

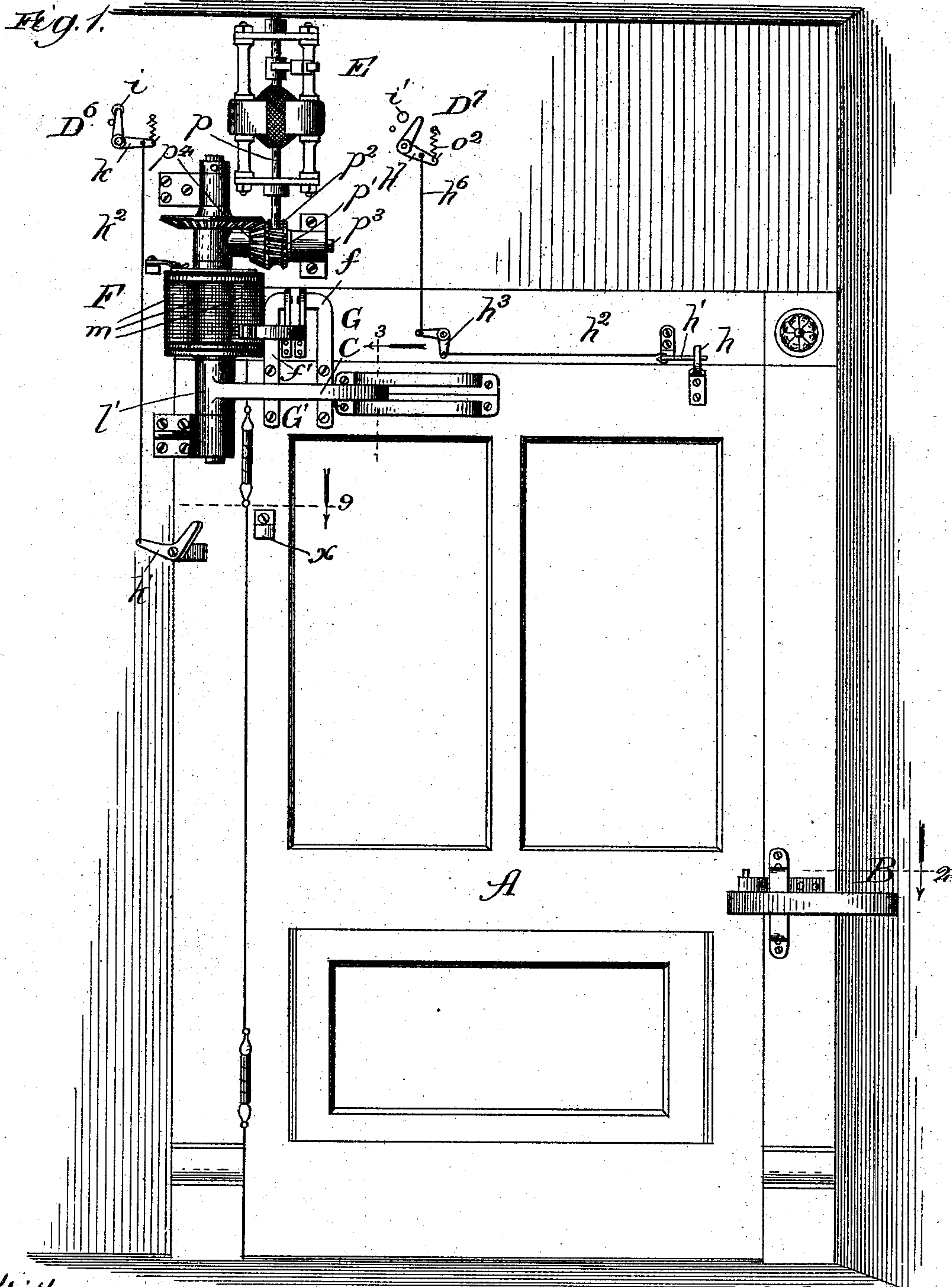
(No Model.)

5 Sheets—Sheet 1.

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

No. 505,271.

Patented Sept. 19, 1893.



Witnesses:  
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Inventors:  
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(No Model.)

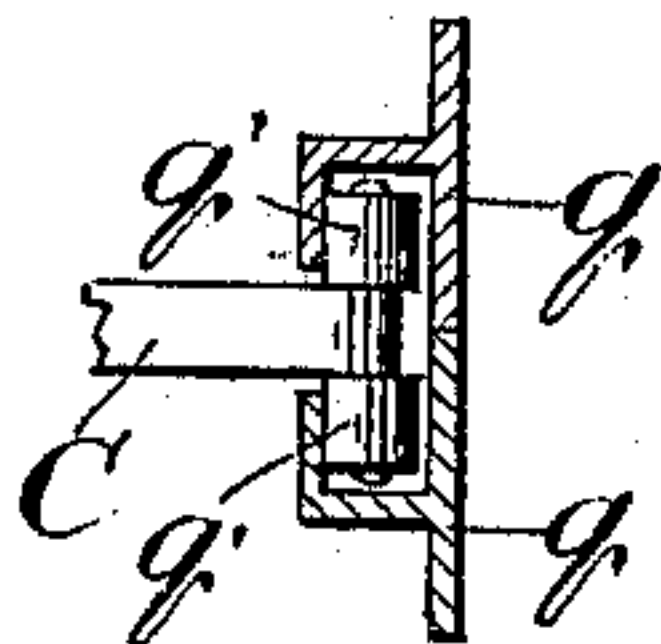
5 Sheets—Sheet 2.

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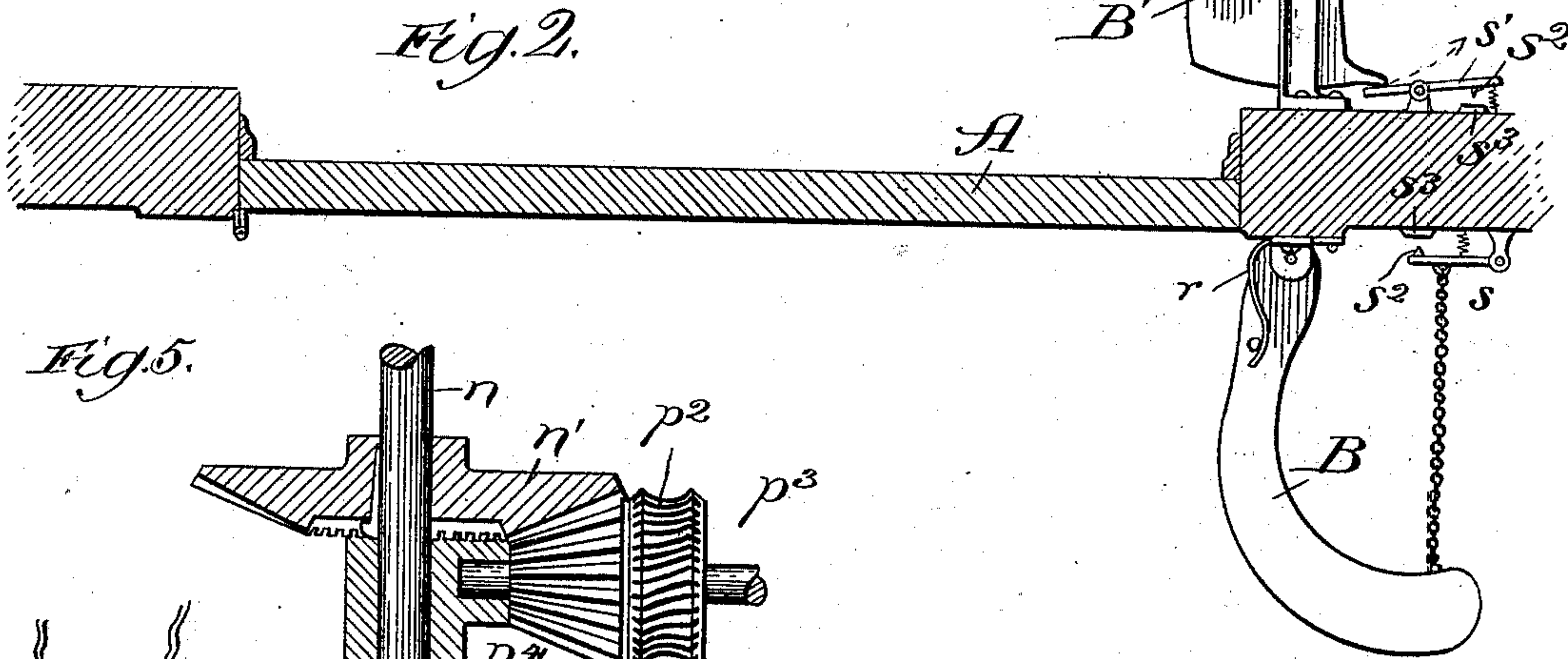
*Fig. 3.*



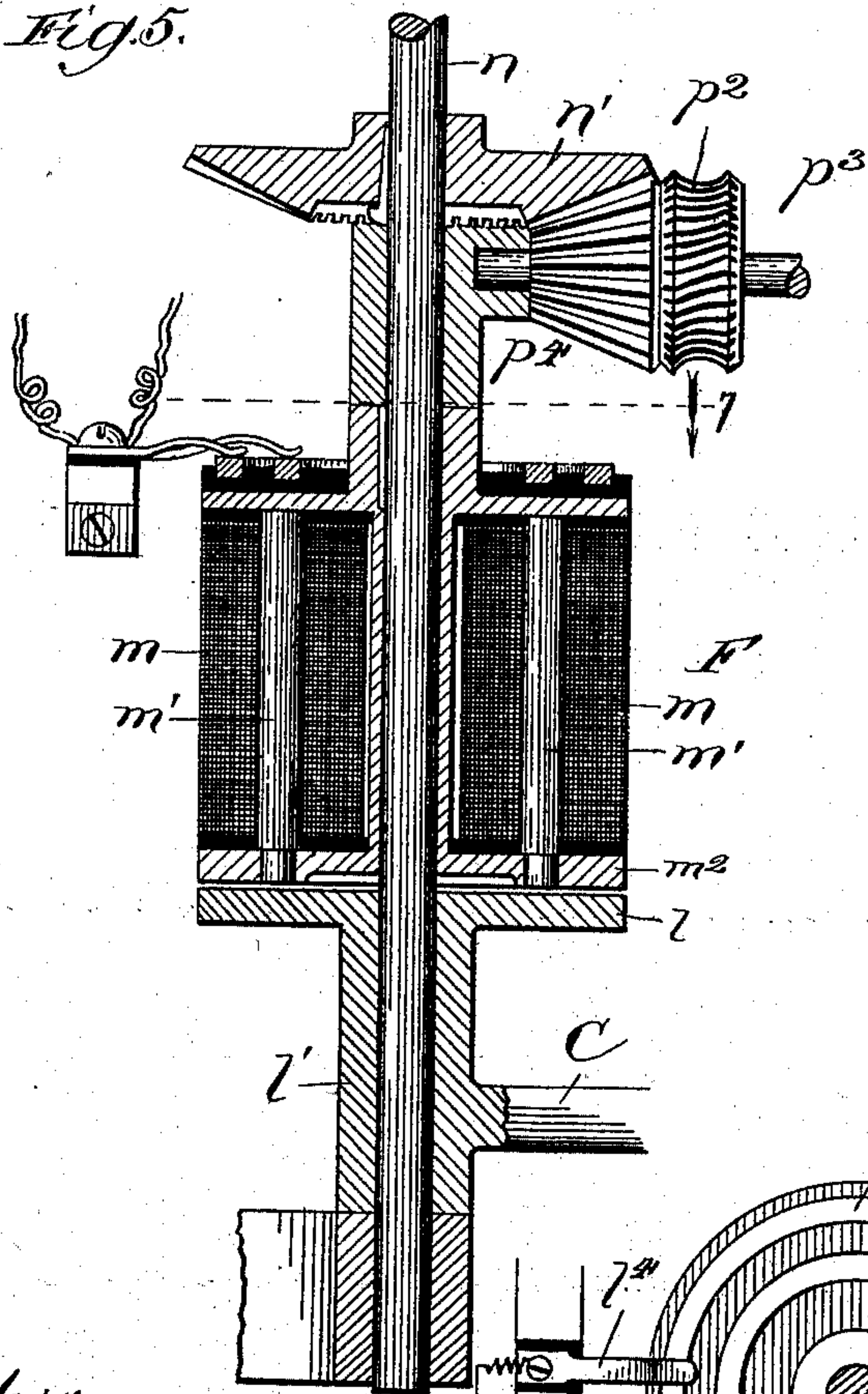
*Fig. 4.*



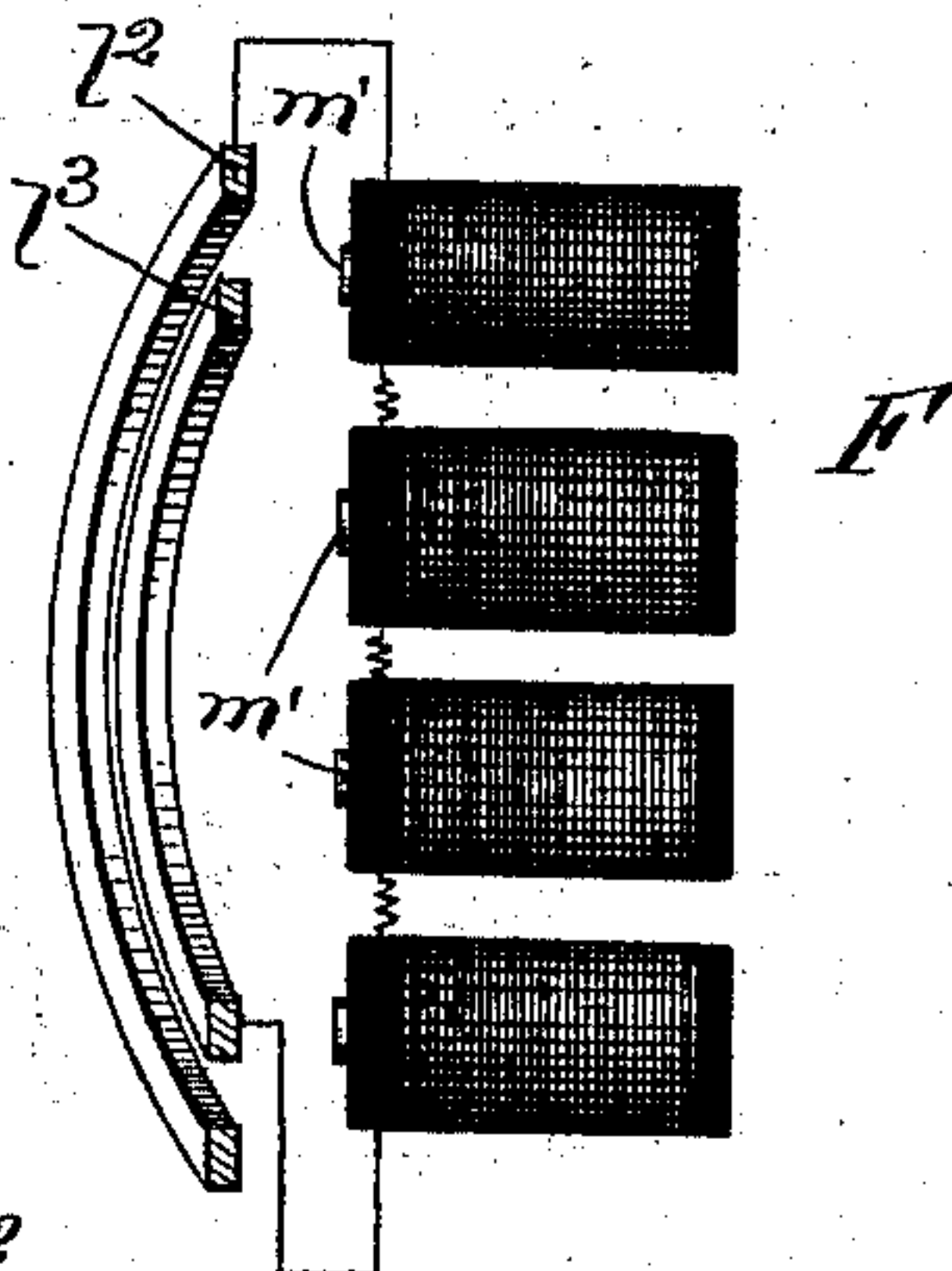
*Fig. 2.*



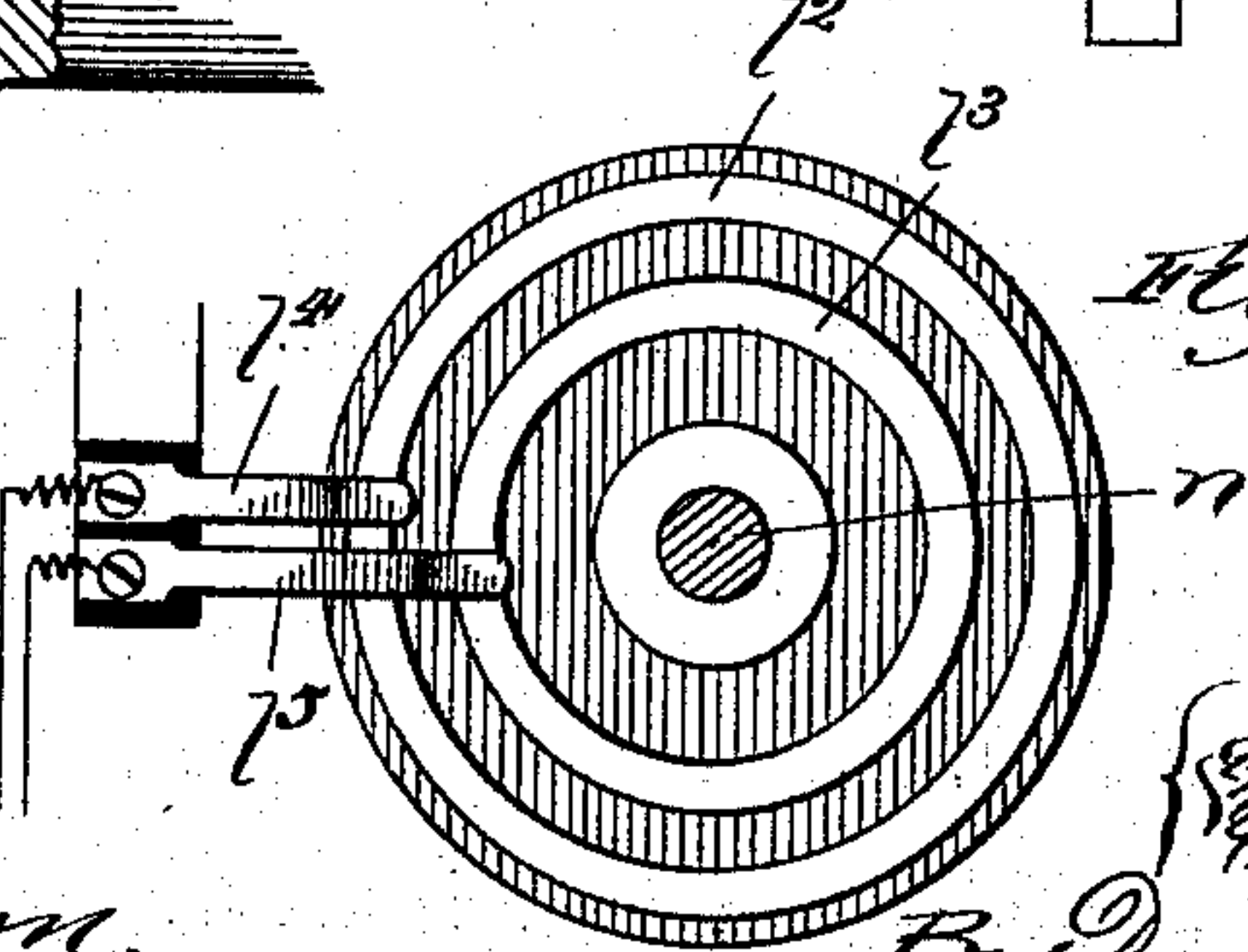
*Fig. 5.*



*Fig. 6.*



*Fig. 7.*



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(No Model.)

5 Sheets—Sheet 3.

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Fig. 9.

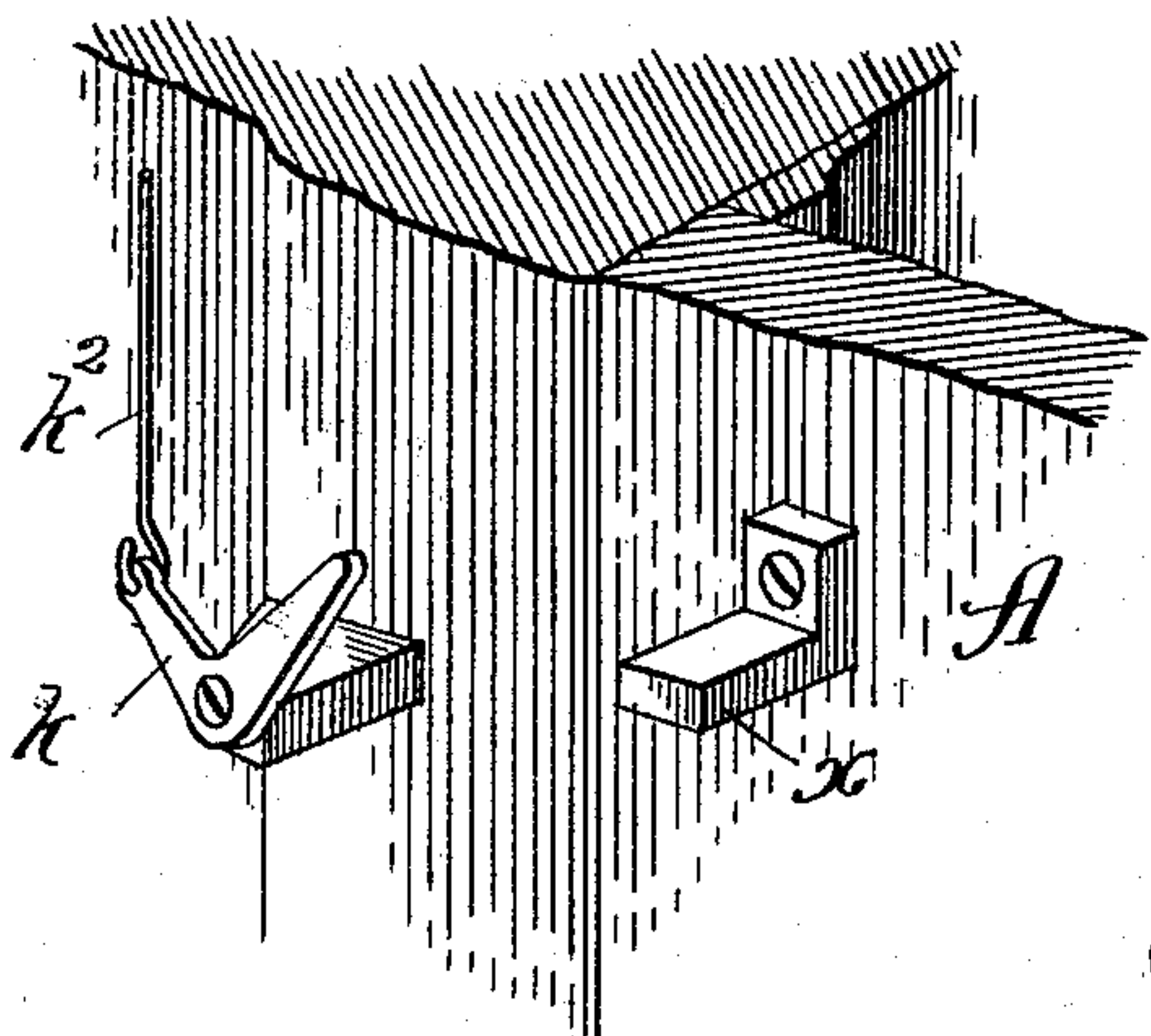


Fig. 8.

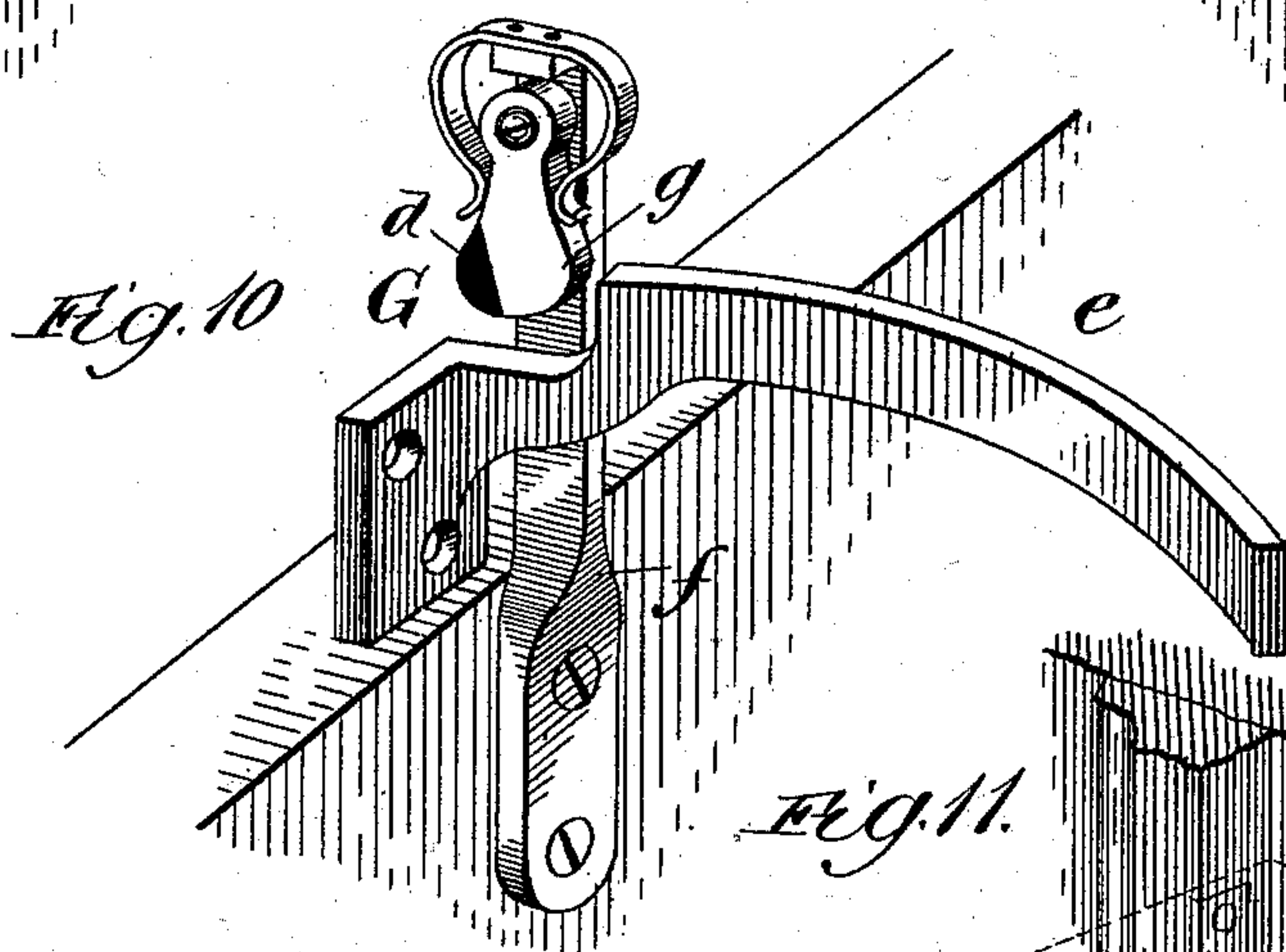
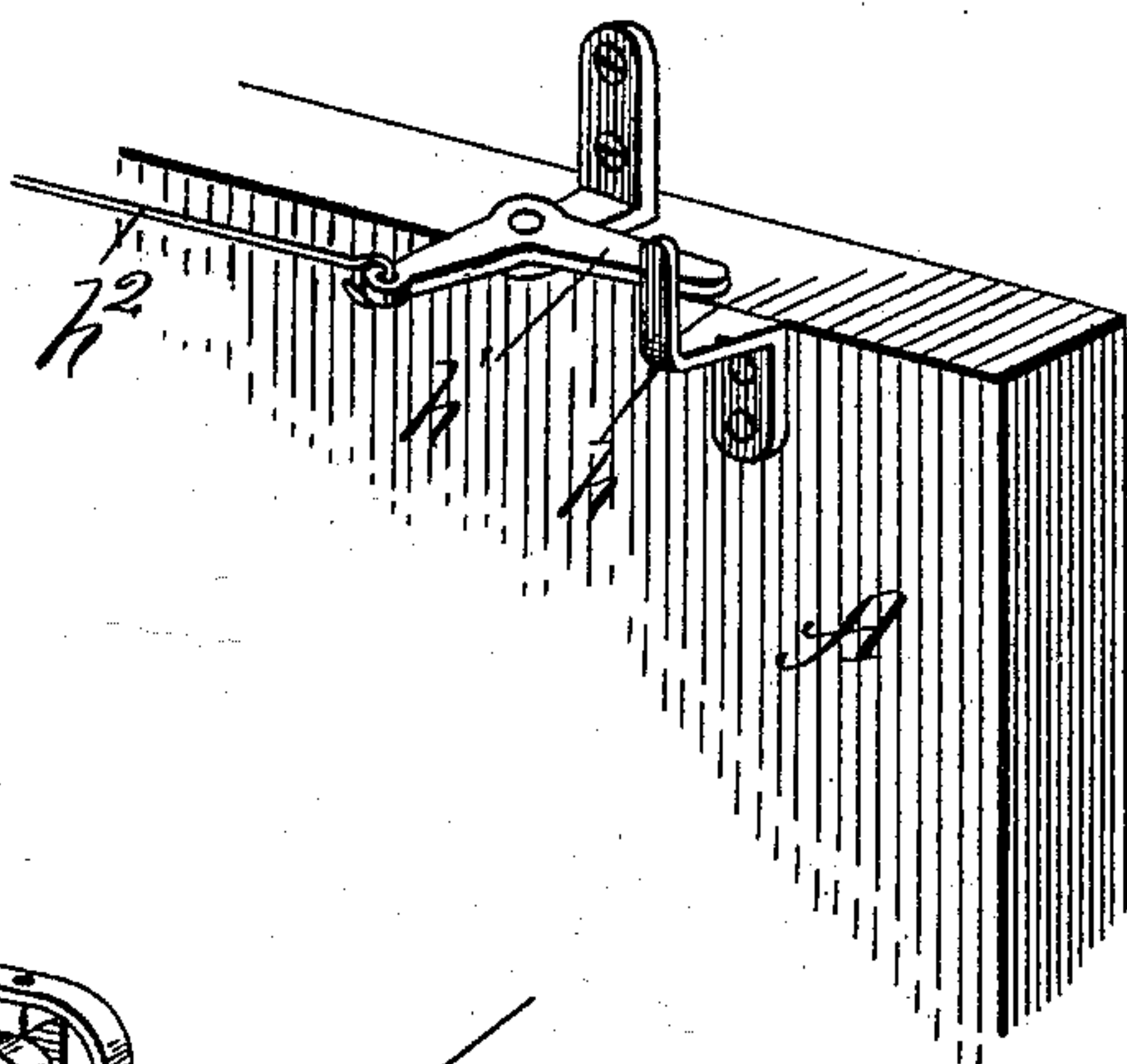
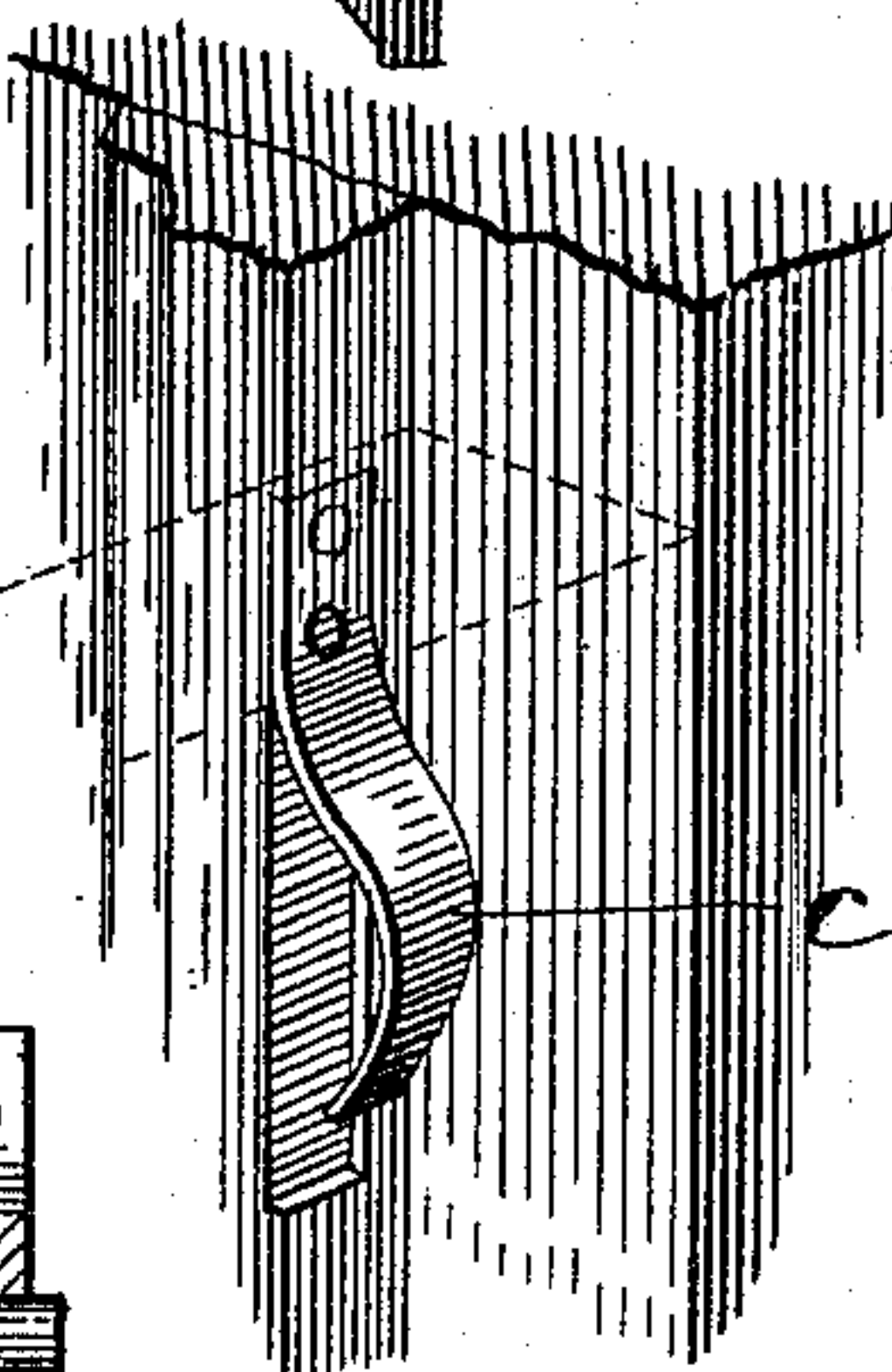
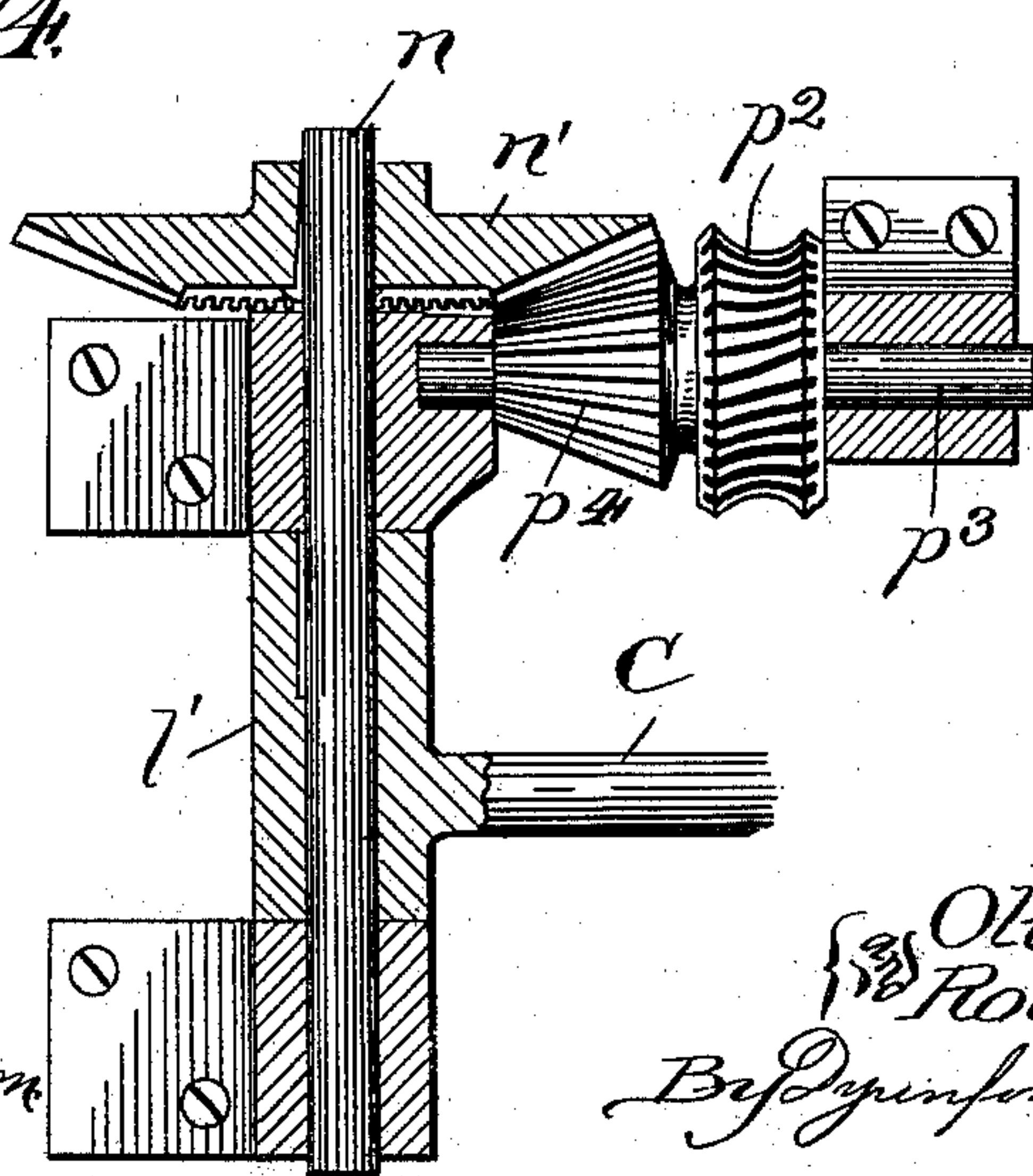


Fig. 10.

Fig. 11.



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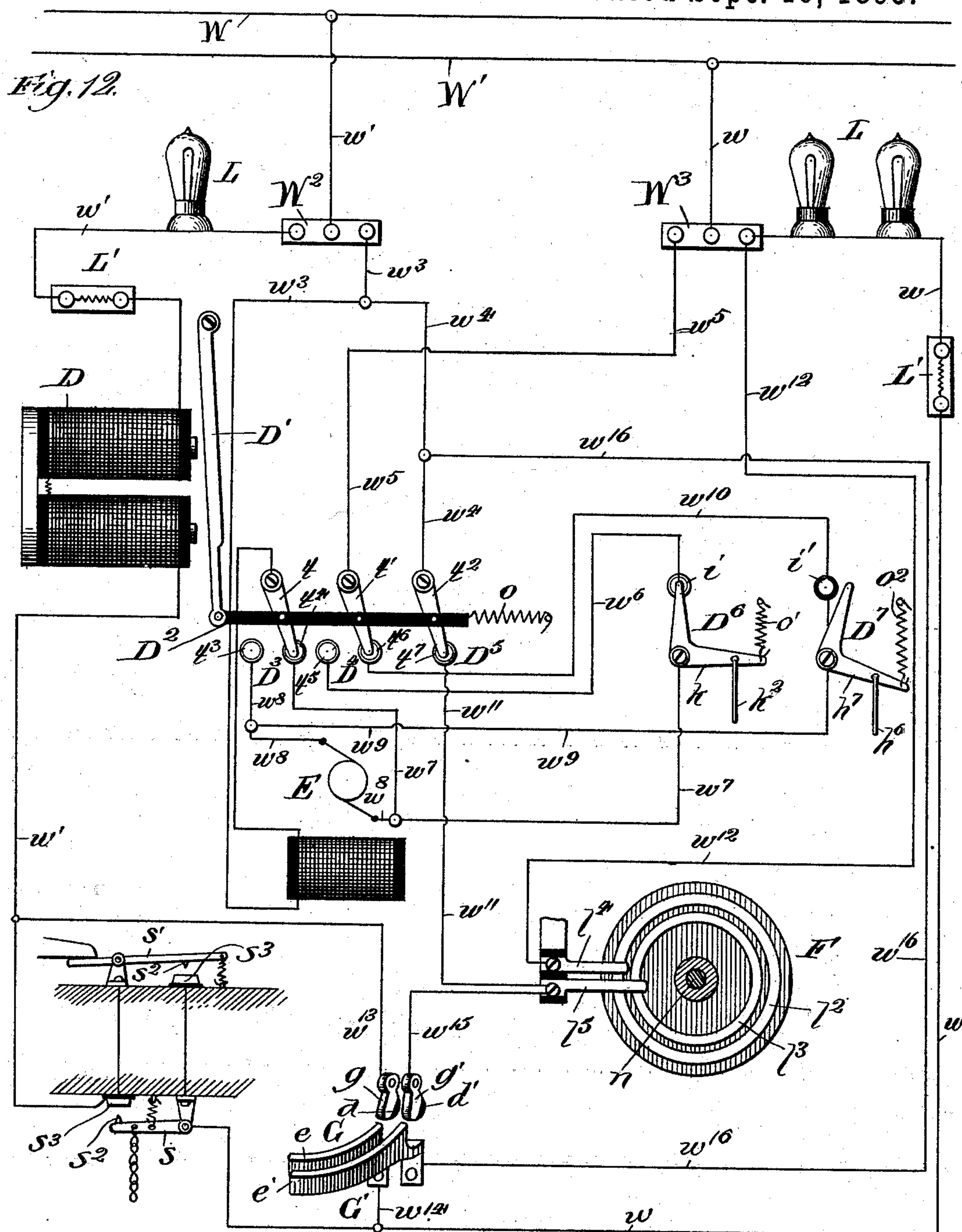
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5 Sheets—Sheet 4.

No. 505,271.

Patented Sept. 19, 1893.



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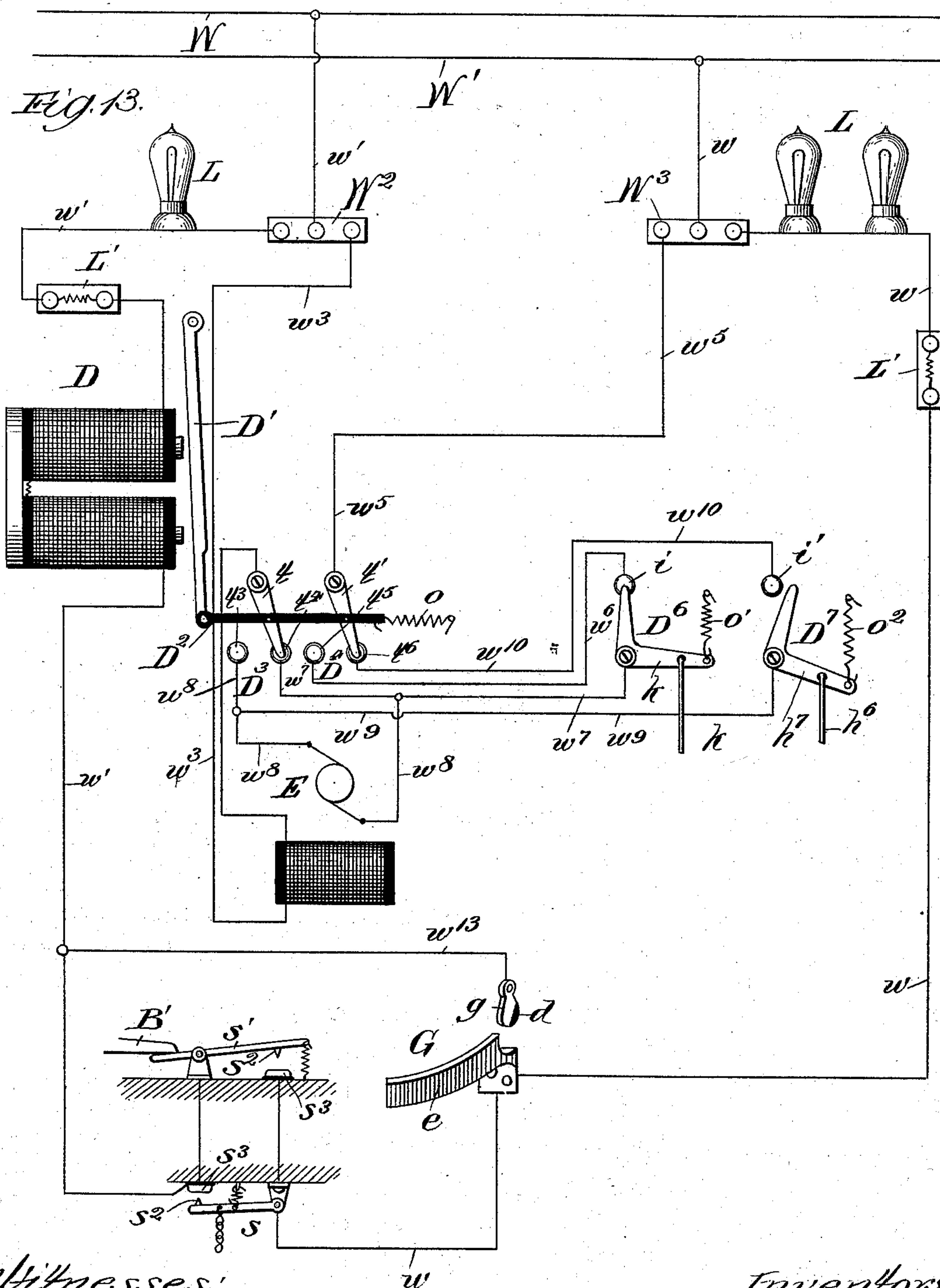
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5 Sheets—Sheet 5.

No. 505,271.

Patented Sept. 19, 1893.



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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. 505,271, dated September 19, 1893.

Application filed May 15, 1893. Serial No. 474,343. (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 in 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 above the plane of the base thereof, 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 other genus being a plate on or adjacent to the door, in position where it will naturally be 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. The plate-form of contact is set forth in our joint application for Letters Patent, Serial No. 474,342, filed concurrently herewith. 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, elevated 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 with the motor-means employed, with the door, as will cause the latter to be operated.

Our present application relates, broadly, to the contact-projection extending into the path of the approach to a door, as the primary means for producing opening of the 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, with its mode of operation, modified however, to operate the door in each direction (thus to open as well as to close it) by the rotation in alternate directions of an electric motor.

In the accompanying drawings—Figure 1 is a view in elevation showing our improvement applied to a swinging door, represented as closed. Fig. 2 is a section taken at the line 2 on Fig. 1, viewed in the direction of the arrow and enlarged. Fig. 3 is a section, showing a detail, taken at the line 3 on Fig. 1, viewed in the direction of the arrow and enlarged. Fig. 4 is a perspective view of one-half of the guide-detail on the door with which the swinging arm, actuated by the motor, engages to operate the door. Fig. 5 is a broken sectional view of an electric clutch carrying the arm and showing its gear-connection with the motor. Fig. 6 is a diagrammatic view of the clutch. Fig. 7 is a view in sectional end-elevation of the clutch, the section being taken at the line 7 on Fig. 5, and viewed in the direction of the arrow. Figs. 8 and 9 are views in perspective, showing different electrical contact making and breaking details on the door. Fig. 10 is a perspective view of a detail for maintaining closed the primary, or electro-magnet, circuit while the door is being operated in one direction (opening) and for maintaining it open while the door is being operated in the opposite direction (closing). Fig. 11 is a broken perspective view of a spring-detail for starting the opening of the door when the operating mechanism involves the use of the electric



clutch. Fig. 12 is a diagrammatic view of the apparatus including the clutch and showing the different electric circuits. Fig. 13 is a view like that presented by Fig. 12, but showing the apparatus simplified by the omission of the electric clutch and its connections. Fig. 14 is a sectional view like that presented in Fig. 5, with the electric clutch omitted.

Following is a detailed description of our improvement as illustrated in Figs. 1 to 12, inclusive, of the drawings:

A is a door, represented as of the variety hinged at one edge to swing in a horizontal plane, though our improvement applies equally to other varieties of door.

At opposite sides of the door, extending above the plane of the floor or threshold from the door frame, adjacent to the free edge of the door, into the path of the approach are projections B and B' of any suitable variety, but preferably in the form of pivotal arms controlled by springs *r* to tend normally to assume the positions, in which they are represented in Fig. 2, of projecting into the path to the edge of the door at which it is opened, whereby either will be turned (depending on the side of the door toward which the approach is made) by contact with it of the person approaching the door to make the primary electrical contact for effecting operation of the motor mechanism hereinafter described. The primary-contact means are shown at *s* and *s'* in Fig. 2 in the form of levers controlled by springs, to tend to make contact at their points *s*<sup>2</sup> with terminals *s*<sup>3</sup> of a circuit *w*, *w'*, hereinafter described, from which terminals, however, the points are normally separated by the effect of the springs *r* of the arms B and B'.

According to our present arrangement, which is preferred for the particular apparatus, both the opening and closing operations of the door are effected by the positive movement of a horizontally swinging arm C engaging, at its free end, where it is provided with anti-friction rollers *q'* (see Fig. 3), a horizontal guide formed in two parts *q* and secured on the door near its upper end. The other end of the arm is connected with the motor-mechanism, which is set in motion by closure of the circuit at a contact *s* or *s'*, and the best location for which is above the plane of the door, as represented, where it may be suitably incased.

D (Fig. 12) is an electro-magnet having the pivotal armature D' connected, at its free end, with one end of a non-conducting bar D<sup>2</sup>, which is pulled, with the attraction of the armature by its magnet, against the resistance of a spring *o*. The bar D<sup>2</sup> connects the pivotal contact-fingers *t*, *t'* and *t*<sup>2</sup> of three circuit closers, D<sup>3</sup>, D<sup>4</sup> and D<sup>5</sup>, the two first-named of which form a reversing switch and are each provided with two alternate contact-points, *t*<sup>3</sup>, *t*<sup>4</sup>, and *t*<sup>5</sup>, *t*<sup>6</sup>, respectively, while the third finger has only a single contact-point *t*<sup>7</sup>.

E is an electric motor, of any suitable construction,

having the end of its armature-shaft *p* provided with a worm *p'*, engaging a worm-wheel *p*<sup>2</sup> on a rotary shaft *p*<sup>3</sup> carrying, to rotate with the worm-wheel, a bevel-pinion *p*<sup>4</sup>, meshing with a horizontal bevel-gear *n'* on a vertical rotary shaft *n* (see Fig. 5) carrying an electro-magnetic clutch F. The clutch F comprises a series of electro-magnets *m* secured on the shaft *n* to rotate with it, and the cores *m'* of which extend at their pole-ends through a non-magnetic (as brass) head *m*<sup>2</sup>, and an armature *l* in the form of a disk loosely supported on the shaft *n*, which passes through it and through its sleeve-extension *l'*, from which extends the arm C already described. At one end of the clutch are contact-rings *l*<sup>2</sup> and *l*<sup>3</sup>, to which, respectively, are applied the brushes *l*<sup>4</sup> and *l*<sup>5</sup>, and which are electrically connected with the magnets *m* as indicated in the diagrammatic view presented by Fig. 6.

Other details are hereinafter set forth in the explanation of the electric circuits illustrated diagrammatically in Fig. 12, 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 primary contact circuit, though by way of further precaution we insert into that 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, the conductor *w'* leads through a binding-post device W<sup>2</sup>, and through the adjacent resistances L and fuses L' and electro-magnet D, to the terminals *s*<sup>3</sup>; and from the line W', the conductor *w* leads through a binding-post device W<sup>3</sup> and the adjacent resistances L and fuses L' to the door contact *s*. A wire *w*<sup>3</sup> from the binding-post W<sup>2</sup> leads through the field of the motor E to the contact-finger *t*, and has a branch *w*<sup>4</sup> leading to the contact *t*<sup>2</sup>; and a wire *w*<sup>5</sup> from the binding-post W<sup>3</sup> leads to the contact finger *t'*.

On the side of the door-frame toward which the door A opens is a bell-crank *k'* (Fig. 1) in the path of a projection *x* on the door, and having a wire or cord connection *k*<sup>2</sup> with a bell-crank *k* forming part of a circuit-closer D<sup>6</sup> and normally maintained by a spring *o'* in contact with a terminal *i*, connected by a wire *w*<sup>6</sup> (Fig. 12) with the contact *t*<sup>5</sup>, while the bell-crank *k* is connected with the contact *t*<sup>4</sup> by a wire *w*<sup>7</sup> having a branch *w*<sup>8</sup> leading through the motor E to the contact *t*<sup>3</sup>.

On the upper end of the door A is a finger *h*, which, when the door is closed, bears against a bell-crank *h'*, pivotally supported by a wire or cord *h*<sup>2</sup> with another bell-crank *h*<sup>3</sup> having a wire or cord connection *h*<sup>6</sup> with a third bell-crank *h*<sup>7</sup> forming part of a circuit-closer D<sup>7</sup> and normally tending by the force of a spring



o<sup>2</sup> to make contact with a terminal i'. A branch w<sup>9</sup> of the branch-wire w<sup>8</sup> leads to the bell-crank h<sup>7</sup>; and the contact i' is connected by a wire w<sup>10</sup> with the contact t<sup>6</sup>. From the contact t<sup>7</sup>, a wire w<sup>11</sup> leads to the clutch-brush t<sup>5</sup>; while from the brush t<sup>4</sup> a wire w<sup>12</sup> leads to the binding-post W<sup>3</sup>.

For maintaining the circuit w, w' of the magnet D closed during the opening operation of the door (for a purpose hereinafter described), we provide a peculiar construction of circuit-closer G (see, particularly, Fig. 10) comprising a spring-controlled contact-brush g pivotally suspended on a vertical post f on the door A and extending beyond the upper end of the latter to cause the brush to depend into the plane of a stationary horizontally curved track e extending from the top of the door frame. One side of the pivotal brush g is formed with a section d of insulating material, the brush being connected by a branch-wire w<sup>13</sup> with the wire w', while the track is connected by a branch-wire w<sup>14</sup> with the wire w. It will, thus, readily be seen, that when the circuit w, w' is not closed at the primary contact s or s', and the brush g is in contact at its conducting portion with the track e, the circuit w w' is closed, as by bridging, through the branch-wires w<sup>13</sup>, w<sup>14</sup>.

A circuit-closer G' is provided for use when a clutch F is employed, and is constructed in all respects like the circuit-closer G with which its parts correspond, being denoted by the same reference-letters with prime-marks. Its pivotal depending spring-controlled brush g' is connected by a wire w<sup>15</sup> with the clutch-brush t<sup>5</sup>, while its track e' is connected with a branch-wire w<sup>16</sup> of the wire w<sup>4</sup>. With the door A closed, as represented, the parts occupy the relative positions illustrated; and the holding of the door closed, as by latching, or by the means for the purpose hereinafter described, causes the bearing of the finger h against the bell-crank h' meantime to maintain, (through the intermediate connections) the bell-crank h<sup>7</sup> in the position in which it is illustrated in Figs. 1, 12 and 13, wherein it is out of contact with the terminal i'. Thus, as will be seen, with the door A closed, all the circuits of the apparatus are open except the clutch-circuit formed with the wire w<sup>4</sup>, circuit-closer D<sup>5</sup> and wires w<sup>11</sup> and w<sup>12</sup>. Opening of the door follows closure of the circuit containing the magnet D, at s or s' by the pressure, which would naturally be exerted by a person approaching the door to open it, against a projecting arm B or B'; and such closure of the circuit w, w' causes the magnet D to be energized to attract its armature D', with the result that the fingers t and t' are switched, respectively, to the contacts t<sup>3</sup> and t<sup>5</sup>, while the finger t<sup>2</sup> is moved off the contact t<sup>7</sup> and opens the clutch-circuit between the wires w<sup>4</sup> and w<sup>11</sup>. The clutch-magnet being thus de-energized, and its armature l freed, a spring c (Fig. 11) on the door-jamb, compressed by the door in its closed position, starts, by its

recoil, the door to open, and opens it sufficiently to bring the brush g of the circuit-closer G into contact with the track e, whereby the circuit w, w' is maintained closed even if the pressure of the person against the projection B or B' is immediately removed therefrom, as it is liable to be. Immediately the armature D' is attracted, the motor-circuit is closed through the wire w<sup>3</sup>, finger t, contact t<sup>3</sup> and wires w<sup>8</sup> and w<sup>7</sup>, to circuit-closer D<sup>6</sup>, wire w<sup>6</sup>, circuit-closer D<sup>4</sup>, (then formed with contact t<sup>5</sup> and finger t'), to wire w<sup>5</sup>, thereby causing the motor to rotate in one direction; and the action of the spring c in jumping the brush g' of circuit-closer G' onto the track e', closes the clutch-circuit through the clutch-brushes on the wires w<sup>16</sup>, w<sup>15</sup>, w<sup>12</sup>, thereby causing the clutch-armature to be attracted by the clutch-magnet and to rotate with the motor and be turned in the direction which causes the arm C to open the door. The track e' may, however, be sufficiently long to prevent the brush g' from clearing it, whereby the respective clutch-circuit remains closed the longer. It is also to be mentioned, that the moment the door starts to open, the bearing of the finger h against the bell-crank h' being released, the bell-crank h<sup>7</sup> of the circuit-closer D<sup>7</sup> is caused by the spring o<sup>2</sup> to engage the contact i'. When the door has opened to the desired extent (which may be predetermined by the relative setting of the projection x and bell-crank k') the engagement of the projection x with the bell-crank k' opens the circuit-closer D<sup>6</sup> momentarily, whereby the motor-circuit w<sup>3</sup>, t, t<sup>3</sup>, w<sup>8</sup>, w<sup>7</sup> is opened at i, causing stoppage of the motor; and this immediately after the brushes g and g' will have cleared their tracks e and e' to the extent of bringing against the outer ends of the latter the insulated portions d and d' of the pivotal depending brushes, whereby the magnet-circuit w w' is opened, releasing the armature D' and permitting the spring o to act against the bar D<sup>2</sup> to return the fingers t, t' and t<sup>2</sup> to the contacts on which they are illustrated. As the result, the clutch-circuit is closed over the wire w<sup>11</sup> and the motor-circuit is closed over wire w<sup>3</sup>, finger t, contact t<sup>4</sup>, wire w<sup>7</sup> to wire w<sup>8</sup> through the motor, branch-wire w<sup>9</sup> through circuit-closer D<sup>7</sup>, over wire w<sup>10</sup> and circuit-closer D<sup>4</sup>, then formed with contact t<sup>6</sup> and finger t', to wire w<sup>5</sup>, thereby producing rotation of the motor and clutch in the direction to turn the arm C to force the door closed. During the closing motion of the door, the insulated portions of the brushes g and g' will travel on the tracks e and e', thereby maintaining open the circuit of the magnet D and the branch w<sup>15</sup> of the clutch-circuit. When the door is shut, the finger h again breaks the motor-circuit at D<sup>7</sup>, leaving the other parts of the mechanism in the original condition shown and described, wherein the clutch, being in a closed circuit, holds the door closed.

We may entirely dispense with the clutch



F, when the device G' and the clutch-circuits would be omitted, leaving the mechanism in the condition represented in Fig. 13. Then, as shown in Fig. 14, the sleeve l' carrying the door-operating arm C, would be permanently fastened to the shaft n to turn with it.

The operation of the remaining parts of the mechanism would be as described, though owing to the permanent unyieldingness of the arm C independently of its carrying shaft n, the starting-spring c would be of no service, and would therefore be omitted, thereby throwing upon the motor the entire work of starting the opening of the door, as well as of continuing the opening operation, and also that of effecting the door-closure, which tends to delay, slightly though undesirably, the opening at the beginning, which should be prompt and immediately responsive to the closure of the primary circuit.

By following out the diagram represented in Fig. 13, it will be seen that by closure of the circuit w, w' by contact of the person with a projection B or B', the magnet D will be energized to attract its armature D' and draw the rod D<sup>2</sup>, against the spring o, to turn the fingers t and t' upon the contacts t<sup>3</sup> and t<sup>5</sup>, thereby closing one motor-circuit to effect rotation of the motor in the proper direction to open the door, which, immediately after beginning to open, produces closure of the bridging circuit at G to maintain closed, during the door-opening operation, the magnet circuit. It will also be seen that the door, on opening to the predetermined extent, produces breaking of the motor-circuit at D<sup>6</sup> and consequent momentary stoppage of the motor, and also that the magnet-circuit will then be opened at G, whereupon the fingers t and t' will resume the positions in which they are represented in Fig. 13, whereby, with the other motor-circuit closed at D<sup>7</sup>, the motor will be rotated in the direction to produce closing of the door.

The nature of our improvement requires that the description of the particular means we have selected for illustrating it shall be in the foregoing accurate 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 present improvement, moreover, various other means for accomplishing our purpose with the aforesaid projection-form of primary contact-producing means, are likely to suggest themselves to others; and we desire that all such shall be considered subordinate to our invention. Moreover those skilled in the art might adapt our improvement to operate by opening a normally closed circuit by pressure against a projection; and though the appended claims mention the circuit as being thus closed, it is not intended thereby so to 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 projection extending, in a plane above the threshold, into the path of the approach to the door, and having an electrical-contact connection with the motor-mechanism actuated by pressure against the projection to set in motion the motor-mechanism to operate the door, substantially as described.

2. In combination with a door, a projection extending, in a plane above the threshold, into the path of the approach to the door and controlling an electric circuit closed by pressure against the said projection, and motor-mechanism connected with the door for operating it and actuated to operate the door by closing the circuit by the said projection, substantially as described.

3. In combination with a door, a projection extending, in a plane above the threshold, into the path of the approach to the door and controlling an electric circuit closed by pressure against the said projection, a swinging arm connected with the door, and motor-mechanism connected with the swinging arm and in a normally open electric circuit closed, upon closing the circuit controlled by the said projection, to actuate the motor-mechanism to swing the said arm to operate the door, substantially as described.

4. In combination with a door, a projection extending, in a plane above the threshold, into the path of the approach to the door and controlling an electric circuit closed by pressure against the said projection, a swinging arm connected at one end with the door, and motor-mechanism with which the swinging arm is connected at its opposite end, said motor-mechanism being in two normally open electric circuits, the one being closed, upon closing the circuit controlled by the said projection, to actuate the motor-mechanism to swing the said arm to operate the door in one direction and the other being closed by such operation of the door to actuate the motor-mechanism to swing the said arm to operate the door in the opposite direction, substantially as described.

5. In combination with a door, a projection extending, in a plane above the threshold, into the path of the approach to the door and controlling an electric circuit closed by pressure against the said projection, and motor-mechanism having a clutch connected with the door for operating it and set, by closing the circuit by the said projection, to operate the door, substantially as described.

6. In combination with a door, a projection extending, in a plane above the threshold, into the path of the approach to the door and controlling an electric circuit closed by pressure against the said projection, an electric-motor in two normally open electric circuits and having an electric clutch in a normally closed electric circuit momentarily opened by the closure of the circuit controlled by said projection and provided with and operating a swinging arm connected with the door, and



a starting-spring, set by the door when closed and released on momentarily opening the said clutch-circuit to start the door to open, one of said motor-circuits being closed by closure of the circuit controlled by said projection to actuate the motor to turn the clutch and swinging arm to open the door and the other of said motor-circuits being closed by the opening of the door to actuate the motor to turn the clutch and swinging arm to close the door, and a circuit-closer actuated by the door, when opened to a desired extent, to open the first of said motor-circuits, substantially as described.

7. In combination with a door, a projection extending, in a plane above the threshold, into the path of the approach to the door and controlling an electric circuit closed by pressure against the said projection, an electric motor in two normally open electric circuits, a swinging arm on a rotary shaft geared to the motor, said arm being connected at its free end with the door to open and close it by swinging in opposite directions, a circuit-closer G comprising a stationary track *e* electrically connected with one branch of the circuit controlled by the said projection and a pivotal brush *g* having an insulated section *d* and connected with the other branch of said circuit and supported to engage the track and close said circuit in the opening of the door and to open it in the closing of the door, one of said motor-circuits being closed by closure of the circuit controlled by said projection to actuate the motor to turn the swinging arm to open the door and the other of said motor-circuits being closed by the opening of the

door to actuate the motor to turn the swinging arm to close the door, and a circuit-closer actuated by the door when opened to a desired extent to open the first of said motor-circuits, substantially as described.

8. In combination with a door A, projections B and B' at opposite sides of the door, each extending, in a plane above the threshold, into the path of an approach to the door, and controlling an electric circuit closed by pressure against either projection, said circuit containing an electro-magnet D having its pivotal armature D' connected with a spring-controlled reversible switch and with a circuit-closer D<sup>5</sup>, an electric motor E in two normally open electric circuits controlled by said reversible switch and containing, respectively, the circuit-closers D<sup>6</sup> and D<sup>7</sup>, means for opening the circuit-closer D<sup>6</sup> by the door in opening, means for holding the circuit-closer D<sup>7</sup> open when the door is closed, a starting-spring *c* set by the door when closed, a rotary electric clutch F geared to the motor and in circuit with the circuit closer D<sup>5</sup>, a swinging arm C secured at one end to the clutch-armature and connected at its opposite end with the door, a circuit-closer G' in a circuit containing the clutch, and a circuit-closer G for the circuit containing the magnet D, the whole being constructed and arranged to operate substantially as described.

OLIVER H. HICKS.  
ROBERTUS F. TROY.

In presence of—

M. J. FROST,  
W. N. WILLIAMS.