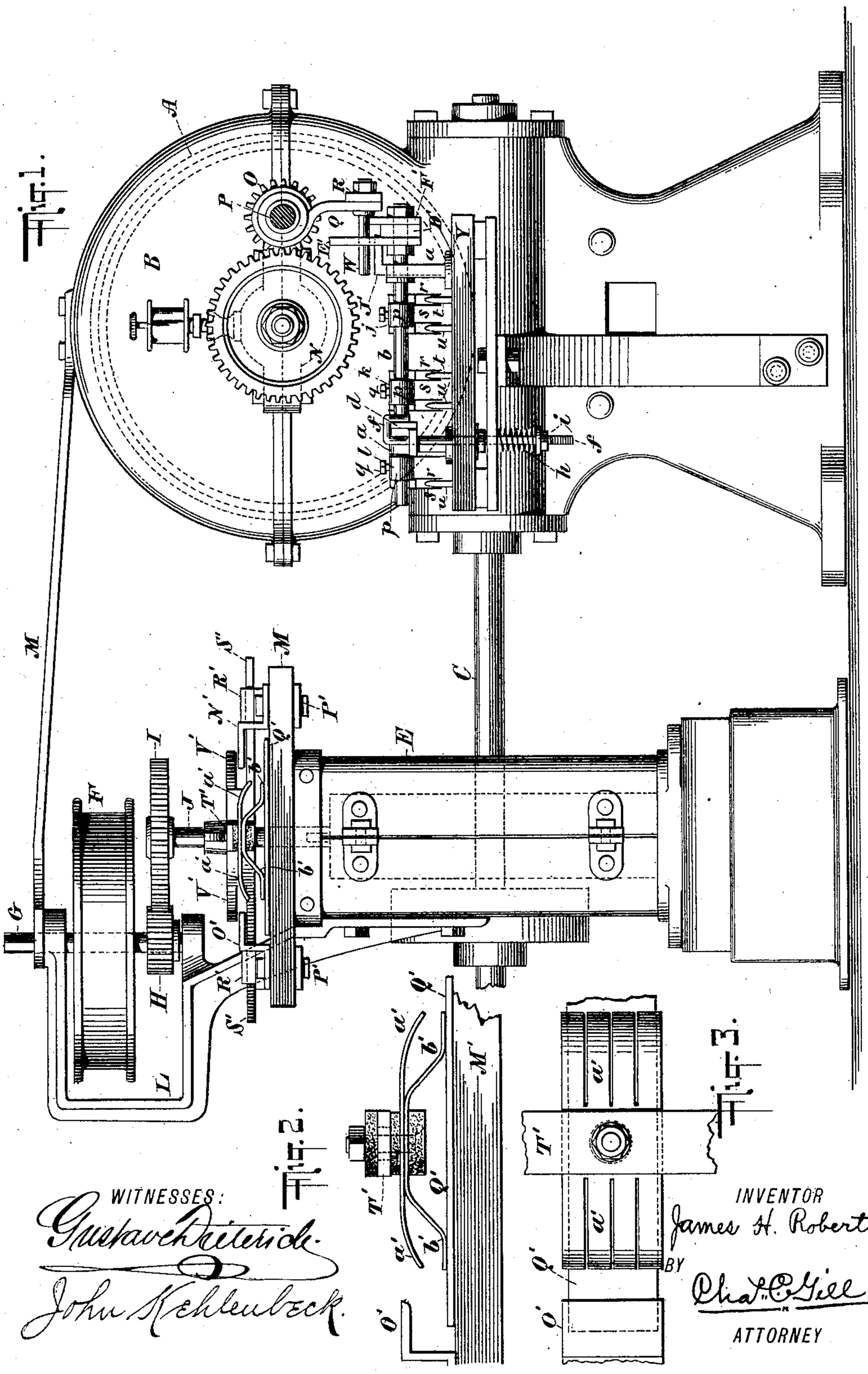

Fig. 2.

Fig. 3.

WITNESSES:

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John Kehlenbeck.

INVENTOR

James H. Roberts

BY

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(Application filed Dec. 27, 1895.)

(No Model.) 4 Sheets—Sheet 2.

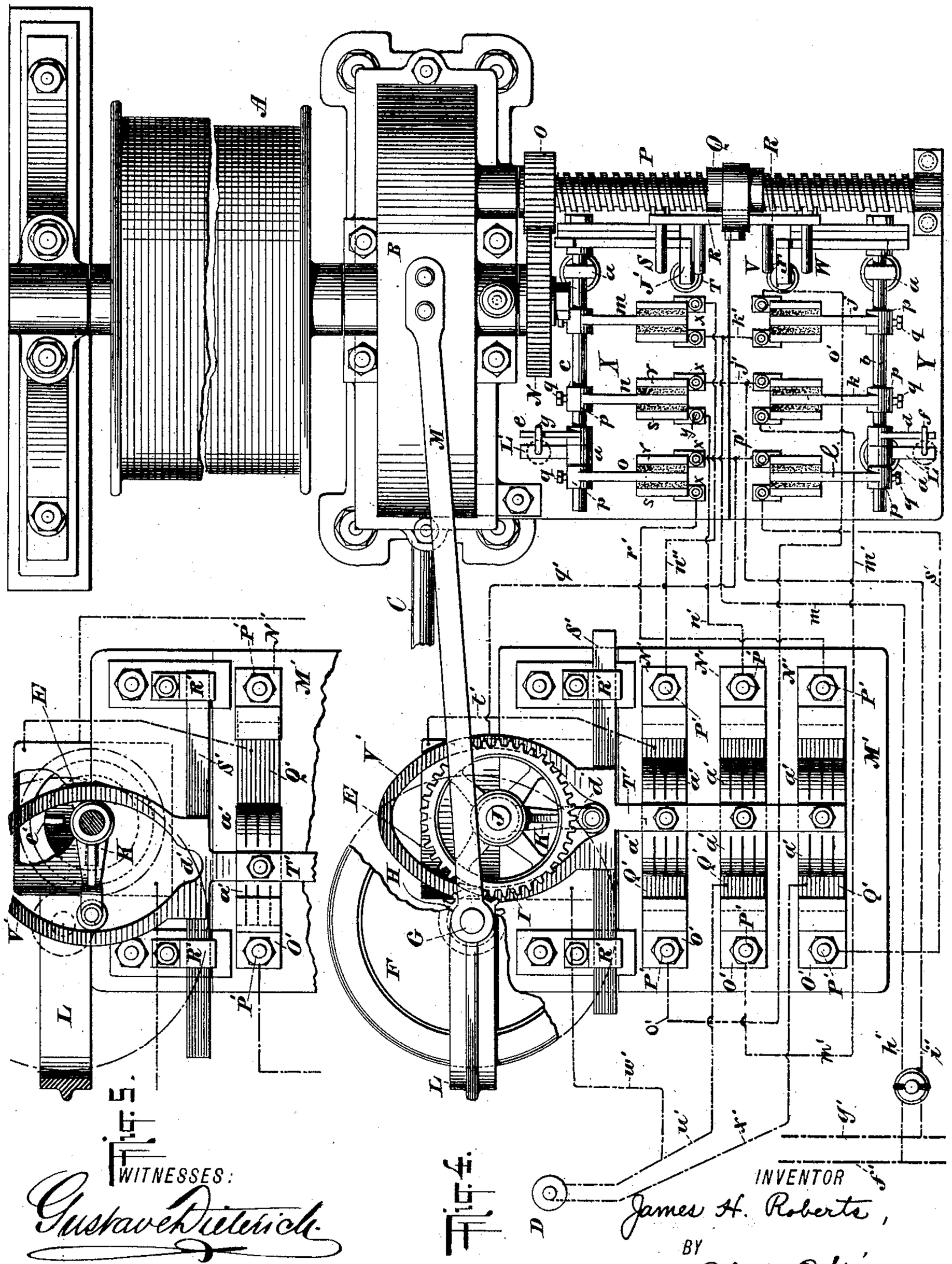

FIG. 5.

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(No Model.) 4 Sheets—Sheet 3.

Fig. 6.

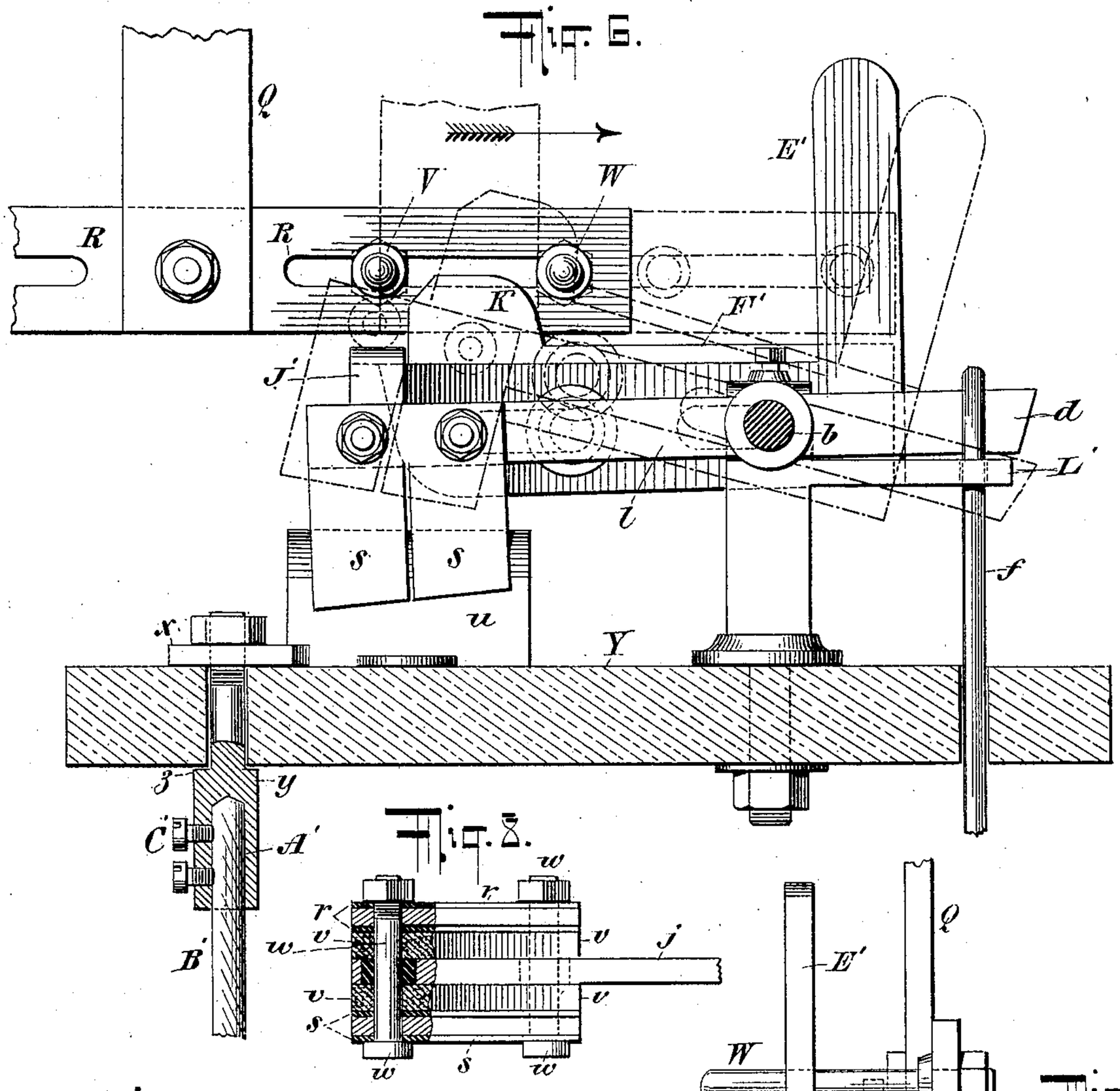

Fig. 7.

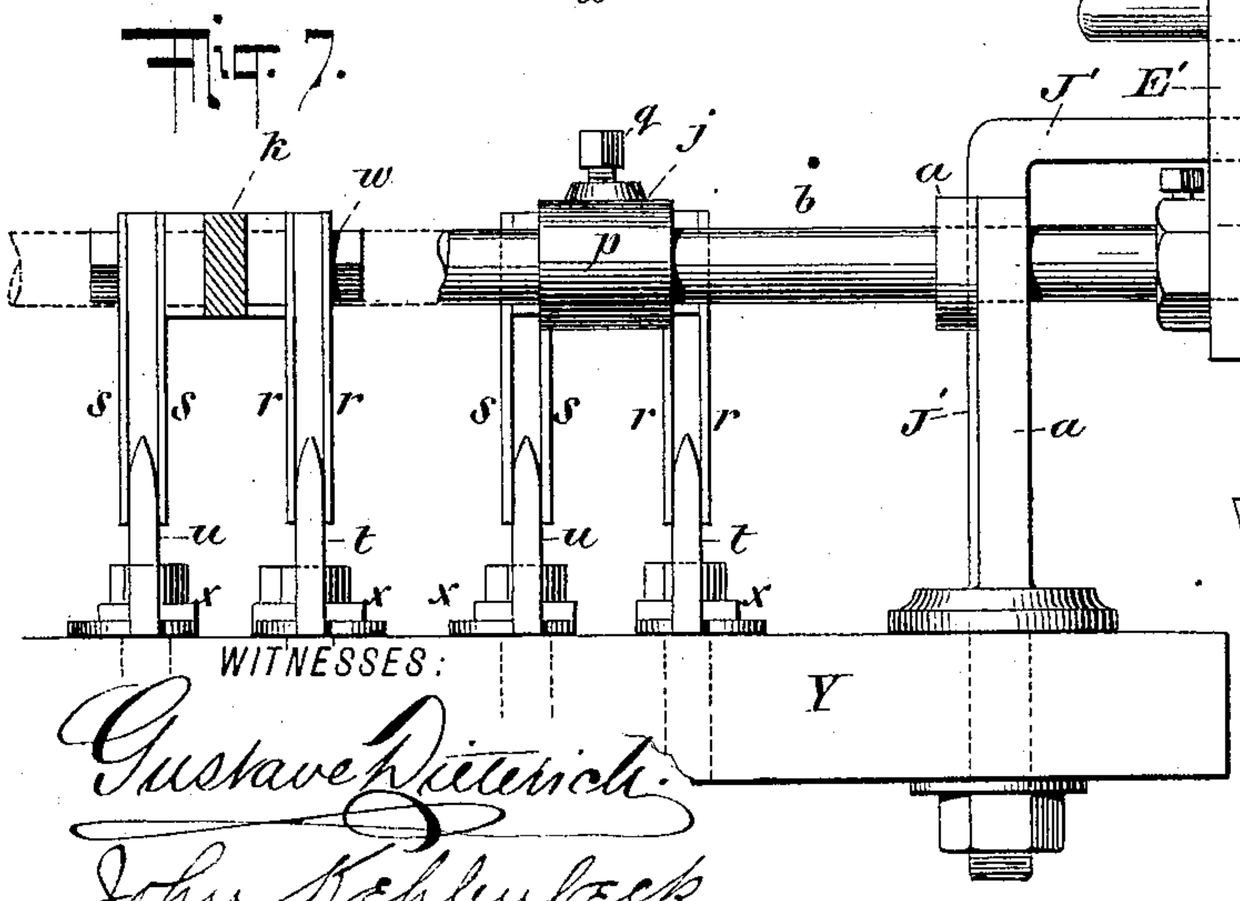

Fig. 8.

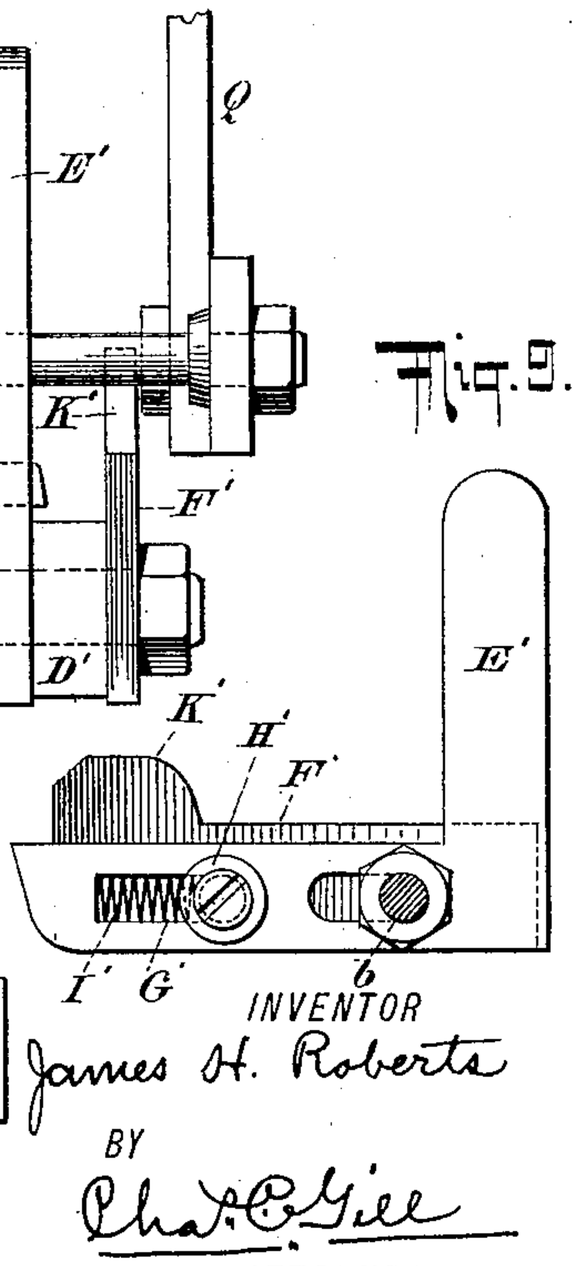

Fig. 9.

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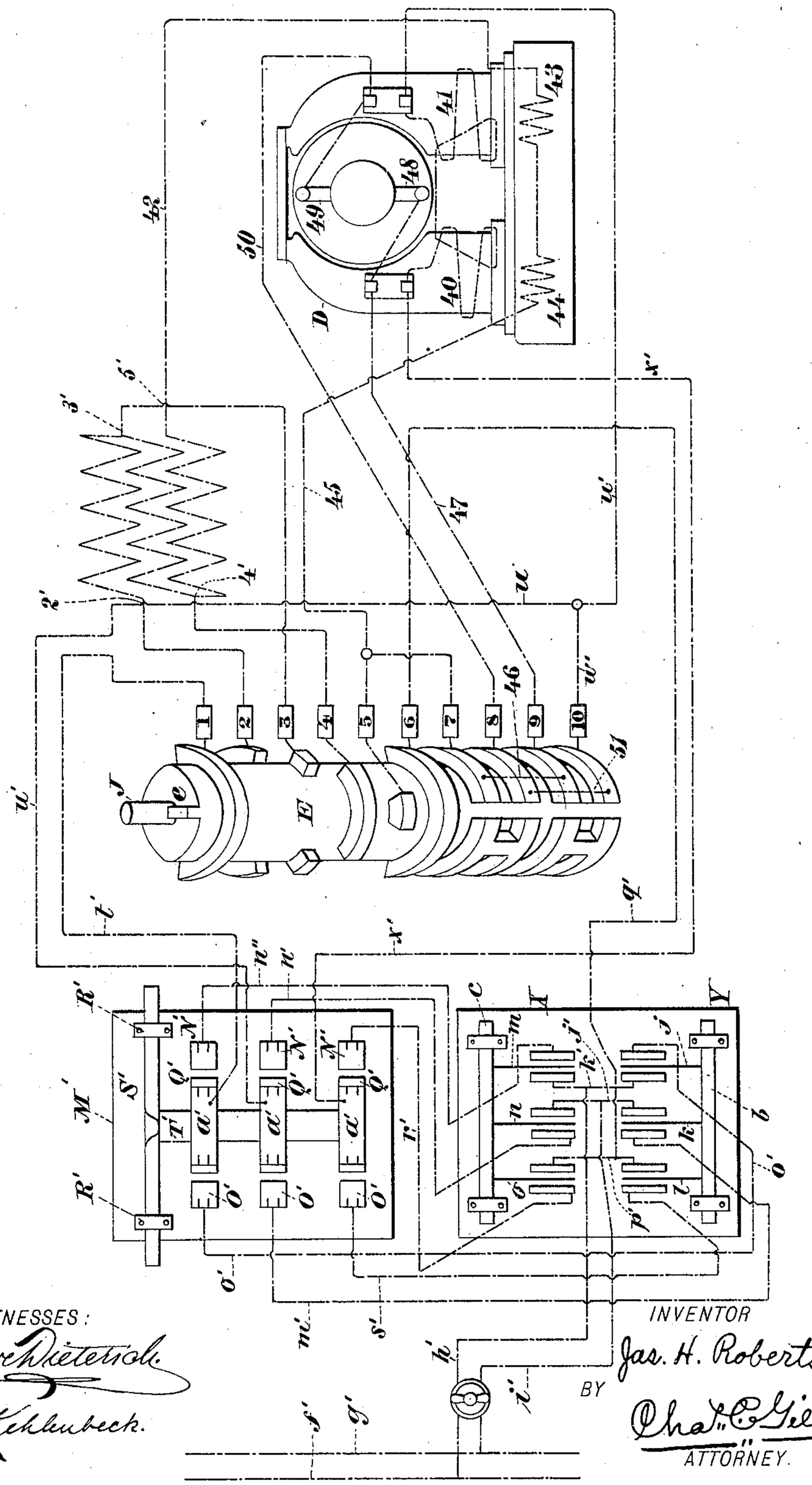
(Application filed Dec. 27, 1895.)

(No Model.) 4 Sheets—Sheet 4.

Fig. 10.



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UNITED STATES PATENT OFFICE.

JAMES H. ROBERTS, OF GRAND RAPIDS, MICHIGAN.

ELECTRICAL APPLIANCE FOR ELEVATORS.

SPECIFICATION forming part of Letters Patent No. 615,365, dated December 6, 1898.

Application filed December 27, 1895. Serial No. 573,536. (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 Grand Rapids, in the county of Kent and State of Michigan, 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, first, in the novel switches hereinafter described, timed with the shaft of the winding drum or gearing operating the same or other movable part 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, second, in the novel switches, also hereinafter described, 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 cable is connected through suitable gearing with a revoluble arm, by which the switches forming the second part of my invention may be directly moved in either direction and locked against accidental displacement, and these switches are connected with the usual "controller" or rheostat in a manner which will be hereinafter pointed out. The controller 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 is operated from the stopping and starting cable simultaneously with the operation of the switches forming the second part of my invention.

The switches constituting the first part of my invention are pivotally mounted on a switchboard and adapted to be independently operated by a traveler moving between them and actuated by a screw or other device, whose motion is derived from some part of the hoisting mechanism—preferably the shaft of the drum or gearing which causes said drum to revolve—the part or parts actuating said switches being in time with the hoisting mechanism, so that when the elevator reaches the upper end of its line of travel one of said switches will be moved and when the elevator reaches the lower end of its line of travel the other of said switches will be moved, while when said switches are both relieved from said traveler, as while the carriage is in motion in either direction, the said switches will be retained in their normal position by suitably-placed springs and locking devices hereinafter described. The switches connected with the hoisting mechanism, or "cut-off" switches, as they may be called, are provided with means of adjustment and novel features of construction, all of which will be fully explained hereinafter.

The invention will be more 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 enlarged end view of a part of the switch and switchboard connected with the controller. Fig. 3 is a top view of same. Fig. 4 is a top view of the apparatus shown in Fig. 1, a part of the wheel operable by the starting and stopping cable being broken away to disclose the mechanism appearing directly below the same, and in this figure the follower timed with the hoisting mechanism is shown in practically its intermediate position, and the switches connected with the controller are shown in their neutral position, this being the position they will have when moved by the starting and stopping cable to stop the elevator-carriage at any point intermediate the ends of its travel. Fig. 5 is a top view, partly broken away, of the switches connected with the controller and illustrating said switches as having been moved to the left from their neutral position for the purpose of setting the carriage in motion, and this figure also illustrates the manner of locking the arm by which said switches are actuated, so that it will not permit any accidental displacement of said switches. Fig. 6 is an enlarged transverse sectional view through a portion of the switchboard for the switches connected with the

hoisting mechanism and illustrates by full and dotted lines, respectively, the two positions of one of said switches. Fig. 7 is an enlarged end view, partly broken away and partly in section, of same and illustrating more particularly the form of the contacts for the switches. Fig. 8 is a detached top view, partly in section, of one set of the contacts present on each of the switch-arms of the switches operable from the hoisting mechanism. Fig. 9 is a detached side elevation of one of the angular levers forming a part of the switches operable from the hoisting mechanism; and Fig. 10 is a diagrammatic view of the motor, controller, and circuits.

In the drawings I have illustrated the switches, the wiring, and other parts in a form adapted for a Crocker-Wheeler compound-wound brake-motor of well-known form and construction.

A indicates the usual winding-drum, B the customary worm-and-pinion gearing for operating said drum, and C the shaft to which power is applied for actuating said gearing from the compound-wound motor, which is indicated in Fig. 4 by the reference-letter D.

The controller is indicated by the reference-letter E and is of well-known construction, being the Crocker-Wheeler railroad-controller of the form and construction employed in connection with the Crocker-Wheeler compound-wound brake-motor.

The controller E and the stopping and starting switches operable in connection therewith by the attendant in the carriage are illustrated in their relative positions in Figs. 1 and 4, in which it will be observed that the usual stopping and starting wheel F is mounted above said controller upon a vertical shaft G, which carries a pinion-wheel H, the latter being in engagement with the gear-wheel I, mounted directly upon the vertical shaft J of the controller E, and which shaft carries the arm K, by which the stopping and starting switches are actuated, and hence it will be noted that the attendant in the carriage, through the medium of the stopping and starting cable, will actuate both the switch-arm K and the controller E. The shaft G is mounted in a bracket L of ordinary form and is strengthened by its connection with the casing of the worm-and-pinion gearing by a brace M, as indicated in Fig. 1. The relative proportions of the pinion H and gear-wheel I are such that with a very small movement in the shaft G a rapid movement is attained in the controller-shaft J, and hence with but a small movement of the starting and stopping cable the actuating-arm K of the stopping and starting switches and controller E are quickly given their full movement.

I will first describe the cut-off switches adjacent to the hoisting mechanism and operable therefrom, and in this connection it is to be said that these switches shown in this specification embrace improvements upon the switches shown and described in Letters Patent of the United States, No. 537,856, granted to me April 23, 1895.

Upon the shaft of the hoisting-drum A is secured the gear-wheel N, which engages the pinion-wheel O upon the end of the revoluble threaded shaft P, which is suitably mounted and has upon it the traveler Q, which is analogous to the traveler upon the similarly-threaded shaft illustrated in the said Patent No. 537,856, with the exception that in the present instance the transverse bar R of said traveler has at each of its ends the two actuating-pins, (lettered S T and V W, respectively,) as illustrated more clearly in Fig. 4, and the purpose of which will appear hereinafter. The threaded shaft P is adjacent to the switch-boards X Y, which will preferably be of slate, and each of which has mounted in suitable bearings *a* the shafts *b c*, both of the latter being adapted to revolve and each connected with a spring exerting a tension to turn the shafts outward from the center of the switch-boards X Y. The shafts *b c* are provided with the lateral arms *d e*, which have hooked over them the upper ends of the rods *f g*, which extend downward through the slate switchboards X Y and carry upon their lower portions below said switchboards the coiled springs *h*, whose lower ends bear upon the adjacent nuts *i*, screwed upon the said rods *f g*. The relation of the spring *h*, nut *i*, slate switchboard Y, rod *f*, and arm *d* is plainly illustrated in Fig. 1, in which it will be observed that the pressure of the spring *h* is exerted to pull the rod *f* downward against the outer end of the arm *d*, and in this manner to turn the shaft *b* outward. Upon the shafts *b c* are secured the arms *j k l* and *m n o*, respectively, said arms extending inward from said shafts and being provided with collars *p* and set-screws *q*, by which they are adjustably secured upon the said shafts. The arms *j k l* and *m n o* correspond exactly with one another, and each has upon its inner end two pairs of contact-plates *r s*, which extend downward and are adapted to receive between them the metal contact-posts *t u*, respectively, as illustrated more clearly in Fig. 7. The pairs of plates *r s* are separated from the arms carrying them by means of the interposed layers of insulating material *v*, as indicated more clearly in Fig. 8; but said pairs of plates *r s* are themselves in electrical connection with each other through the bolts *w*, which pass through but are insulated from the arm carrying the said pairs of plates, as clearly illustrated in the left-hand portion of Fig. 8.

The relative proportions of the contact-plates *r s* with the contact-posts *t u* are illustrated in Fig. 6, in which it will be observed that the posts *t u* are in the form of plates seated upon the slate contact-boards and that the plates *r s* are slit to facilitate spring action therein. The upper edges of the posts *t u* are tapered to an edge to facilitate their entrance between the pairs of plates *r s*, and

the latter are of spring metal, in order that they may yield outward while passing downward upon the said posts and always maintain a firm contact therewith. The posts *t u* will be bolted or otherwise secured to the slate contact-boards, and each of said posts is provided with the lug *x*, which is integral therewith and is in electrical connection with the binding-post *y*, the latter entering an aperture in the slate switchboards, as illustrated in Fig. 6, and being at its upper end secured by the nut to the said lug *x*. The upper end of the binding-post *y* is threaded to receive said nut, and its lower end below the slate switchboard is provided with the annular shoulder *z*, the latter operating as a stop, and with the socket A′, which receives the conductor or wire B′, the latter being held in said socket by means of the screws C′ or other convenient means. Each of the arms *n m o* and *j k l* carries two pairs of the contact-plates *r s*, and the switchboards *x y* are provided with a pair of the contact-posts *t u* for the pairs of plates *r s*, carried by each of the said arms *m n o* and *j k l*, and each of the contact-posts *t u* is provided with a lug *x* and binding-post *y* of the construction illustrated in Fig. 6. Each of the arms *m n o* and *j k l* is provided with the collar *p* and securing-screw *q*, and each is thereby rendered adjustable upon the shafts *b c* for the purpose of regulating the relation of the contact-plates *r s* with the contact-posts *t u*. The contact-plates *r s*, carried by the arms *m n o j k l*, respectively, are never all at one time free from the contact-posts *t u*, but are always all in contact with the said posts when the follower Q is in the position illustrated in Fig. 4 and the elevator-carriage is intermediate the ends of its line of travel. At the termination of the travel of the elevator in one direction the contact-plates *r s*, carried by the arms *m n o*, are elevated to break the circuit and automatically stop the carriage, while the plates carried by the arms *j k l* remain in contact with the said contact-posts *t u*, and at the termination of the travel of the elevator in the other direction the contact-plates *r s*, carried by the arms *j k l*, are elevated to break the circuit and stop the carriage, while at this time the contact-plates carried by the arms *m n o* are in their lower position, engaging their contact-posts *t u*. The axial rotation of the shafts *b c* to elevate and depress, respectively, the arms *j k l* and *m n o* is accomplished by the follower Q, which travels upon the threaded shaft P, the latter receiving its motion from the hoisting mechanism. Upon the outer ends of the shafts *b c* are secured the plates D′, upon the inner faces of which are arranged the angular lever-arms E′, and upon the outer faces of which are arranged the plates F′. The lever-arms E′ have in their horizontal portion the elongated slots G′, (shown more clearly in Fig. 9,) through one of which passes the bolt H′, which retains the plates F′ and lever-arms E′ in position upon the plates D′. The shafts *b c* pass through the elongated slots in the lever-arms E′, and hence the latter arms are permitted to have a reciprocating movement to a limited extent upon the said plates D′. Within one of the slots G′ in the plates E′ is placed a spring I′, whose tension is exerted to draw the lever-arms E′ inward toward the center of the switchboards X Y. Adjacent to the inner ends of the lever-arms E′ are secured upon the switchboards X Y the stops J′, the form of which is illustrated more clearly in Fig. 7, and the purpose of which is to receive beneath them the inner ends of the lever-arms E′, and thereby retain the contact-plates *r s*, carried by the shafts *b c*, connected with said arms, in their lower position, the stops J′ resisting the tension of the springs *h* to throw said contact-plates *r s* upward over the contact-posts *t u*. When the arms *m n o* and *j k l* are in their horizontal position, as shown in Fig. 4, the inner ends of the lever-arms E′ will be beneath the upper bent ends of the stops J′, and said arms *m n o* and *j k l* will be retained in their horizontal position until the pins S W, carried by the follower Q, operate against the vertical portions of the lever-arms E′ to free the latter from the stops J′ and permit the springs *h* to throw said arms upward from the contact-posts *t u*.

It may be assumed for purposes of explanation that the follower Q is traveling toward the shaft *b* in Fig. 4, and under such assumption the pin W will gradually move toward the vertical portion of the lever-arm E′, connected with said shaft, and its action will be to move the said lever-arm longitudinally along the plate D′ until the inner end of said lever-arm has slipped from under the stop or post J′, at which time the spring *h*, being then unrestrained, will operate through the rod *f* and arm *d* to turn the shaft *b* and throw the arms *j k l* upward, thereby freeing the contact-plates *r s* carried by said arms from the contact-posts *t u*. The plate D′, being rigid with the shaft *b*, will under the conditions named turn upward simultaneously with the arms *j k l* and carry with it the lever-arm E′ and plate F′, and the latter during this movement will have its shoulder K′ brought into near relation to the pin V, carried by the follower Q, the pins V W at this time being between the upright portion of the lever-arm E′ and the said shoulder K′. Upon the return of the follower Q to the central part of the switchboards X Y or toward the shaft *c* the pin V will come into contact with the shoulder K′ of the plate F′ and depress the said plate and through it the plate D′ and lever-arm E′, and thereby the shaft *b* will be turned inward and the arms *j k l* will be depressed to their former horizontal position, the force of the pin V against the shoulder K′ serving to overcome the tension of the spring *h*. During the inward travel of the pin V from the shaft *b* the inner inclined end of the lower portion of the lever-arm E′ will move

downward against the stop J′, the spring I′ yielding to permit of said movement, and when the said portion of the lever-arm E′ has passed slightly below the bent upper end of the stop J′ the spring I′ will project the said lever-arm inward and cause its said inclined inner end to pass below the said stop J′ to its former position. The pin V will not pass over the shoulder K′ until the lower portion of the lever-arm E′ has passed substantially below the stop J′, and after the pin V has passed over the shoulder K′ the plate D′ and the parts connected with the same will turn upward sufficiently for the inner end of the lever-arm E′ to contact with the lower surface of the upper bent end of the stop J′. During this latter movement the pairs of contact-plates *r s* carried by the arms *j k l* pass downward upon the contact-posts *t u* and then slide upward slightly upon the same, the pairs of plates *r s* yielding to permit of this action, which is rendered necessary simply to enable the pin V to securely lock the lever-arm E′ below the stop J′ and then pass inward with the follower Q. The pins V W are utilized exclusively for operating the shaft *b*, and the pins S T are employed exclusively for operating the shaft *c*, and the operation of the pins S T is identical with that of the operation above specified for the pins V W, each of the shafts *b c* having the plate D′, lever-arm E′, and plate F′ and each of the switchboards X Y being provided with a stop J′ for contact with the lower inner end of the lever-arm E′. The action of the springs *h* upon the shafts *b c* is limited by the fact that the shoulders K′ of the plates F′ ascend into close relation to the pins V T of the follower Q and by the further fact that the rods *f g*, upon which the said springs *h* are placed, cannot descend when acting upon the arms *d e* farther than the arms L′, through which they pass, will permit. In the Letters Patent granted to me April 23, 1895, No. 537,856, the follower carried but one pin at each end instead of the two pins at each end, (shown in Fig. 4 of the present application,) and hence the advantages of the inner pins V T are not present in the apparatus described and claimed in said patent. A further advantage of the pins V T in the present application is that upon the return movement of the follower Q from the ends of the shaft P the depression of the plates D′ upon the shafts *b c* is more quickly effected than could possibly be the case if the pins V T were omitted and the pins S W were compelled not only to effect the elevation of the plates D′ and their connections, but also the depression of the same.

The switches hereinbefore described and located upon the switchboards X Y are operated automatically by the follower Q from the hoisting mechanism and are only operated at the terminus of the travel of the elevator, one set of the arms on said boards X Y being elevated when the elevator has reached the upper end of its line of travel and the other set of said arms being elevated when the elevator has reached the other end of its line of travel. The switches upon the switchboards X Y serve to automatically break the circuit at the ends of the line of travel of the carriage, and thereby operate to automatically arrest the latter. The switch-arms *l o* on the switchboards X Y, with their connections, would be unnecessary in many 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 switch-arms *l o* serving when said arms *l o* are in their lower position to establish the circuit which renders active the magnet which holds the brake and when in their upper position 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. If the switches and connections illustrated in connection with the switchboards X Y were employed in connection with the apparatus referred to in the aforesaid Letters Patent No. 537,856 or in Letters Patent granted to me April 23, 1895, No. 537,855, it would be unnecessary to employ the switch-arms *l o* or their connections, and hence in this application I do not limit the invention to the use of any special number of switch-arms on the shafts *b c*.

The second part of my invention pertains, as above described, to the switches connected with the stopping and starting devices of the elevator and with the controller E, and this part of my invention is more clearly illustrated in Figs. 1 to 5, inclusive. Upon the upper end of the casing for the controller E is provided the slate switchboard M′, which has at its opposite side edges the plates N′ O′, there being in this instance three of the plates N′ at one edge of the board and three of the plates O′ at the other edge of the board. The plates N′ O′ correspond with one another and are directly opposite to each other and are provided with the binding-posts P′. The upper portions of the plates N′ O′ are above the slate board M′, as illustrated more clearly in Fig. 1, and upon said board M′, between each pair of the plates N′ O′, is secured a transverse plate Q′, which at its ends is free of the plates N′ O′, as indicated by dotted lines in Figs. 3 and 4 and full lines in Figs. 1 and 2.

Upon the switchboard M′ are secured the guides R′, within which is placed the bar S′, connected with the arm T′, the latter being integral with the oval locking-frame V′, which incloses the actuating-arm K, hereinbefore described as being secured upon the shaft J of the controller E. The arm K is operated by the attendant in the carriage through the medium of the stopping and starting cable

connected with the wheel F and the gearing intermediate such wheel and the shaft J, as above described.

Upon the arm T′ are secured the contact-springs a' b', the outlines of which are clearly illustrated in Figs. 2. and 3. The contact-springs a' b' are arranged in pairs and project correspondingly from both sides of the arm T′, but are insulated from said arm, as shown in Fig. 2. The lower contact-springs b' rest upon and move along the surface of the plates Q′, secured to the switchboard M′, and the contact-springs a' at their outer ends are substantially above the springs b' and are adapted for contact with the lower surfaces of the upper inwardly-bent portions of the plates N′ O′ when the arm T′ is shifted toward the right or left over the switchboard M′. When the arm T′ is in a neutral position, as illustrated in Fig. 4, the springs b' will be in contact with the plates Q′, and when the arm T′ is moved to the right, looking at Fig. 4, the right-hand ends of the springs a' will pass below the upper bent ends of the plates N′, while when said arm T′ is moved to the left the left-hand ends of the springs a' will pass below the upper bent ends of the plates O′, as shown in Fig. 5. When the arm T′ is in its neutral position, as illustrated in Fig. 4, the elevator-carriage will be at rest. When the arm T′ is moved to the right to bring the spring-plates a' into electrical connection with the plates N′, the car will ascend, and when the arm T′ is moved to the left, so as to bring the spring-plates a' into electrical connection with the plates O′, the carriage will descend. The arm T′ has a positive reciprocating movement across the switchboard M′, being guided in its movement by the bar S′ and guides R′, and, as above described, the arm T′ receives its movement through the arm K, acting against the inner surface of the oval frame V′. When the shaft J is turned to move the arm K toward the left, as indicated in Fig. 5, the pressure of the roller at the outer end of said arm will drive the frame V′ to the left, and thereby cause the arm T′ and contact-springs a' b' to move toward the left, as shown in Fig. 5, the carriage being thereby caused to descend. When it is desired to shift the arm T′ to a neutral position, the arm K will be moved to a central position and the roller at its outer end will reach the concavity d' and come to a position in line with the length of the said arm T′, as indicated in Fig. 4, and when it is desired to shift the arm T′, with its contact-springs a' b', to the right the arm K will be turned to the right against the inner surface of the right-hand side of the frame V′, thereby effecting the movement of the said frame and arm T′ to the right. When the arm K is moved either to the right or left, it substantially occupies the diameter of the frame V′ and locks the latter against accidental movement, and hence the arm K, in connection with the frame V′, operates not only as a means for shifting the arm T′, but also as a lock for securing the said arm in its adjusted position. The arm K does not at any time make a complete revolution, but turns either to the left or right from the center position illustrated in Fig. 4, and the upper end of the controller within the casing E is provided with a stop e', which prevents the controller-shaft J and arm K from having a complete revolving motion. The switch represented at the left-hand side of Fig. 4 and hereinbefore described possesses three pairs of the spring-plates a' b', and the switchboard is provided with three pairs of the plates N′ O′, 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 limited to any special number of the plates a' b' and plates N′ O′ for the switchboard M′, 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. 537,855, it would be unnecessary to employ more than two pairs of the contact-plates a' b' and two pairs of the contact-plates N′ O′, and for some classes of elevator apparatus the said starting and stopping switches will be used as described in the said patent and also in Letters Patent granted to me March 27, 1894, No. 517,169.

The wiring illustrated in Fig. 4 is that which will be followed when the apparatus is used in connection with the Crocker-Wheeler railroad-controller and with the Crocker-Wheeler compound-wound brake-motor, and in said figure f' g' represent the main line conductors, to which are connected the auxiliary conductors h' i', the latter of which extends to the conductor j', connecting the binding-posts y of the contact-posts t u for the contact-plates r s, carried by the lever-arms k and n. The conductor h' passes to the conductor k', which connects the binding-posts y for the contact-posts t u, which receive the contact-plates r s, carried by the lever-arms j m. As above described, the contact-plates carried by the arms k j and m n, with their connections, are those used primarily for the making and breaking of the operating electric circuit, while the contact-plates carried by the arms l o and their connections are utilized in connection with the brake forming a part of the Crocker-Wheeler compound-wound brake-motor. One of the posts y of the contact-posts t u for the contact-plates r s carried by the lever-arm k is connected by the conductor m' with the binding-post of the upper plate O′, and the corresponding binding-post y of the contact-posts t u for the plates r s carried by the lever-arm n is connected by the conductor n' with the binding-post of the middle contact-plate N′ of the switchboard M′. One of the binding-posts y of the contact-posts t u for the plates r s carried by the lever-arm m is

connected by the conductor n'' with the binding-post of the upper contact-plate N′ of the switchboard M′, and the corresponding binding-post y of the contact-posts t u for the plates r s carried by the lever-arm j is connected by the conductor o' with the binding-post for the middle contact-plate O′ of the switchboard M′. The contact-posts t u for the plates r s carried by the lever-arms l o are connected together by the conductor p', and this conductor is by the conductor q' connected with the controller, and the contact-posts t u of the plates r s carried by the lever-arm o are by means of the conductor r' connected with the lower contact-plate N′ of the switchboard M′, while the contact-posts t u for the plates r s carried by the lever-arm l are through the medium of the conductor s' in electrical connection with the binding-post for the lower contact-plate O′ of the switchboard M′. The upper plate Q′ of the switchboard M′ is by means of the conductor t' connected with the controller. The middle plate Q′, of the switchboard M′ is by means of the conductor u' connected with the motor D, and from this conductor u' a conductor w' passes to the controller, and the lower plate Q′ of the switchboard M′ is by means of the conductor x' connected with the motor. The wiring shown in Fig. 4 is that which will be used when a controller and a compound-wound motor are used, and when these devices are not used the wiring may be of the nature described in the Letters Patent heretofore granted to me and hereinbefore referred to by number.

When the switch-arm T′ is in the neutral position illustrated in Fig. 4, the contact spring-plates a' b' are not in electrical connection with either the plates N′ or the plates O′, and hence the operating-circuit will be broken and the elevator-carriage will necessarily come to a stop and the brake for the motor will be released, so as to apply itself to check the momentum of the revolving portion of the motor.

The actuating-arm K makes and breaks the circuits when the arm T′ and plates a' b' are through it moved toward and from the plates N′ O′, and the shaft J, upon which said arm K is mounted, actuates the controller to reverse the current.

The automatic stopping of the elevator-carriage at the upper and lower ends of its line of travel is effected by the follower Q, in connection with the contacts and lever-arms j k l and m n o, with their coöperating devices present at the switchboards X Y. With the wiring illustrated when the elevator-carriage reaches the top of the elevator-shaft the follower Q through its pin S will turn the shaft c outward, and thereby elevate the arms m n o, which will break the circuit and cause the elevator-carriage to come to a full stop and the brake to be released from its magnet, the brake being thus permitted to check the momentum of the revolving portion of the motor. Upon the descent of the elevator-carriage the pin T on the follower Q, acting upon the plate F′, will restore the shaft and its arms m n o to their former position, and upon the elevator-carriage reaching the lower end of the elevator-shaft the pin W on the follower Q will turn the shaft b and arms j k l upward and thereby break the circuit, causing the elevator-carriage to come to a full stop and the brake at the motor to be released. Upon the next ascent of the elevator-carriage the pin V of the follower Q, acting upon the plate F′, will restore the shaft b and arms j k l to their former position, thus reëstablishing the electrical connection of the contacts carried by said arms j k l with the contact-posts t u, as illustrated in Fig. 7.

In Fig. 10 I show in a diagrammatic view the controller, motor, and circuits, these all being of the usual well-known form and arrangement.

The connections between the switches, controller, and motor are illustrated in Fig. 10, which diagrammatically shows the wiring for the several circuits. These circuits may be understood by a very brief description of Fig. 10. When the car is to ascend, the switch-arm T′ will be moved toward the right and the controller E will be turned toward the right, and under such condition of the parts the circuit will be from the main line-wire f', through the wire h' and connecting-wire k', to the switch m, thence through the wire n'' to the upper right-hand contact N′ and top plate a', and thence through the wire t' to the contact No. 1 of the controller. The shunt-field current is from contact No. 1 of the controller, through the body of the controller, to the contact No. 6 thereof, thence through the conducting-wire q' to the connecting-wire p', thence through the switch o and conducting-wire r' therefrom to the lower contact N′ and bottom switch-plate a', thence through the conducting-wire x', the left-hand shunt-field 40, the right-hand shunt-field 41, and the conducting-wire u' to the middle switch-plate a' and middle contact N′, and thence through the conducting-wire n', the switch n, and conductor j' to the wire i' and main line conductor g'. The armature-current from the contact No. 1 of the controller E is through the body of the controller from said contact No. 1 to the contact No. 2 of said controller, thence through the resistance denoted by the characters 2′ 3′ 4′ 5′, and thence through the conducting-wire 42, the right-hand series field 43, the left-hand series field 44, and the conductor 45 to the contact No. 7 of the controller, thence through the embedded conductor 46 to the contact No. 9 of the controller, thence through the conductor 47 to the lower brush 48 of the commutator, thence through the armature to the top brush 49 of the commutator, then through the conductor 50 to the contact No. 8 of the controller, thence through the embedded conductor 51 of the controller to the contact No. 10 of the

controller, thence through the conductor w' and up through the conductor u' to the middle switch-plate a' and middle contact N', and thence through the wire n', the switch n, the wire j', and the wire i' to the main line-wire g'.

When it is desired that the car shall descend, the switch-arm T' is moved to the left and the controller is turned to the left, and the current starts from the main line-wire f' and passes through the conductor h' and connecting-conductor k' to the switch j, and thence passes through the conductor o' to the upper contact O' and top switch-plate a', and thence through the wire t' to the contact No. 1 of the controller. The shunt-field current is from contact No. 1 of the controller, through the body of the controller, to the contact No. 6 thereof, then through the conductor q' and connecting-conductor p' to the lower switch l, thence through the wire s' to the lower contact O' and bottom switch-plate a', then through the wire x', the left-hand shunt-field 40, the right-hand shunt-field 41, and the wire u' to the middle contact-plate a' and middle contact O', then through the conducting-wire m' to the switch k and then through the conductor j' and wire i' to the main line-wire g'. The armature-current is from contact No. 1 of the controller, through the body of the controller, to the contact No. 2 of said controller, thence through the resistance indicated by the characters 2' 3' 4' 5', then through the conductor 42, the right-hand series field 43, the left-hand series field 44, and conductor 45 to the contact No. 7 of the controller, thence through the controller to the contact No. 8 thereof, then through the wire 50 to the upper brush 49 of the commutator, then through the armature to the lower brush 48 of the commutator, then through the conducting-wire 47 to the contact No. 9 of the controller, then through the controller from contact No. 9 to the contact No. 10, thence through the wire w' and up through the wire u' to the middle switch-plate a' and middle contact O', then through the conductor m' to the switch k and conductor j', and thence through the wire i' to the main line-wire g'.

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

1. In electrical apparatus of the character described, the shafts b, c, carrying the arms j, k, and m, n respectively, said arms being provided with the contact-plates r, s in electrical connection with one another, combined with the contact-posts t, u, for said contact-plates, means for turning said arms j, k and m, n, respectively, at the ends of the travel of the elevator-carriage to break the circuits and then downward on the reverse movement of the carriage to restore the circuits, and suitable conductors forming the circuits; substantially as set forth.

2. In electrical apparatus of the character described, the shafts b, c, carrying respectively the arms j, k and m, n, the said arms being provided with the pairs of contact-plates r, s, combined with the contact-posts l, u, the lever-arms upon the ends of said shafts b, c, the threaded shaft P timed with the hoisting mechanism, the follower on said shaft and adapted to contact with said lever-arms and elevate and depress the arms j, k and m, n, respectively, at the ends of the travel of the elevator-carriage, and suitable conductors forming the circuits substantially as set forth.

3. In electrical apparatus of the character described, the shafts b, c, carrying the arms upon which are secured the contact-plates, combined with the contacts t, u, for electrical connection with said plates, suitable conductors forming the circuits, the lever-arms E' secured upon the ends of said shafts, the plates F' also secured upon the ends of said shafts, and the follower Q having the pairs of pins S, T and V, W, respectively, for contact with said lever-arms and plates; substantially as set forth.

4. In electrical apparatus of the character described, the shafts b, c, carrying respectively the arms j, k, and m, n, the pairs of contact-plates r, s carried by said arms and being in electrical connection with one another, combined with the contact-posts l, u, adapted to pass between the said plates, the arms d, e respectively upon said shafts b, c, the rods f engaging said arms d, e, the springs upon said rods f, the arms L' for limiting the movement of the said rods f, and means substantially as described for turning said arms j, k and m, n respectively upward to break the circuit and then downward to complete the circuit at the ends of the travel of the elevator-carriage; substantially as set forth.

5. In electrical apparatus of the character described, the shafts b, c, and the arms j, k, and m, n, thereon, said arms being provided with the contact-plates r, s, in electrical connection with one another but insulated from said arms, combined with the contacts t, u, for connection with said contact-plates, the binding-posts y having the shoulder and socket and connected with said contacts t, u, means for turning said arms j, k and m, n, at the ends of the travel of the elevator-carriage to break the circuits and then to restore the circuits on the reverse movement of the carriage; substantially as set forth.

6. In electrical apparatus of the character described, the shafts b, c, the arms j, k, and m, n, adjustably secured thereon, and the contacts r, s, on said arms, combined with the contacts t, u for said contacts r, s, and means for actuating said arms from the hoisting mechanism; substantially as set forth.

7. In electrical apparatus of the character described, and in combination with the starting and stopping devices of an elevator, the frame V', the arm K adapted to be actuated by the said stopping and starting devices and to have its movement within the said frame V', the switch-arm T' connected with said

frame and provided with the series of pairs of contact-plates a', b', the switchboard M', the series of contact-plates N', O', for coöperation with said contact-plates a', the plates Q' upon which the said contact-plates b' move, and suitable conductors; substantially as and for the purposes set forth.

8. In electrical apparatus of the character described, the arm K adapted to have an oscillatory motion from the starting and stopping devices, the frame V' receiving said arm K and being of somewhat oval outline and having the central recess d', and the switch-arm T' connected with said frame, combined with the spring contact-plates a', b', carried by but insulated from the said arm T', the switchboard M' having the contacts N', O', and plates Q', and suitable conductors; substantially as and for the purposes set forth.

9. In electrical apparatus of the character described the wheel F adapted to be actuated from the stopping and starting devices in the elevator-carriage and mounted upon the shaft G, the pinion H also on said shaft, the gear-wheel I engaging said pinion and mounted upon the shaft J, and the arm K mounted upon said shaft J, combined with the sliding switch-arm T' adapted to be actuated from said arm K, a series of pairs of contacts a', b', carried by but insulated from said switch-arm T', the plates Q' upon which the said contact-plates b' move, the contacts N', O', for electrical connection with said contacts a, and suitable conductors; substantially as and for the purposes set forth.

10. In electrical apparatus of the character described, the arm K adapted to be actuated from the elevator-carriage, and the sliding frame receiving and adapted to be moved by said arm K, the guides for directing the said frame in its movement, the arm T' connected with said frame, the spring-contacts a', b', carried by but insulated from the said arm T', the plates Q' upon which said contacts b' move, the contacts N', O', for electrical connection with said contacts a', and suitable conductors; substantially as and for the purposes set forth.

11. In electrical apparatus of the character described, the arm K adapted to be moved from the elevator-carriage, the switch-arm T' adapted to be actuated from said arm K, the spring-contacts a', b', carried by said arm T', the plates Q' upon which the contacts b' move, the contacts N', O', adapted to receive said contacts a', and suitable conductors; substantially as and for the purposes set forth.

12. In electrical apparatus of the character described, the arm K adapted to be actuated from the elevator-carriage, the switch-arm T' adapted to be moved by said arm K, the spring-contacts a', b', carried by said arm T', the plates Q' for electrical connection with said contacts b', the contact-plates N', O', for electrical connection with said contacts a', and suitable conductors and switches; substantially as and for the purposes set forth.

13. In electrical apparatus of the character described, the switch-arm T', and means for moving the same from the elevator-carriage, combined with the pairs of contacts a', b', carried by but insulated from said arm, the plates Q' upon which the contacts b' move, the contacts N', O', to receive said contacts a', and suitable conductors and switches; substantially as and for the purposes set forth.

14. In electrical apparatus of the character described, the compound-wound brake-motor, the controller, the starting and stopping switch, and means for operating said switch and controller from the elevator-carriage, said switch having three sets of contacts for forming the circuits at the ends of the movements of said switch, combined with the pair of switches operated from the hoisting mechanism and each having three pairs of contacts, 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 26th day of November, A. D. 1895.

JAMES H. ROBERTS.

Witnesses:
CHAS. C. GILL,
E. JOS. BELKNAP.