(No Model.) 4 Sheets—Sheet 1.

J. H. ROBERTS.

ELECTRIC APPLIANCE FOR ELEVATORS.

No. 537,855. Patented Apr. 23, 1895.

Fig. 1.

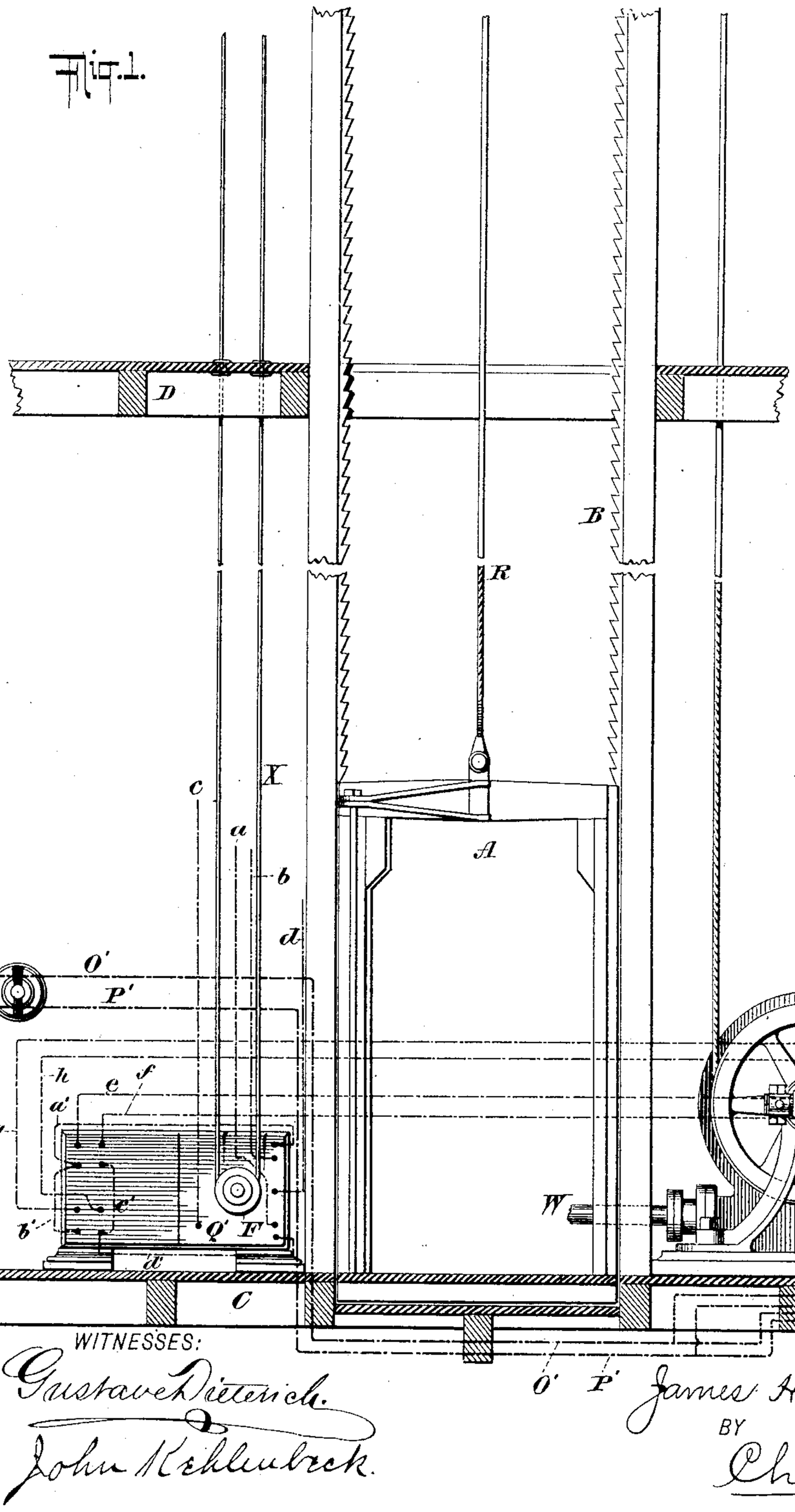
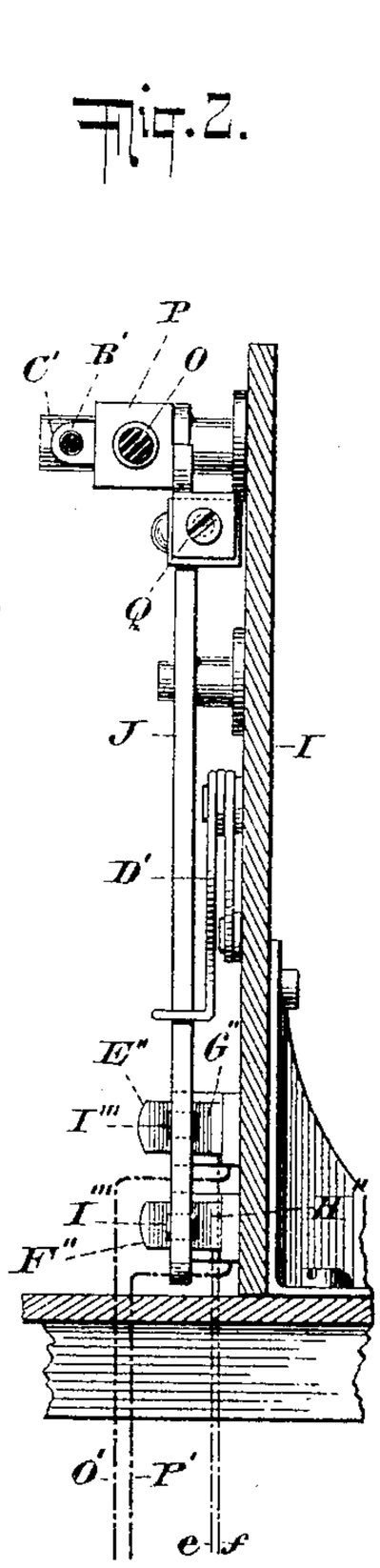


Fig. 2.



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(No Model.) 4 Sheets—Sheet 2.

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ELECTRIC APPLIANCE FOR ELEVATORS.

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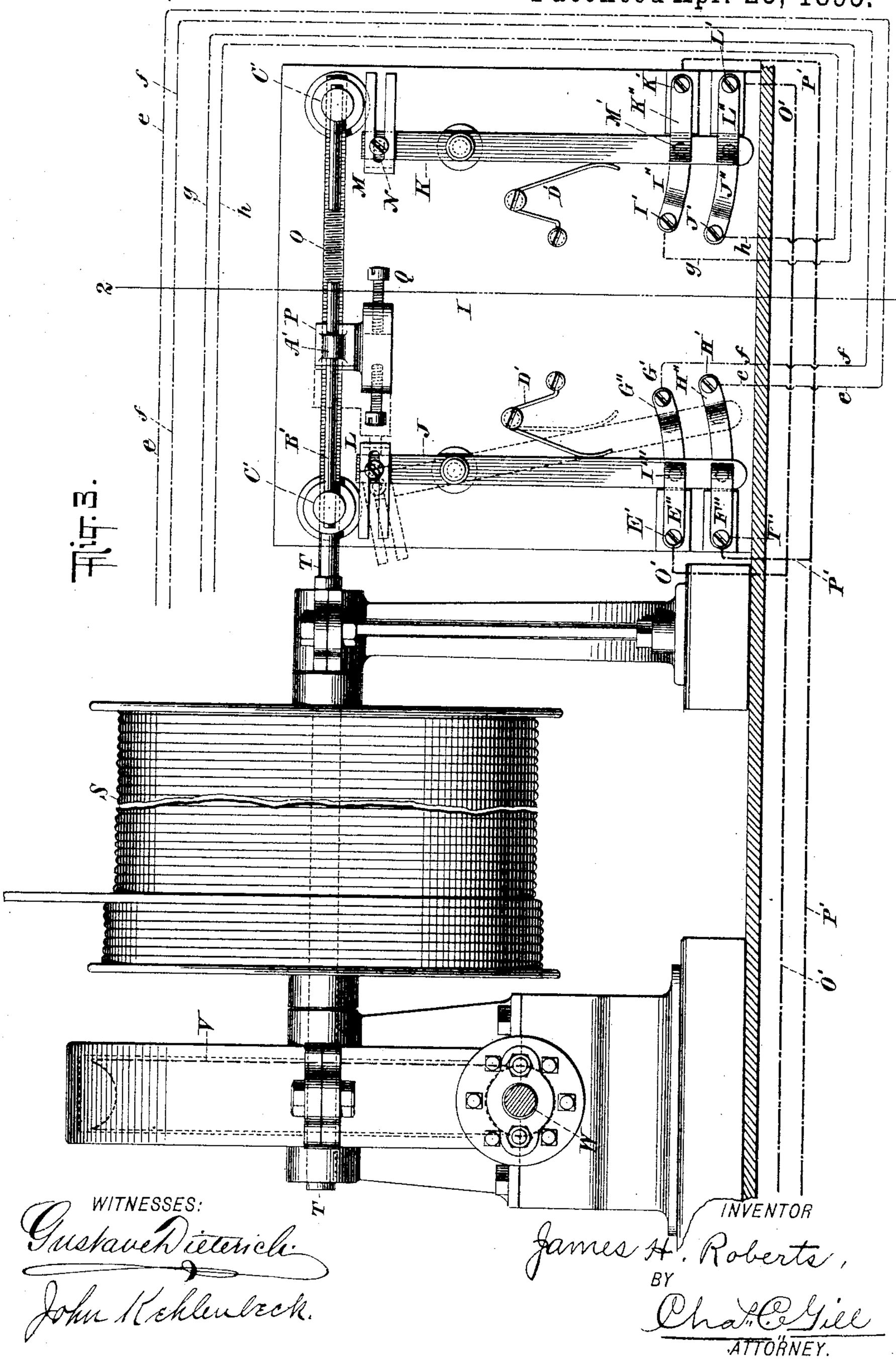

Fig. 3.

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(No Model.) 4 Sheets—Sheet 3.

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ELECTRIC APPLIANCE FOR ELEVATORS.

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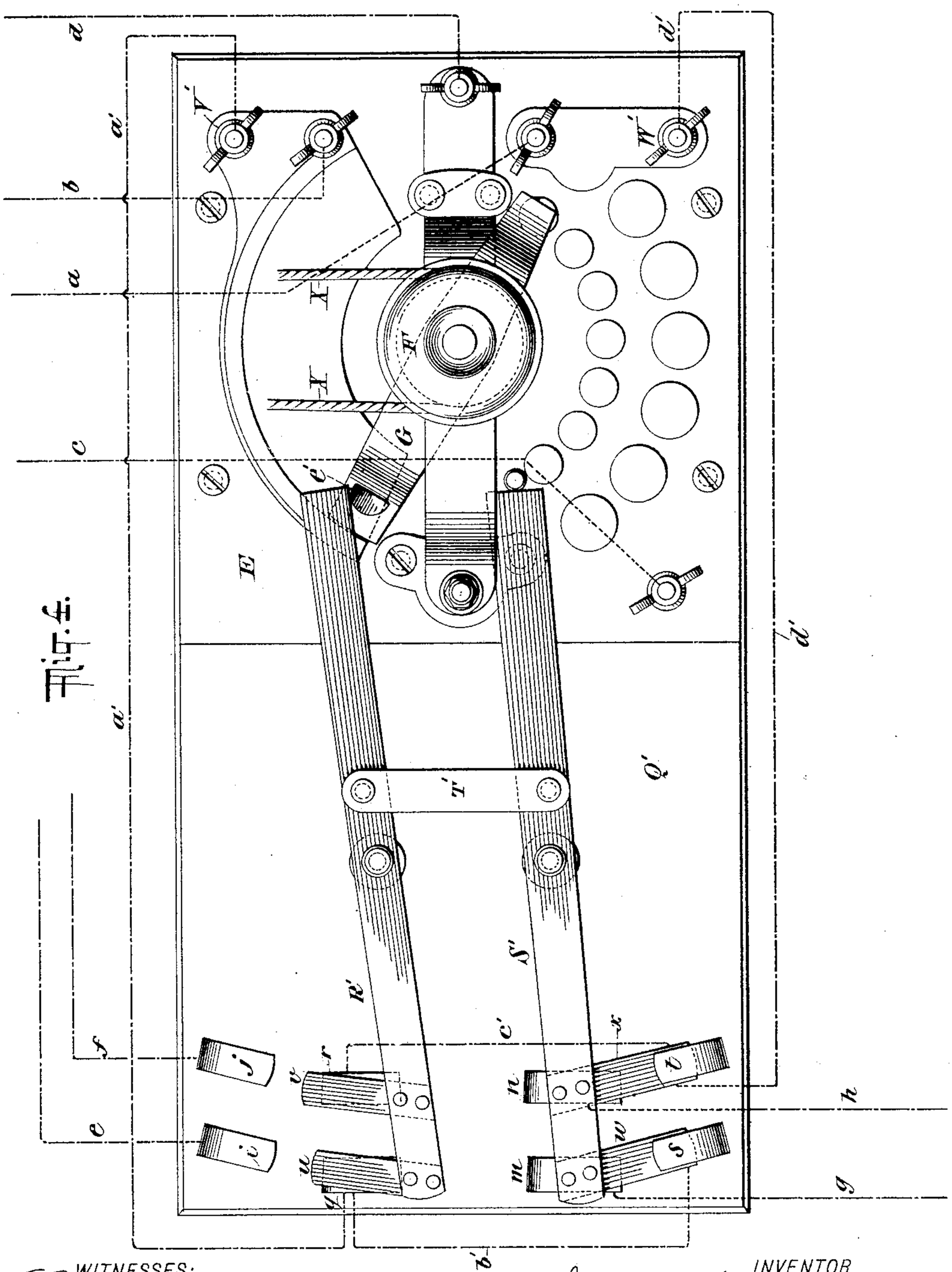

Fig. 4.

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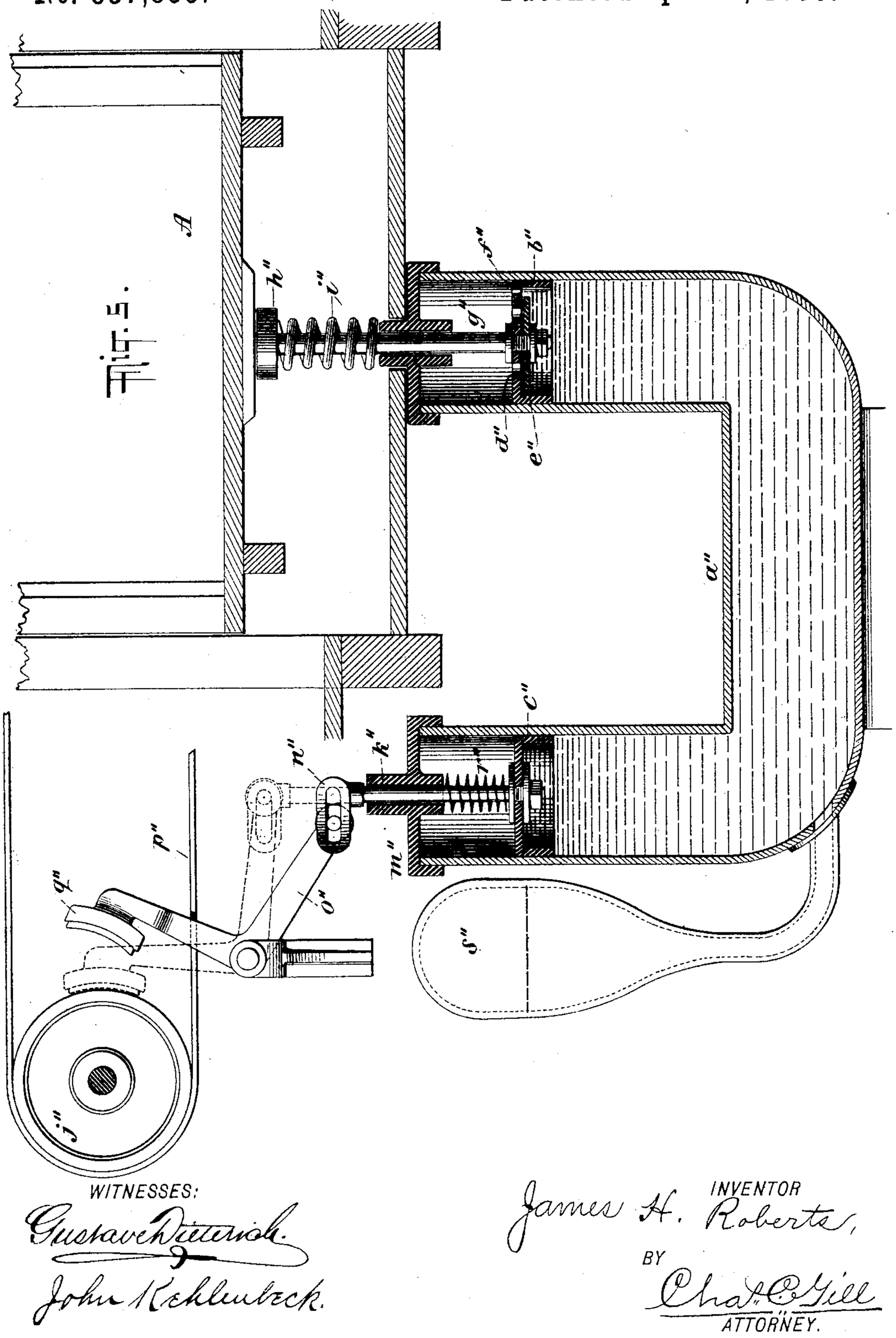
ELECTRIC APPLIANCE FOR ELEVATORS.

No. 537,855. Patented Apr. 23, 1895.

Fig. 5.



WITNESSES:

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UNITED STATES PATENT OFFICE.

JAMES H. ROBERTS, OF GRAND RAPIDS, MICHIGAN.

ELECTRIC APPLIANCE FOR ELEVATORS.

SPECIFICATION forming part of Letters Patent No. 537,855, dated April 23, 1895.

Application filed October 6, 1894. Serial No. 525,089. (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 Electric Appliances for Elevators, of which the following is a specification.

The invention relates to improvements in electric appliances for elevators or other forms of hoisting or elevating apparatus, and consists, first, in the novel switches hereinafter described timed with the shaft of the winding drum 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 combination with the switches above mentioned of the reversible rheostat and the switch operable therefrom, as hereinafter described, under the action of the usual stopping and starting cable, whereby the elevator may be started and stopped at will by the attendant at any time. The stopping and starting cable is connected with a revoluble wheel applied to the rheostat and having on its spindle an arm whose oscillation actuates the rheostat switch arms, as hereinafter described. The rheostat, in the combination presented, performs its usual functions of offering the resistance and affording a convenient means of controlling the current and determining the direction of movement of the elevator. The switch connected with the rheostat comprises two pivoted arms connected by a link to insure simultaneous movement and each carrying at its outer end two independent elongated contacts adapted to be brought into electrical connection with and complete the circuit between the conductors leading from the cut-off switch in the waiter-shaft, and the conductors leading to the rheostat. The switch board has eight terminals or contacts, four at its upper portion for connection in pairs by means of the two contacts on one of said pivoted switch arms, and four at its lower portion for connection in pairs by the two contacts on the other of said arms. The pivoted switch arms being connected by a link will have a simultaneous movement but not a simultaneous active operation, since as said arms are moved to cause the contacts carried on the end of one thereof to connect the four upper terminals in pairs to complete one circuit, the arm carrying the other two contacts will be carried away from the four lower terminals and break the previously existing circuit. Thus when the outer ends of the switch arms are in their upward position the circuit will be formed through the four upper terminals, the electrical connection between the four lower terminals being broken, and when the outer ends of the switch arms are in their lower position the circuit will be formed through the four lower terminals, the electrical connection between the upper terminals being broken.

The switches constituting the first part of my invention are pivotally mounted on a switch board 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 revolving drum or its shaft, the part or parts actuating said switches being in time with said 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. The switches connected with the hoisting mechanism, or cut off switches as they may be called, are provided with means of adjustment and incidental novel features of construction, all of which will be fully explained hereinafter.

A further part of the invention consists in means located below the elevator and which upon the descent of the elevator thereupon will operate to "brake" the belt wheel of the motor, so that after the circuit has been broken by the switches the said wheel will not under the action of its momentum continue to revolve. In accordance with this part of my invention the force of the descending car

or elevator at the end of its travel is utilized to "brake" the motor wheel temporarily, the brake being released promptly thereafter in order that when it is desired to cause the ascent of the car the motor may be free.

The invention made the subject hereof comprises certain improvements on the apparatus described and claimed in Letters Patent of the United States, No. 517,169, granted to James H. Roberts, then residing in Brooklyn, New York, on the 27th day of March, 1894; and said 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 vertical section through a portion of a building and showing an elevator with its usual hoisting mechanism and also the electrical apparatus constructed in accordance with and embodying the present invention. Fig. 2 is a vertical section through the switch board of the cut-off switches connected with the hoisting mechanism. Fig. 3 is an enlarged side elevation of the hoisting mechanism and the switches operable therefrom and indicating by the dotted line 2—2 the section on which Fig. 2 is taken. Fig. 4 is an enlarged plan view of the reversible rheostat and the switches operable therefrom, the said switches and the details of the rheostat being omitted from Fig. 1 in order not to confuse the illustration; and Fig. 5 is a vertical longitudinal section through a portion of the elevator and the means for "braking" the belt wheel of the motor.

In the drawings A designates the elevator; B, the usual elevator shaft through which the elevator travels, and C, D, respectively, floors of the building.

The elevator A is provided with the hoisting cable R which is adapted to be wound upon and unwound from the usual hoisting drum S, whose shaft T is provided with the usual worm gearing V, set in motion by a worm secured upon the shaft W, whose rotation is effected by an electric motor, any suitable motor being employed for this purpose. The cable R, drum S, worm gearing V, shaft T and shaft W are of the usual form of mechanism employed in connection with elevators.

The electric motor which will be connected with the shaft W will have its field and brushes connected by conducting wires *a*, *b*, *c*, *d*, respectively, with the rheostat E, the wires *a*, *b*, being the conductors for the field and those lettered *c*, *d*, the conductors for the brushes. The rheostat E is of the well known construction in which the current may be readily reversed for the purpose of reversing the motion of the motor shaft W and hence determining the direction of travel of the elevator A, the motion of said shaft W in one direction causing the ascent of the elevator and in the opposite direction the descent of the same. The rheostat E is provided with the pulley wheel F, of non-conducting material, which is adapted to be operated by the usual starting and stopping cable X within reach of the attendant in the elevator, and which pulley wheel F when turned by said cable X causes in the usual manner the customary movement of the arm G (see Figs. 2 and 4), the said arm when turned upward from a horizontal or neutral position completing the circuit to cause the descent of the elevator and when turned downward from said horizontal or neutral position effecting the reversal of the current and causing the ascent of the elevator.

The rheostat which I have employed with advantage in carrying my invention into effect and have illustrated in the accompanying drawings is the one known in the trade as the Crocker-Wheeler reversible rheostat.

In suitable relation to the hoisting mechanism for the elevator, is provided a switch board I upon which are pivotally mounted the switch arms J, K, having at one end the adjustable contact plates L, M, which are slotted as illustrated in Fig. 3, and held in place upon said switch arms by means of the screws N, which admit of the lateral adjustment of said plates. Above the contact plates M and mounted in suitable bearings is provided the threaded shaft O, which in the present instance is connected with the shaft T of the winding drum S and is adapted to revolve therewith. Upon the threaded shaft O is placed the internally threaded traveler P, the main body of which travels in a horizontal plane intermediate the contact plates L, M, and is provided at its opposite ends with screws Q which during the travel of the follower P come into contact with the plates L, M, and effect the movement in one direction of the switch arms J, K. The screws Q are adjustable and hence the exact moment of their contact with the plates L, M, may be regulated at will. The follower P is provided with the lug A′ having a small aperture loosely fitting upon the guide rod B′, which is held at its opposite ends in the posts C′, the purpose of the rod B′ and lug A′ being to prevent the traveler P from rotating with the threaded shaft O and to guide the said traveler along the said shaft in the space between the contact plates L, M, or the upper ends of the switch arms J, K. The switch arms J, K, are retained in their normal position shown by full lines in Fig. 3 by means of the springs D′ and are alternately moved from such position by the contact of the follower P with one or the other of the plates L, M, or the upper ends of said switch arms. In Fig. 3 the follower P is shown by full lines at an intermediate point between the upper ends of the switch arms J, K, and under such condition the elevator A will be at some intermediate point in its line of travel; and in Fig 3 I have by dotted lines illustrated the traveler P in contact with the plate L upon the upper end of the switch arm J and under this condition the said traveler will maintain the said switch arm J in the position in which it is illustrated by dotted

lines until during the following movement of the elevator A the said traveler is by the rotation of the shaft O caused to recede from the said switch arm J, at which time the spring D′ will return the said switch on J to its normal position, illustrated by full lines in Fig. 3. The shaft O is connected with the shaft T in order that the winding drum S and the said shaft O shall have a simultaneous movement, and the parts are so timed with respect to each other that upon the drum S having made a sufficient number of revolutions for the elevator A to have completed its ascent the said shaft O will at the same time have made a sufficient number of revolutions to move the traveler P from one extreme position to its other extreme position, thereby releasing one of the switch arms on the board I and engaging the other switch arm, and that when the winding drum S shall have made a sufficient number of revolutions to permit the complete descent of the elevator A the said shaft O will have revolved sufficiently to return the traveler P to its former or initial position, releasing the switch arm engaged at the end of its first movement and re-engaging the switch arm with which it was in contact at the starting of the elevator A on its ascent. The object of connecting the shaft O with the shaft T is merely to time the revolution of the former with the latter and with respect to the movement of the elevator A, and hence the invention is not limited to a direct connection of the shaft O with the shaft T in the manner illustrated in the drawings since it is well known that various forms of gearing and connecting mechanism may be introduced intermediate the shaft O and the shaft T, or the parts driven thereby, to insure the shaft O having its movement simultaneously with the winding drum S and being capable of being timed therewith.

Upon the switch board I are provided the contacts E′, F′, G′, and H′, for the switch arm J, and the contacts I′, J′, K′, L′, for the switch arm K. The contacts E′, F′, are provided with the spring plates E″, F″, and the contacts G′, H′, with the plates G″, H″, which extend toward and on a lower plane than the plates E″, F″, the lower end of the switch arm J being adapted to move between the upper plates E″, F″, and the lower plates G″, H″, as indicated, and provided with conducting pins I‴ extending through the same so as to connect said plates in pairs, as illustrated in Figs. 2 and 3. The contacts I′, J′, for the switch arm K are provided with the plates I″, J″, and the contacts K′, L′, with the upper spring plates K″, L″, the said pairs of plates being upon opposite sides of the lower end of the switch arm K, which is provided with the conducting pins M′ adapted to connect said plates in pairs, as illustrated in Figs. 2 and 3. The contacts E′, F′, K′, L′, of the switches J, K, are in electrical connection with the main line wires or conductors O′, P′, and the contacts G′, H′, I′, J′, of said switches are in electrical connection with the auxiliary wires or conductors *e*, *f*, and *g*, *h*, leading to the switch board Q′, adjoining the rheostat E. When the switch arm J is in its normal position, as shown by full lines in Fig. 3, the main line wires or conductors O′, P′, and auxiliary wires or conductors *e*, *f*, are at the switch in electrical connection with each other, through the plates E″, F″, G″, H″ and conducting pins I‴, and when the switch arm K is in its normal position, as shown by full lines in Fig. 3, the main line wires or conductors O′, P′, and auxiliary wires or conductors *g*, *h*, are at the switch in electrical connection with each other through the plates I″, K″, J″, L″ and pins M′. When the switch arm J is turned to the position illustrated by dotted lines in Fig. 3 by the contact therewith of the traveler P, the main line wires O′, P′, and auxiliary wires E′ F′, are at the switch thrown out of electrical connection, the conducting pins I‴ being withdrawn absolutely from the plates E″, F″, and when the arm K is moved outward from its normal position by the contact therewith of the traveler P, the main line wires O′, P′, and auxiliary wires *g*, *h*, are at the switch thrown out of electrical connection by the withdrawal of the connecting conducting pins M′ from the plates K″, L″. The auxiliary wires or conductors *e*, *f* lead from the switch J to the stationary contacts or terminals *i*, *j*, of the switch board Q′, and the auxiliary wires or conductors *g*, *h*, lead from the switch K to the stationary contacts or terminals *m*, *n*, of the switch board Q′. The switch board Q′ is provided adjacent to the contacts *i*, *j*, with the contacts *q*, *r*, and adjacent to the contacts *m*, *n*, with the contacts *s*, *t*, the said contacts *i*, *j*, and *s*, *t*, being folded spring metallic strips whose upper portion is free and has when pressed outward a spring tension toward the lower portion thereof which is secured to the switch board Q′. The contacts *i*, *j*, and *s*, *t*, substantially form pockets to receive, respectively, at the proper time the elongated contacts *u*, *v*, and *w*, *x*, carried respectively by the non-conducting arms R′, S′, which are pivoted to the board Q′ and connected together to have a simultaneous movement by the link T′. The contacts *q*, *r* and *m*, *n*, are spring metallic strips bowed upward at their centers to positively engage with the lower surfaces of the elongated contacts *u*, *v* and *w*, *x*, respectively, the latter contacts being metallic strips of sufficient length to connect the contacts *i*, *j*, with the contacts *q*, *r*, or the contacts *m*, *n*, with the contacts *s*, *t*, according to whether the outer ends of the arms R′, S′, are moved upward or downward. From the contact or terminal *q* a conducting wire *a′* passes to the post V′ of the rheostat E, and another conducting wire *b′* to the contact *s*, and from the contact *t* one conducting wire *c′* leads to the contact *r* and another lettered *d′* to the post W′ of the rheostat. The elongated con-

tacts u, v and w, x, are carried by the outer ends of the arms R′, S′, and slide against the surface of the contacts q, r and m, n, and their purpose is to form an electrical connection between the contacts i, j and q, r, or between the contacts m, n and s, t. The inner ends of the arms R′, S′, extend over the edge of the rheostat E in position to be met and moved by the stud e' on the arm G (see Fig. 4) as the latter is actuated by the starting and stopping cable X and pulley wheel F to move upward or downward from its neutral position.

In explaining the operation of the electrical mechanism above described it may be assumed for convenience that the elevator is at rest at some point intermediate its line of travel in the elevator shaft, and that it is desired to cause the further ascent of the same. When the elevator is in such condition, it will have been brought to a stop by the attendant, through the cable X and wheel F having turned the arm G of the rheostat to a neutral position and separting the contacts u, v and w, x, from the contacts i, j, and s, t. To re-establish the circuit and cause the elevator to ascend it will be necessary simply by means of the cable X to turn the wheel F to the left, carrying the arm G downward and causing the stud e' to depress the inner end of the arm S′. Thus the outer ends of the arms R′, S′, are moved upward and the contacts u, v thereon connect the contacts i, j, with the contacts q, r, while immediately following such electrical connection of said contacts the said arm G completes as usual the circuit through the rheostat, the result being that a complete circuit will be formed from the main line wires O′, P′, and switch J through the auxiliary conductors e, f, contacts i, j, contacts q, r, and conductors a', c', d', to the rheostat and that the elevator will ascend until the drum S and shaft T have made a sufficient number of revolutions to cause the traveler P to move against the upper end of the switch J and throw the lower end thereof outward to the position shown by dotted lines in Fig. 3, thus breaking the circuit and causing the stoppage of the elevator and motor. The movement of the winding drum, or of any other part of the hoisting mechanism from which the traveler P may receive its motion, automatically breaks the circuit at the end of the line of travel of the elevator and causes the latter to come to a stop. While the elevator is at rest at the top of the elevator shaft the traveler P maintains the switch J in the position indicated by dotted lines in Fig. 3, thus absolutely preventing the elevator from making any further ascent or any renewal of the circuit from the main line wires O′, P′, through the switch J and wires e, f. When it is desired to cause the descent of the elevator the wheel F by means of the cable X will be turned toward the right, carrying the arm G upward over the face of the rheostat and causing the stud e' to move upward against the arm R′, thereby depressing the outer ends of the arms R′, S′, withdrawing the contacts u, v, from the contacts i, j, and moving the contacts w, x to connect the contacts m, n, with the contacts s, t, under which condition the electric circuit will be complete from the main line wires O′, P′, and switch K through the wires g, h, contacts, m, n, w, x, s, t, and wires d', b' and a' to the rheostat, and the elevator will at once descend and continue its descending movement until either the wheel F is turned to bring the elevator to a stop or the winding-drum S and shaft O have made a sufficient number of revolutions to cause the traveler P to move from the position in which it is shown by dotted lines in Fig. 3 to a similar position at the opposite end of the shaft O, where it will upon arriving at such position force the lower end of the switch K outward from the contact plates K″, L″, and break the circuit, at which time the elevator and electric motor will come to a stop; and while the elevator and motor are thus stationary the traveler P will prevent the spring D′ from returning the switch K to its normal position to re-establish the circuit through the said switch K. After the elevator has started downward the traveler P leaves the upper end of the switch J and said switch upon being released by the traveler P will be returned to its normal position, shown by full lines in Fig. 3, by means of the spring D′ in contact therewith, at which time an electrical connection will be established through the said switch (its conducting pins I‴) from the main line wires O′, P′ to the wires e, f. When the switch K is in its normal position, illustrated by full lines in Fig. 3, an electrical connection is established from the main line wires O′, P′, through said switch (its conductors M′) to the wires g, h.

It will be observed that while the elevator is on its line of travel, the traveler P is moving between the switches J, K, and that both of the latter are in their normal position preparatory to the circuit being established to either elevate or lower the elevator by turning the wheel F toward the left or the right, as the case may be. The switches J, K, break the circuit at the ends of the line of travel of the elevator and the wheel F on the rheostat is utilized to arrest the elevator at any intermediate point of its line of travel and to cause said elevator to ascend or descend at will. It is thus plain that the operation of the elevator is under the absolute control of the attendant, who, by simply pulling on the cable X, may cause the elevator to ascend or descend or come to a full stop at will.

The elevator stops automatically at the ends of its lines of travel and may be arrested at any other point by the turning of the wheel F to bring the arm G of the rheostat to a neutral position.

In the foregoing description has been presented a full explanation of the switches and

wires and their mode of operation. In view of the fact however, that upon the descent of the car and the breaking of the circuit at the switch K, the momentum of the belt wheel of the electric motor is likely to cause said wheel to continue its motion for a few revolutions, I have provided mechanism, shown in Fig. 5, for "braking" said wheel immediately upon the descent of the elevator and then releasing said wheel so as to free the motor preparatory to the ascent of the elevator.

In Fig. 5 a'' denotes a substantially U-shaped tube containing liquid and provided at its opposite ends with the pistons b'', c'', the former containing apertures d'' and provided upon its lower side with the plate valve e'', which during the downward movement of the piston b'' closes the said apertures d'' and during the upward movement of said piston recedes from said apertures d'' and permits whatever liquid may have arisen above the piston to return through the same. The piston d'' is also provided with a vent aperture f'', the purpose of which will be hereinafter referred to. The piston rod g'' of the piston b'' passes upward through the cap upon the upper end of the tube a'' and is provided upon its upper extremity with the head h'', a coiled spring i'' being provided intermediate said head and the cap of the tube a''. The head h'' is centrally below the elevator A and is adapted to receive the force of the elevator during the last portion of the descent of the latter, whereby it depresses the piston b'' closing the apertures d'' and driving the liquid contained in the tube a'' upward against the piston c'', the upward movement of which effects the "braking" of the motor wheel j'' as hereinafter described. The rod k'' connected with the piston c'' ascends through the cap m'' and is provided with the slotted head n'' which receives a transverse pin formed on the lower arm of the bell crank lever o'', the upper arm of which is turned inward around the belt p'' and carries the brake shoe q'', which during the upward movement of the piston c'' is forced againt the surface of the motor wheel j'' and prevents the revolution of the same. During the downward motion of the piston c'' the slotted head n'' acting through the bell crank lever o'' withdraws the brake shoe q'' from the wheel j'' as indicated by full lines in Fig. 5. Intermediate the cap m'' and the piston c'' is provided upon the piston rod k'' the coiled spring r'' which serves to retain the piston c'' against the liquid contained in the tube a'' and to afford a pressure on said liquid which will aid in the movement thereof toward the piston b''. The spring r'' also insures the quick release at the proper time of the shoe q'' from the motor wheel j''. To the tube a'' is connected the air chamber s'' of the usual kind employed in pumps.

During the latter portion of the descent of the elevator A and after the electric circuit has been broken at the switch K, the elevator will come into contact with the head h'' and depress the piston b'' against the liquid contained in the tube a'' and thereby cause said liquid to move toward the piston c'' and elevate the same for the purpose of applying the brake shoe q'' to the wheel j'', as indicated by dotted lines in Fig. 5, and the purpose of thus applying the brake shoe q'' is to prevent the wheel j'' from continuing to revolve under the action of its own momentum after the electric circuit has been, as above mentioned, broken at the switch K. In order that after the wheel j'' has ceased to revolve the shoe q'' may be automatically released preparatory to the ascent of the elevator A and the further revolution of the wheel j'' I have provided in the piston b'' the aperture f'' which immediately upon the brake shoe q'' having been applied will permit a portion of the liquid contained in the tube a'' to escape upward to the upper side of the piston b'' thus releasing the pressure against the piston c'' and allowing the spring r'' to force the said piston c'' downward sufficiently to withdraw the shoe q'' from the wheel j'', releasing the latter and enabling the starting of the motor without any retardation from the brake. Upon the ascent of the elevator the spring i'' acting on the head h'' will elevate the piston b'', thus further releasing the pressure on the liquid in the tube a'' and permitting the plate valve e'' to lower, at which time the liquid which ascended through the aperture f'' will desend to the lower side of the piston b'' through the apertures d''.

From the foregoing description it will be observed that after the electric circuit has been broken at the switch K the elevator will automatically apply a brake to the motor wheel whereby to prevent the momentum of the latter from continuing the revolution of the wheel, and that the brake is automatically released from said wheel prior to the circuit being again completed for the elevation of the carriage A.

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

1. In electrical appliances for elevators and the like, the independent pivotally mounted switches J, K, independent springs acting against said switches, the two pairs of contacts for each of said switches, the screw connected with the shaft of the hoisting drum, and the traveler on said screw and adapted to alternately move said switches and thereby break the circuit at each end of the movement of the elevator, combined with the main line conductors leading to one pair of said contacts for each of said switches, the reversible rheostat having the operating pulley wheel, the switch board adjacent to said rheostat, auxiliary conductors leading from said switch board to said rheostat, auxiliary conductors leading from said switch board to the other pair of said contacts for each of said switches, a switch operable from the said rheostat and pulley wheel to connect either the auxiliary

conductors of one of the independent switches and the auxiliary conductors to the rheostat in circuit or the auxiliary conductors for the other independent switch and the auxiliary conductors to the rheostat in circuit, and the stopping and starting cable on said pulley wheel for operating the same; substantially as set forth.

2. In electrical appliances for elevators and the like, the independent pivotally mounted switches J, K, having respectively the conductors I‴, M′, the contacts E″, F″, G″, H″, for the switch J, the contacts I″, J″, K″, L″, for the switch K, and suitable main line and auxiliary conductors, combined with the traveler intermediate said switches and operable to alternately move the same directly from the hoisting mechanism, one pair of said contacts at each switch being at one side of the switch and the other pair at the opposite side thereof; substantially as set forth.

3. In electrical appliances for elevators and the like, the independent pivotally mounted switches J, K, having respectively the conductors I‴, M′, the contacts E″, F″, G″, H″, for the switch J, the contacts I″, J″, K″, L″ for the switch K, and suitable main line and auxiliary conductors, combined with the traveler intermediate said switches and operable to alternately move the same directly from the hoisting mechanism, and means of adjustment whereby the time at which the traveler may strike said switches may be independently regulated for each switch, one pair of said contacts at each switch being at one side of the switch and the other pair at the opposite side thereof; substantially as set forth.

4. The elevator, and means for creating power to effect the movement thereof, combined with the liquid chamber having a piston at each end, and the brake mechanism connected with the rod of one of said pistons, the rod of the other piston being exposed to the action of the descending elevator; substantially as set forth.

5. The elevator, and the motor therefor, combined with the liquid chamber having a piston at each end, and brake mechanism intermediate the motor and one of said pistons, the other piston having the releasing vent and being exposed to the action of the descending elevator; substantially as set forth.

6. The elevator, and the motor therefor, combined with the liquid chamber having a piston at each end, one of said pistons being provided with brake mechanism, and the other being valved and provided with a releasing vent and exposed to the action of the descending elevator; substantially as set forth.

7. The elevator, and the motor therefor, combined with the liquid chamber having a piston at each end, springs for depressing one and raising the other of said pistons, and brake mechanism intermediate said motor and one of said pistons, the other piston being exposed to the action of the descending elevator; substantially as set forth.

8. In appliances for elevators, an electric motor, conductors, and cut-off switches, combined with the elevator, the liquid chamber having a piston at each end, and brake mechanism intermediate said motor and one of said pistons, the other piston being exposed to the action of the descending elevator; substantially as set forth.

9. The elevator, and the motor therefor, combined with the liquid chamber having a piston at each end, one of said pistons being provided with brake mechanism for said motor, and the other adapted to be operated after the power has been cut off from the motor on the descent of the elevator; substantially as set forth.

Signed at New York, in the county of New York and State of New York, this 4th day of October, A. D. 1894.

JAMES H. ROBERTS.

Witnesses:
CHAS. C. GILL,
EDWARD D. MILLER.