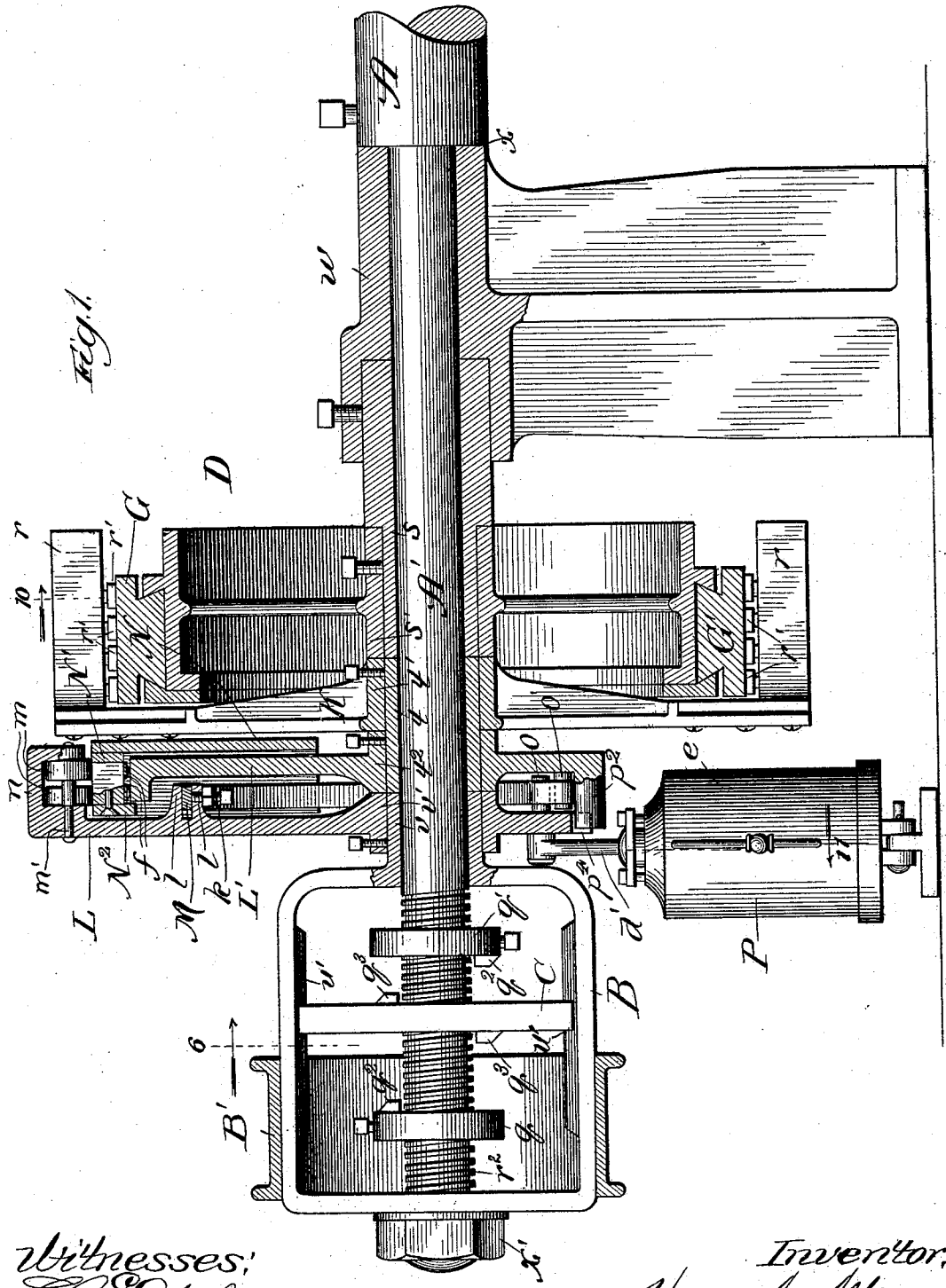
(No Model.) 4 Sheets—Sheet 1.

H. A. ALLEN.

REGULATING SWITCH FOR ELECTRIC ELEVATORS.

No. 509,279. Patented Nov. 21, 1893.



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THE NATIONAL LITHOGRAPHING COMPANY,
WASHINGTON, D. C.

(No Model.) 4 Sheets—Sheet 2.

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Fig. 2.

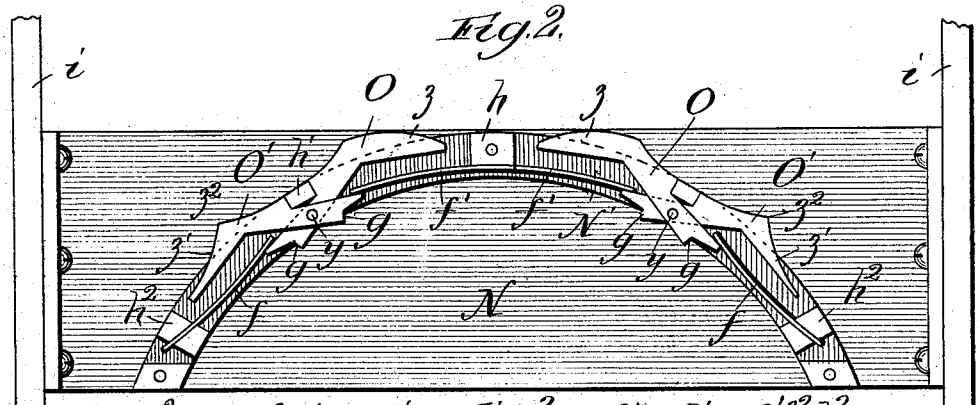

Fig. 3.

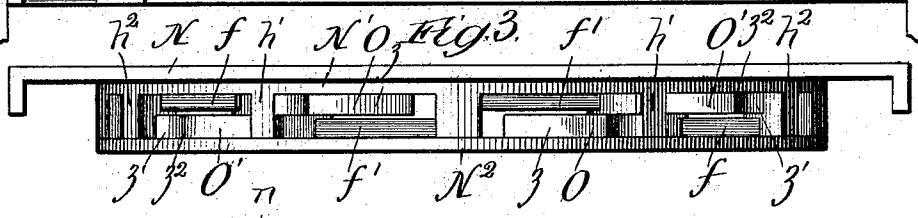

Fig. 4.

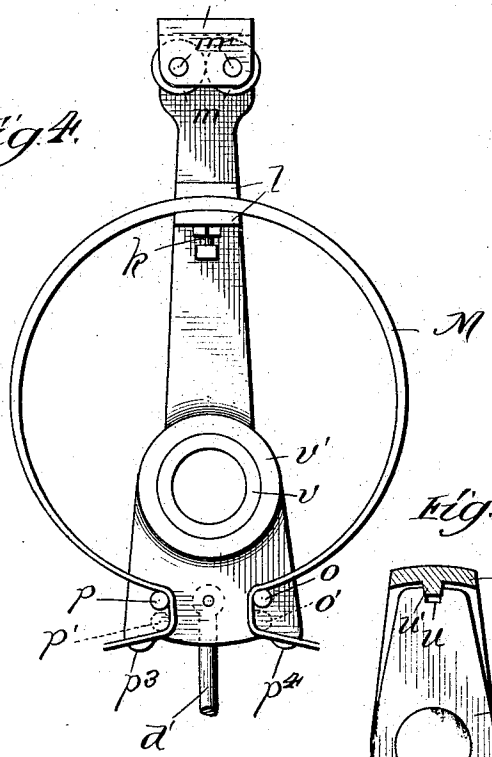

Fig. 5.

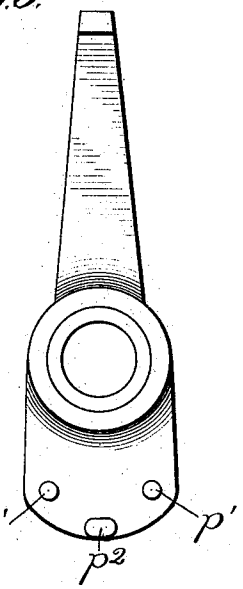

Fig. 6.

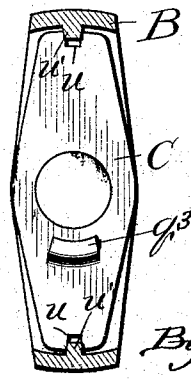

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Fig. 7.

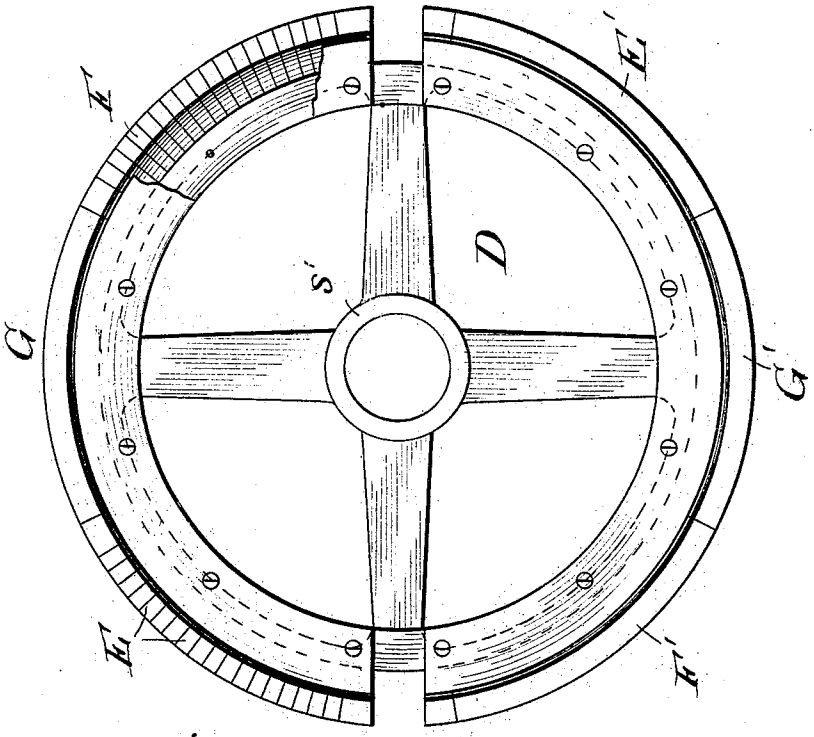


Fig. 8.

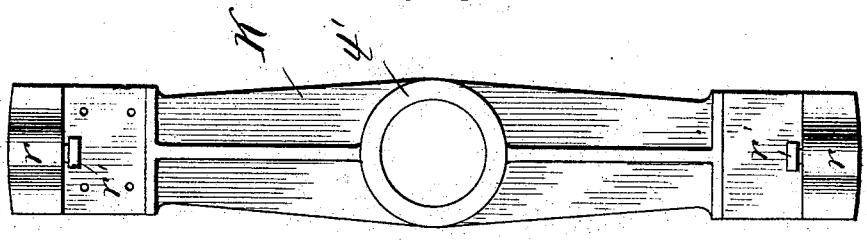
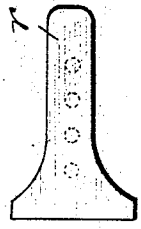


Fig. 9.



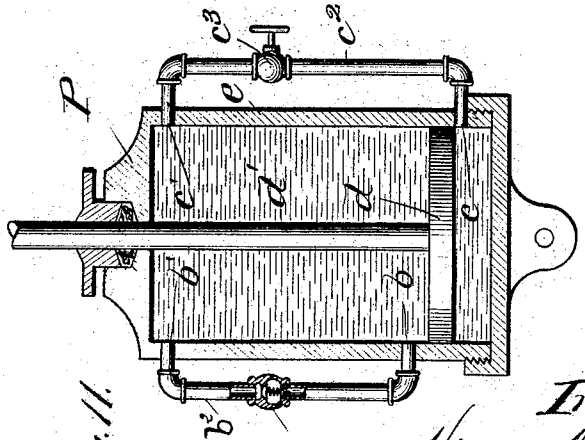


Fig. 11.

Fig. 10.

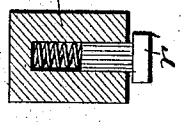


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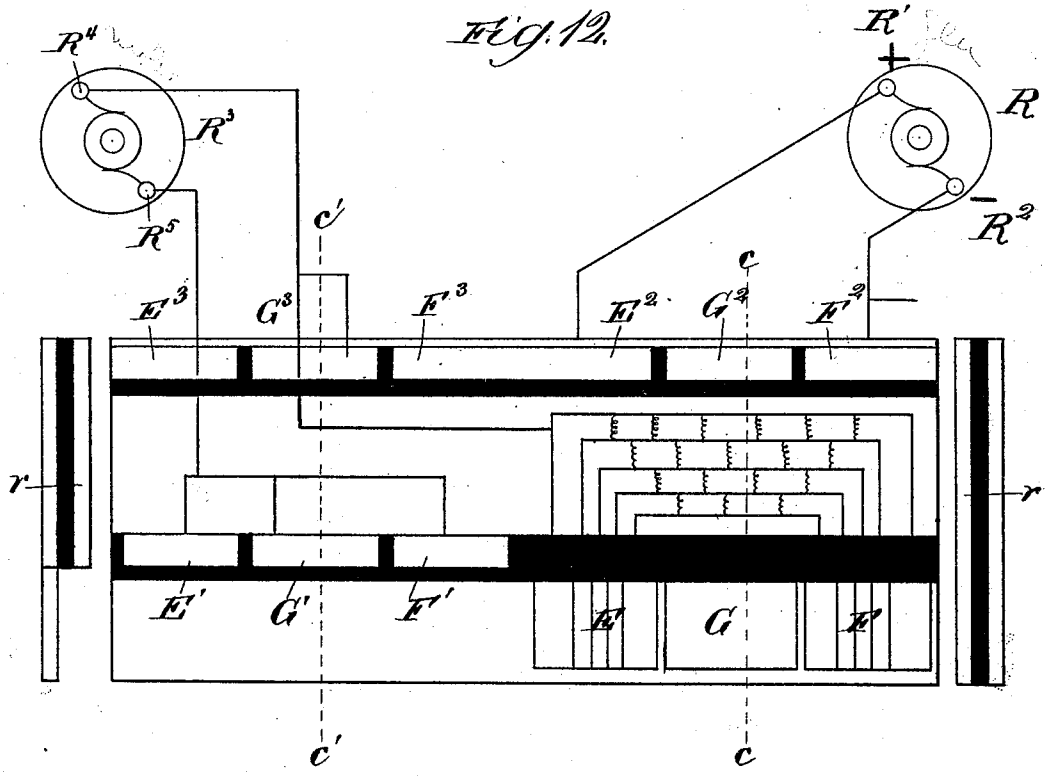
Fig. 12.



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WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

HENRY A. ALLEN, OF CHICAGO, ILLINOIS, ASSIGNOR TO THE EATON & PRINCE COMPANY, OF SAME PLACE.

REGULATING-SWITCH FOR ELECTRIC ELEVATORS.

SPECIFICATION forming part of Letters Patent No. 509,279, dated November 21, 1893.

Application filed February 20, 1892. Serial No. 422,177. (No model.)

To all whom it may concern:

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

My invention relates principally, (though it is not necessarily confined thereto) to an improvement in the class of rheostat-switches, in which a series of contacts is arranged, commonly, in a circular plane and has its members so connected as to adapt them to have the current gradually cut in and out by the movement across them of the contact-finger.

The main objects of my improvement are to insure such rapid make and break operations between the switch-board contacts and contact-finger as to reduce to the minimum the liability to draw a spark; to insure the contact-finger being entirely off, or entirely on, (as the case may be) the switch-board contacts; and to provide for so controlling the movement of the contact-finger across the switch-board contacts, as to prevent its too rapid operation in performing the cutting-in and cutting-out functions.

My further object is to provide an improved electric switch, both as to its general construction and as to details thereof.

The improvements involved in my switch adapt it for use in the various connections in which electric switches are employed; hence I do not wish to be understood as limiting my invention to use in any particular connection. It has, however, been especially devised by me for use with electrically operated passenger and freight elevators; and for that reason, mainly, and because that particular connection renders convenient explanation of the construction and manner of operation of my improved device, I illustrate it as applied to an electrically operated elevator in the accompanying drawings, in which—

Figure 1 is a broken view of the spindle-end of the drum-shaft of an elevator, carrying a so-called automatic-stop device and my improved switch-mechanism, shown in section, and a dash-pot detail shown in elevation. Fig. 2 is a broken view showing in elevation a bearing plate carrying spring-dogs pivotally supported on a bearing-bar on the plate forming an arc of a circle, and which dogs form the primary medium through which the desired suddenness of the make and break of the switch contact-finger is effected. Fig. 3 is a top view of the mechanism illustrated in Fig. 2, but showing, in addition, a companion arc-shaped bearing-bar for that illustrated in the preceding figure, and between which two bars the spring-dogs are journaled. Fig. 4 is a view in elevation showing the one of two levers which carries a spring and operates the same first to set it and then to release it for the purpose of effecting, by its resilient force, the quick throw of the contact-finger. Fig. 5 is a similar view of the other of the said two levers through the medium of which, by its stoppage, and the aforesaid dogs the spring is set for effecting the quick throw of the contact-finger. Fig. 6 represents a section taken on the line 6 of Fig. 1 and viewed in the direction of the arrow. Fig. 7 is a view in elevation of the switch-proper or "switch-board" in its preferred circular or cylindrical form. Fig. 8 is a face view, or view regarded from the right-hand side in Fig. 1, of the pivotal contact-finger. Fig. 9 is a plan view of a head, for one end of the contact-finger, as represented in Fig. 1. Figs. 10 and 11 are sections taken respectively on the lines 10 and 11 of Fig. 1 and viewed as indicated by the arrows. Fig. 12 is a diagrammatic view representing the motor and the circuit connections through the rheostat to the operating mechanism.

A (see Fig. 1) denotes the drum-shaft of an elevator, reduced in diameter, toward one end, to afford the spindle-extension A′, on which, between the shoulder x formed by the reduction and a nut x' at the extremity of the spindle-portion, are confined sleeves v, t and s carrying parts hereinafter described, and the journal-box w. Toward its outer extremity the spindle A′ is screw-threaded, as shown at r^2, and carries a yoke B, extending from the sleeve v loosely surrounding the spindle, which yoke, however, is not normally or directly engaged by the screw r^2, and which is provided, toward its outer end, with a sheave B′, for the operating cable, the latter not being shown, but extending, as will readily be

understood, either vertically through the elevator-car (not shown) or into engagement with an operating lever in the car.

Inside the yoke, and at opposite sides of the center of the screw-threaded portion, are adjustable stops q and q', in the form of collars having stop-lugs q^2 upon them; and between the two stops is a nut C (shown also in Fig. 6) through the center of which passes the threaded portion of the spindle and which is held against rotation and caused to move longitudinally of the spindle by rotation of the latter, by engagement at recesses u in its opposite ends, with guides u' extending along the opposite sides of the yoke B. The nut C is provided at each side, respectively above and below the spindle A', with lugs q^3 to engage the lugs q^2 on the stops q and q'.

The mechanism thus described is a well-known device, commonly referred to in the art of elevators as an "automatic" for automatically stopping the elevator car at the upper and lower limits of its travel in the elevator-shaft and operating as follows: Rotation of the drum-shaft in one direction, by revolving the spindle-extension A', causes the nut C to travel toward one stop, say the stop q, while the rotation thereof in the opposite direction brings the nut against the other stop q'. The stops are so relatively adjusted, and the engagement of the screw with the nut is such, as to cause the nut to be moved the distance from one stop to the other by the travel of the elevator-car to the limit in the elevator-shaft in either direction. When, therefore, the car reaches the limit of its upward course, the nut C will have been brought against, say, the stop q, causing one of its lugs q^3 to be engaged by the lug q^2 of the stop q and thereby effecting rotation of the yoke B by that of the spindle, whereby a contact-finger of the switch, moved by rotation of the yoke, is turned to the neutral point of the switch, and thus effects stoppage of, or shuts off, the motive power. The direction of travel of the car is then reversed by turning, through the medium of the operating-cable, or lever hereinbefore referred to, the sheave B' and, consequently, the yoke B, to bring the contact-finger upon the proper part of the switch. In the same way the car is automatically stopped and reversed on reaching the opposite limit in its course, by the resultant engagement of the nut C, at a lug q^3, with the adjacent lug q^2 on the stop q' and proper turning of the sheave B' and yoke B to effect setting of the switch-finger accordingly on the proper switch-board contacts. Obviously, also, stoppage of the car at any point of its course in the elevator-shaft may be accomplished by turning the yoke to shift the contact-finger to the dead-point on the switch by manipulating the cable on the sheave B'; and reversal of the direction of motion of the car is similarly to be effected after such stoppage.

My invention relates entirely to the switch-mechanism through the medium of which, if or when applied to an electrically operated elevator, the motive current of electricity may be cut in and cut out, as required or desired, to control the driving-mechanism which operates the drum-shaft A.

D is the "switch-board" or switch proper, preferably in the form of a cylindrical ring, as shown, having a central bearing or hub s' at which it surrounds and is secured to the sleeve s loosely surrounding the spindle A'. Two rheostatic series of contact-strips, E and F, extend at opposite sides of one half the circumference of the ring and flank a "dead-point" G, and, as is intended to be the case in the present instance, the companion part G' diametrically opposite the part G may contain a short circuit for the motor as is common. The dead-point G' is flanked by contacts E' and F', which, however, need not be in rheostatic series, as the contacts E and F are represented, but may be continuous plates, as shown. These contact and insulated pieces are secured to the outer periphery of the ring preferably by dovetailing them in place, as represented. While preferred, it is not necessary, however, that the contacts shall be peripherally arranged on a "switch-board," as the other features of my improvement could be readily adapted to co-operate with them if arranged on the face of a circular or other form of switch-board.

K is the contact-finger, having a central hub-portion t', at which it seats around and is fastened to the sleeve t on the drum-shaft spindle, the contact-finger being, by preference, double, in the sense of contacting at both of its ends. At its opposite ends the contact-finger has fastened to but insulated from it, heads r, each in the form of a right-angle, the horizontally extending portion of each of which may be expanded, for strengthening purposes, toward one end, extends across the periphery of the switch-board, and carries a series of spring contact-points or "brushes" r', projecting from its inner side against the said periphery. A desirable form and construction of these spring contact-points, or brushes, is shown in detail in Fig. 10.

L and L' are levers. The lever L is provided near one end with a hub-portion v' at which it seats around and is secured to the sleeve v on the yoke B, and beyond which, toward that end, it widens, as shown in Fig. 4, and carries there, at opposite sides of its longitudinal center, the studs p and o. The upper end of the lever L is extended at right-angles, as shown at n, and affords a bearing for the shaft m' of two anti-friction rollers m. Between the bearing n and hub v' is a seat l for a spring M, shown as bent into circular form with its ends bent in opposite directions about the studs p and o, and about studs p' and o' on the lever L', hereinafter described. The spring M may be adjustably fastened in its seat l by means of a set-screw k. The lever L', which is shorter than its companion-lever L, has, near one end, a hub-

portion t^2, at which it seats around and is secured to the sleeve t' surrounding the spindle A'; and near that end, toward which it is expanded, like the lever L, it carries, at opposite sides of its longitudinal center, the studs p' and o', hereinbefore referred to.

On a rigid plate N supported between stationary uprights i (see Fig. 2) is a bearing-bar N' formed in the arc of a circle; and secured to and coinciding with it is a similar bar N^2.

A pair of spring-dogs O, O', is pivotally supported between the arc-shaped bearing-bars N' and N^2, at each side of a central lug h. The members of each pair of the spring-dogs extend in contrary directions, both being supported on a single pivot-pin y, whereby they extend contrarily side by side, with a lug h', forming a stop, between them. The dog O of each pair should be curved convexly toward its upper end, as shown at z, while each dog O' is preferaby curved concavely toward its corresponding end, as shown at z', thereby forming on each an abrupt apex z^2. The opposite end of each dog is formed with an offset or shoulder g. The springs f which bear against the ends of the dogs O, may be fastened in suitable bearing-lugs h^2; while both dogs O' are controlled by springs f' fastened to the bearing h. The plate N is supported to extend between the contact-finger K and lever L' in position to cause the arc-shaped dog-bearings N' and N^2 to project between the adjacent ends of the levers L and L', whereby the parts z and z^2 of the dogs O and O' project into the circular parallel paths of the rollers m on the lever L, and the shoulders g of the dogs normally project into the circular path of the upper end of the lever L'.

From the foregoing description it will be apparent that when the yoke B is turned, whether by the "automatic stop" or by turning the sheave B' from the car, the lever L is thereby simultaneouly turned in the same direction; and so turning the lever L', owing to the connection between it and the lever L' by the spring M at the studs p, p', and o, o', causes it to carry with it the lever L', till the latter strikes a shoulder g on a spring-dog O or O', as the case may be, in its path, which stops it. The continued turning of the yoke B thenceforward turns the lever L alone until a roller m thereon reaches the part z or z^2 of the dog, the shoulder-end g of which is obstructing the lever L'; and this separation of the two levers obviously sets the spring M at the studs p, o', or o, p', depending on the direction of turning the lever L. When the last-named lever reaches, as it were, the cam-end of the respective dog, it trips the latter against its controlling-spring, thereby raising its shoulder-end g out of the path of the lever L', thus left to the resilient force of the spring M, which, by its recoil, quickly pulls the lever L' into coincident position with its companion-lever L. As the lever L' is thus quickly turned, it necessarily carries with it the contact-finger K, which is thereby caused to move so rapidly off or on the respective switch-contacts, as to avoid, or reduce to the minimum, the drawing of a spark. In case the spring M should ever break it is desirable that the switch should be inoperative to move the contact-finger K off the dead-point when on the same, but that the movement of the contact-finger to the dead-point when on the contacts, should not be interfered with. Accordingly I provide a lug p^2 on the inner face of the expanded end of the lever L' which plays between lugs p^3 and p^4 on the sides of the corresponding end of the lever L. When the lever L, to turn the finger K in the direction toward the dead-points G G', engages, at a friction-roller m, the convex cam-end of a dog O, it holds the stop-end g thereof up out of the path of the lever L' long enough to permit its lug p^2 on the latter to be reached and engaged by a lug p^3 or p^4 on the lever L, which thence moves the lever L' with it past the said shoulder g before the roller m clears the convex cam-end of the dog to permit the shoulder to return to its obstructing position as to the end of the lever L'. If, however, when the spring M is broken, the lever L be moved in the direction to bring the contact-finger K upon the switch-contacts, it will be prevented from reaching them, since the lever L, at one of its rollers m, will reach and clear the apex z^2 of a spring-dog before the lever L' meets the stop g^2 on the dog, which, therefore, practically remains continuously in the path of the lever L' and prevents any tendency to move it and, consequently, the contact-finger.

To render the operation, thus described, the more readily comprehensible, it should be stated that the adjustment is such as to cause the first portion of the simultaneous movement of the two levers L L', (that is, before the lever L' meets a shoulder g) to move the contact-finger K from the ends of the dead-points G G', at which the stoppage of the lever L' occurs, and whence the subsequent tripping of the dog causes the spring, meantime set, to quickly carry the brushes r' entirely from the insulating pieces firmly upon the contacts, or the contrary.

The particular form of the spring M as well as of other features of my improvement, the foregoing minute description of which is, to enable the invention to be readily comprehended, at least desirable, may be variously departed from, as also the exact manner of operation of the aforesaid details, without thereby departing from the spirit of my invention, in which I desire to be understood as including all modifications.

It is very desirable to provide means tending to prevent carelessly rapid throwing of the contact-finger K over the switch D, in cutting in the current or in the movement of the finger over a dead-point after contact has been broken, by providing a yielding resistance to the throw of the operating-lever in

the elevator-car, or, in other words, to the turning of the yoke B. I accomplish this end by means of a dash-pot P, preferably of the peculiar construction illustrated, applied to the lower end of the lever L, and which is most clearly illustrated in Fig. 11. It comprises a water-tight cylinder *e* pivotally supported at its lower head, to adapt it to oscillate, and containing a piston *d*, the rod *d'* of which has a crank-connection, as shown in Fig. 1, with the lower end of the lever L. The piston *a* is shown at the lower limit of its stroke, just above a port *c*, connected from outside the cylinder with another port *c'* at the upper side of the piston, by means of a pipe c^2 containing an ordinary shut-off valve c^3. In the same horizontal plane with the port *c'*, and shown as diametrically opposite the latter in the shell *e*, is a port *b'* connected with a port *b* in the shell just above the lower limits of the stroke of the piston, by a pipe b^2 containing an upwardly opening check-valve b^3. Accordingly the throw of the levers L and L' involving the rise of the piston *d*, which brings the contact-finger K to the initial-end of the switch-contacts and cuts in the current, will be resisted by the dash-pot, since the liquid will pass through the port *c'* only (after the piston passes the port *b*), for the check-valve in the pipe b^2 obstructs the downward passage through it of liquid. When, however, the piston descends with the turning of the finger K to cut out the current, its stroke is the freer, since its pressure is enabled to force the liquid through both ports *c* and *b* and the respective pipes c^2 and b^2, till the piston reaches the position of closing the port *b*, at which time the contact-finger will have reached the dead-points G, G', on the switch, from which point to the end of the down-stroke of the piston, the resistance is increased by reason of the pressure of liquid being only through the port *c*, and tends to prevent such carelessly rapid turning of the operating-lever as might throw the finger K over the dead-points to the reversal side of the switch contacts, and thereby cause too sudden reversal of the motor, which, while not necessarily involving serious consequences, unduly strains the machinery. Thus my improved resisting device P prevents too rapid cutting in of current and also too rapid reversal of the motor.

The operation of the device to gradually control the motor will be understood from the following description with relation to the diagrammatic view presented in Fig. 12. This figure represents the cylindrical surface of the switch-board rolled out in a horizontal plane. R denotes the source of electric energy, and R^3 the motor to be governed by the switch. R' and R^2 are the two poles of the generator, marked, respectively, + and −; and R^4 and R^5 are the two poles of the motor-armature, the fields (that is, the shunt-fields) of which are charged directly from the generator R. The dead-point G, flanked by the contact-strips E and F, is diametrically opposite the dead-point G', flanked by the contacts E' and F'; and the strips E and F are respectively diametric to the strips E' and F'. As the brushes on the heads (see Fig. 1), and which are indicated by the reference-letters *r*, *r*, in Fig. 12, are at opposite ends of the switch-finger K, they move relatively in opposite directions. Therefore, in Fig. 12, when one brush (that at the right) moves from the central position, indicated by the dotted line *c*—*c*, on G, (the opposite center being indicated by the dotted line *c'*—*c'* on G') toward the rheostatic contact-strips F, or toward the right, the other brush moves to F', diametrically opposite, and therefore also toward the right. Conversely, both brushes move to the left on moving the brush at the right in the opposite direction to that described. The strips E and F (shown in rheostatic connection) are insulated from the other parts of the switch, but are electrically connected to the armature-pole R^4. When no current is passing from the generator through the motor-armature,—that is when the motor is stopped—the brushes are on the two diametrically opposite neutral points G, G^2, and the two diametrically opposite neutral points G', G^3. It will be noticed that the parts G' and G^3 are electrically connected with the poles R^5 and R^4, respectively. This short-circuits the motor-armature when the current from the generator is cut off, by the brushes being on the neutral points G, G^2 and G', G^3, thereby tending to cause the motor-armature to act, itself, as a brake to stop itself when the current from the generator is cut off. E^3 and F^3 denote ends of the contact-strips, the other ends of which are denoted as E^2 and F^2. In other words, E^3 and F^3 are those ends of the strips over which the one brush moves, and E^2 and F^2 are those over which the opposite brush moves. It should be remembered that the switch-finger K moves less than a quarter turn either way from the central position. Hence the circuits will be understood to be as follows: F^2, E^3, connected with generator-pole R^2 and F^3, E^2, connected with the pole R'. The current from the generator is assumed to remain constant in direction. When the one brush moves, toward the right, to F, F^2, the other brush moves, toward the right, to F', F^3. Thus the first-named brush (that at the right on Fig. 12) makes electric connection between the dynamo strips F^2, E^3, and the rheostatic strips F, in electrical connection with the pole R^4 of the motor. The circuit is as follows: R' to dynamo-strips F^3, E^2, brush *r* (at the left) to motor-strip F', to pole R^5, through armature to pole R^4, to rheostatic series F (which are electrically connected with corresponding strips E); from F to dynamo-strips F^2, E^3, and thence to pole R^2 of the generator. When the switch-finger K is moved in the opposite direction, the current through the motor-armature is reversed (as will be seen by following out the circuit) thus causing the armature to revolve in the re-

verse direction. The circuit in this case is as follows: R′ to E^3, F^3, to rheostatic strips, to pole R^4, through motor-armature to pole R^5, to motor-strip E′ across brush (at left in Fig. 12) to E^3, F^2, thence to the negative pole of the generator. It will be seen that the nearer the switch-finger brings the brush (at the right in Fig. 12) to the extreme throw either way, the less resistance there remains external to the armature-circuit.

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

1. In combination with an electric switch having a switch-board provided with contacts in rheostatic series and a pivotal switch-finger, a dash-pot P controlling the switch-finger against unduly rapid movement and comprising a cylinder containing a piston and having ports *b* and *b′* connected by a pipe b^2 containing a check-valve, and ports *c* and *c′* connected by a pipe c^2, substantially as described.

2. In an electric switch, the combination with a switch-board and pivotal switch-finger, of a pair of levers yieldingly connected by a spring and one of which is firmly connected with the switch-finger to move with it, and a pivotal dog interposed between adjacent arms of the two levers and extending at one end, as a stop, into the path of the lever connected with the switch-finger and, toward its opposite end, as a cam into the path of the other lever, substantially as and for the purpose set forth.

3. In an electric switch, the combination with a switch-board and pivotal switch-finger, of a pair of levers yieldingly connected by an interposed spring secured to one of said levers and engaged at its ends by the said levers to be set by separating them against its resistance, and one of said levers being firmly connected with the switch-finger to move with it, and a pivotal dog interposed between adjacent arms of the two levers and extending, at one end, as a stop into the path of the lever connected with the switch-finger and, toward its opposite end, as a cam into the path of the other lever, substantially as and for the purpose set forth.

4. In an electric switch, the combination with a bearing A′, of a switch-board, a switch-finger K and a lever L′ loosely supported on said bearing and connected to move together, a lever L loosely supported on said bearing and carrying a spring M engaged at its opposite ends by the said levers, to resist, resiliently, their separation, and pivotally supported spring-dogs O O′, interposed between adjacent arms of the two levers and each extending, at one end, as a stop into the path of the lever L′ and, toward its opposite end, as a cam into the path of the lever L, substantially as and for the purpose set forth.

5. In an electric switch, the combination with a bearing A′, of a switch-board D having segmental series of contacts and neutral points arranged in diametrically opposite pairs on its periphery, a switch-finger K loosely supported on said bearing and extended at its opposite contact-ends across the said periphery, a lever L′ connected with the said switch-finger and carrying studs *p′* and *o′*, a lever L loosely supported on said bearing and carrying studs *p* and *o* and rollers *m*, a spring M secured to the lever L and having its ends bent respectively around the studs *p p′* and *o o′*, a bearing-plate N supported between the finger K and lever L′ and carrying arc-shaped bearings N′ and N^2 extending between adjacent ends of the two levers, and pivotal spring-dogs O and O′ supported in pairs at opposite sides of the center of the bearings N′ and N^2 and each extending, at one end, as a stop into the path of the adjacent end of the lever L′ and, toward its opposite end, as a cam into the path of the roller-carrying end of the lever L, substantially as and for the purpose set forth.

6. In combination with the drum-shaft A of an electric elevator having an automatic stop on its spindle-extension A′, an electric switch comprising a switch-board, a switch-finger K and a lever L′ loosely supported on the spindle and connected to move together, a lever L loosely supported on the spindle and carrying a spring M engaged at its opposite ends by the said levers to resist, resiliently, their separation, and pivotally supported spring-dogs O O′, interposed between adjacent arms of the two levers and each extending, at one end, as a stop into the path of the lever L′ and, toward its opposite end, as a cam into the path of the lever L, the whole being constructed and arranged to operate substantially as described.

7. In an electric switch, the combination with the switch-board and pivotal switch-finger, of a pair of levers L and L′, the former having lugs p^3 and p^4, and the latter a lug p^2 and being connected with the switch-finger to move with it, said levers being yieldingly connected by a spring, and a pair of pivotal dogs O, O′, interposed between adjacent arms of the two levers, each extending at one end as a stop *g*, into the path of the lever L′, and extending at their opposite ends as cams *z* and z^2 into the path of the other lever, substantially as and for the purpose set forth.

HENRY A. ALLEN.

In presence of—
J. N. HANSON,
W. N. WILLIAMS.