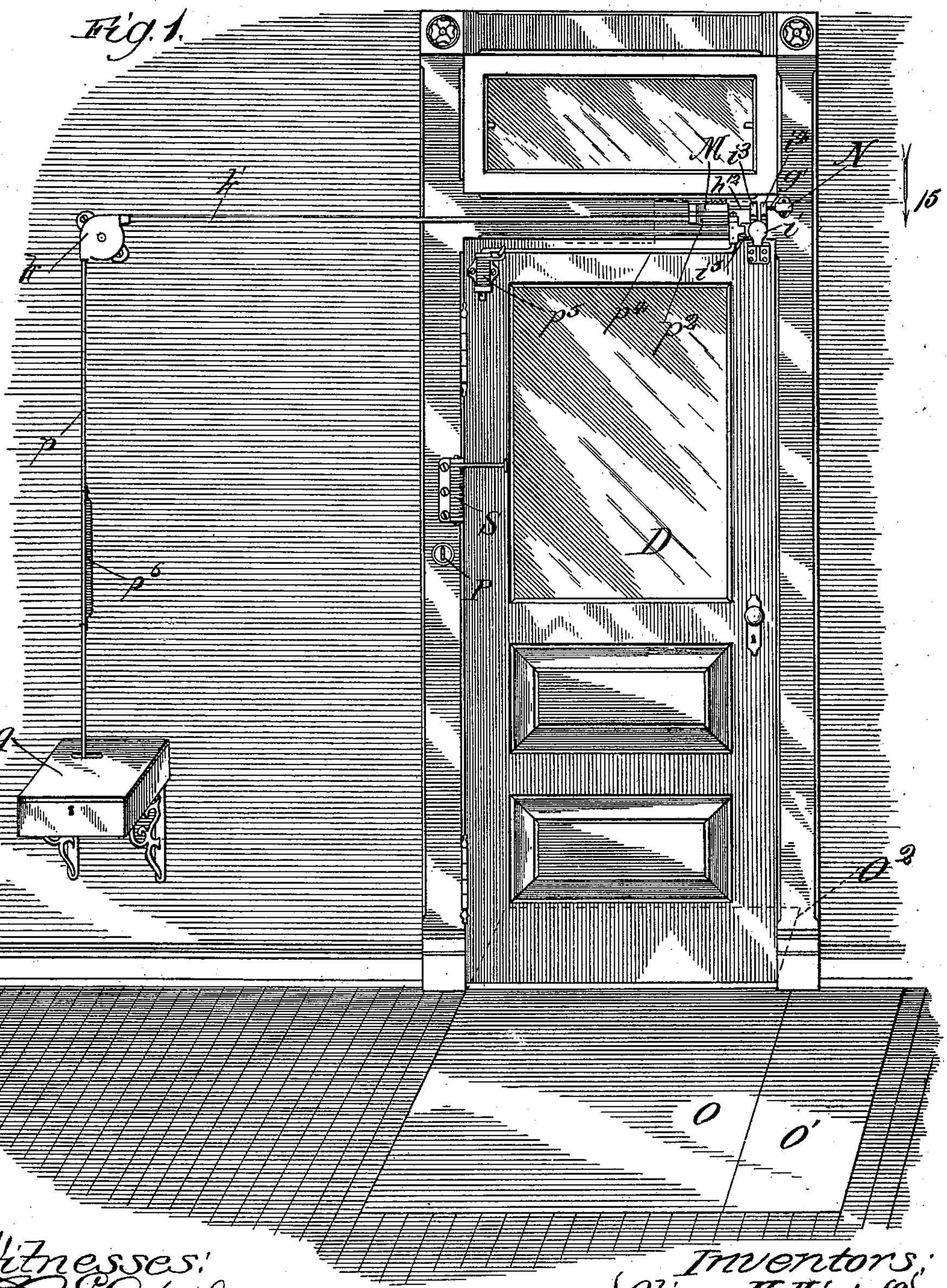
(No Model.) 10 Sheets—Sheet 1.

O. H. HICKS & R. F. TROY.

ELECTRIC DOOR OPERATING APPARATUS.

No. 572,301. Patented Dec. 1, 1896.

Fig. 1.



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Lutie J. Alter

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(No Model.) 10 Sheets—Sheet 2.

O. H. HICKS & R. F. TROY.

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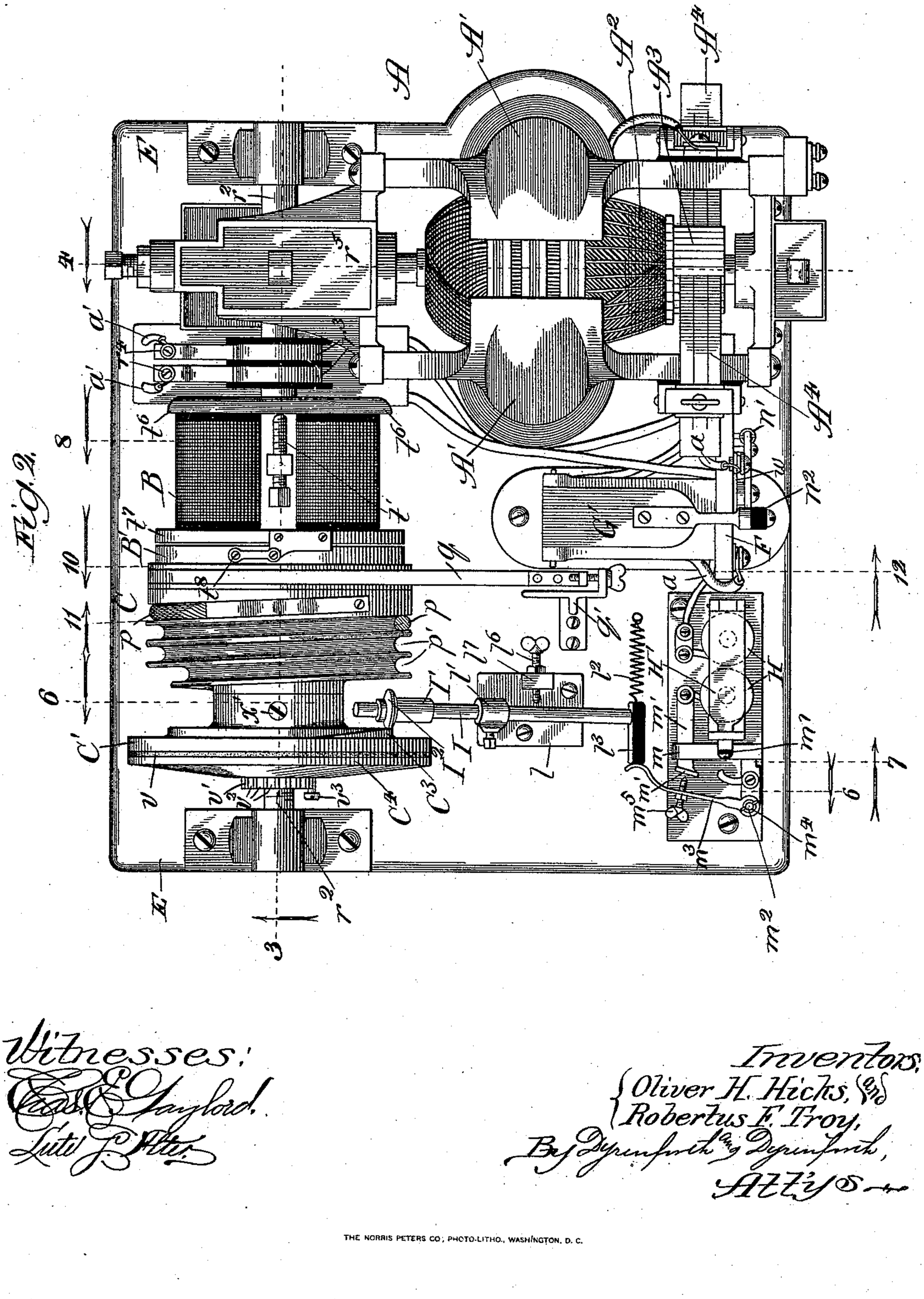
FIG. 2.



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(No Model.) 10 Sheets—Sheet 3.

O. H. HICKS & R. F. TROY.

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Fig. 3.

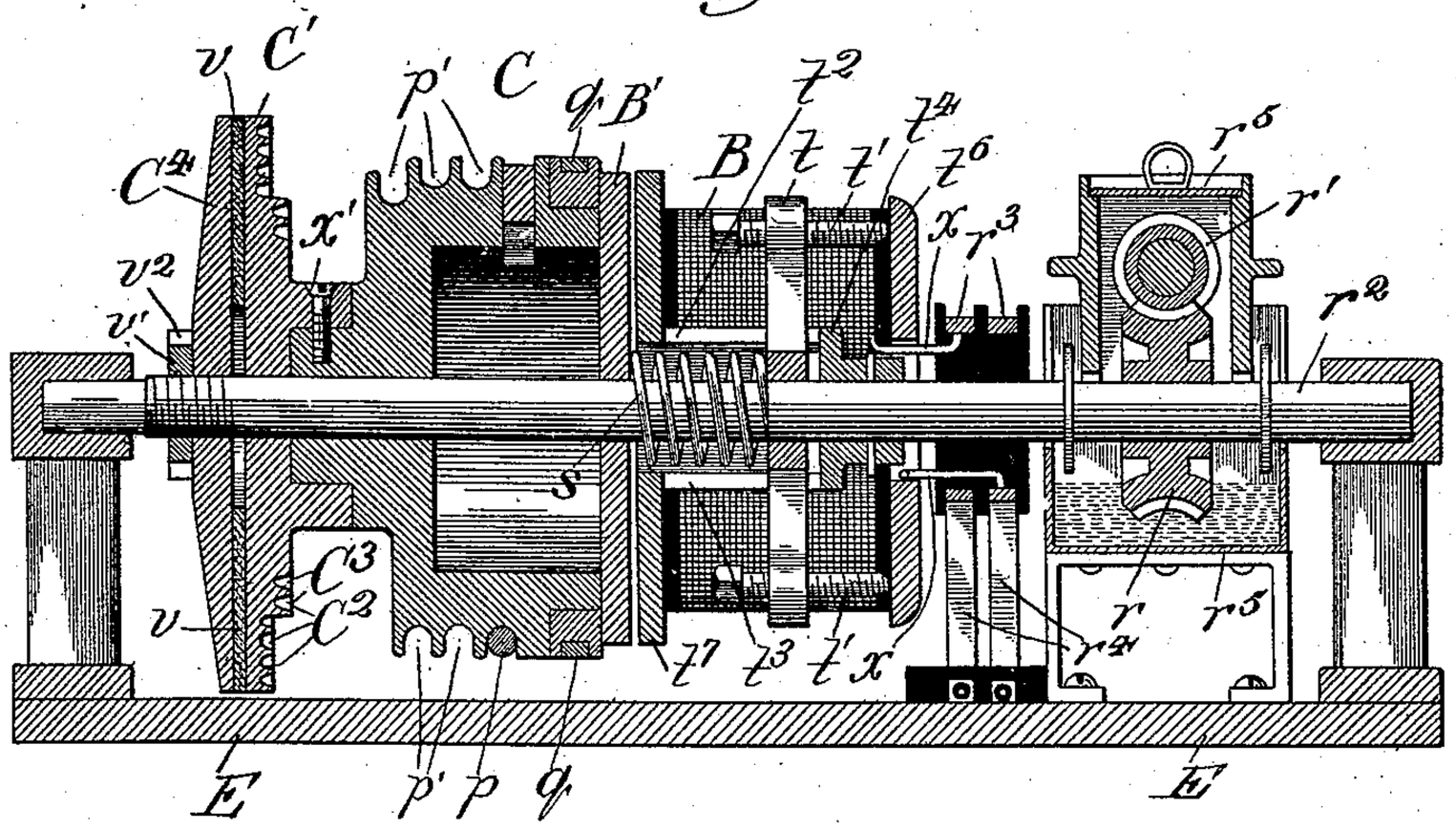
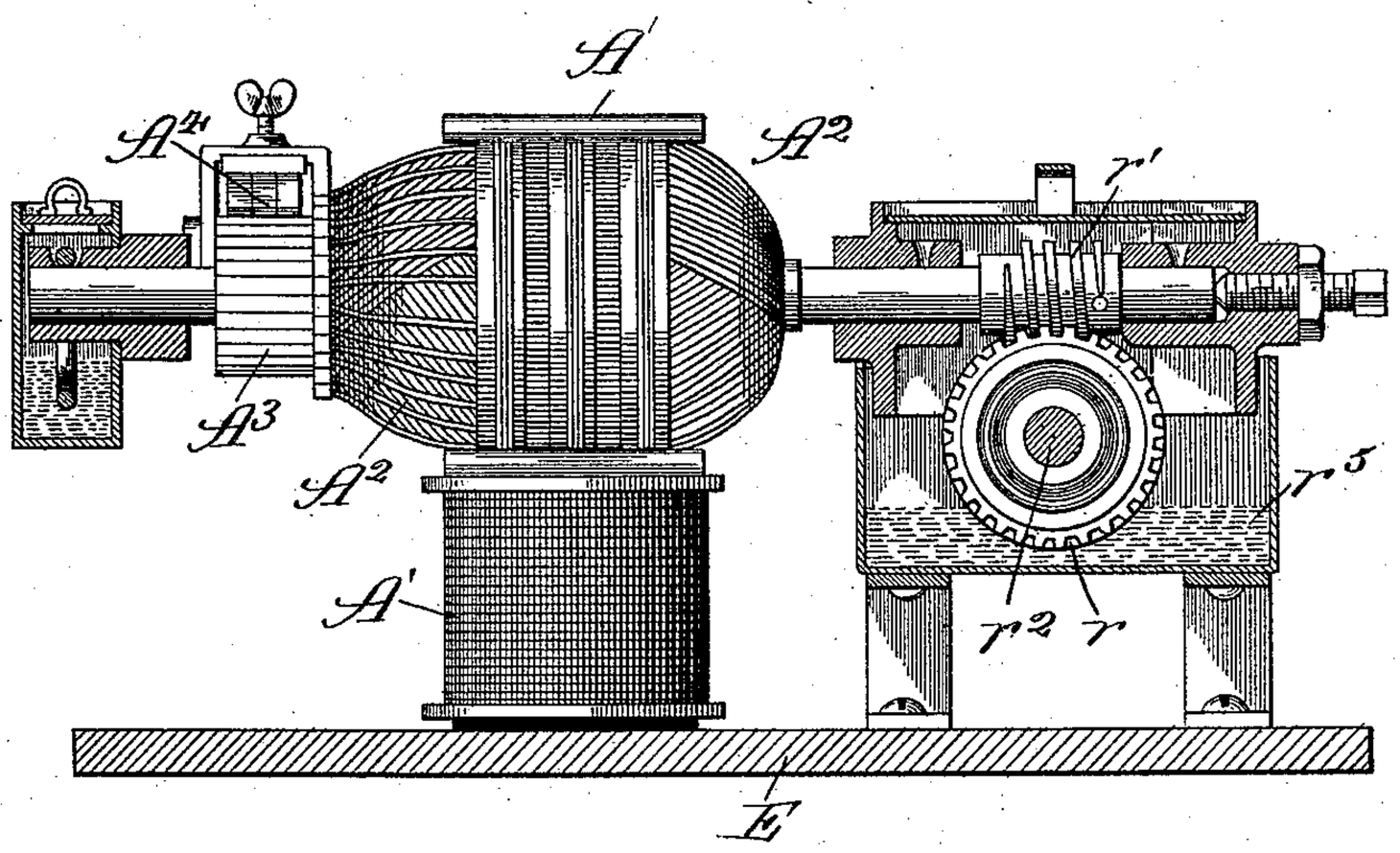


Fig. 4.



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(No Model.) 10 Sheets—Sheet 4.

O. H. HICKS & R. F. TROY.

ELECTRIC DOOR OPERATING APPARATUS.

No. 572,301. Patented Dec. 1, 1896.

Fig. 5.

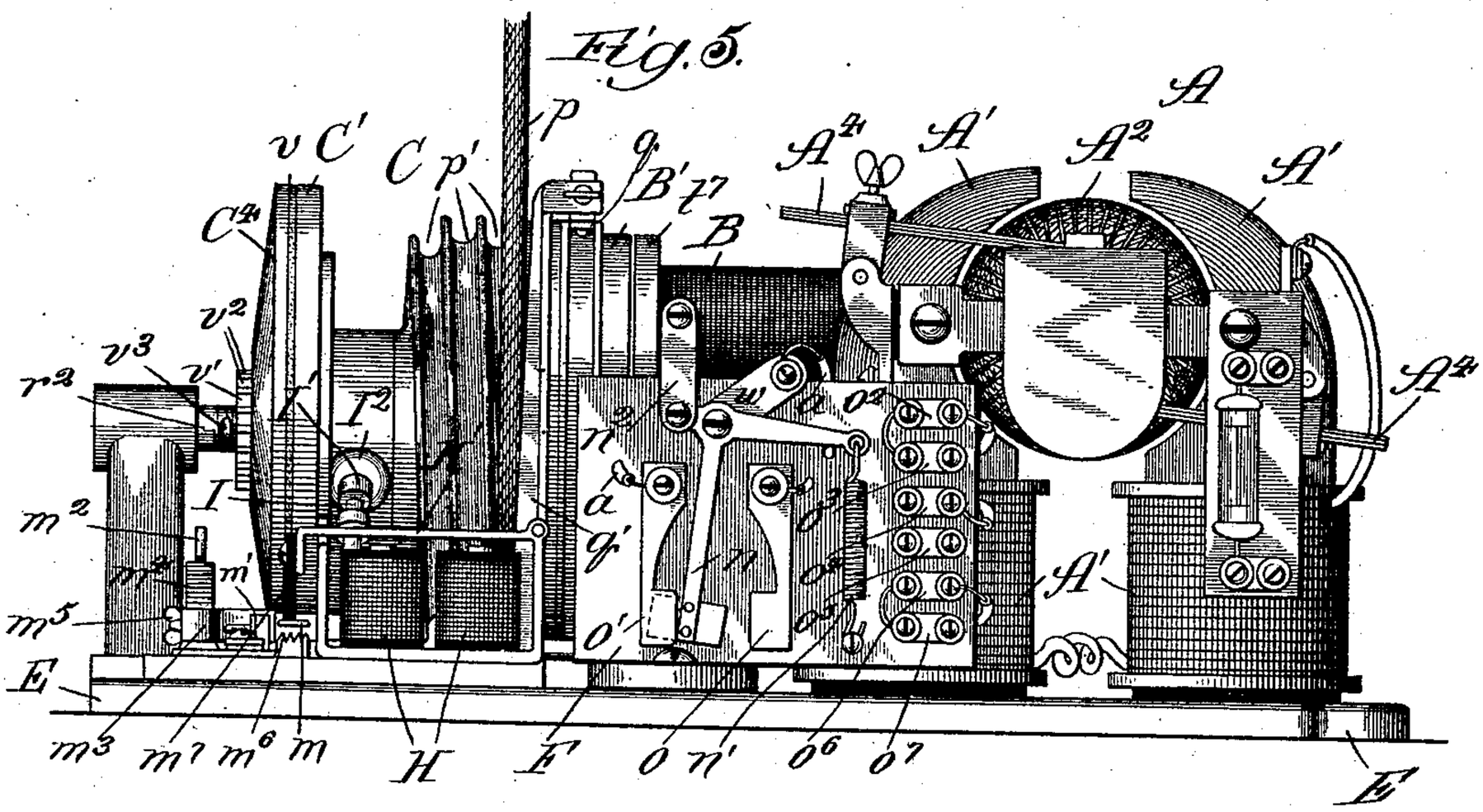


Fig. 6.

Fig. 7.

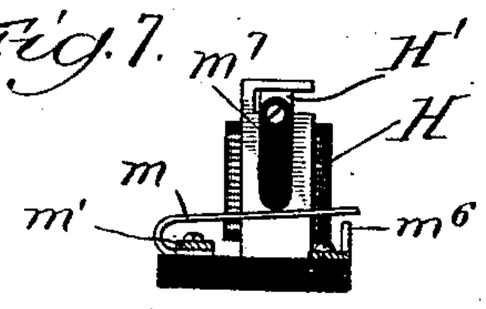
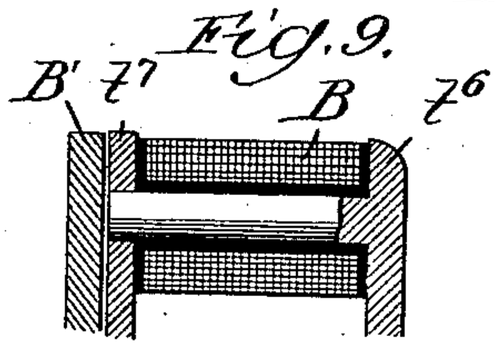


Fig. 9.



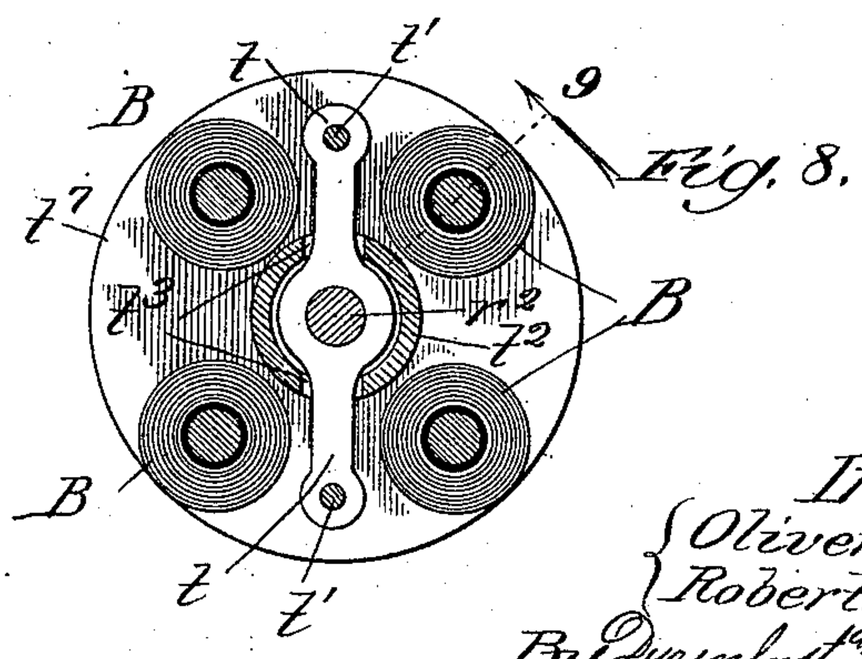


Fig. 8.

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O. H. HICKS & R. F. TROY.

ELECTRIC DOOR OPERATING APPARATUS.

No. 572,301. Patented Dec. 1, 1896.

Fig. 11.

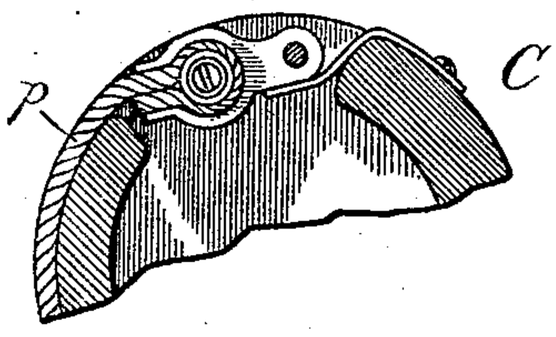
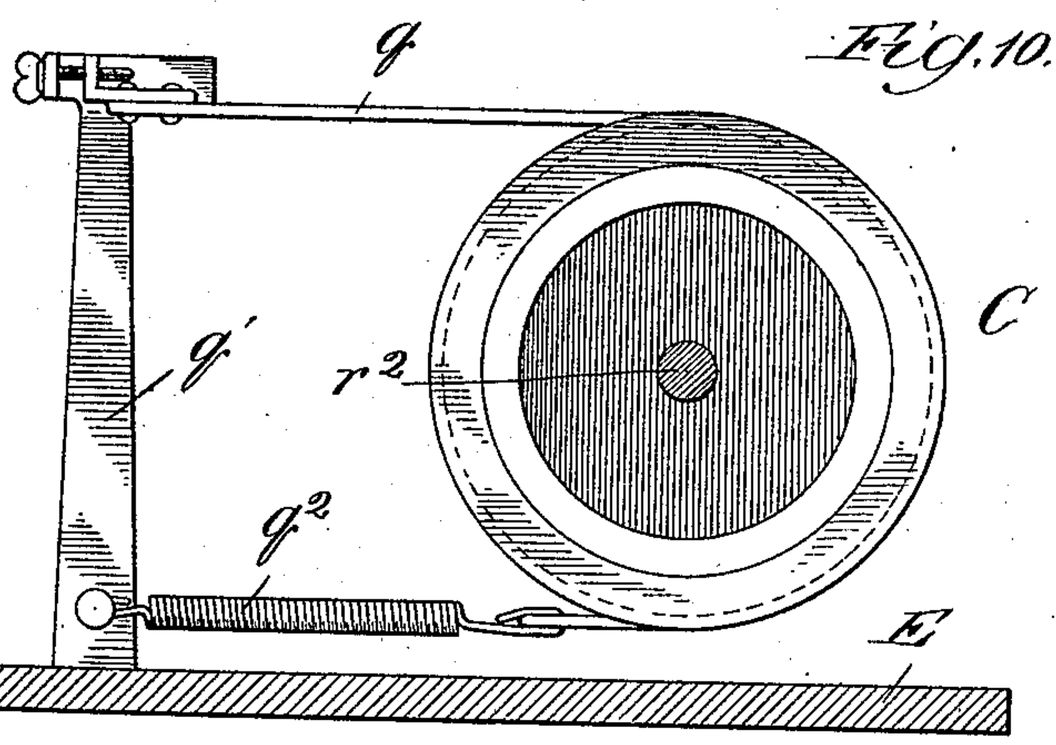


Fig. 10.



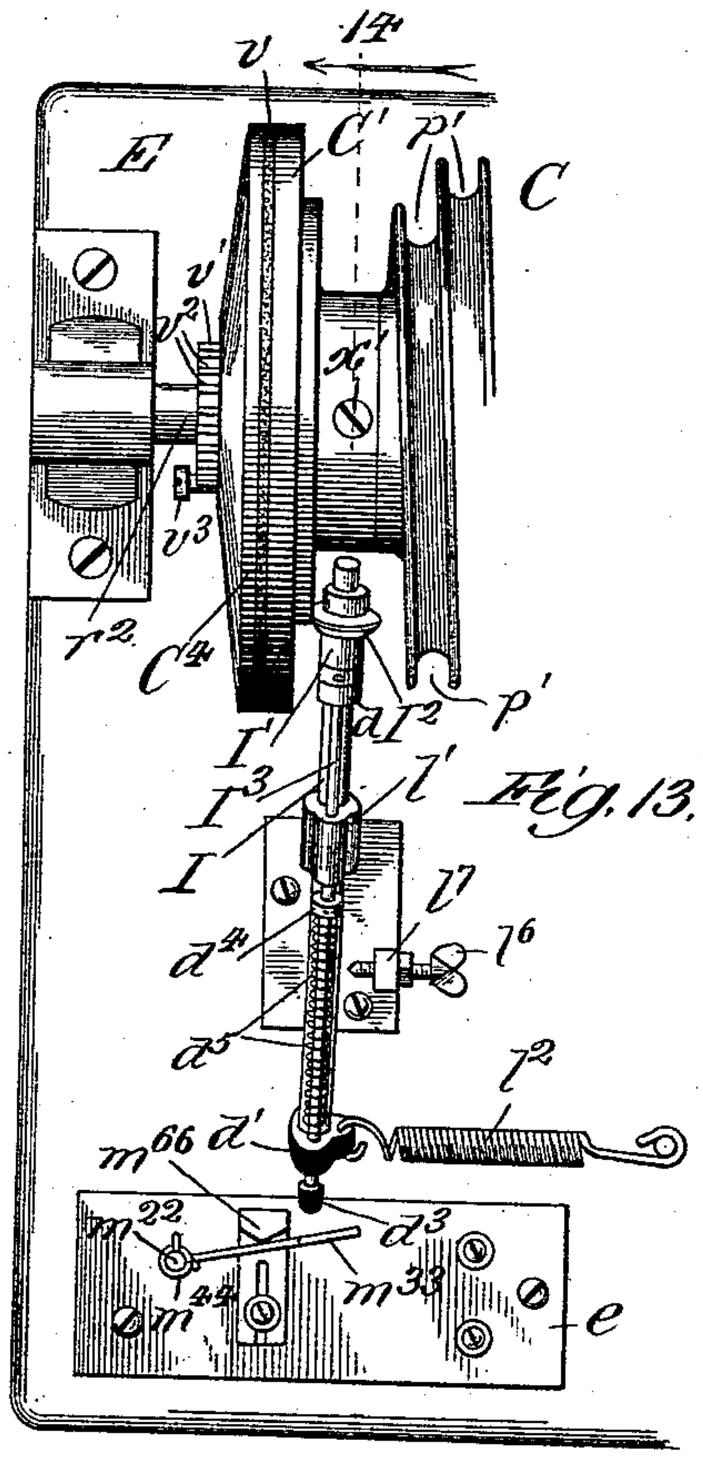


Fig. 13.

Fig. 12.

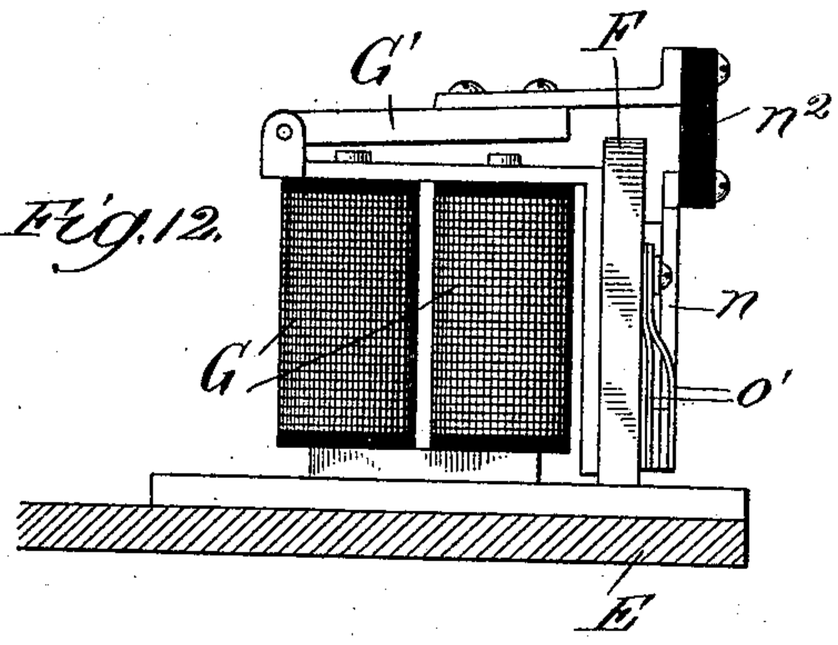
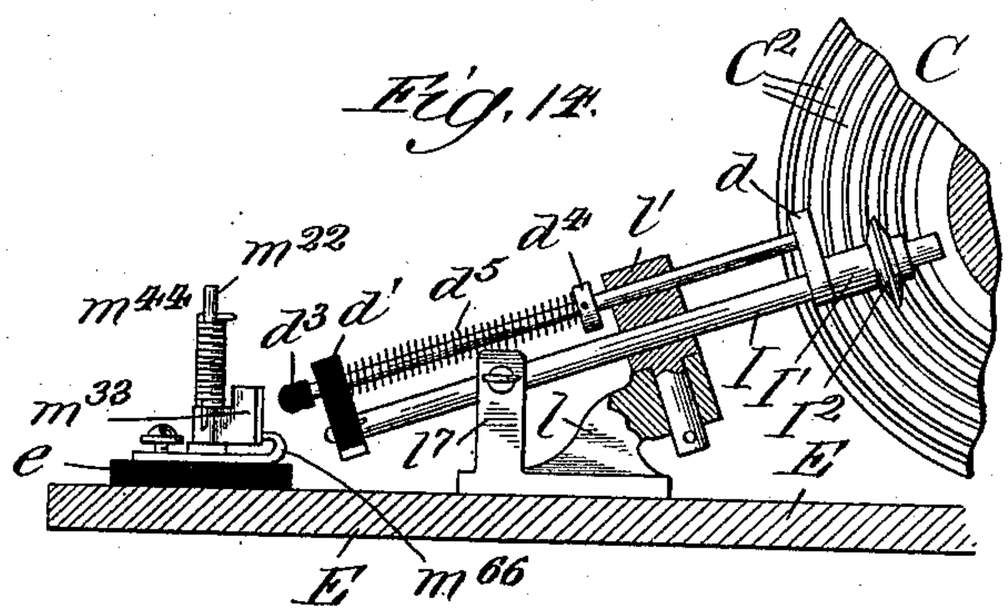


Fig. 14.



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(No Model.) 10 Sheets—Sheet 6.

O. H. HICKS & R. F. TROY.

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Fig. 15.

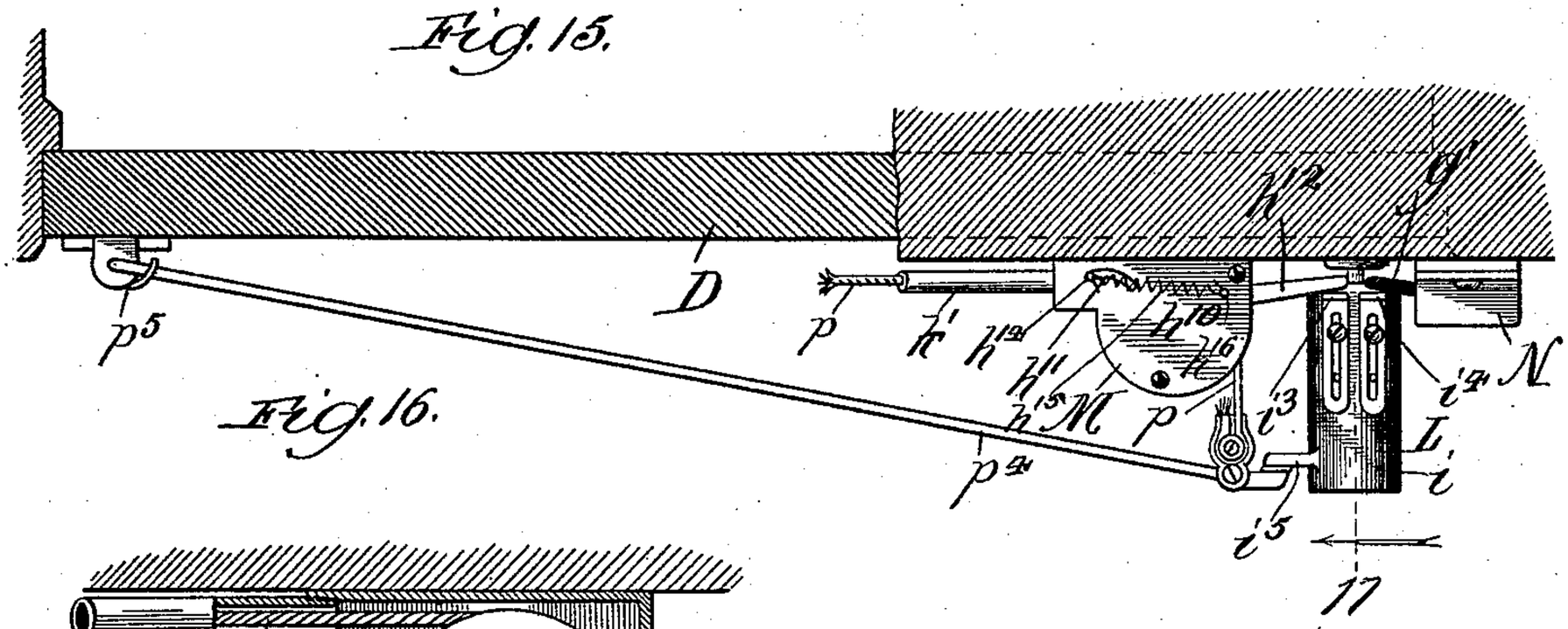


Fig. 16.

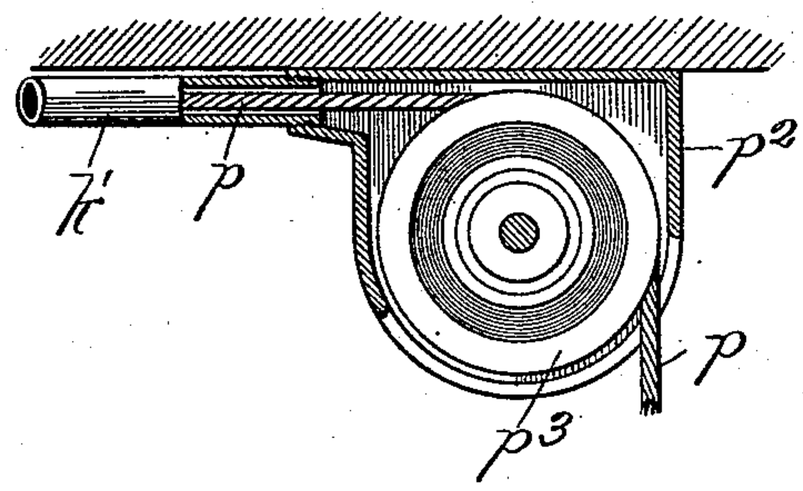
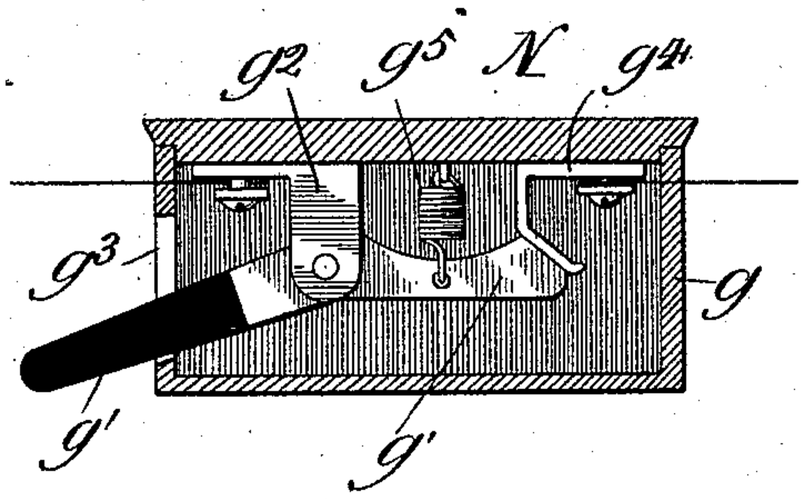


Fig. 18.



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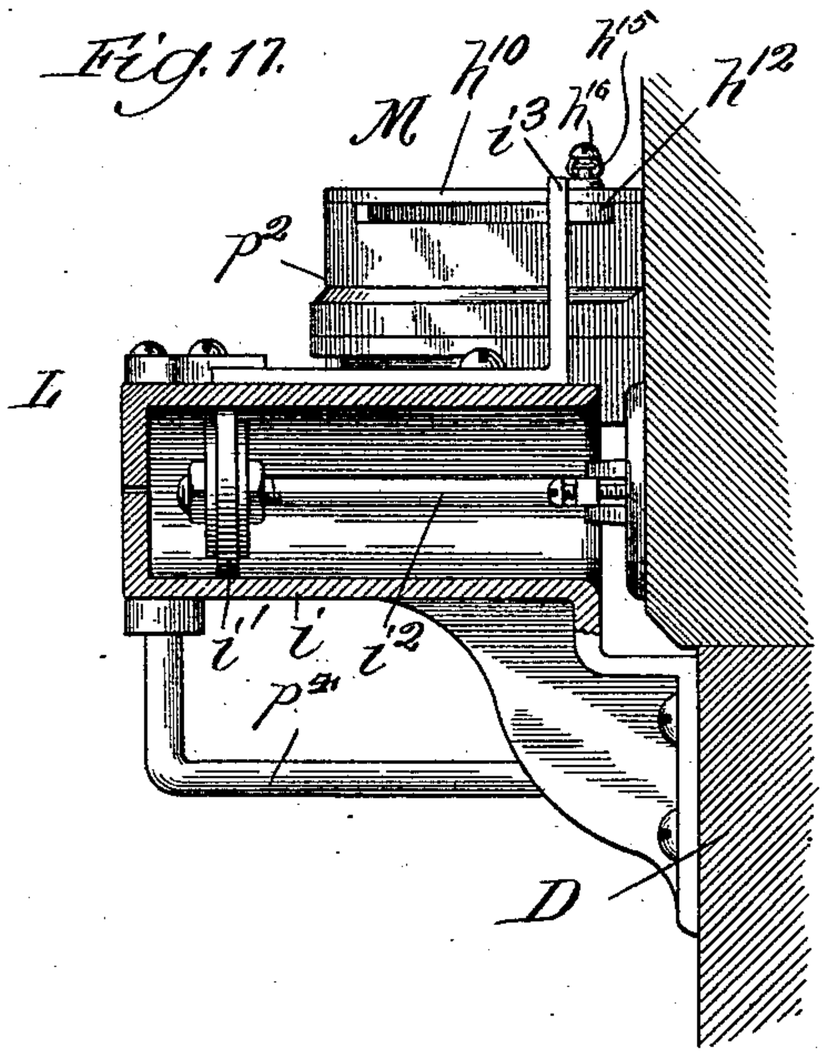

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O. H. HICKS & R. F. TROY.

ELECTRIC DOOR OPERATING APPARATUS.

No. 572,301. Patented Dec. 1, 1896.

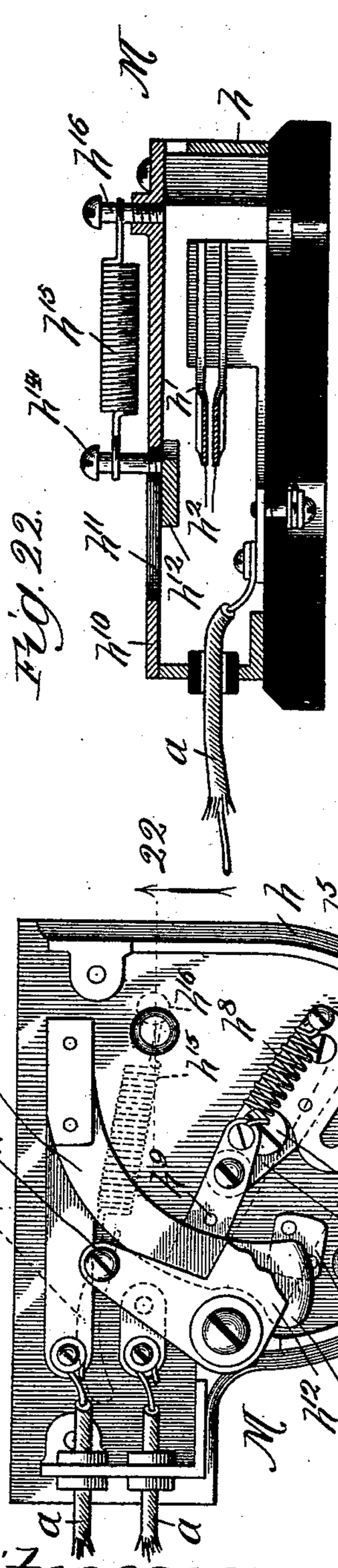

Fig. 22.

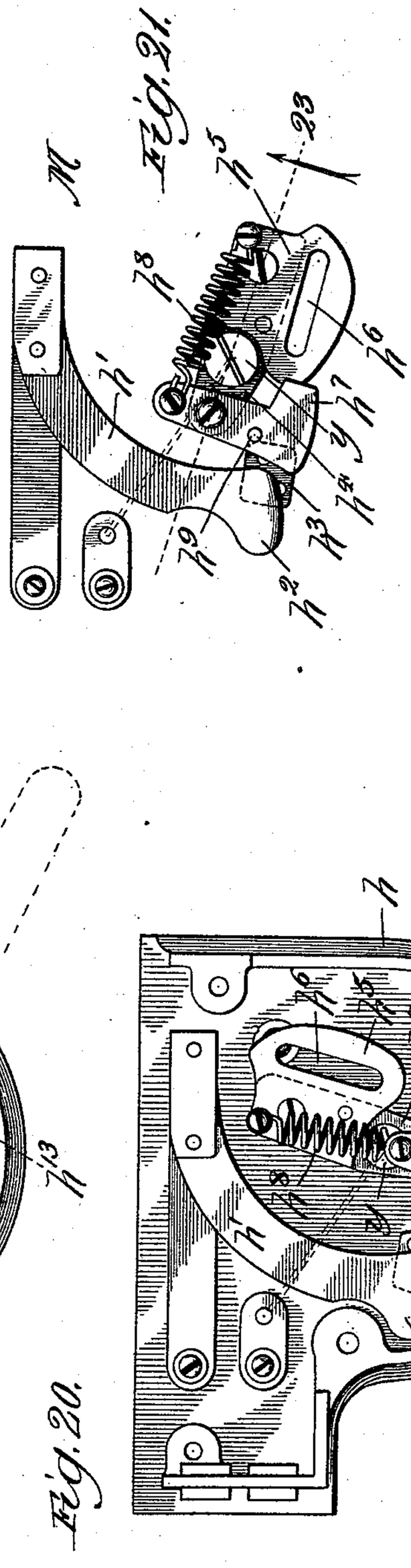

Fig. 21.

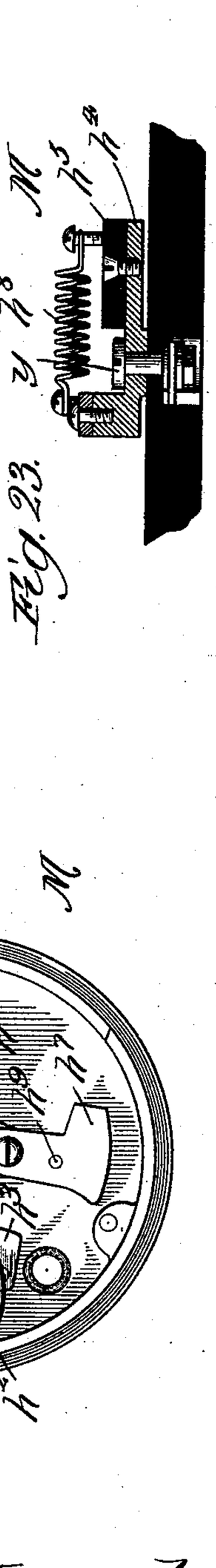

Fig. 23.

Fig. 19.

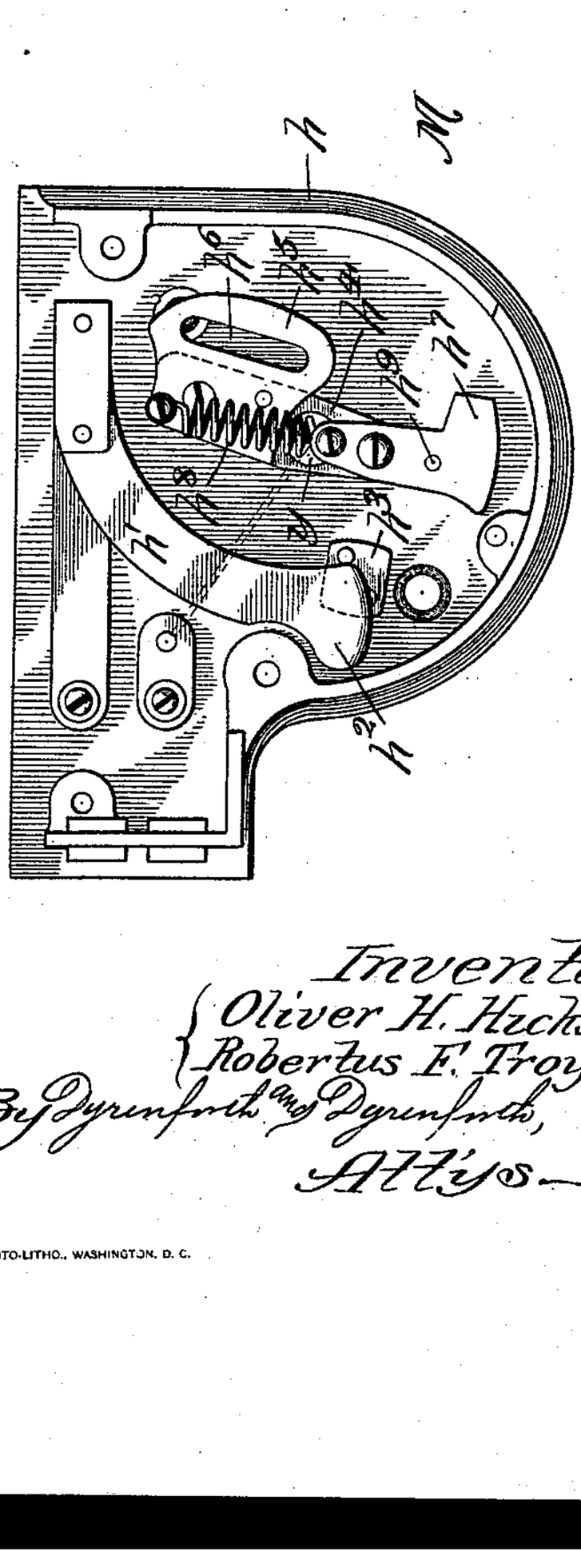

Fig. 20.

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O. H. HICKS & R. F. TROY.

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Fig. 24.

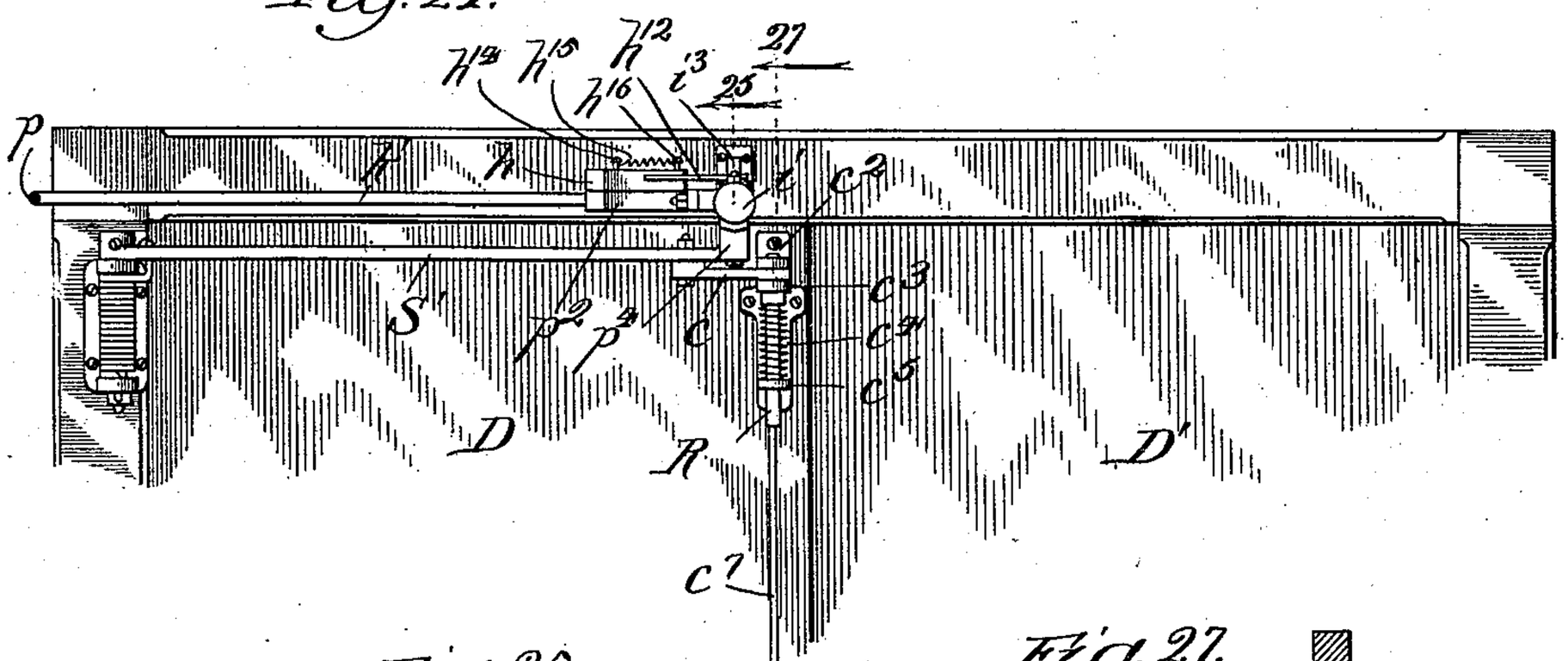


Fig. 25.

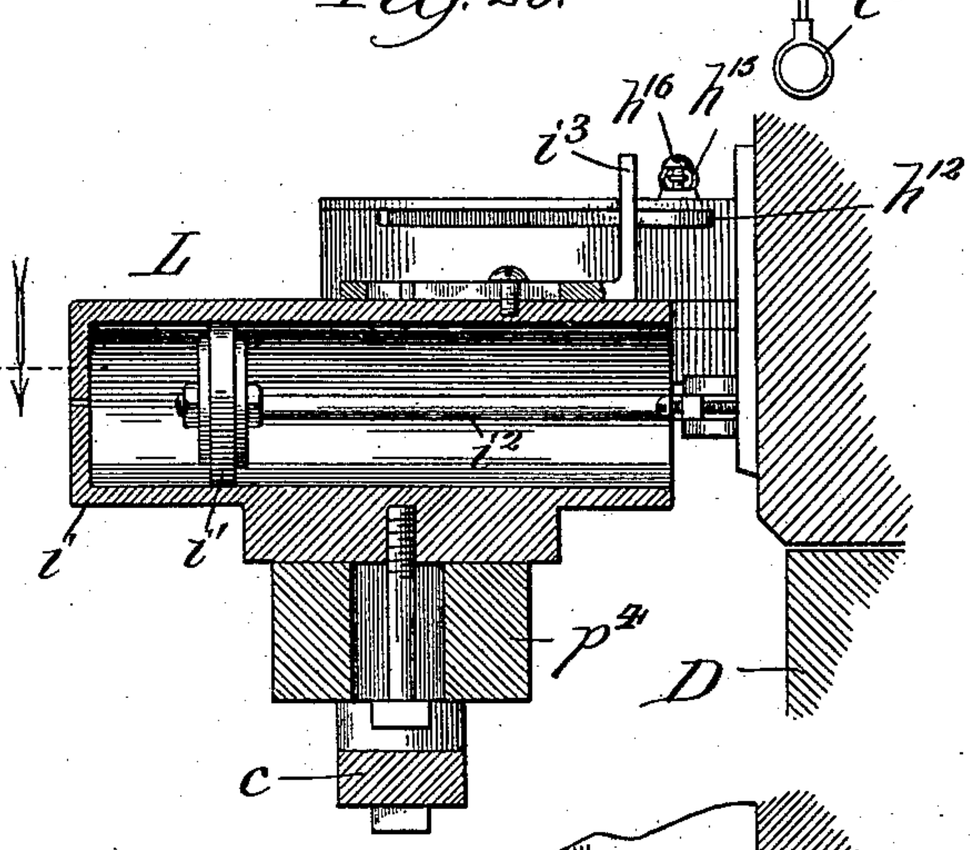


Fig. 27.

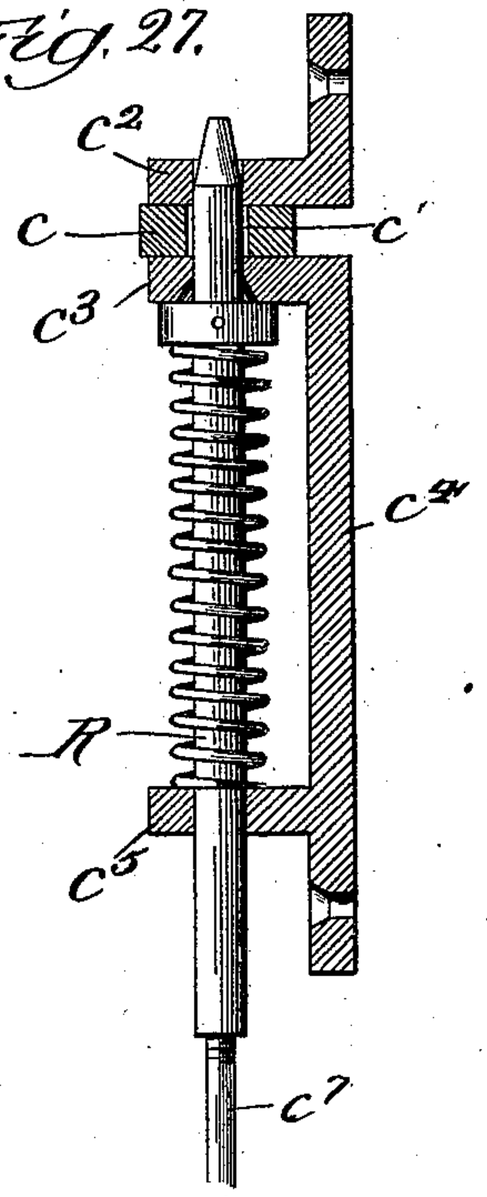
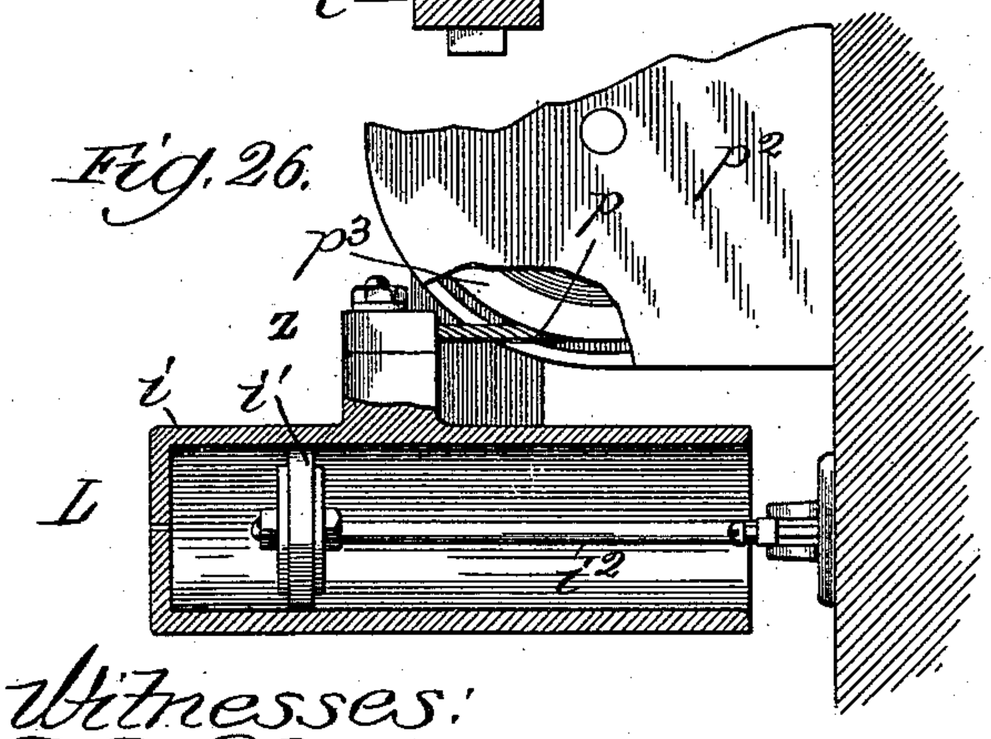


Fig. 26.



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O. H. HICKS & R. F. TROY.

ELECTRIC DOOR OPERATING APPARATUS.

No. 572,301. Patented Dec. 1, 1896.

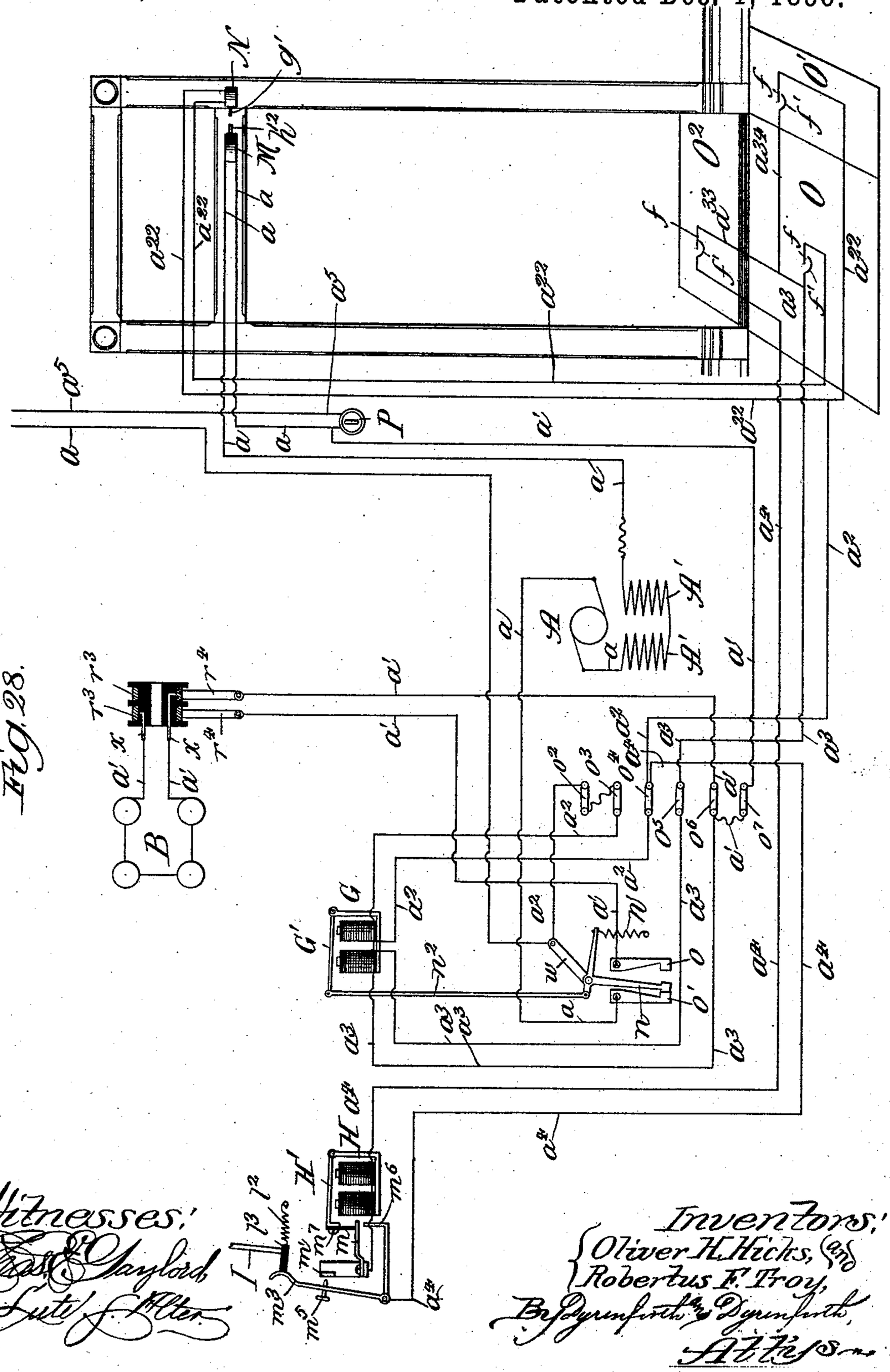

Fig. 28.

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O. H. HICKS & R. F. TROY.

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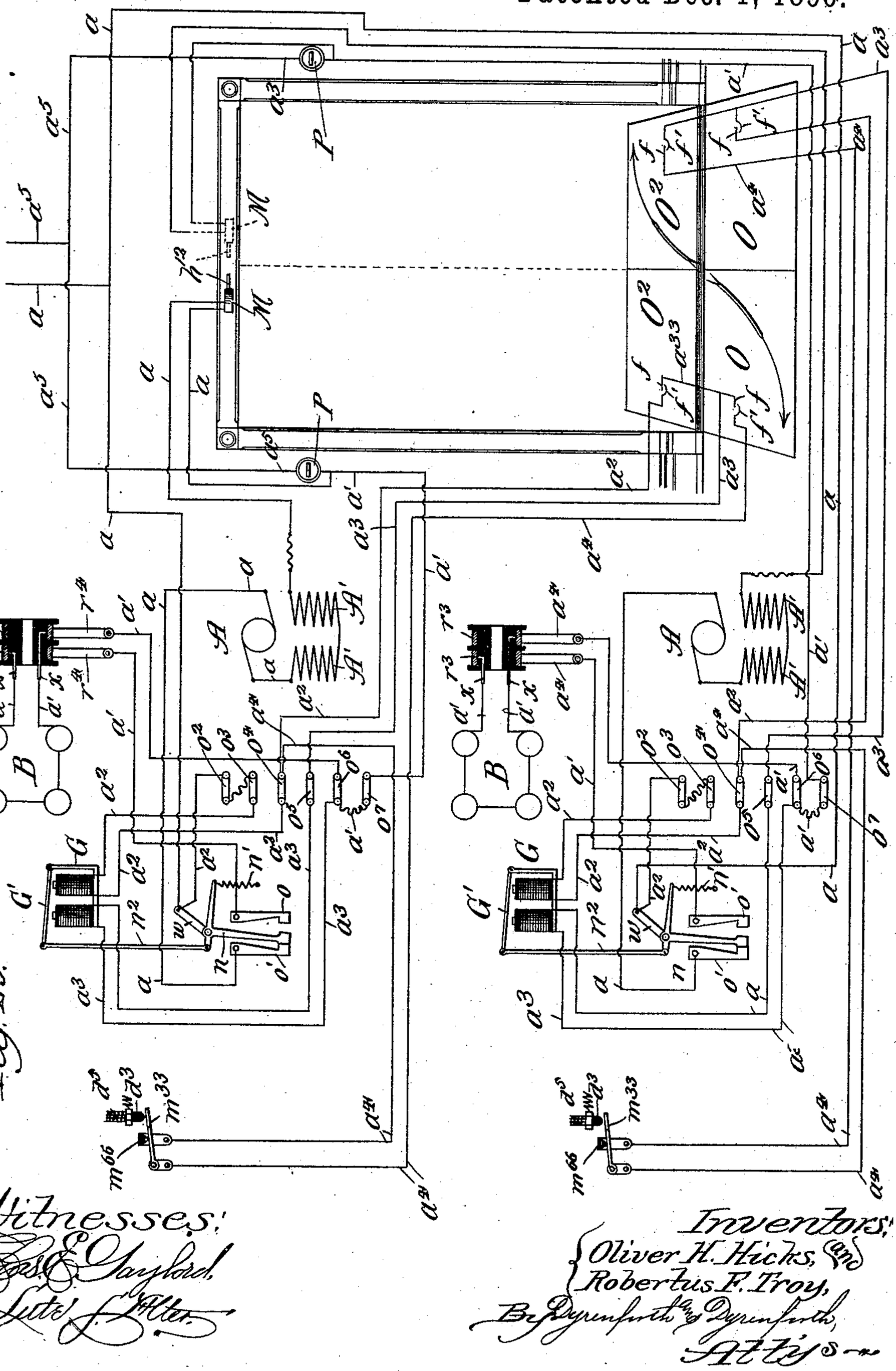

Fig. 29.

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UNITED STATES PATENT OFFICE.

OLIVER H. HICKS AND ROBERTUS F. TROY, OF CHICAGO, ILLINOIS, ASSIGNORS TO THE HICKS-TROY ELECTRIC DOOR COMPANY, OF SAME PLACE.

ELECTRIC DOOR-OPERATING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 572,301, dated December 1, 1896.

Application filed January 28, 1896. Serial No. 577,208. (No model.)

To all whom it may concern:

Be it known that we, OLIVER H. HICKS and ROBERTUS F. TROY, citizens of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented an Improvement in Electric Door-Operating Apparatus, of which the following is a specification.

Our present invention relates to an improvement in the class of electric door-operating apparatus which is exemplified by Letters Patent of the United States No. 461,122, issued October 13, 1891, to R. F. Troy, one of the present applicants, and by Letters Patent of the United States Nos. 505,270 and 505,271, granted to us jointly on the 19th day of September, 1893.

The generally-stated construction and mode of operation of the class of apparatus to which our invention relates may be briefly described as follows: Primary actuating means, preferably electric, such as a mat at the threshold, a plate on the door, or some form of projection in the path of passage through the doorway, so control the circuit or circuits of electric-motor mechanism that when the primary means are actuated, as by pressure or strain exerted upon or against the same, the motor mechanism is caused to operate the door. The operation may be that of either opening or closing the door, or both, although we find it to be most practical to employ the electric-motor mechanism for closing the door and to control the opening thereof by a spring arranged to be set by the closure, for the reason that the spring is more immediately responsive in its action than an electric motor, owing to the greater resistance the latter presents to overcoming its inertia, and a door should, for obvious reasons, be more prompt in starting to open than in starting to close.

The construction involved in the mechanism forming the subject of this application is the result of our constant combined effort, since devising the aforesaid patented constructions, to produce a perfected so-called "electric" door which should perform all functions which may be required or desired in an automatically opening and closing door.

Our object, therefore, has been to provide an electric door of generally-improved construction and operation by improving and adding to the formerly-patented features of construction. Thus as the more prominent particulars of improvement may be mentioned the following: Formerly the door was held in its closed condition against the recoil force of its opening-spring (which was set ready to recoil by the closure of the door) by the electric operating mechanism, thereby necessitating the employment of current during all the time of closure of the door to resist the normal door-opening tendency of the spring.

According to our present improvement all electric circuits in the apparatus are open when the door is in its closed condition, whereby all extravagance in current is avoided. Then we have devised a novel and greatly-improved construction of automatic check for the door to gage the distance to which it is desired to permit it to open, and the electric clutch for controlling winding up of the cord which connects the motor and door to close the latter and for releasing the cord to permit the door to open, as also the means of connection of the cord with the door, is novel and materially improved. The same is also the case with the circuit opening and closing mechanism. Moreover, we have provided a novel circuit arrangement whereby when a passer through the doorway from the side toward which the door opens has stepped from the inner mat or mat at that side (having thereby caused the door to open) through the doorway upon the outer mat or mat at the opposite side of the door, and while such passer is still on the outer mat, the door will start to close, whereas by passing through the doorway in the opposite direction the effect of stepping upon the same outer mat is to cause the door to open and remain open as long as the passer remains upon the mat. These and other details and their particular functions are hereinafter more definitely and fully described.

Referring to the accompanying drawings, Figure 1 is a view in elevation of a single door of the swinging variety equipped with our improved electric operating apparatus; Fig.

2, a plan view of the electric motor with its electromagnetic clutch, its brake or check, and switch attachments; Fig. 3, a section through the clutch mechanism, taken at the line 3 on Fig. 2 and viewed in the direction of the arrow; Fig. 4, a section taken at the line 4 on Fig. 2 and viewed in the direction of the arrow; Fig. 5, a view in elevation of the mechanism presented by Fig. 2; Fig. 6, a section taken at the line 6 6 on Fig. 2 and viewed in the direction of the arrows; Fig. 7, a section taken through a switch device at the line 7 on Fig. 2 and viewed as indicated by the arrow; Fig. 8, a section taken through the electromagnet of the clutch at the line 8 on Fig. 2 and viewed in the direction of the arrow; Fig. 9, a broken section taken at the line 9 on Fig. 8 and viewed in the direction of the arrow; Fig. 10, a section through the clutch, taken at the line 10 on Fig. 2 and viewed in the direction of the arrow; Fig. 11, a broken section taken through the spirally-grooved spool of the clutch at the line 11 on Fig. 2 and viewed in the direction of the arrow; Fig. 12, a section taken at the line 12 on Fig. 2 and viewed in the direction of the arrow to show a switch device for both the double doors and the single door; Fig. 13, a broken view in elevation, showing the portion of the spirally-grooved spool and the door-checking end of the clutch device, with a modified form of the switch controlled by it, for use with double swinging doors; Fig. 14, a broken section taken at the line 14 on Fig. 13 and viewed in the direction of the arrow; Fig. 15, a section taken at the line 15 on Fig. 1 viewed in the direction of the arrow and enlarged; Fig. 16, a broken sectional view of the cord-pulley located beyond the door; Fig. 17, a section taken at the line 17 on Fig. 15 viewed in the direction of the arrow and enlarged; Fig. 18, an enlarged sectional view of a switch detail located beyond the door; Fig. 19, an enlarged broken plan view, with the cover removed to show the internal mechanism and with the parts in their closed relative positions, of a novel switch device also located beyond the door; Fig. 20, a similar view of the same with the parts in their opposite relative positions wherein the switch is open; Fig. 21, a plan view of the parts of the aforesaid switch mechanism removed from their inclosing case and shown in the relative positions they assume when the switch is about to close; Fig. 22, a section taken at the line 22 on Fig. 19 and viewed in the direction of the arrow; Fig. 23, a section taken at the line 23 on Fig. 21 and viewed in the direction of the arrow; Fig. 24, a broken view in elevation of double electric swinging doors equipped with releasing mechanism adapted to permit both doors to be swung open in the same direction, freed from the electric controlling mechanism in case of emergency, as fire or panic, or to permit more convenient egress or ingress of a crowd; Fig. 25, a section taken at the line 25 on Fig. 24 viewed in the direction of the arrow and enlarged; Fig. 26, a broken section taken at the line 26 on Fig. 25 and viewed in the direction of the arrow; Fig. 27, a broken section taken at the line 27 on Fig. 24 viewed in the direction of the arrow and enlarged; Fig. 28, a diagram showing the arrangement of the electric circuits as applied in connection with a closed single swinging door equipped with our improved electric operating apparatus, and Fig. 29 a similar view of the same as applied in connection with closed double swinging doors equipped with our improved electric operating mechanism.

A (see particularly Figs. 2, 3, and 4) is the electric motor of any suitable construction involving field-magnets A′ and an interposed rotary armature A^2, carrying at one end of its shaft a commutator A^3 for engagement by the brushes A^4, and carrying at the opposite end of its shaft a worm r', meshing with a worm-wheel r in a lubricating-housing r^5 and supported on a rotatable shaft r^2, journaled to extend at a right angle to the armature-shaft. The shaft r^2 carries, suitably insulated from it, the cylindrical contacts r^3, engaged by the brushes r^4, adjacent to which are the electromagnets B, electrically connected at $x\,x$ with the contacts r^3, as most clearly shown in Fig. 3. Between the spools of the magnets the shaft r^2 carries a loose sliding bar t, projecting at its opposite ends through longitudinal slots t^3 in the sleeve t^2, which extends from the thimble t^4, by which the magnets are fastened to the shaft to rotate therewith, and the extremities of this bar afford internally-threaded bearings for set-screws t', which bear at their ends against the head t^6 of the magnets for a purpose hereinafter described.

B′ is the armature of the magnets B, (shown as a disk,) of suitable metal, loosely surrounding the shaft r^2 and connected with the adjacent head t^7 of the electromagnets by a link-joint t^8, Fig. 2, and confining a spring s, Fig. 3, against the hub of the bar t inside the sleeve t^2. Adjacent to the armature B′ and loosely surrounding the shaft r^2 is a spool C, surrounded near one end by a brake-band q, adjustably fastened at one end to the upper end portion of a post q', Fig. 10, and containing at its opposite end a spring-section q^2, by which it is fastened lower down on the same post. Adjacent to the part of the spool C upon which the brake-band is applied the spool is formed with a somewhat tapering spiral groove p' for the cord p, by which the motor mechanism of the apparatus is connected with a door D in the manner hereinafter described. Next to the spool C and fastened to its hub portion at x', as clearly shown in Fig. 3, is a disk C′, loose on the shaft like the spool, and having formed on its inner face a continuous spiral groove C^2, provided toward its inner end with a cam elevation C^3. Adjacent to the cam-disk C′ is supported on the shaft r^2, to rotate with it, a disk-head C^4 against an interposed friction-piece v, which

may be of leather, the head C^4 being adjustably fastened by a nut v', containing peripheral recesses v^2 to receive a stop screw or pin v^3 for preventing the nut from turning on its supporting-shaft.

As will be seen, the armature B′ and head C^4 form a clutch for the spool C. When the magnet B is energized, the armature is attracted against the resistance of the spring *s*, (which may be set to any desired tension by properly adjusting the screws t',) thereby unshipping the clutch device to permit the spool C to revolve freely on its shaft, and when the magnet is deënergized the recoil of the spring *s* forces the armature against the spool and the disk C′ thereon against the head C^4, whereby the spool is clutched between the armature and the head and caused to rotate with the shaft r^2.

As will hereinafter more definitely appear, the force of the spring *s* is superior in effect to that of the spring S (hereinafter described) on the door D for opening it, so that when the door is once closed by the action of the motor A against the resistance of the door-spring the door is held closed against that resistance by the effect of the spring *s*, which may properly be termed the "clutch-spring."

On the base E, which supports the mechanism thus described and which may be located in any convenient part of a building for connection with a door therein, are also supported a mat-magnet and a supplemental magnet, together with the switch devices for controlling their circuits and the motor-circuit. On an upright plate F, of insulating material, Fig. 5, are fastened the contacts *o* and *o*′, the binding-post devices o^2, o^3, o^4, o^5, o^6, and o^7, and a bell-crank-shaped switch-lever *n*, so fulcrumed at its angle that one arm extends between the contacts *o* and *o*′ and having its other arm connected with a spiral spring *n*′, fastened to the plate.

G is an electromagnet for the mat-circuit, formed with two spools supported at the inner side of the plate F and having a pivotal armature G′, connected at its free end by an insulated link n^2 with the spring-controlled switch-finger *n*. Adjacent to the electromagnet G, when the apparatus is employed in connection with a single swinging door having an outside and an inside mat at the threshold, is supported another electromagnet H, having its armature H′ pivoted at one end and carrying at its opposite end a depending bar m^7 of insulating material bearing at its lower end against a spring *m*, which extends at its free end into proximity with a contact m^6, and electrically connected with the contact m^6 is a post m^2, having pivotally supported upon it a contact-finger m^3, controlled by a spring m^4, tending to force it against a contact *m*′, from which the spring *m* proceeds and with which the contact-finger m^3 engages through the medium of a set-screw m^5, carried by the finger m^3. A bearing *l* on the bed E carries pivotally the stem of a holder *l*′, in which there is supported in inclined position a rod I, provided at one end with a sliding rotatable sleeve I′, carrying a disk I^2, engaging at its edge the spiral groove C^2 in the disk C′, and from the opposite end of the rod I, where it is controlled by a spring l^2, tending to force the disk I^2 into engagement with the spiral groove, there extends toward the free end of the contact-finger m^3 an insulated foot-piece l^3.

At S in Fig. 1 is shown the door-opening spring, which may be of any suitable variety, properly applied for its purpose, to cause it to be set for recoiling by closing the door.

The operating-cord *p* is fastened at one end to the spool C, preferably in the manner represented in Fig. 11, passes thence over a suitably-located guide-pulley *k*, whence it may pass through and be concealed in a tube *k*′, leading to a pulley-housing p^2, located above the door D and containing a horizontally-disposed pulley p^3. About this the cord passes and is connected at its opposite end with the adjacent end of a rod p^4, engaged near its opposite end by a coiled-spring device p^5 on the door D, tending normally to pull the cord in the direction in which the door opens. In Fig. 1 the cord *p* is shown to have a spiral spring p^6, attached in stretched condition at its opposite ends to a length of the cord for taking up slack in the latter.

L is a pneumatic buffer device, which may be of the well-known construction involving a piston *i*′ on the spring-controlled rod pivotally supported on the door-casing near the upper right-hand corner of the door D, which carries, to work upon the piston, a perforated cylinder *i*. On the upper side of the cylinder of the buffer device are adjustably supported side by side for the single-door-operating mechanism two abutments i^3 and i^4, for purposes hereinafter described.

On the pulley-housing p^2 is supported a switch device M, involving the construction illustrated in Figs. 19 to 23, inclusive, and of which the following is a description: In a case *h*, preferably of metal and of the form illustrated, is supported rigidly on the base of insulating material a curved bifurcated spring-contact *h*′, the open end of which is made with somewhat-flaring lips h^2, which extend over a cam-plate h^3 on the base. At *y* is pivoted between its ends, directly upon the base, a metal lever h^4, carrying rigidly at one end a head h^5, of insulating material, containing an elongated slot h^6 and having pivoted upon its opposite end in position to aline with the mouth of the spring-contact *h*′ a contact-finger h^7, connected from one side of its pivot by a spring h^8 with the head h^5 and carrying near its opposite end a depending guide-stud h^9 in position to engage with the adjacent cam edge of the plate h^3. On one side of the case, underneath its cover h^{10}, which contains a curved slot h^{11}, Fig. 15, is fulcrumed at its angle a bell-crank-shaped lever h^{12}, the longer arm of which projects through an elongated

slot in the opposite side of the case and carries a depending stud h^{13}, which enters the slot h^6 in the head h^5, and the shorter arm of which carries an upward-projecting pin h^{14}, which passes through the curved slot h^{11} in the cover h^{10}. This pin h^{14} on the lever is connected outside the cover by a spring h^{15} with a rigid pin h^{16}, extending from the cover.

By this construction of the switch M (the parts of which are shown in their normal relative positions in Fig. 19) when the lever h^{12} is turned on its fulcrum against the resistance of the spring h^{15} to open the circuit and bring the parts to the relative positions in which they are represented in Fig. 20 the engagement of the stud h^{13} with the slot h^6 in the head h^5 turns the latter on its fulcrum y, and thereby brings the stud h^9, depending from the pivotal contact-finger h^7, against the cam edge of the plate h^3, whereby the contact-finger is turned upon its pivot and forced out from between the lips of the bifurcated spring-contact h', and in this movement of the contact-finger h^7 until its stud passes the side edge of the cam-plate the spring h^8 is obviously stretched, and when the stud passes that side edge to the end edge of the cam-plate the spring is released and its recoil suddenly completes the final separation of the contact-finger h^7 from the jaws of the bifurcated spring-contact h'. In this manner the break in the circuit is rendered so sudden as to avoid drawing a spark.

When the force which was applied to the projecting end of the lever h^{12} (namely, that of the closing door, as hereinafter described) to produce the described operation is removed, the spring h^{15} returns the lever h^{12} to its normal position, and in doing so the depending stud h^{13} on the lever, by its engagement with the slot h^6 in the head h^5, turns the latter back on the fulcrum of the lever h^4, in which movement of the latter the stud h^9, depending from the contact-finger h^7, bears against and travels along the end edge of the cam-plate h^3 till it reaches the position shown in Fig. 21, meantime turning the contact-finger on its pivot to the position therein illustrated and thereby stretching the spring h^8; and when the stud h^9 has reached that position and the free end of the finger h^7 has thereby been brought into close proximity with the jaws of the spring-contact h' the spring h^8 is freed to recoil and suddenly complete the remainder of the return movement of the finger h^7 to turn its free end between the jaws of the spring-contact. Thus the closure of the switch is also produced suddenly and, which is of more importance, positively. It will thus be seen that there can be no half-way movement of this switch. When it breaks, it must break wide open, and when it closes it must throw clear in and make a perfect contact.

The lever h^{12} of the switch device M projects into the path of the stop-abutment i^3 on the cylinder i of the pneumatic buffer.

On the door-casing above the single swinging door D is located still another switch device N, Fig. 18, comprising a case g, the base of which should be of insulating material, containing a contact-lever g', fulcrumed between its ends on a terminal bracket g^2 to project at one insulated end through an elongated slot g^3 in the case into the path of the abutment i^4 on the buffer-cylinder i, and normally engaging at its opposite end, under the control of a spring g^5, a spring-terminal g^4.

The foregoing describes the mechanism mainly as especially adapted for use in connection with a single swinging door. For the double swinging doors the mechanism is duplicated and changed in some particulars, as hereinafter described.

The following is a description of the circuits as arranged in connection with the single-door mechanism as illustrated in Fig. 28, and including the mat-sections O, O', and O^2 therein indicated, the construction of which may be well known and is not therefore herein shown in detail.

At P on the side of the door-frame is shown an electric switch of any suitable or well-known construction for cutting in and out all the circuits. From the source of current supply (not shown, but which may be an especial generator or a wire of an incandescent-electric-lamp circuit in a building) leads the outgoing-wire a to the connection with the switch-finger n, normally engaging the contact o', from which the wire a continues through the armature and the field-magnets A' of the motor and thence through the switch M to one side of the switch P, from the opposite side of which leads the return-wire a^5 to the source of the current. The circuit thus described is the motor-circuit, which is normally open at the switch M, that is, when the door D is closed by the pressure of the latter against the switch-lever h^{12} when the parts of that switch are in the relative positions in which they are illustrated in Fig. 20. From the contact o leads the wire a' through the contacts r^3 on the shaft r^2 and through the magnets B, from which the wire passes through the binding-posts o^6 and o^7 and connects with the wire a adjacent to the switch P. The circuit thus described, which is a branch of the circuit formed with the wire a, is the clutch-circuit and is normally open (when the mat is not depressed) at the contact o. From the connection w the wire a branches, as a wire a^2, and leads through the binding-posts o^2 o^3 through one spool of the mat-magnet G, thence through the binding-post o^4 to the rigid contact f on the mat O' by a branch a^{22} through the switch device N, from which the branch wire a^{22} leads to the rigid contact f on the mat O, while the spring-contact f' on the last-named mat is connected to the wire connection a' by a wire a^3, which leads from said spring-contact to the binding-post o^5, thence through the other spool of the mat-magnet G and from the latter through the binding-post

o^6. The rigid contact f on the outdoor portion of the mat O^2 is connected by a branch wire a^{33} with the wire a^3, and the spring-contact f' on the mat-section O′ is connected by a branch wire a^{34} with the branch a^{33}, which joins the wire a^3. The circuit thus described is the mat-circuit. From the binding-post o^4 there proceeds a branch wire a^4 to the contact-finger m^3 and contact m^6 for the spring m, and through the contact m' from the finger m^3 and the electromagnet H, which is in the nature of a supplemental mat-magnet, to the spring-contact of the outside mat-section O^2.

The operation of the mechanism, with the switch P closed and the parts in the position which they occupy when the door D is closed, the mat-contacts f and f' being separated from each other and all the other circuits open, is as follows: By stepping on the mat O in approaching the closed door from the side toward which it opens no action ensues, since the circuit remains broken at the switch device N. The object of this dead condition of the mat O when the door is closed is to prevent it from opening in the face of or against a would-be passer through the doorway, who must, accordingly, step on the mat-section O′ to effect the opening. The pressure on the mat O′, by bringing its contacts f and f' together, closes the mat-circuit through the wire a to the connection w, thence through the wire a^2, binding-posts o^2 o^3, one spool of the magnet G, through the binding-post o^4 to the contact f of the mat O′, thence from the contact f' on that mat over the wires a^{34} a^{33} to the wire a^3, which leads through the binding-post o^5 and other spool of the magnet G and thence through the binding-post o^6, where it connects with the wire a', leading to the switch P, through which it connects with the main return-wire a^5. This closure of the mat-circuit energizes the magnet G, causing it to attract its armature G′, the movement of which turns the switch-finger n from the contact o' to the contact o, thereby closing the clutch-circuit from the wire a, through the connection w, finger n, and contact o to the wire a', which passes through the contacts r^3 and electromagnet B and through the binding-posts o^6 and o^7 to the switch P, and through the latter to the main return-wire a^5. Closure of the clutch-circuit energizes the magnet B, causing it to attract its armature B′ against the resistance of the spring s, whereby the spool C is freed from the clutching or binding effect by the spring between the armature and the head C^4 and is loose to revolve on the shaft r^2. The force of the spring s being thus withdrawn from opposing that of the door-spring S, the recoil of the latter throws open the door D to permit passage through the doorway.

The door in opening carries an abutment i^5, Fig. 15, projecting from a side of the buffer-cylinder i against the adjacent end of the spring-controlled arm p^4, to which the cord is attached, thereby forcing that arm to move with the door and drawing upon the cord p, thus unwinding it from the spirally-grooved spool C by rotating the latter upon the shaft r^2, with the effect upon the rod I and results thereof hereinafter described.

Obviously the moment the door begins to open, its pressure against the levers h^{12} and g' of the switch devices M and N being removed, the latter immediately close, the former under the recoil of its spring h^{15} and the latter under that of its spring g^5.

As will be observed, the pivotal rod I is resiliently held against turning in one direction by the spring l^2; but the spirally-grooved cam-disk C′, in rotating with the spool C by the opening of the door, causes the rotary head I^2 on the rod, by following the groove in the disk, to be forced, when it reaches the cam elevation, in the direction to turn the opposite end of the rod I against the resistance of its controlling-spring l^2, which is thus caused to exert, through the headed rod, a binding or checking effect against the cam-disk, and through the latter against the spool C for checking the opening of the door. Through the medium of the set-screw l^6 (shown in Fig. 2) the effect of the force of the spring l^2 upon the bearing strain of the head I^2 against the cam-disk C′ may be so regulated as to check the opening of the door D by its controlling-spring S at any desired point, though the main adjustment for the checking effect is attained by properly setting the cam-disk C′ on its bearing on the spool-hub. Moreover, the described turning against the resistance of the spring l^2 of the rod I by the opening door causes the rod to perform the further function of bearing at its foot l^3 against the spring-finger m^3 to force its contact m^5 away from the contact m', whereby, as will presently be seen, the described conditions of the mat and clutch circuits are maintained at least for a short period after the passer through the doorway has reached the outside mat-section O^2 and pressed the contacts f f' thereon together.

For the sake of clearness it should be stated that the condition of the various parts shown in Figs. 2 to 14, inclusive, and in Figs. 18, 19, 28, and 29, is that wherein the door D is open and the mat has been released and the mechanism is in condition to start to close the door; and Figs. 1, 15, 17, 20, 24, 25, and 26 show the relative condition of the parts of the operating mechanism in the relative positions they assume when the door is closed.

On reaching the outside mat-section O^2 the passer through the doorway from the inside by leaving the mat-section O′ permits its contacts f f' to separate and thus open the described mat and clutch circuits, whereby the magnet G is deënergized and permits the switch-finger n by the recoil of its controlling-spring n' to engage the contact o', and the magnets B are deënergized to permit the spring s to press the clutching-armature B′ against the spool C and clamp the latter to

cause it to rotate when the shaft r^2 is rotated. This condition of the parts is not changed when the passer through the doorway reaches and steps upon the outside mat-section O^2, for though he then presses the contacts $f f'$ thereof together the circuit containing the supplemental magnet H is still open between the points m^5 and m', as will be seen by following the wire a from its beginning through the connection w, whence its branch a^2 passes to the binding-posts o^2 o^3, one spool of the magnet G, and binding-post o^4, from which the branch a^4 leads to the switch-finger m^3, and from the contact m' and spring m thereon to the contact f' of the outer mat-section. However, the engagement of the switch-finger n with the contact o' closes the motor-circuit, as follows: on the wire a, through the connection w and switch-finger o', whence the wire a continues through the armature and field-magnets of the motor A and through the switch device M to the main switch P, through which it connects with the main return-wire a^5.

Closure of the motor-circuit causes the armature A^2 to revolve and by its worm-gear connection with the shaft r^2 rotate the latter, and with it the spool C, (then clutched, as aforesaid, by the spring s between the armature B′ and head C^4,) in the direction to wind upon it, in its groove p', the cord p. If the person immediately clears the mat-section O^2 in passing out, therefore, the door closes behind him by the winding of the cord p upon the spool C, and when the door is completely closed the motor-circuit is opened at the switch device M, and the mat-circuits are also opened at the mat-contacts; but if the person should stand even for a brief period of time on the outer mat-section, as in talking, or to turn around for the purpose of returning through the doorway, the door, instead of closing completely, will, after having closed part way, again open. The way this result is accomplished will presently be described.

When the door D is open, the disk-head I^2 on the inclined rod I is at the highest point of elevation on the cam C^3 on the face of the disk C′, whereby the foot-piece l^3 on the opposite end of the rod is forced against the spring-controlled finger m^3 to separate its contact m^5 from the contact m', thus opening the circuit containing the magnet H and holding it open till after the door begins to close. By the rotation of the spool C in closing the door the disk-head I^2, under the tension of the spring l^2 on the pivotal rod I′, engages the groove C^2 beyond the elevation C^3 therein, thus retracting the foot-piece l^3 from the finger m^3 and permitting its controlling-spring m^4 to force the contact m^5 into engagement with the contact m'. Then, if the passer be still on the outer mat-section, the circuits containing the magnet G and clutch-magnets B will be closed, as will be seen by following the wire a to the connection w, thence the wire a^2 through the binding-posts o^2 o^3, through a spool of the magnet G, and through the binding-post o^4. Thence the wire a^4 leads to the finger m^3, contact m', and through the magnet G to the contact f' on the outer mat-section, from the contacts f, on which the current then flows, by way of the wire a^{33} to the wire a^3, which leads through the binding-post o^5, thence through the other spool of the magnet G to the binding-post o^6, where it joins the wire a', which passes through the clutch-controlling magnets B from the contact o (with which the lever n is then in engagement) to the main switch P. Of course under these last-named conditions the motor-circuit is broken by the throw of the switch-lever n from o' to o, and the clutch-armature B′ being attracted against the resistance of the spring s the spool C is free to revolve loosely on its shaft r^2 and permit the cord p to pay out by the force of the door-spring S in opening the door. Of course, also, when the door shall have then opened fully, or to its limit permitted by the checking effect of the mutual action on each other of the cam elevation on the disk C′ and the disk-head I^2 on the rod I, the latter will have been turned to force the foot-piece l^3 against the finger m^3 and separate the contact m^5 from the contact m'; but that will not break the circuit containing the magnet H, because by energizing it its armature H′ was attracted to press the spring m against the contact m^6, thereby maintaining the circuit closed till it is opened by the passer stepping off the mat O^2; but should he reënter the doorway while the door is still open, and in doing so step on the mat-section O, the door will remain open or continue to open in the same way that it is caused to operate, as presently to be described, by stepping upon it in passing through the doorway from the outside.

A person approaching the door D from the outside with the purpose of passing through the doorway first steps upon the mat-section O^2, with the effect of keeping the door open if it is still open as the result of another person being on either mat-section, and if the door be closed with the effect of opening it by the closure of circuits as follows: on the wire a to the connection w, thence on the wire a^2 through the binding-posts o^2 o^3, one spool of the magnet G, and binding-post o^4 to the wire a^4, which passes through the magnet H to the contact f' on the outer mat-section, and from the contact f thereon the wire a^{33} connects with the wire a^3, which passes through the binding-post o^5, the other spool of the magnet G, and connects at the binding-post o^6 with the wire a', which includes the magnet device B, from the contact o to the main switch P. Again, by the closure of these circuits the spool C is freed to rotate independently of its shaft r^2 and permit the spring S to open the door in the manner described, and the door continues to open or remains open while the person in passing steps upon the inner mat-section O, since thereby the contacts $f f'$ thereon are pressed

together with the effect of keeping open the motor-circuit and keeping closed the circuit containing the magnet G and that containing the clutch-magnet B, as will be seen by tracing these circuits as follows: on the line *a* to the connection *w*, thence by the wire a^2 through the binding-posts o^2 o^3, one spool of the magnet G, and binding-post o^4 to the branch a^{22}, which passes through the switch device N to the contact *f* on the mat-section O, and from the companion contact *f'* the wire a^3 leads through the binding-post o^5 and other spool of the magnet G to the binding-post o^6, whence it connects with the wire *a'*, proceeding from the switch-lever *n*, (then in engagement with the contact *o* as the result of the attraction of the armature G',) through the clutch-magnet device and through the binding-posts o^6 and o^7 to the main switch P and main return-wire a^5.

From the foregoing the following points to be remembered will be clear: First, that when the door is closed all the circuits are open; second, that for egress through the doorway pressure on the mat-section O closes no circuit, and consequently produces no effect upon the door; third, but that pressure on the mat-section O' closes the circuit containing the magnet G, which then closes the circuit containing the magnet B and causes it to attract the clutch-armature B' and withdraw the force of the spring *s* from the spool C to loosen it and permit the door-spring S to act to open the door, whereby the cord *p* is paid off its spool by the rotation of the latter; fourth, that by the rotation of the spool C loosely upon its shaft r^2 the cam-groove C^2, by engagement with the head I^2 on the rod I, eventually checks the door in opening and turns the rod I to effect separation of the contact m^5 on the switch-finger m^3 from the contact *m'*; fifth, that by the opening of the door both switch devices M and N are permitted to close; sixth, that in continuing the egress through the doorway by stepping on the outer mat-section O^2, owing to the circuit on the wire a^4 being open at the magnet H, the circuit containing the magnet G, and consequently that containing the clutch-magnet, is opened by separation of the contacts *f f'* on the mat-section O' as the result of removing the stress therefrom of the person seeking egress, whereby the switch-lever *n* engages the contact *o'*, thus closing the motor-circuit and causing rotation of the motor to turn the shaft r^2 and with it the spool C, clutched thereon to wind upon it the cord *p* and start closure of the door; seventh, that if the pressure on the outer mat-section O^2 be immediately removed by stepping off it on the way out the door continues its closing movement till it closes completely; eighth, but that if the pressure remains for a brief period until the spool C in its rotation shall have moved the head I^2 from the cam elevation C^3 the circuit containing the magnet H will close, thereby closing the circuit containing the magnet G and opening the motor-circuit and closing the circuit containing the clutch-magnet B, with the result that the door will open; ninth, that when the door is closed it opens the switch devices M and N; tenth, that a person seeking ingress through the closed doorway by stepping on the outer mat-section O^2 and thus bringing its contacts *f f'* together closes the circuit containing the magnet H (it will be remembered that the contacts m^5 and *m'* are together when the door is closed) and the circuits containing the magnets G and B, with the result that the door is opened by the spring S; eleventh, and that when such person reaches and presses on the mat-section O to bring its contacts *f f'* together the circuits containing the said magnets remain closed, (through the then closed switch device N,) with the result that the door continues to open until checked or until the person steps off the mat-section O, when these circuits open at the mat-contacts and the motor-circuit closes at the lever *n* to actuate the motor A to close the door.

Owing to the manner of connecting the cord *p* with the door at the spring-controlled arm p^4 thereon, the door may be closed at any time by pressure or strain exerted against it without in any way affecting its operating machinery other than the spring S. Suppose, as an instance, where this feature would be advantageous, that in closing up the building the switch P were turned while the door is open. Then by forcing the door closed to lock it the spring S will be set, so that when the door is unlocked from the outside to permit entry into the building (say the next morning) the recoil of the spring will open it. The door having no connection with the cord *p*, except at the spring-arm p^4, the latter will hold the cord taut while the door is being closed in the manner described.

When the door is opening and the cord is being paid off its spool C, the turning of the latter may pay off the cord faster than it is taken up by the speed with which the door opens. Then the cord tends to buckle more or less. The stretched spring p^6 on the cord immediately takes up the slack when this buckling takes place.

In the application of our improvement to double swinging doors, according to the diagrammatic representation in Fig. 29, we may dispense with the switch device N, and consequently with the abutment i^4 on the buffer-cylinder *i*, and also with the magnet device H and its immediate companion mechanism, and the action of the rod I is also modified, all as hereinafter described. Otherwise the parts of the mechanism are all duplicated, one set being provided for each of the two doors, except that the mat-sections O' are omitted and only an inner mat-section O and an outer mat-section O^2 are provided at the threshold of each door. When our improvement, moreover, is applied to two swinging companion doors, each should be arranged to

swing only through about a quarter of a circle and in the direction opposite to that in which the other swings, so that egress through the doorway may be had only at one door and ingress only at the other. In Fig. 29, though the doors themselves are omitted from the view, the relative directions in which they open are indicated by arrows, the door D, Fig. 24, being thus arranged to open inward and the door D′ to open outward. In this construction the inclined rod I is also supported in a pivotal head l' on a bearing l, from one end of which there extends a post l^7, carrying a set-screw l^6, the rod being controlled in its movement with the pivotal head l' by the spring l^2, as and for the purpose hereinbefore described with relation to the corresponding parts, and on the end of the rod adjacent to the cam-grooved disk C′ it carries the sliding collar I′ and rotary disk-head I^2, as also a sliding bearing d, while at its opposite end it carries a rigid bearing d', shown as of insulating material, though it need not be. A supplemental rod I^3 is loosely supported between its ends in the pivotal head l' and supported at its opposite ends, respectively, in the bearings d and d', the end of the rod I^3 (if the latter be of metal) which projects beyond the bearing d' being insulated, as shown at d^3 in Fig. 14, and between the bearing d', in which the supplemental rod is supported to slide, and a rigid collar d^4 on the rod is confined about the latter a spiral spring d^5. On a bearing-plate e on the base E is supported a contact m^{66}, adjacent to the end d^3 of the rod I^3, in engagement with which end is a switch-finger m^{33}, extending from a post m^{22}, carrying a spring m^{44}, which controllably engages the switch-finger.

When either of the two doors is closed and its controlling-switch P is in its normally-closed condition, by stepping on the mat O^2 of the door D for ingress through the doorway that door opens, since the circuits containing a magnet G and a clutch-controlling magnet device B are closed as follows: over the main outgoing wire a to the connection w with the switch-lever n, thence by the wire a^2 through the binding-posts o^2 o^3 and one spool of the magnet G, thence through the binding-post o^4 to the contact f' on the mat-section O^2, from the contact f, on which the wire a^{33} connects with the wire a^3, which passes thence through the binding-post o^5 and other spool of the magnet G to the binding-post o^6, where it connects with the wire a', leading through the binding-post o^7 to the switch P, and thence to the main return-wire a^5, and by the consequent attraction of the armature G′, whereby the circuit containing the motor A is broken at o', (this circuit being on the wire a through the lever n, contact o', motor A, and switch device M to the switch P,) the circuit containing the clutch-magnets B is closed over the wire a, connection w, and lever n to the contact o, whence the wire a' leads through the clutch-magnet device, and the binding-posts o^6 o^7 to the switch P. As a result of thus pressing the mat O^2 in front of the door D, its spring S is free to open it in the same manner, as already described.

When the person passing through steps from the mat-section O^2 upon the mat-section O behind the door D, the same condition of the circuits is maintained, since, when the door opens, the turning of the grooved disk C′ has, by its engagement with its groove of the sliding head I^2 on the rod I, carried the head to its position nearest the center of the disk, thereby permitting the spring d^5 to expand and retract the supplemental rod I^3 from engagement with the switch-finger m^{33}. Hence the circuits will be closed over the wire a to the connection w, thence over the wire a^2, through the binding-posts o^2 o^3 and one spool of the magnet G to the binding-post o^4, from which the wire a^4 leads through the contact m^{66} and finger m^{33} to the contact f' on the said mat-section O; and from the companion contact f the branch a^{33} connects with the wire a^3, which leads through the binding-post o^5 and other spool of the magnet G to the binding-post o^6, where it joins the wire a', which leads through the switch P to the return-wire a^5; and the circuit containing the clutch-magnet device is closed on the wire a to the connection w and on the lever n to the contact o, and thence on the wire a', which passes through the magnets B and binding-posts o^6 and o^7 to the return-wire a^5 through the switch P. When such person steps off the respective mat-section O, the door D being open, obviously the mat-circuit opens at the mat-contacts, leaving the spring n' free to bring the lever n into engagement with the contact o' and thereby close the motor-circuit and open the clutch-circuit in the manner hereinbefore described, with the result that it turns the shaft r^2 to wind the cord p upon the spool C and pull the door to.

With the door D closed it will not be opened by stepping upon its inner mat-section O in an attempt to pass through the doorway from that side, since then, by the rotation of the spool C to wind the cord p upon it, the head I^2 on the rod I will have been brought by the groove C^2 in the disk C′ to a remote point from the center of the disk, thereby sliding the sleeve I′ downward upon the rod against the sliding bearing d and forcing the supplemental rod I^3 out through its bearing d' against the switch-finger m^{33} to separate the latter from its contact m^{66}.

It may here be stated that when by the contrary rotation of the disk C′ the sleeve I′ is drawn, in following the spiral groove, toward the center of the disk it is followed by the supplemental rod I^3 under the force of the recoil of its spring d^5, which was compressed by the movement of the rod I^3 in the opposite direction; and in this connection it may further be mentioned that when the sliding disk-head I^2 is in the position in which it is represented in Fig. 13, namely, in en-

gagement with the cam C^3, it exerts, under the influence of the spring l^2, the checking effect in the opening in the manner already described. When the finger m^{33} is thus separated from the contact m^{66}, notwithstanding the engagement of the contacts f f' on the respective mat-section O, the circuits containing the magnet G and clutch-magnets B are obviously open at that separation, as may be verified by tracing the circuits, so that the mat-section O is then dead. The advantage of this is that the door cannot open in the face of the person undertaking to pass through it from that side; and such person must accordingly step on the adjacent mat-section O to cause the other door, D′, to open. The results of stepping on and off the mat-sections O O^2 of the door D′ need not be described, as they are practically the same as those ensuing from stepping on and off the mat-sections of the other door, as may readily be verified by any one skilled in the art to which our invention relates tracing out the circuits, which are indicated correspondingly for both of the double swinging doors.

In the use of a pair of double doors which, like the doors D D′, are arranged for the use thereon of our improved electric operating mechanism to open and close in relatively opposite directions, but each to open in only one direction, it is desirable in case of emergency, as of a fire or a panic, or to facilitate the egress of a crowd, that both doors may be swung outward without interference from our operating appliance. Accordingly we apply to the door D (the other door already opens in an outward direction, so that no further provision to that end is required for it) means for normally preventing its outward swing, but which may be readily adjusted to release the door to be swung outward, it being hinged to permit swinging to open it in either direction.

The following is a description of the means referred to with particular reference to Figs. 24 and 27: At the outer end of the arm extension S′ of the door-spring S (the spring p^5 and arm p^4 being omitted from the double-door arrangement, and the spring S being raised to the position shown in Fig. 24 and provided with the arm extension S′) the arm extension is adjustably connected with the cylinder i of the buffer L, with which also the end of the cord p is connected at z, Fig. 26. In this way the buffer-cylinder is carried by the arm S′. From near the outer end of the arm S′ there extends a link c, pivotally connected at one end with the arm and embraced at its opposite end, which is perforated at c' between a perforated upper clip c^2 (shown as fastened to the door D near its upper right-hand corner) and a perforated lower clip c^3, extending from the upper end of a plate c^4, fastened on the door and carrying near its lower end a perforated guide-bearing c^5 for a spring-bolt R, having a depending handle c^6, connected with the bolt by a flexible or rigid connecting medium c^7. The perforations in the clips c^2 c^3, link c, and bearings c^5 aline with each other, whereby the spring-bolt R may pass through all of them and stop the door D by its indirect connection thus afforded with the cord p and the buffer-cylinder which alines with the upper door-casing from opening outward. When it is desired to throw open the door D in the outward direction, (thus correspondingly with the door D′,) the bolt R is withdrawn sufficiently to clear the link c, which is then swung outward from between the clips c^2 and c^3, thereby absolutely disconnecting the cord p from the door, which is accordingly free to be swung outward without impediment from or interference with the door-operating mechanism.

The complicated nature of this invention has rendered necessary for its proper explanation the foregoing somewhat minute description of the various parts and their functions. We do not wish to be understood, however, as implying that our invention is dependent upon the particular details, their particular relative arrangements, and their precise functions, as these, or some of them, at least, may without departure from our invention, be variously modified by those skilled in the art to which it relates.

As one example of a departure which is within the spirit of our invention may be mentioned that the primary actuating means are not essentially mats, electric or otherwise, though they are preferably electric mats, and as another such example it is suggested that our arrangement of the various circuits may be changed without materially, if at all, impairing the functions of the door-operating mechanism. Furthermore, it is within our invention to arrange the door-spring to close the door and the motor mechanism to open it, though for the reason suggested this is not so desirable, and it is not essential for the application of our invention that the door or doors shall be of the swinging variety.

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

1. In combination with a door, an electric motor primary actuating means in the approach to the door, a magnetic clutch device spring-actuated in one direction and electrically actuated against its spring in the contrary direction, a connecting medium between said clutch device and door, a check on said clutch device for regulating the extent of opening the door, and electric circuits including said primary actuating means and said magnetic spring-clutch device and motor, substantially as and for the purpose set forth.

2. In combination with a door, primary actuating means in the approach to the door at its opposite sides, an electric motor, a magnetic clutch device, a connecting medium between said clutch device and door, electric circuits including said primary actuating means and said magnetic clutch device and motor, and a switch connected with said

clutch device and controlled thereby to maintain open the circuit containing the primary actuating means at one side of the closed door for a short time after their contacts are brought into mutual engagement and thus render such means temporarily inoperative, substantially as and for the purpose set forth.

3. In combination with a door, electric mat-sections in the approach to the door, one in front of the door and two behind it, an electric motor, a magnetic clutch device, a connecting medium between said clutch device and door, electric circuits containing said mat-sections, and an electromagnetic switch device, electric circuits containing, respectively, said clutch device and motor, and both controlled by said electromagnet switch device from said mat-sections, a switch device in a mat-circuit, and a connection between said switch device and clutch device actuated by said clutch device to open said switch while opening the door, and thereby cut out of circuit a mat-section behind the door, substantially as and for the purpose set forth.

4. In combination with a door, electric mat-sections in the approach to the door, one in front of the door and two behind it, an electric motor, a magnetic clutch device spring-actuated in one direction and electrically actuated against its spring in the contrary direction, a connecting medium between said clutch device and door, a check on said clutch device for regulating the extent of opening the door, electric circuits containing said mat-sections and an electromagnetic switch device, electric circuits containing, respectively, said clutch device and motor and both controlled by said electromagnet switch device from said mat-sections, a switch device in a mat-circuit, controlled by said check to open by opening the door and thereby cut out of circuit a mat-section at the door, and a switch device in a mat-circuit and a switch device in the motor-circuit, both located in position to be engaged by the door and maintained open when the door is closed, substantially as and for the purpose set forth.

5. In combination with a door, a door-spring, primary actuating means in the approach to the door, an electromagnet G, a switch device controlled by the armature of said magnet, electric circuits containing said primary actuating means and magnet, a rotary magnetic clutch device comprising an electromagnet B supported on a rotary shaft r^2, and included in a branch circuit controlled by said switch device, an armature B′ controlled by a spring s in opposition to said door-spring, a spool C loosely supported on the shaft and a head C^4 between which and said armature the spool is clutched by the force of said spring, a cord p connecting said spool with the door, an electric motor A geared to said shaft and contained in another branch circuit controlled by said switch device, and a switch device in the motor-circuit located in position to be engaged by the door when closed, substantially as and for the purpose set forth.

6. In combination with a door, a door-spring, primary actuating means in the approach to the door, an electromagnet G, a switch device controlled by the armature of said magnet, electric circuits containing said primary actuating means and magnet, a rotary magnetic clutch device comprising an electromagnet B supported on a rotary shaft r^2 and included in a branch circuit controlled by said switch device, an armature B′ controlled by a spring s in opposition to said door-spring, a spool C loosely supported on the shaft and carrying the cam-disk C′, a head C^4 and the interposed friction-piece v, a cord p connecting said spool with the door, an electric motor A geared to said shaft and contained in another branch circuit controlled by said switch device, a switch device in the motor-circuit and located in position to be engaged by the door when closed, a branch of said circuit, including the primary actuating means, a switch device in said branch circuit, and a connecting-rod between said switch device and disk actuated by the rotation of the spool in the opening of the door to open said switch device, substantially as and for the purpose set forth.

7. In combination with a door, a door-spring, primary actuating means in the approach to the door, an electromagnet G, a switch device controlled by the armature of said magnet, electric circuits containing said primary actuating means and magnet, a rotary magnetic clutch device comprising an electromagnet B supported on a rotary shaft r^2 and included in a branch circuit controlled by said switch device, an armature B′ controlled by a spring s in opposition to said door-spring, a spool C loosely supported on the shaft and carrying the spirally-grooved cam-disk C′, a head C^4 and the interposed friction-piece v, a cord p connecting said spool with the door, an electric motor A geared to said shaft and contained in another branch circuit controlled by said switch device, a switch device in the motor-circuit and located in position to be engaged by the door when closed, a switch device in a mat-circuit, a connecting-rod between said switch device and disk operated by the rotation of the spool in the opening of the door to open said switch device, and a switch device in said mat-circuit located in position to be engaged by the door when closed, substantially as and for the purpose set forth.

8. In combination with a door, a door-spring, electric mat-sections in the approach to the door, one in front of the door and two behind it, an electromagnet G, a switch device controlled by the armature of said magnet, electric circuits containing said mats and magnet, a rotary magnetic clutch device comprising an electromagnet B on a rotary shaft r^2 and included in a branch circuit controlled by said switch device, and armature B′ con-

trolled by a spring *s* in opposition to said door-spring, a spool C loosely supported on the shaft and carrying the cam-disk C′, a head C^4 and the interposed washer *v*, a cord *p* connecting said spool with the door, an electric motor A geared to said shaft and contained in another branch circuit controlled by said switch device, a switch device M in the motor-circuit located in position to be engaged by the door, a switch device in a mat-circuit, comprising an electromagnet H, a spring *m* controlled by the armature H′ of said magnet and connected with a contact *m′* and a spring-controlled switch-finger m^8 having an extension m^6, a pivotally-supported rod I for engagement at one end with said switch-finger and provided at its opposite end with a head at which it engages the said cam-disk, and a switch device N in said mat-circuit located in position to be engaged by the door, substantially as and for the purpose set forth.

9. In combination with a door, electric mechanism for operating it, containing a switch device M comprising a stationary contact, a pivotal contact, a cam in position to be engaged by said pivotal contact, a pivotal head on which said pivotal contact is supported and having a spring connection therewith, an operating-lever engaging said head, and a support for the switch mechanism, substantially as described.

10. In combination with a door, electric mechanism for operating it, containing a switch device M comprising a stationary bifurcated contact *h′*, a pivotal contact h^7, a cam h^3, in position to be engaged by said contact h^7, a pivotal head h^5 having a slot h^6 and on which said contact h^7 is pivotally supported, a spring h^8 connecting said head and contact therein, a spring-controlled operating-lever h^{12} having a stud h^{13} entering said slot, and a case *h* supporting the switch mechanism, substantially as described.

11. In combination with a door, electric mechanism for operating it, a spring-controlled arm adjacent to the door in position to engage it and a cord connecting said mechanism with said arm at the free end of the latter, substantially as and for the purpose set forth.

12. In combination with a door, electric mechanism for operating it, including a rotary spool, a spring-controlled arm, p^4, on the door, a buffer device L between said arm and door, and a cord *p* fastened at one end to said spool and at its opposite end to said arm and passing between its ends over an interposed guide-pulley p^3, substantially as described.

13. In combination with a door, a door-opening spring S, electric mat-sections O, O′ and O^2 at the door-threshold, an electromagnet G, a switch device controlled by the armature of said magnet, electric circuits containing said mats and magnet, a rotary magnetic clutch device comprising an electromagnet B on a rotary shaft r^2 and included in a branch circuit controlled by said switch device, an armature B′ controlled by a spring *s* in opposition to the door-opening spring, a spool C loosely supported on the shaft and carrying the cam-disk C′, a head C^4 and the interposed friction-piece *v*, a cord *p* connecting said spool with the door, an electric motor A geared to said shaft and contained in another branch circuit controlled by said switch device, a switch device M in the motor-circuit located in position to be engaged by the door, a branch circuit of said mat-circuits containing a switch device a connecting-rod between said switch device and disk and actuated by the rotation of the spool in the opening of the door to open said switch device, a switch device N in said branch circuit and located in position to be engaged by the door, a spring-controlled arm p^4 on the door, a cord *p* connecting said spool with said arm and a buffer device L in position to engage said arm and to engage said switch devices M and N in the closing of the door, substantially as and for the purpose set forth.

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