

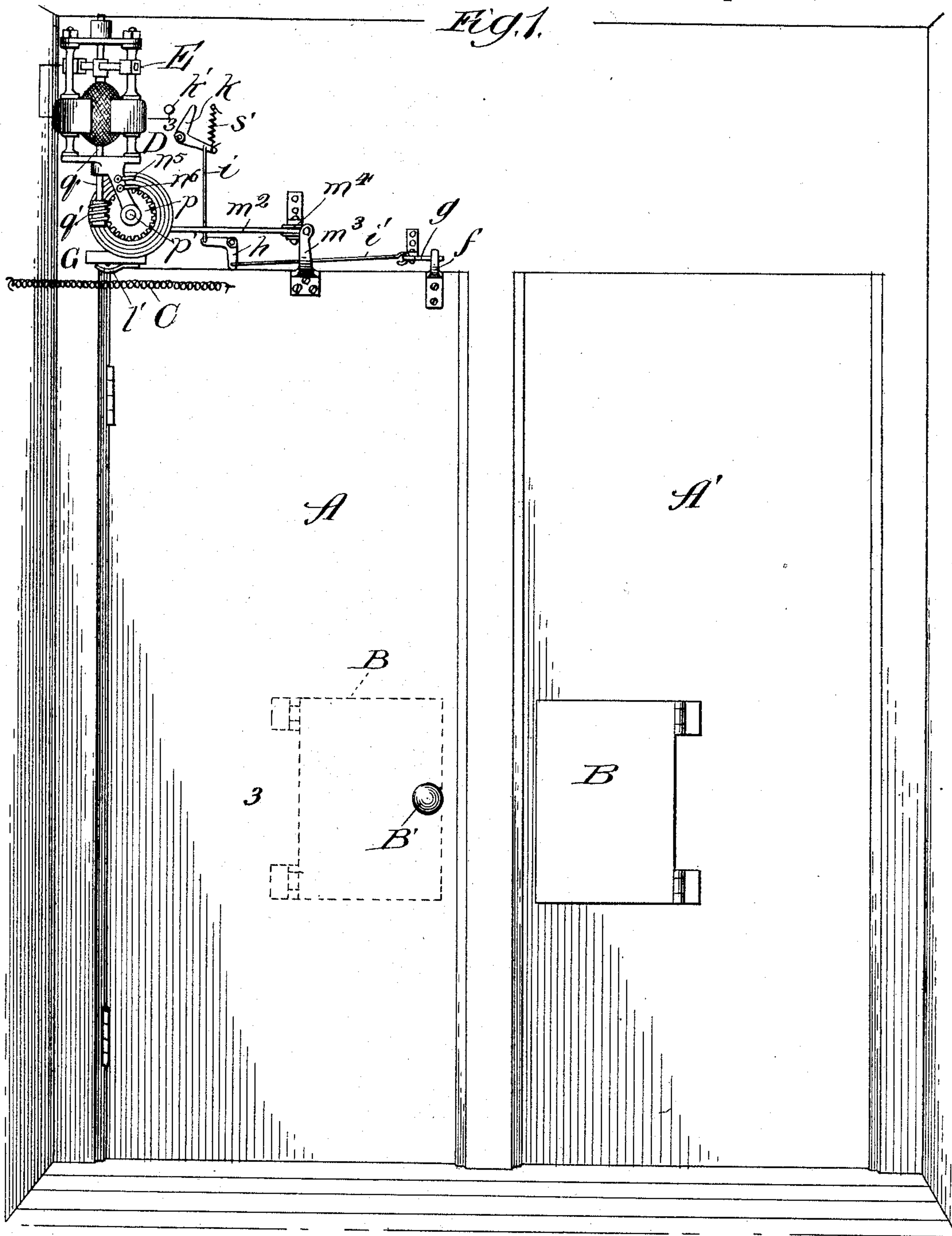
(No Model.)

3 Sheets—Sheet 1.

O. H. HICKS & R. F. TROY.
ELECTRIC DOOR OPERATING APPARATUS.

No. 505,270.

Patented Sept. 19, 1893.



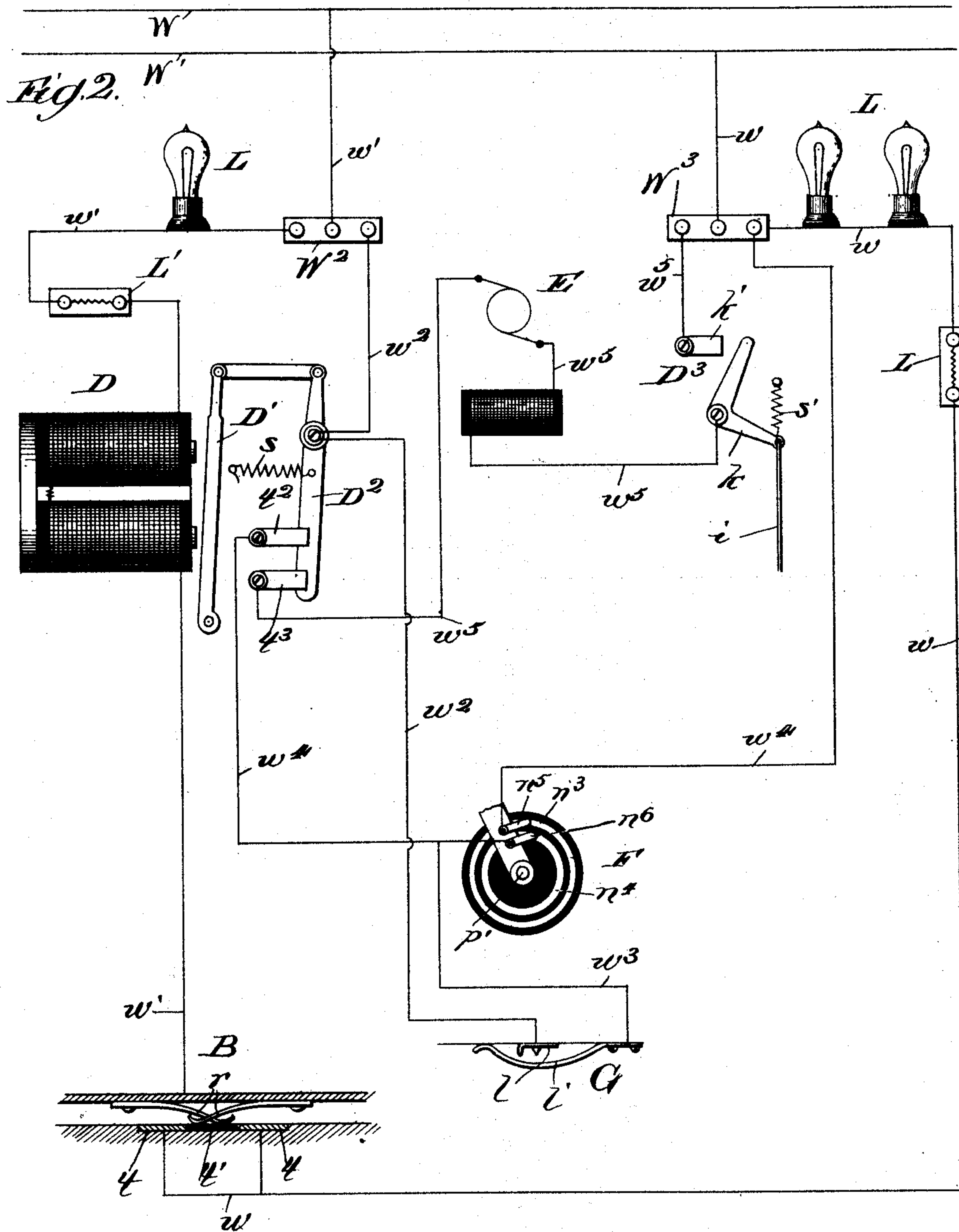
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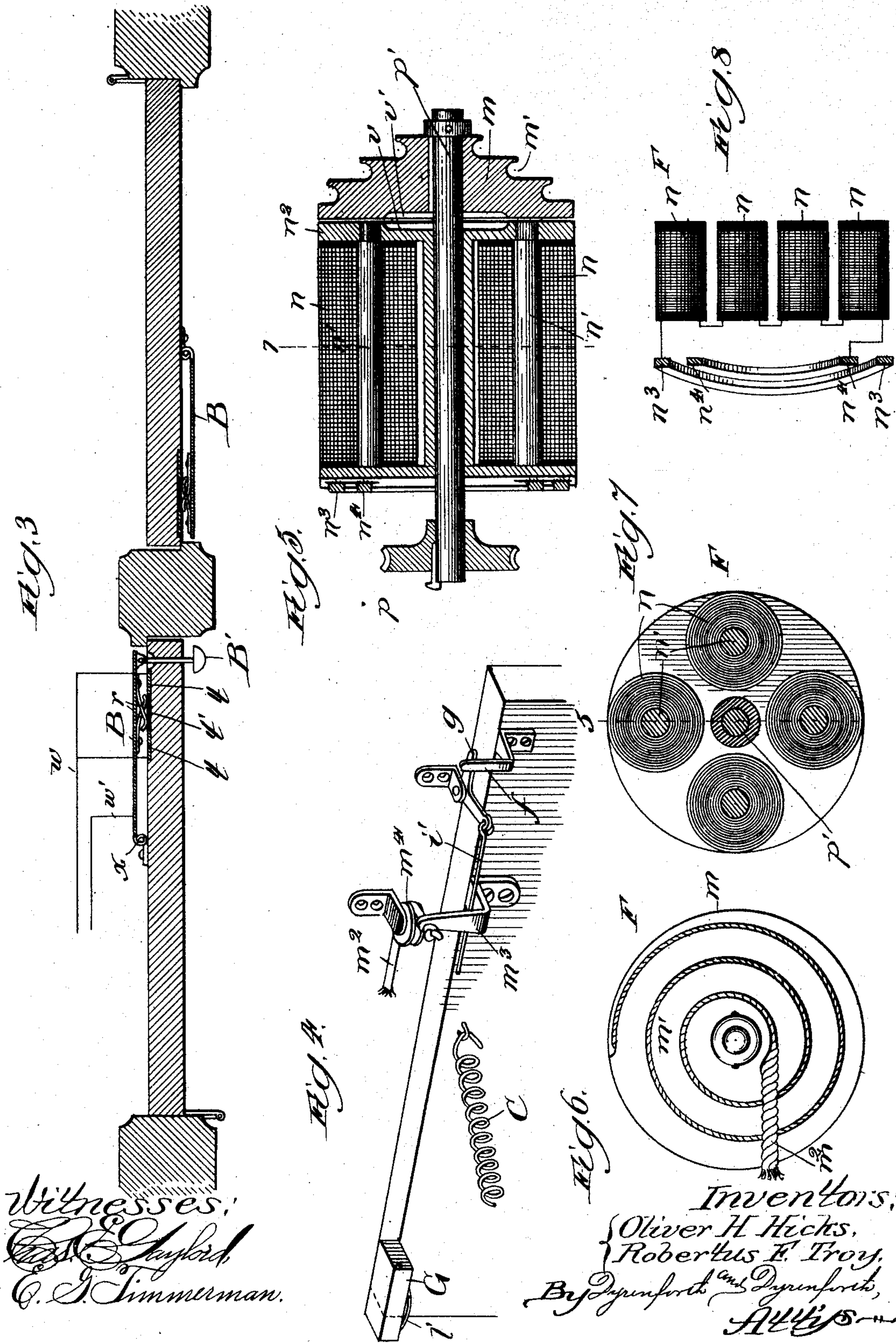
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3 Sheets—Sheet 3.

No. 505,270.

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UNITED STATES PATENT OFFICE.

OLIVER H. HICKS AND ROBERTUS F. TROY, OF CHICAGO, ILLINOIS; SAID
TROY ASSIGNOR TO SAID HICKS.

ELECTRIC DOOR-OPERATING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 505,270, dated September 19, 1893.

Application filed May 15, 1893. Serial No. 474,342. (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 a new and useful Improvement in Electric Door-Operating Apparatus, of which the following is a specification.

Our invention relates to an improvement in the class of door-operating devices represented in Letters Patent of the United States No. 461,122, granted to Robertus F. Troy, one of the joint applicants herein, on the 13th day of October, 1891. Generally stated, the aforesaid patent describes a device comprising an electric motor operatively connected with a door, a switch for cutting the motor into and out of circuit and a platform in front of the door adapted to be operated to work the switch to set the motor in motion to operate the door; the primarily essential function of the device being to cause the approach of a person toward the door to produce opening thereof.

We find that it is practically quite feasible to provide for operating a door with electric apparatus, perhaps equally as well, as by the platform, by employing either of two other different genres of primary actuating means, namely, a projection extending into the path of the approach to the door whereby contact with it by the person in approaching the door is rendered, by the position of the projection, practically unavoidable, such contact effecting the required condition of the motor to cause it to operate the door, the same forming the subject of our joint application, Serial No. 474,343, filed May 15, 1893; the other genus being a plate on or adjacent to the door, in position where it will be naturally touched by a person at the door, and his contact with which effects the required condition of the motor-mechanism to cause it to operate the door. We also find that our purpose may be satisfactorily accomplished without the employment of an electric motor, strictly considered as such, though we deem it necessary, for practical efficacy of the apparatus, that the primary actuating means, (platform, projection, or plate, referred to) at least, shall operate, by pressure or strain upon it, so as to

affect an electric circuit, (either by opening or closing it, and preferably the latter,) as will produce such operative connection of the motor-means employed, with the door, as will cause the latter to be operated.

Our present application relates, broadly, to the contact-plate, referred to, as the primary means for producing opening of a door in approaching it; and to illustrate our improvement in this connection we have selected electric mechanism somewhat analogous, in its general arrangement, to that shown and described for the same purpose in the aforesaid patent.

In the accompanying drawings—Figure 1 shows a pair of swinging doors in their frame with our improvement applied to one of the doors, the other door being shown with only a contact-plate upon it. Fig. 2 is a diagrammatic view of the circuits containing our improved electrical door-operating mechanism. Fig. 3 is a section taken at the line 3 on Fig. 1, viewed in the direction of the arrow, and enlarged. Fig. 4 is a perspective view showing the upper end of a door and certain details of the operating mechanism. Fig. 5 is a longitudinal sectional view of an electro-magnetic clutch employed as a detail in our improved apparatus, the section being taken at the line 5 on Fig. 7 and viewed in the direction of the arrow. Fig. 6 is an end view of the same, and Fig. 7, a section taken at the line 7 on Fig. 5 and viewed in the direction of the arrow. Fig. 8 is a diagrammatic view, in side elevation, of the electro-magnet portion of the clutch.

Following is a detailed description of our improvement as illustrated in the drawings:

A and A' are double doors, with our operating mechanism shown, however, as applied only to the first-named, since its application to the other may involve duplication of the mechanism; and the second door is shown merely to illustrate the contact-plate side thereof, not shown on the other, but, instead, an addition to the contact-plate serving a purpose hereinafter described. The doors are represented as of the variety supported at one edge on hinges to swing in a horizontal plane, though our improvement applies equally to other varieties of door.

B is a contact plate (of metal) or a contact-carrying plate (when it may be of insulating material provided with a metal contact), the preferred position for which is directly on the door, and covering, about the point at which a handle is provided, a space so great that any person would naturally, or would be likely to, touch it in approaching the door to open it.

In Fig. 3 we show details of construction which we prefer to employ for yieldingly supporting the plate B and adapting it, by but very slight pressure upon or strain against it, to make an electrical contact for causing the motor-mechanism to work. The plate is represented as hinged at one edge, (at x ,) whence it extends toward the inner edge of the door and carries a pair of crossed springs r normally bearing against an insulating section t' between contacts t , whereby slight pressure against the plate, as by the hand placed against it in an attempt to push open the door, will spread the springs r against the contacts t and effect closure of a circuit on the wires w, w' , with the result hereinafter described. We also show a knob or handle B' extending from the plate B through the door to the side thereof toward which it is shown to be arranged for opening, in order that a person approaching the closed door from that side may, on taking hold of the handle, effect the desired contact of the plate.

As shown of the door A, it is adapted, in accordance with our preferred arrangement, to be closed against a spring C, (Figs. 1 and 4) represented as a spiral spring fastened at one end to the door and at its opposite end to some stationary object, whereby when the door is released from the means which hold it in its closed condition, the resilient force of the spring will open it; and the operation is hereinafter so described, though the mechanism may readily be adapted, and it is within the spirit of our improvement so to adapt it, to open the door against a closing spring, or to both open and close the door positively without the employment of any spring for either purpose.

The motor-mechanism, which is set into operation by the closure of the circuit at the plate B, is best located above the door, as represented, where it may be suitably incased.

D (Fig. 2) is an electro-magnet having its pivotal armature D' linked at its free end with one end of a pivotal circuit-closing finger D^2 tending normally, by the effect of a spring s , in opposition to which the armature is attracted, to engage the contacts t^2, t^3 .

E is an electric motor of any suitable construction; and from the rotary armature of the motor depends an extension of its shaft q terminating in a worm q' meshing with a worm-wheel p on the end of a suitably journaled rotary shaft p' , carrying an electro-magnetic clutch F (Figs. 6, 7 and 8). The clutch F comprises a series of electro-magnets n secured on the shaft p' to rotate with it, and

the cores n' of which extend at their pole-ends through a non-magnetic (as brass) head n^2 , which may be recessed, as shown at v in Fig. 6, about its center; an armature m in the form of a pulley, which may be recessed, as at v' , about its center, is loosely supported on the shaft p' to rotate with it only when attracted by the magnets. The pulley has a spiral series of circumferential grooves m' in the innermost of which is fastened one end of a cord m^2 , or the like, the other end being fastened to a clip m^3 (Fig. 1) extending from the upper end of the door A near which it passes about a stationary guide-pulley m^4 . At the rear end of the magnets n are two conducting rings n^3 and n^4 to which, respectively, are applied the brushes n^5 and n^6 . This forms a friction-clutch, not wholly positive in its operation, the friction being that of the spool or pulley upon the face of the non-magnetic plate and the magnet-poles which extend through the plate and are flush with its surface.

Other details are hereinafter set forth in the explanation of the electric circuits illustrated diagrammatically in Fig. 2 and of which the following is a description: W and W' may be the line-wires of an incandescent-lamp circuit, lamps L in a branch of which then serve as resistances against excessive current entering the door-plate circuit, though by way of further precaution we insert into the circuit the fusible cut-outs L' . As will be understood, we do not limit our improvement to use with any particular kind of electric generator; but have selected for illustration the incandescent-lamp circuit because it is liable to be found in buildings employing our device and may then be conveniently utilized for our purpose. From the line W leads the conductor w' through a binding-post device W^2 , the adjacent resistances L and fuses L' and electro-magnet D, to the plate B; and from the line W' leads the conductor w through a binding-post device W^3 and the adjacent resistances L and fuses L' to the door-contacts t . A branch-circuit is formed with the wire w^2 leading from the device W^2 to the finger D^2 and thence to a contact t on an automatic circuit-closer G, hereinafter described. Another branch-circuit is formed with the wire w^4 leading from the contact t^2 of the circuit-closer D^2 through the electro-magnet of the clutch F to the binding-post W^3 ; and with this circuit is joined the wire w^3 leading from the spring-contact t' of the circuit-closer G. Still another branch-circuit is that formed with the wire w^5 leading from the contact t^3 of the circuit-closer D^2 through the motor E to a circuit-closer D^3 , whence the wire w^5 leads to the binding-post W^3 . We form the circuit-closer D^3 with a bell-crank shaped finger k and contact-plate k' , the finger being controlled by a spring s' to tend normally to make contact with plate k' , and having fastened to one of its arms a cord i connecting it with a bell-crank h pivoted above the door

and connected by a cord i' with another bell-crank g pivotally supported above the door, on which is an upward projecting finger f in position to engage the bell-crank g in the closure of the door. With the door A closed, as represented, the parts occupy the relative positions illustrated; and the holding of the door closed, either by latching, or by the means for the purpose hereinafter described, causes the bearing of the finger f against the bell-crank g , meantime to maintain the bell-crank k in the position in which it is illustrated in Fig. 2, wherein it is out of contact with the plate k' . The contacts r , in the closed condition of the door, being on the insulation t' , and the parts l and l' of the device G out of contact, it will thus be clear that, in that condition of the door all the circuits, but one, are open, and the motor-mechanism is at rest, with the cord m^2 wound upon the clutch armature-pulley m to hold the door to against the spring C, the cord being held by the clutch, which is, during the closed condition of the door, in the closed circuit formed with the wires w' , w^2 , finger D^2 , contact t^2 and wires w^4 and w , whereby the magnet-portion of the clutch is energized to hold the pulley m . The door is opened by exerting sufficient pressure against the plate B (which may be produced either directly or by a slight manipulation of the knob B') to bring the contacts r against the plates t . Thereby, primarily, closure of the circuit is produced over the wire w and the wire w' through the magnet D, and consequent attraction of the armature D' , with the result that the finger D^2 is separated from the contacts t^2, t^3 , thus breaking the circuit containing the clutch F and releasing the armature-pulley m , whereby it may yield to the recoil of the spring C, which opens the door and thereby turns the pulley m to cause the cable m^2 to pay off it. As the door opens, separation ensues of the finger f from the bell-crank g , whereby the spring s' is free to recoil and bring the finger k against the contact k' and thus prepare the motor-circuit for closure when the finger D^2 shall again engage the contact t^3 . So long as the contact producing pressure is maintained against the plate (and the tendency would naturally be for the operator to maintain it during passage through the door-way), the motor and clutch containing circuits will remain broken at D^2 . When the pressure ceases, as by the person passing from the door, the spring-contacts r immediately open the circuit w, w' , thus causing de-energizing of the magnet D and permitting the spring s to recoil and produce engagement of the finger D^2 with the contacts t^2, t^3 . This effects closure of the motor-circuit and of the clutch-circuit, whereupon magnetization of the clutch F ensues to attract and hold its pulley-armature m , and also rotation of the motor E, which produces, through the worm-gear, rotation of the clutch-shaft p' and consequent winding

on the pulley m of the cord m^2 with resultant closure of the door. As the door closes, the finger f bears against the bell-crank g and disconnects the finger k from the contact k' , cutting out the motor and stopping it and the rotation of the clutch, which, however, still remains in the closed circuit $w', w^2, D^2, t^2, w^4, w$ and therefore continues to maintain its hold on the door against the spring C. Of course it may occur that a person, after pressing the plate B in approaching the door, will maintain the circuit-closing pressure thereon only momentarily, when the effect would follow of closure of the motor-circuit and starting of the door to close, but the person's attempt to prevent the closure would again, obviously, produce the opening operation of the mechanism; and no harm or material inconvenience would ensue by the repeated closure followed by opening of the motor-circuit in a passage through the door-way. However even this might be avoided by the provision of any suitable contrivance for maintaining circuit-closure between the wires w and w' during the opening-motion of the door.

A matter of very considerable importance for the practicability of our improvement, is that the operating mechanism shall be sensitively responsive to the primary contact or circuit-closing means to a degree that will cause the automatic re-opening of the door from any point in closing that it may have reached, so that a person, say, following another through a door-way during the swinging of the door toward its position of closure, shall not be required to await the full closing of the door to be enabled to pass. This function, as will be seen, is performed to a nicety by the described mechanism; since whatever point in closing the door may reach, contact as r, t will immediately effect stoppage of the motor and release of the pulley m , and thus permit the opening-spring C to act.

A further detail, which we prefer to provide, limits, according to predetermined desire, the distance to which the door may be opened by causing, when the door has reached that limit, automatic closure of the clutch-circuit to check the door. This function is performed by the circuit-closing device G, comprising the stationary contact l secured above the door and connected with the wire w^2 , and a stationary spring-contact l' also secured above the door but extending into the path of the upper end thereof and connected by a wire w^3 with the wire w^4 , whereby, wherever the device may be set, as to proximity with the door-fulcrum, (hinges,) when the upper end of the door passes under the spring l' it will compress the latter against the contact l and, obviously, by closing the clutch-circuit actuate the clutch to check the cord m^2 from further paying out. The device G or any equivalent electric door-check may be used to advantage with any form of the primary cir-

cuit-closer other than the plate B, and with other arrangements than the present of door-operating motor-mechanism.

The nature of our improvement requires that the description of the particular mechanism we have selected for illustrating it shall be accurate in the foregoing detail. But we wish to be clearly understood as not limiting our invention to details except where manifestly intended to be so limited by the terms of the appended claims.

From the disclosure of our improvement various other means for accomplishing our purpose with the plate-contact are likely readily to suggest themselves to others; and we desire that all such shall be considered subordinate to our invention.

A minor change, which occurs to us, would involve an arrangement of our invention to cause a door to be closed by a spring and opened by motor-mechanism operated by the primary electrical contact-production; and another might be to both open and close the door by employing for each purpose positively actuated motor-mechanism. The latter is set forth in a separate application for Letters Patent filed concurrently herewith. Moreover those skilled in the art might adapt our improvement to operate by opening a normally closed circuit by pressure on the plate; and though the appended claims mention the circuit as normally open, it is not intended thereby to so limit them.

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

1. In combination with a door, motor-mechanism, and a contact-plate on the door having an electrical connection with the motor mechanism and operating, by pressure against the plate, to set in motion the motor-mechanism to operate the door, substantially as described.

2. In combination with a door, a contact-plate thereon controlling a normally open electric circuit closed by pressure against the plate, and motor-mechanism connected with the door for operating it and actuated to operate the door by closing the circuit by the contact-plate, substantially as described.

3. In combination with a door, a contact-plate thereon controlling a normally open electric circuit closed by pressure against the plate, motor-mechanism having an electric clutch connected with the door to tend normally to close it and contained in a normally closed electric circuit opened to release the door from the clutch by said pressure against the plate, and a spring set by the closing of the door to open it when released from the clutch, substantially as described.

4. In combination with a door and electric mechanism connected therewith for operating it, an electric door-check operating automatically to control the said mechanism to check the motion of the door in its operation, substantially as described.

5. In combination with a door and electric

mechanism connected therewith for operating it, an electric door-check operating automatically to control the said mechanism to check the motion of the door in its operation, and adjustable with relation to said door to produce its checking effect at a desired predetermined point in the operation of the door, substantially as described.

6. In combination with a door, a normally open primary circuit-closer in position to be closed by a person approaching the door, motor-mechanism provided with an electric clutch connected with the door, and set to effect closure thereof by the motor in the open condition of the primary circuit closer, a spring set by the closing of the door to open it when released, and a normally open circuit-closer in the clutch-circuit and closed by the opening of the door to a predetermined point to actuate the clutch to check its further opening, substantially as described.

7. In combination with a door, a contact-plate thereon controlling a normally open electric circuit closed by pressure against the plate, an electro-magnet D in said circuit, a motor E in an electric circuit normally held open by the door when closed and geared to an electric clutch F in a normally closed electric circuit opened by closure of the contact-plate circuit, the clutch being connected with the door to close it by operation of the motor, a contact-finger D² normally connecting the motor and clutch circuits and controlled to open the same by the armature of the magnet D, and a spring C for opening the door, the whole being constructed and arranged to operate substantially as described.

8. In combination with a door, a contact-plate thereon controlling a normally open electric circuit closed by pressure against the plate, an electro-magnet D in said circuit, a motor E in an electric circuit containing a circuit-closer D³ having a contact-finger *k* controlled by a spring *s'* and connected with a lever *g* above the door, a projection *f* on the door bearing against the lever *g* and maintaining open the motor-circuit when the door is closed, an electric clutch F geared to the motor and in a normally closed electric circuit, a flexible connection *m*² between the clutch and door, a contact-finger D² normally connecting the motor and clutch circuits, and a spring C for opening the door, the whole being constructed and arranged to operate substantially as described.

9. In combination with a door having electric motor-mechanism connected with it for operating the door, an electric clutch in said motor-mechanism for connecting and disconnecting the door therewith, said clutch having the engaging surfaces of its co-operating members frictional in their operation and adapted to slip one upon the other to tend to produce yielding engagement of the door with its operating mechanism, substantially as described.

10. In combination with a door having electric motor-mechanism connected with it for operating the door, an electric clutch in said motor-mechanism, for connecting and disconnecting the door therewith, one of the co-operating members of said clutch forming a rotary armature and being provided with a tapering-pulley extension connected with the door by a flexible connecting medium, substantially as described.

11. An electric clutch comprising, in combination with a rotary shaft, a series of elec-

tro-magnets having at one end a non-magnetic head through which the cores of the magnets extend, and an armature loosely supported on the shaft and carrying a pulley provided with a spiral groove about its perimeter, substantially as and for the purpose set forth.

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In presence of—

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W. N. WILLIAMS.