No. 749,416. PATENTED JAN. 12, 1904.

H. G. WRIGHT.

SAFETY APPLIANCE SYSTEM FOR ELECTRICALLY ACTUATED ELEVATORS.

APPLICATION FILED MAY 9, 1903.

NO MODEL. 4 SHEETS—SHEET 1.

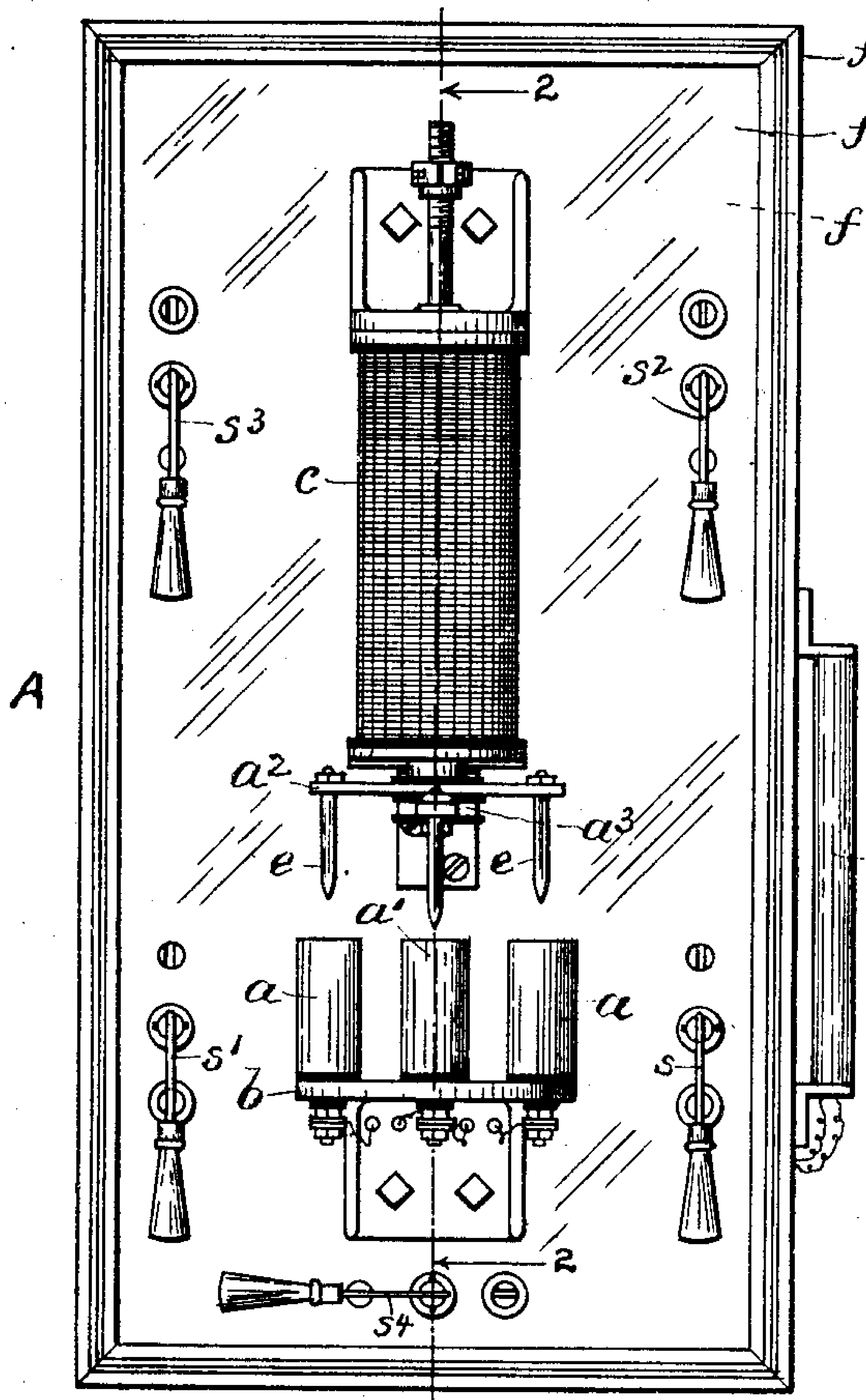

Fig. 1.

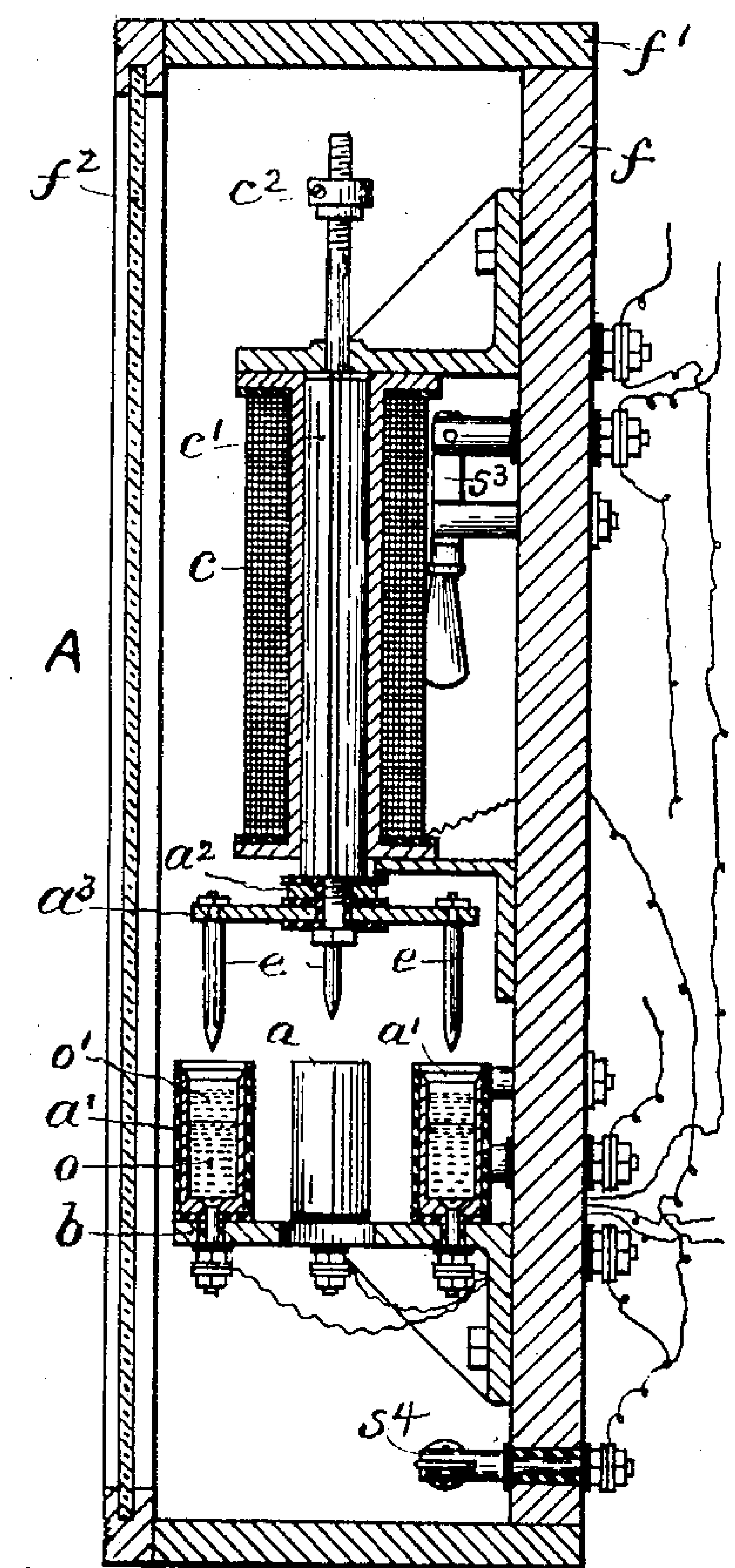

Fig. 2.

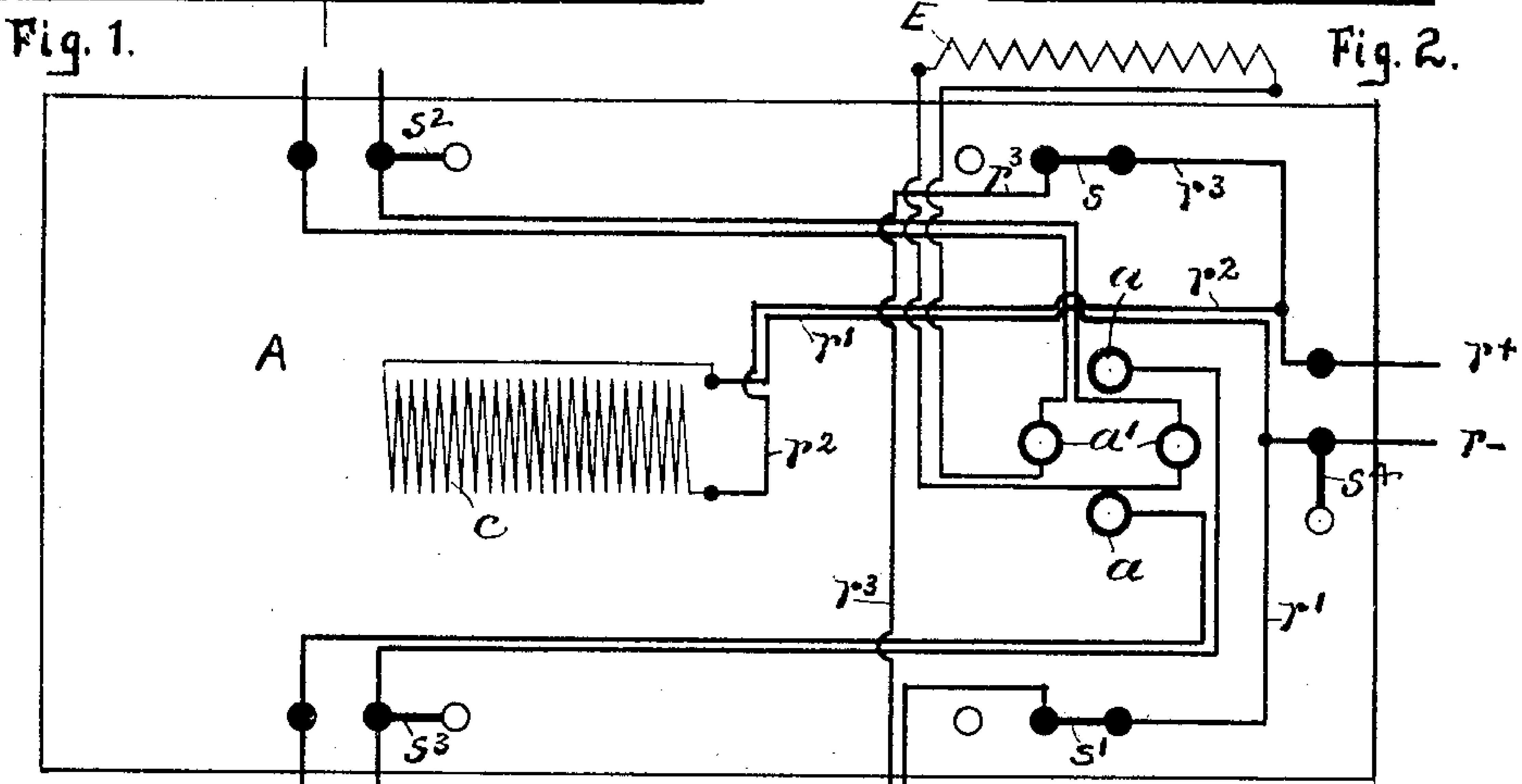

Fig. 3.

Witnesses

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NO MODEL. 4 SHEETS—SHEET 2.

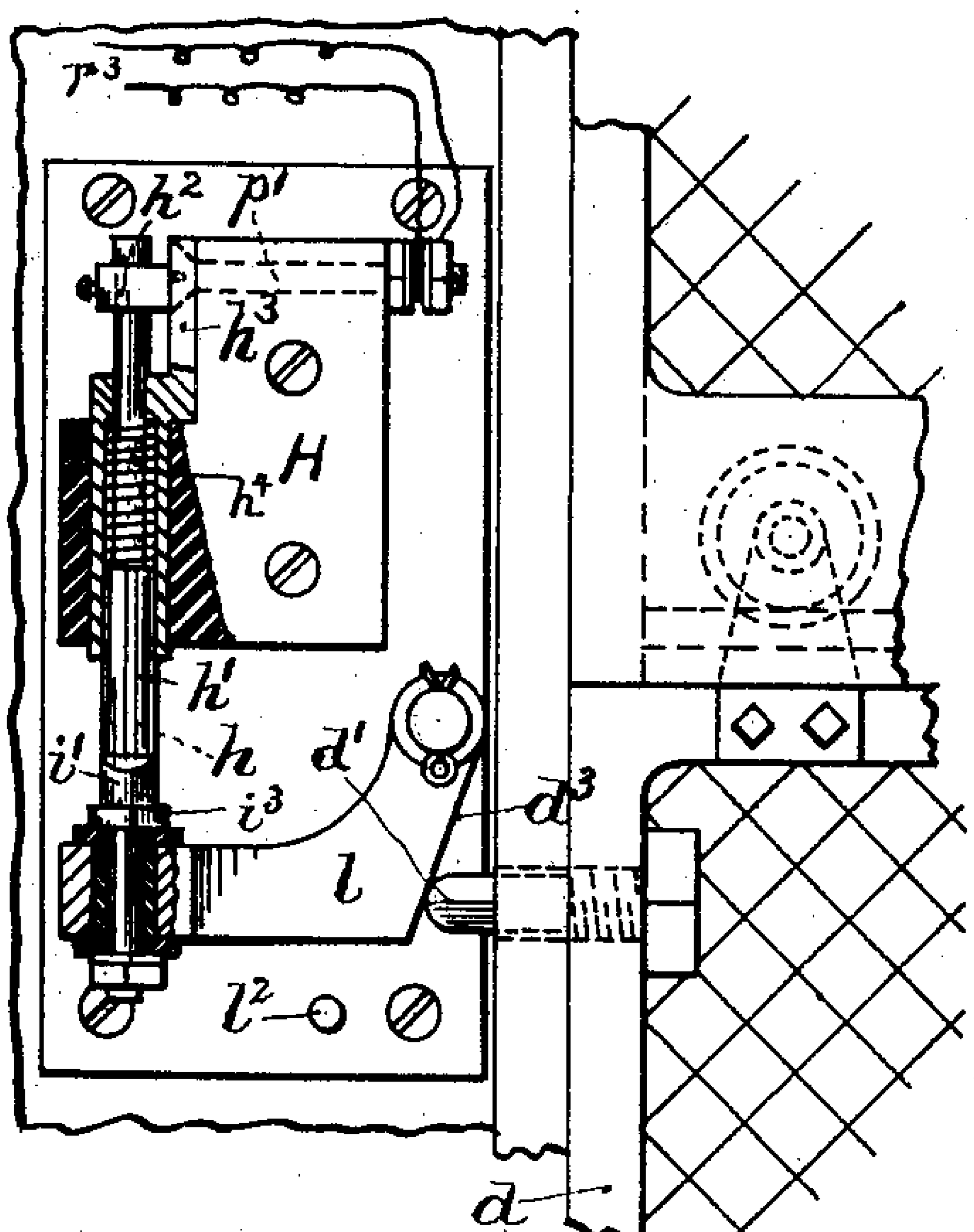

Fig. 4.

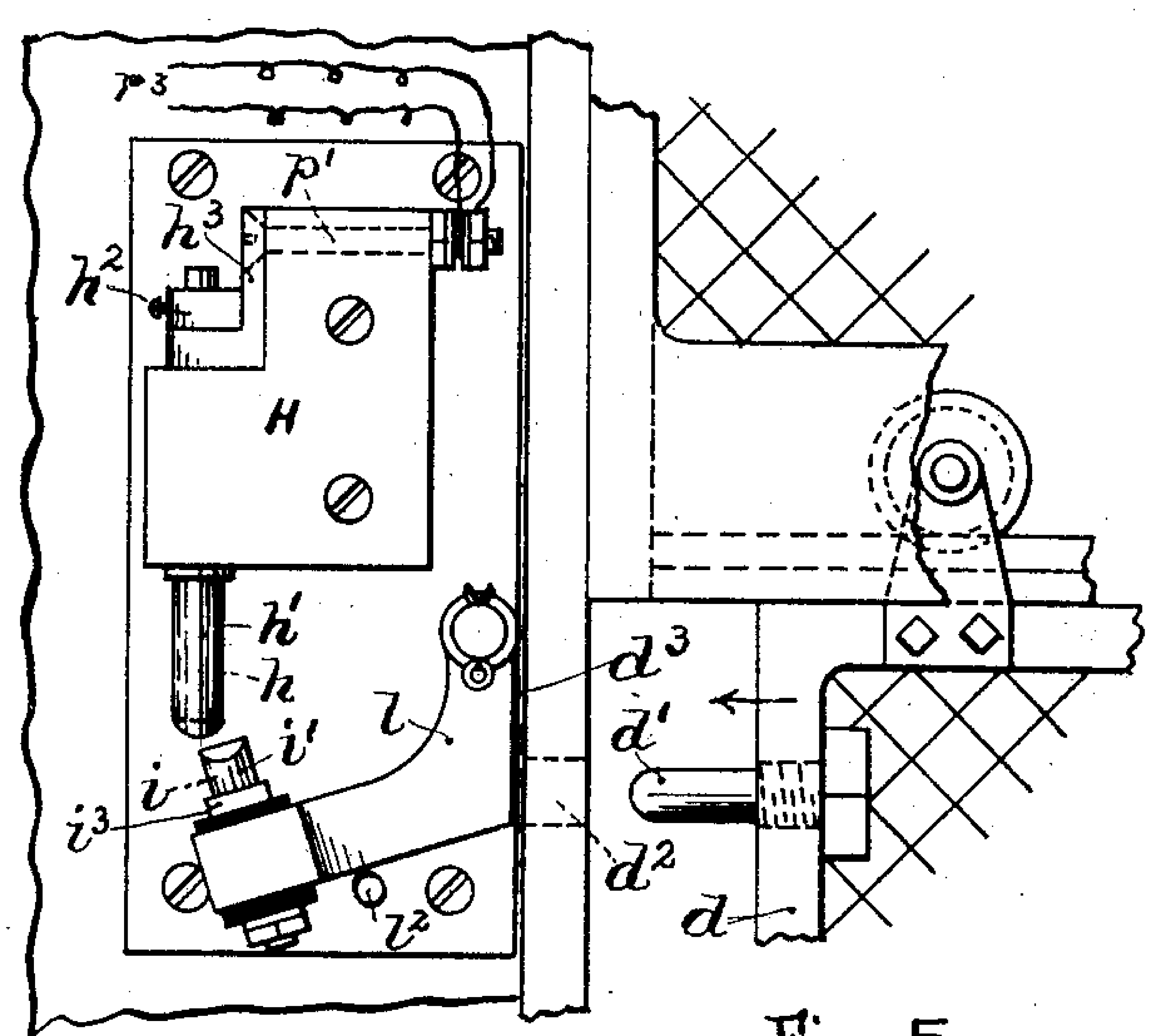

Fig. 5.

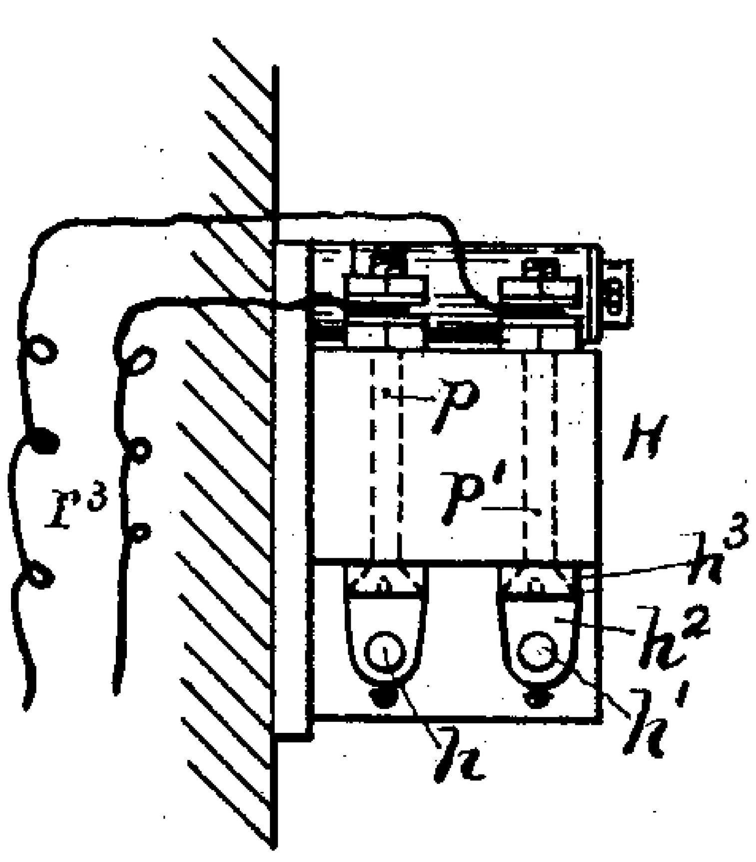

Fig. 6.

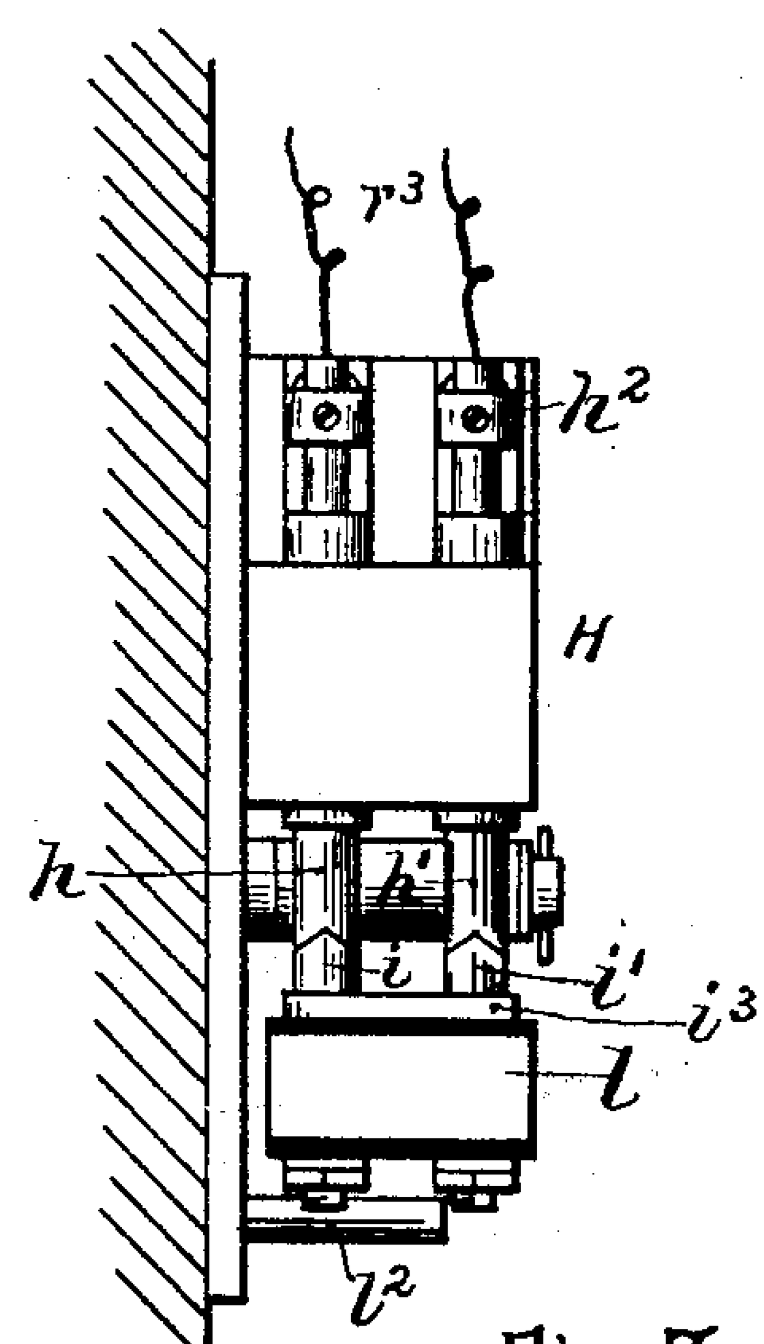

Fig. 7.

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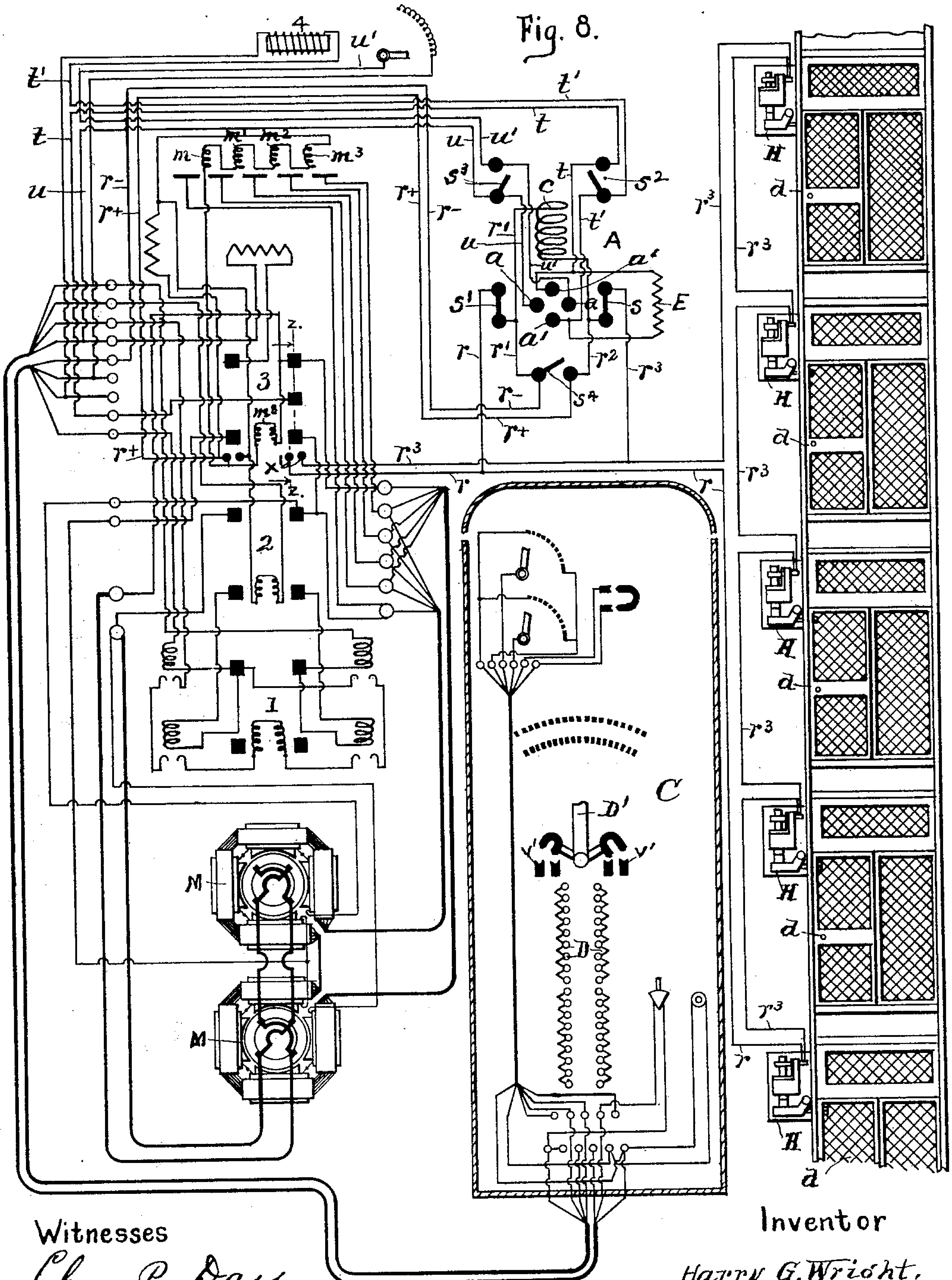
NO MODEL. 4 SHEETS—SHEET 3.

Fig. 8.



Witnesses

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NO MODEL. 4 SHEETS—SHEET 4.

Fig. 9.

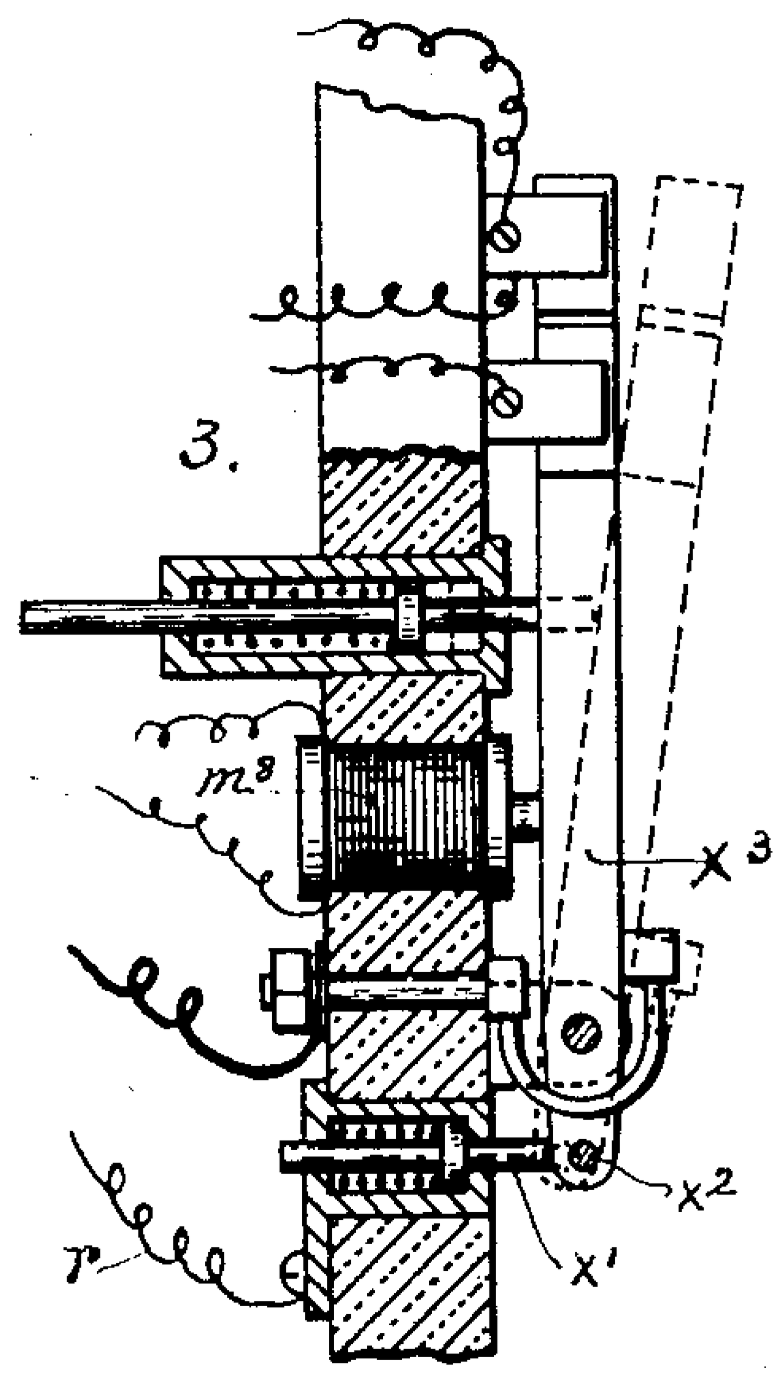
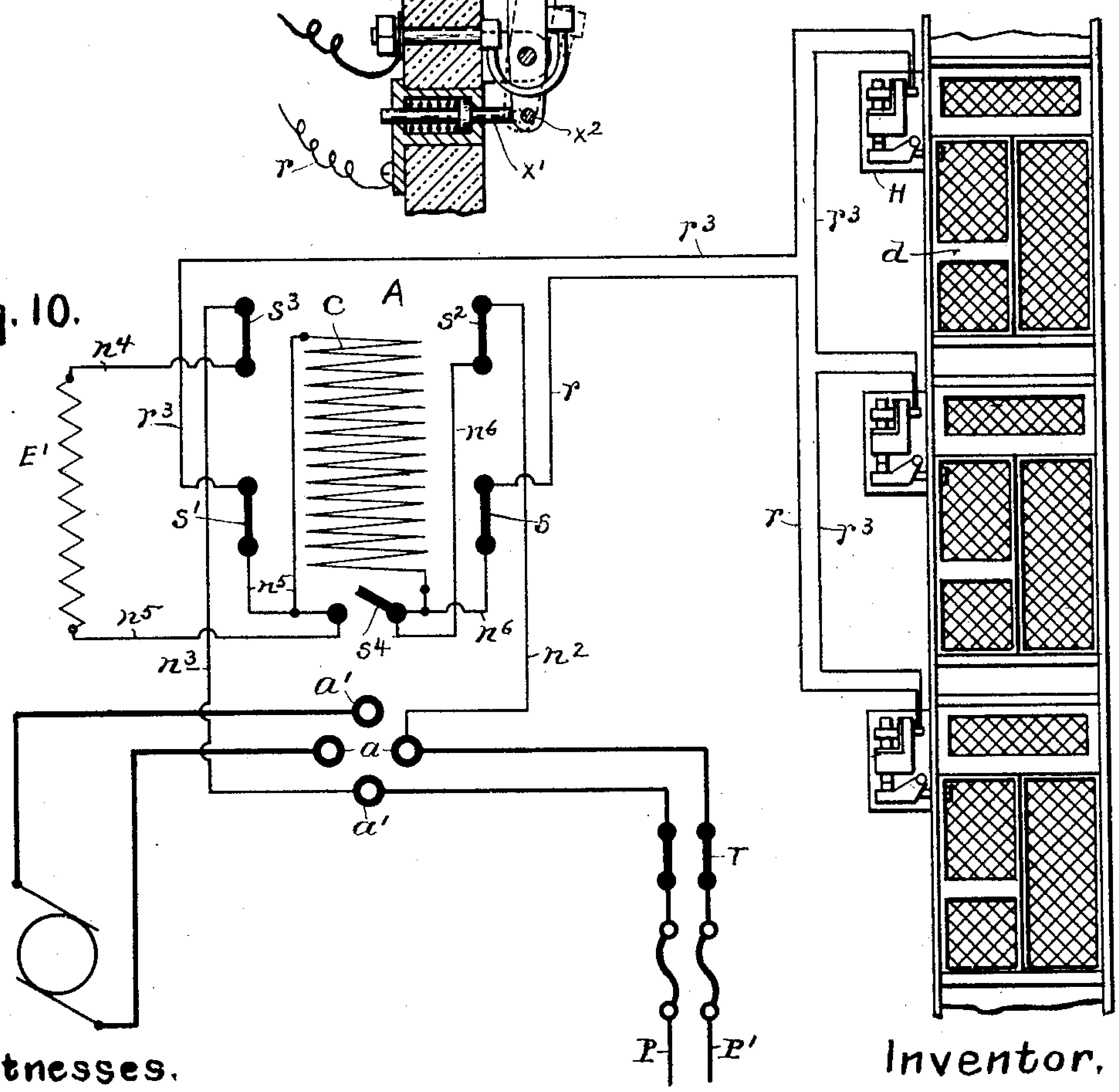


Fig. 10.



Witnesses.

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UNITED STATES PATENT OFFICE.

HARRY G. WRIGHT, OF PROVIDENCE, RHODE ISLAND, ASSIGNOR TO WILLIAM C. WOODWARD, OF PROVIDENCE, RHODE ISLAND.

SAFETY-APPLIANCE SYSTEM FOR ELECTRICALLY-ACTUATED ELEVATORS.

SPECIFICATION forming part of Letters Patent No. 749,416, dated January 12, 1904.

Application filed May 9, 1903. Serial No. 156,415. (No model.)

To all whom it may concern:

Be it known that I, HARRY G. WRIGHT, a subject of the King of Great Britain, and a resident of Providence, in the county of Providence and State of Rhode Island, have invented certain new and useful Improvements in Safety-Appliance Systems for Electrically-Actuated Elevators, of which the following is a specification.

The invention forming the subject of this application for United States Letters Patent has relation to an improved electric safety-appliance system or construction for electrically-actuated elevators, the invention being of the type or class adapted to automatically prevent the car from moving in case any of the landing-doors are not fully closed or in case the normal working of the elevator is interrupted.

In electric safety appliances or systems for electrically-propelled elevators heretofore devised it has been usual, so far as I am aware, to connect the same to some part of the motor or mechanism which actuates and controls the movements of the elevator-car. In some instances the car itself carries some portion of the safety device, the same being connected to the manipulating cord or lever, through which latter the operator is enabled to normally control the car's movements. The electric currents employed for energizing or rendering operative such former safety appliances were usually taken from that of electric-lighting systems or some other source independent of that employed for operating the hoisting mechanism or motor which propelled the car.

In former safety devices, or at least some of them, the construction and arrangement were such that the main driving or hoisting mechanism was stopped or rendered inoperative whenever the safety appliance was brought into action.

In another form of electrically-operated elevators the driving mechanism thereof comprises a pair of electric motors the field-coils of which are in series and permanently connected, the armatures being capable of continuous rotation, but running in opposite directions. A suitable conductor connects the fields and extends to the lever-contact of a resistance-box mounted in the car. By throwing this lever one way or the other from the center of its arc of travel a shunt-circuit of variable resistance may be closed in parallel with the field-circuit of one or the other of the motors, thus weakening the field and varying the speed of the corresponding armature. With the operating-lever moved to one or the other extreme of the arc the car is moving, up or down, as the case may be, at maximum speed, while with the lever in the center position the two field strengths are equal and the armature revolves in unison or at equal speeds, the car then stopping. It may be added that the car is supported by cables passing over a top sheave, the opposite end of the cables being secured to a movable counterweight, carrying a sheave on which is mounted an endless cable, the latter passing downwardly and around the two motors' pulleys and also around a sheave carried in a movable tension-frame, the latter being supported by a cable extending upwardly over a sheave and secured to the counterweight. The tension-frame and car always move in a direction opposed to that of the counterweight. An objection to such former electrically - controlled safety appliances or "gate-locks" of passenger-elevators is that in cases where the "safeties" are made operative by means of an independent electric circuit it is possible that the latter may become accidentally inoperative and unknown to the attendant, in which event it is clear that the car's movements are not then governed in any manner whatever by the presence of the safety attachment. Consequently accidents to the passengers might happen even though the operator exercises a great degree of care. In my invention the electric current employed for the door or gate locks is preferably taken from the main power-circuit that supplies the current which operates the motors. The current for operating said safety attachment is, however, tapped or taken from the main current before the latter passes to the motors. Thus it is clear that even though the motors themselves should become inoperative or "dead" the current communicating with the safety device will still remain operative.

In the drawings I have indicated one class of electrically-propelled elevators, the same being provided with a series of suitably-arranged switches, magnets, resistances, conductors, &c., and physically situated or located between the motor and the source of supply of electric current. In the car itself is mounted a variable resistance electrically connected to said switches, &c. By means of the lever-contact member of said variable resistance the operator is enabled to normally control the car's movements up or down, as desired. These features, however, I disclaim as my invention, but are introduced more especially to represent the adaptability of my improved safety device thereto. This latter includes what I term a "master-switch," the same being capable of carrying the entire current of the controlling-circuit and also being electrically connected to some of the said switches, conductors, &c., (forming branch circuits,) of the main electric circuit. It is also electrically connected to a series of door or gate locks located in a branch or subsidiary circuit. The primary object of the last-named circuit and its door-locks is to provide safety means (wholly automatic in action and disconnected from the car) capable of positively preventing the car from starting or moving when any of the landing-doors are not fully closed. The master-switch is connected to the brake-circuit of the car and also to the circuit, in which are located rheostats for controlling the motors' speed. The main switch of the last-named circuit is kept normally closed, thereby adapting the motors to run continuously. The current for the door-lock circuit is preferably taken from the electric circuit at a point between the main switch and the motor. The resistance of the door-lock circuit is lower than that of the circuit in which the magnet of the master-switch is located, and the magnet of the latter is connected in shunt to the door-lock circuit, the construction being such that the magnet-coil offers a greater resistance to the passage of the current through it than through the more direct and lesser resistance of the circuit controlling the door-locks. Consequently the other circuits controlled by the master-switch are kept normally closed or operative when all the doors or gates of the door-lock circuit are fully closed, the car itself then being movable, as hereinafter explained. When, however, a landing-door is opened to such an extent that the door-lock circuit is thereby broken, the current then is shunted through the magnet-coil of the master-switch and energizes it, the result being to actuate said switch and open the other circuits connected with and controlled by it. In this position of the switch the car is immovable, and the operator in the car cannot possibly actuate it until the door-lock circuit is again made operative by closing the landing-door, at which instant, too, the magnet of the master-switch becomes demagnetized and permits its mechanism to automatically close or reëstablish the other circuits controlled by it, the car then being in the operative condition.

In the four accompanying sheets of drawings illustrating my invention and also indicating the manner of its relation and connection to an electric circuit arranged to propel or actuate the mechanism of a passenger-elevator, Figure 1 is a front view of the mechanical and electrical device or "master-switch," as it may be called, the relation of the parts being in the normal operative position and corresponding with the position of the door-lock shown in Fig. 5. Fig. 2 is a vertical transverse section taken on line 2 2 of Fig. 1. Fig. 3 is a diagrammatic representation of the wiring, &c., corresponding with Fig. 1. Fig. 4 is a front elevation, in partial section, of the improved electrically-connected door-lock or switch, the door being closed. In this position the car may be normally operated. Fig. 5 is a similar view, the door being open or disengaged from the switch. In this position the electric circuit of the door-locks is automatically broken, thereby through the medium of suitable connections rendering the car-controlling mechanism temporarily inoperative. Fig. 1 shows a corresponding position of the master-switch. Fig. 6 is a plan view of the lock. Fig. 7 is a side elevation of it corresponding with Fig. 4. Fig. 8 is a front elevation, in reduced scale, showing a series of landing-doors of an elevator system provided with my improved door-locks and also indicating diagrammatically a passenger-car, electric motors for operating the car, electric circuits connected with the car and motors, and the master-switch in electrical connection with said circuits and with the several door-locks. Fig. 9 is a sectional view, in enlarged scale, of the automatic switch 3, taken on line z z of Fig. 8; and Fig. 10 is a front view, in reduced scale, showing diagrammatically the master-switch located in the main circuit and shunt-connected to the door-lock circuit. In this arrangement the electric motor is adapted to stop whenever it is desired to stop the car at any of the landing-floors.

In Fig. 8 of the drawings I have indicated diagrammatically one form or type of electric-elevator systems substantially as heretofore produced and used and hereinbefore referred to. Said drawing also represents additionally a series of door-locks H, electrically connected to one of the controlling-circuits of the elevator and to the master-switch A. This latter, which is shunt-connected to other electric circuits of the system, constitutes an essential part of my present invention.

I would state briefly that the power-circuit or main electric circuit is conducted to a pair of electric motors M M, in which the field-coils are arranged in series and permanently connected. The car C is adapted to be electrically propelled by cables and mechanism (not shown) in any suitable manner. The electric current may be first taken from a power-circuit through a manually-controlled switch or circuit-breaker, (indicated at 1.) From the latter by means of suitable conductors the current passes to a manually-controlled variable resistance D and lever-contact D′, mounted in the car. An automatic switch (indicated at 2) may be located in the motor-circuit, said switch being so connected and arranged that the movements of the car are controlled by the operator through the medium of the lever D′. Now in order to start the motors the operator closes the two switches v' v' in the car, which action through proper connections energizes a magnet at back of said switch 2 and closes the latter, thereby slowly starting the motors. The current of the motors' armatures passes through a series coil on the fields, the result being to increase the motor's speed up to the normal. When this takes place, the series coil is cut out automatically by a series of magnets m m' m^2 m^3, which lift their corresponding disks successively, thereby imparting sufficient current to a magnet m^8 at the back of the automatic switch 3 to close the latter. Now to operate the car the lever D′ is moved in the desired direction—say to the right in descending and to the left in ascending—the several landing-doors d then being closed and the corresponding circuit short-circuited through the door-locks H. In the event of a door being opened to any extent while the car is moving the latter will stop instantly, although the motors may be continued in action. This result is due to the fact that the thus-open door-circuit then shunts the current through the magnet-coil of the master-switch, which latter thereby elevates the contact-point from the mercury-cups, thus opening the main controlling-circuits and the brake-circuit connected therewith. The motor is stopped by simply opening the two switches v', thereby demagnetizing the magnets of said switches 2 and 3, which latter then automatically drop and open the corresponding circuits in a well-known manner.

The master-switch A may be provided with a series of manually-controlled cut-outs, as s s' s^2 s^3 s^4, substantially as indicated in Figs. 1, 3, and 8. These as well as other parts of the switch are preferably secured to a small conveniently-located switchboard f, the whole being inclosed in a suitable protecting box or casing f', having a locked glass door or cover f^2.

The master-switch A consists, essentially, of two pairs of independent mercury contact-cups a a and a' a', interposed in two independent circuits, adapted to control the elevator's movements, secured to and insulated from a bracket or base member b, of marble or other proper insulating material. The cups are or may be covered on their outer surface with suitable insulation. They are adapted to contain a quantity of mercury o, the surface level of which is substantially uniform in all. I prefer to use suitable oil o' on top of the mercury, thus forming a fluid seal. The oil also serves to greatly lessen and stifle the arc when the switch is being opened. Directly above the mercury-cups is located a vertically-arranged electromagnet-coil c, the spool of which is wound with sufficient conducting-wire to form the desired resistance of the coil. A non-revoluble core or rod c' is mounted to move freely in a vertical endwise direction centrally of the coil, the rod rising upwardly when the magnet is energized and falling by gravity when the electric circuit of the coil is shunted by the lower resistance of the closed door-lock circuit. To the lower portion of said rod are secured a pair of horizontal crossed conductor-bars a^2 a^3, having contact-pins e, of steel or other material unaffected by mercury, depending from their outer or free ends, as clearly shown in Figs. 1 and 2. The said bars are thoroughly insulated from each other and from the core c', the four pins thereof being arranged centrally of the four corresponding mercury-cups. By means of an exterior nut or adjustable stop c^2 of the rod the degree of mercury contact with the pins may be readily controlled as desired.

As drawn, (see Fig. 8,) the mercury-cups a' are connected by suitable conductors t t' to the brake-circuit of the elevator system, the cups a being connected by suitable conductors u u' to the controller-circuit. These circuits being exterior to the master-switch and the manner of their construction, as well as mechanical devices (not shown) connected therewith and with the car, form no part of my invention, except as being combined with or arranged to coact with the master-switch A.

I may state that in an electrically actuated and controlled elevator the "controller-circuit," so called, is connected to certain devices adapted to regulate or control the current which propels the car. The brake-circuit of such form of elevators is usually arranged so that when the circuit is closed the current acts to keep spring-pressed jaws or shoes disconnected from the brake-wheel; but when the circuit is broken said jaws (by means of the springs) clamp the wheel or brake device to prevent the car from further movement. Thus it is obvious that when the conductor-bars are dropped the pins e thereof will form electrically-closed contacts with the mercury-cups, the latter, as just stated, being located in the brake and controller circuits. The circuits are opened by elevating the bars, thereby withdrawing the pins from the mercury. I prefer to have the contact-pins of the bar a^3 (of the brake-circuit) extend below those of the other or controller-circuit. As thus constructed and arranged, it is clear that the latter circuit will become open or dead slightly in advance of the brake-circuit whenever the magnet c is sufficiently energized to elevate the bars, &c., to the position represented in Figs. 1 and 2. I deem this an important feature of my invention.

The door or gate lock proper, H, Figs. 4 to 7, has a frame or housing secured to the door-casing in a suitable manner and at any convenient point—say near the top of the door. In the said lock-frame are mounted two independently-insulated vertically-movable spring-pressed pins or bolts h h', each provided at its upper end with an adjustable current-conducting stop-collar h^2 in sliding contact with a combined guide and conductor plate h^3. A swinging contact-lever l is located contiguous to the lower portion of said bolts. Its outer or free end carries a pair of current-conducting pins or "hammers" i i', insulated from the lever, but united by the conductor i^3. The upper ends of the pins are adapted to engage the lower ends of the bolts. As drawn, the latter are grooved transversely, the ends of the corresponding pins having a counterpart form, thus while the lever is being swung upwardly insuring a more complete and perfect contact of the pins with the yielding bolts.

The landing-door d has a projecting dog or bolt d' secured thereto, arranged to pass through an opening d^2 of the door-frame and engage the adjacent or rear side d^3 of said contact-lever l, thereby when closing the door forcing the pins i i' upwardly into yielding contact with the bolts h h'. Fig. 4 represents the normal position of the parts when the door is fully closed, the collars h^2 then being in engagement with the poles or conductors p p' and plates h^3 of the branch circuit communicating by means of conducting-wires r r^3 with the master-switch A. (See also Figs. 8 and 9.)

The electric current for the circuit which operates the door-locks H is or may be taken from an automatic switch 3, Figs. 8 and 9, in electrical contact with posts x', connected in turn to the conductor-terminals of the locks by said wires r r^3. These latter are connected in shunt to closed switches (later described) s' s, respectively, and from which by conductors r' r^2 the current is led to and from the magnet c of the master-switch.

Referring to Fig. 9, it will be seen that the lower portion of the contact-bar x^3 of the automatic switch 3 is extended and carries a transverse contact member x^2, normally disconnected from the spring-pressed posts x'. At the instant, however, the switch opens (see dotted lines) the said contact member x^2 will engage the yielding posts x', thereby at the same instant closing the door-lock circuit connected therewith. The resistance of the door-lock's circuit is much less than the resistance of the magnet-coil's circuit. Therefore as these circuits are connected in shunt one to the other when the door-lock circuit is closed the greater part of the current will pass through it rather than through the higher resistance of the magnet-coil (c) circuit, the latter then being practically demagnetized and having the pins e of the contact-bars in engagement with the mercury of the respective cups, thereby permitting the currents which control the elevator's movements to act normally. I may add that when the car is at either extreme of movement, top or bottom, the motor stops, but is in continuous operation while the car stops at any of the intermediate floors. Upon stopping the elevator-car and opening the corresponding landing-door, thereby disengaging the bolt d' from the contact-lever l of the door-lock, the springs h^4 of the spring-pressed bolts force the latter downwardly until arrested by the stops h^2, the lever at the same time swinging rearwardly by gravity to its limit or stop l^2, the result being to break the electric circuit of the door-lock. The current then passes via the circuit-wires r' and r^2 and through the magnet-coil c, thereby energizing the latter and breaking the mercury-contacts by causing the rod c', &c., to rise to the limit of movement. The result of this action is to cause the pins e of the controller-circuit to be withdrawn from the mercury in advance of the longer pins of the brake-circuit, thus insuring that the controller circuit is "dead" before the brake mechanism is released by opening the brake-circuit, as hereinbefore stated.

I make no claim to an electric elevator system substantially as indicated in Fig. 8 of the drawings, except as being electrically connected with the master-switch A and door-lock devices. In carrying out the invention I prefer to provide said switch with a series of hand-controlled circuit-breakers or cut-out switches s, s', s^2, s^3, and s^4, arranged substantially as represented in the drawings. The switches s s' are kept normally closed, and when closed they are connected to the conductors r^3 r of the door-lock circuit. They are at all times connected to conductors r^2 r', communicating with the magnet-coil of the master-switch. The normally open switch s^2 is connected by conductors t t' to the magnetic device 4, which constitutes a part of the brake-controlling mechanism of the elevator. Said conductors are further connected to the two mercury-cups a' a' and to a resistance-coil E. This latter is a high-resistance shunt, adapted to carry any excessive increase of voltage in the circuits connected therewith. The normally open switch s^3 is connected by conductors u u' to the controller-circuit, through which circuit passes the current for manually controlling the operation of the car. Said conductors also lead to the other pair of mercury-cups a a. The other or bottom switch s^4 is normally open. It is connected by conductors $r-$ $r+$ to the main supply-circuit and also to said conductors r' r^2 of the door-lock circuit. As thus arranged it is clear that when it is desired to disconnect or cut out the door-lock circuit from the master-switch it is readily effected by opening switches s s', and by closing switch s^4 the master-switch is cut out altogether.

It is to be understood that when the pins e of the conductor-bars a^3 and a^2 are in contact with the mercury contained in the respective cups the corresponding circuits employing the conductors t t' and u u' are thereby closed.

Fig. 10 represents my improved master-switch A and system arranged for use in the class of electric elevators in which the motor's movements cease whenever the car stops. In this case the master-switch is interposed between the motor and a main circuit-breaker T, connected with the conductors P P' of the power-circuit. The mercury-cups a a and corresponding conducting-bar a^2 connect, say, with the main wire P', the other mercury-cups a' a' and bar a^3 being connected with the fellow conductor P. As drawn the several switches s s' s^2 s^3 are kept normally closed, while s^4 is normally open. The switches s^2 and s^3 are in direct and continuous connection with the main circuit by means of conductors n^2 n^3, respectively. From the switch s^3 a conductor n^4 connects with a resistance E', and from the latter the current passes to switches s^4 and s' and magnet-coil c by means of conductors n^5. One of the conductors r^3 of the door-lock circuit is also connected with switch s'. From the switch s^2 a conductor n^6 connects with the switch s^4 and also with said coil c and switch s, the latter being connected with the other conductor r of the door-lock circuit. Now whenever the elevator is working normally the electric current flows from the conductors of the power-circuit through the then closed master-switch to actuate the motor, some of the current at the same time passing via conductors n^2 n^3 n^4 n^5 n^6 and the said manually-controlled switches s s' s^2 s^3 to the conductors r r^3 of the normally closed door-lock circuit. The act of opening a landing-door d breaks the circuit, thus short-circuiting the current through the magnet-coil c, thereby energizing the latter and opening the master-switch by withdrawing the contact-pins e from the mercury, the motor then stopping. The stationary resistance-shunt E' is employed to regulate the amount of current used in the magnet-circuit.

It is obvious that various changes may be made in my improved system for automatically controlling an electric safety device for elevators without departing from the essential features embodied therein, and therefore I desire to cover in this present invention such equivalent changes or modifications.

I claim as my invention and desire to secure by United States Letters Patent—

1. The herein-described system for automatically controlling an electric safety device for elevators, the same consisting of a suitably-located and normally closed master-switch electrically connected with the circuits controlling the movements of the elevator-car, said switch having a magnet-coil of high resistance shunt-connected to the main power-circuit, and a normally closed door-lock circuit electrically connected with and having a lesser degree of resistance than said magnet-coil, arranged whereby upon opening a door in said circuit the latter is automatically broken thereby permitting said magnet-coil to be energized and thus open the circuits which control the car.

2. The herein-described system for automatically controlling an electric safety device for elevators, the same embodying a normally closed master-switch shunt-connected to the brake and controller circuits of the elevator-car, a magnet-coil of high resistance electrically connected with the power-circuit and forming a part of said switch, and a series of normally closed door-locks located in an electric circuit connected to said master-switch, whereby upon energizing said magnet-coil of the switch the latter operates to open the said brake-circuit in advance of the controller-circuit.

3. In an automatic electric safety device for elevators, the combination, in a master-switch of the class described, of a plurality of independent conductor members, as a^2, a^3, provided with contact-pins in normal engagement with mercury-cups electrically connected with circuits controlling the movements of the electric car, the pins of one of said conductor members being longer than those of the other, and a magnet-coil provided with a vertically-movable core having said switch-conductors secured thereto and capable of moving upwardly therewith to open the circuits whenever the coil is sufficiently energized, substantially as described.

4. In an automatic electric safety device for elevators, a normally closed electrically-connected door-lock circuit having a comparatively low resistance, normally closed electric circuits for controlling the movements of the elevator-car, and a master-switch provided with a magnet-coil of high resistance having a vertically-movable core member carrying contacts in normal electrical engagement with said controller-circuits, whereby the act of opening said door-lock circuit energizes the magnet-coil to elevate its core thus at the same time automatically opening the car-controller circuits, substantially as described.

5. In a system for automatically controlling the movements of an electric safety device for elevators, a master-switch provided with normally closed mercury-contacts electrically connected with circuits through which the movements of the elevator-car are controlled, a door-lock circuit of low resistance electrically connected with the power-circuit which

supplies the current for operating said car, a magnet-coil of high resistance in continuous electrical connection with said door-lock and power-circuits, and a movable core for said magnet-coil capable of automatically breaking said mercury-contacts whenever the coil is energized by opening the door-lock circuit, substantially as hereinbefore described.

6. In a system for automatically controlling the movements of an electric safety device for elevators, a master-switch electrically connected with a door-lock circuit having a low resistance and with the power and car-controlling circuits, an electrically-connected magnet-coil of high resistance forming a part of said switch capable of being energized whenever the door-lock circuit is broken, thereby through the medium of said coil opening the said car-controlling circuits, substantially as described.

7. In a system for automatically controlling the movements of an electric safety device for elevators, a master-switch interposed between the door-lock circuit and car-controlling circuits and being electrically connected therewith, and having a plurality of manually-controlled cut-outs connected with said circuits, whereby the elevator's movements may be controlled independently of the door-lock circuit and master-switch, substantially as described.

8. The combination, in a master-switch, of mercury-contacts adapted to be interposed in circuits through which the current passes for controlling the movements of an electric elevator, a suitably-arranged magnet-coil of high resistance, a low-resistance shunt electrically connected with said magnet-coil, and a vertically-movable rod or core carrying conductors in normal engagement with the mercury but capable of being withdrawn therefrom automatically upon energizing the magnet-coil, substantially as described.

9. The combination of two pairs of electrically-connected insulated mercury-cups, a pair of insulated conductors provided with contact-pins in normal engagement with said cups, an electrically-connected stationary magnet-coil of high resistance, a movable core or rod passing through the center of said coil having said pin-carrying conductors secured to its lower end, and manually-controlled cut-outs or subsidiary switches arranged to be located in electric circuits which energize said coil, substantially as described.

10. In an electric safety device for elevators, a master-switch electrically connected with circuits through which the movements of the elevator are controlled and provided with a magnet-coil of high resistance adapted when energized to actuate the switch and open said circuits, thus rendering the car inoperative, a door-lock device located in an electric circuit connected with the magnet-coil, said device being provided with insulated yielding conductor members, and a movable contact member adapted when the door is closed to engage said yielding conductors and form a short-circuit therewith, whereby the door-lock circuit is closed and the magnet-coil of the master-switch demagnetized, substantially as described.

Signed at Providence, Rhode Island, this 8th day of May, 1903.

HARRY G. WRIGHT.

Witnesses:
GEO. H. REMINGTON,
G. E. SMITH.