No. 719,463. PATENTED FEB. 3, 1903.

G. HAIL.

ELECTRIC SYSTEM FOR ELEVATOR SAFETY APPLIANCES.

APPLICATION FILED APR. 8, 1902.

NO MODEL. 4 SHEETS—SHEET 1.

FIG. 1.

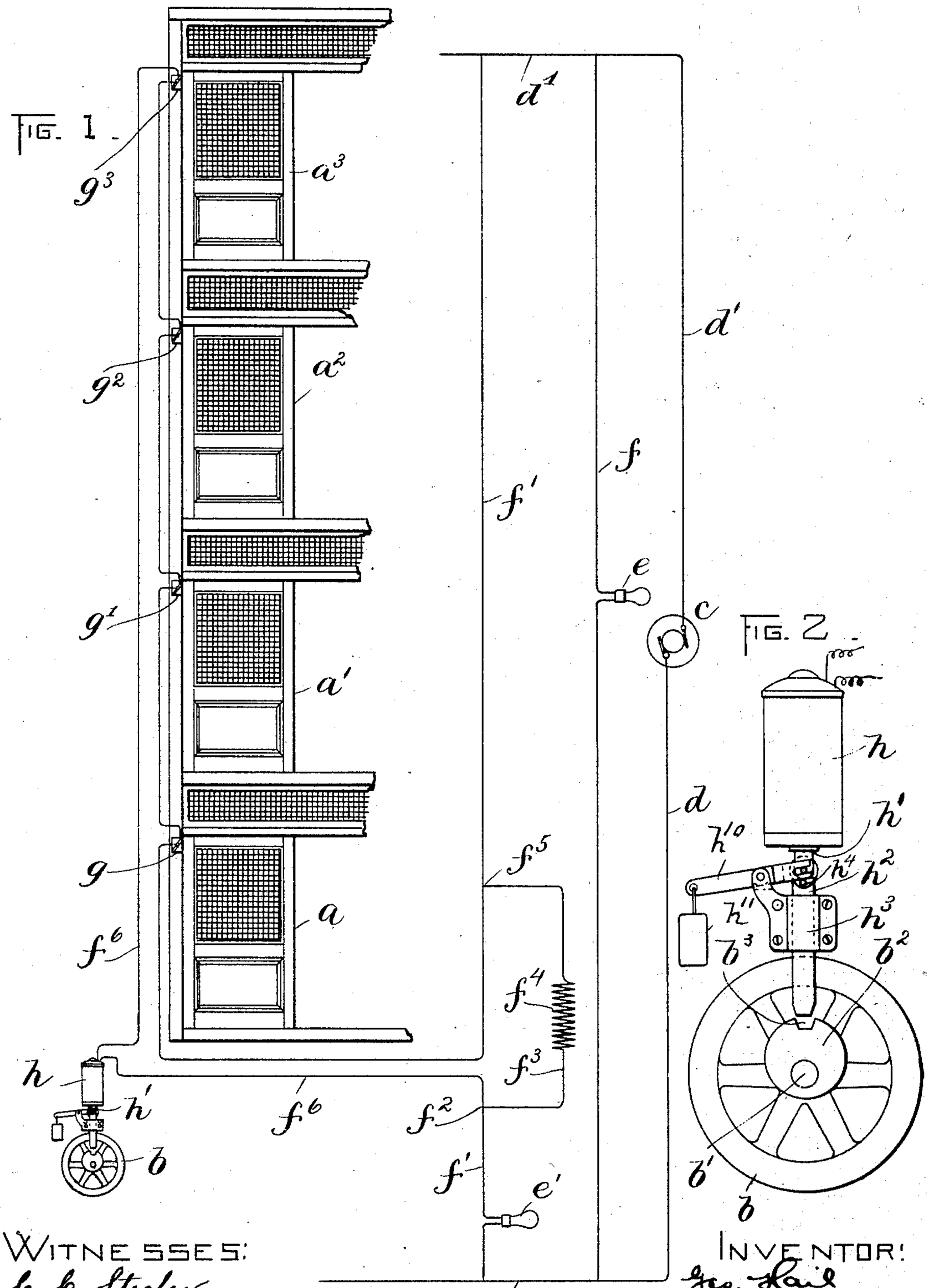

FIG. 2.

WITNESSES:
C. C. Stecher
A. D. Harrison.

INVENTOR:
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NO MODEL. 4 SHEETS—SHEET 2.

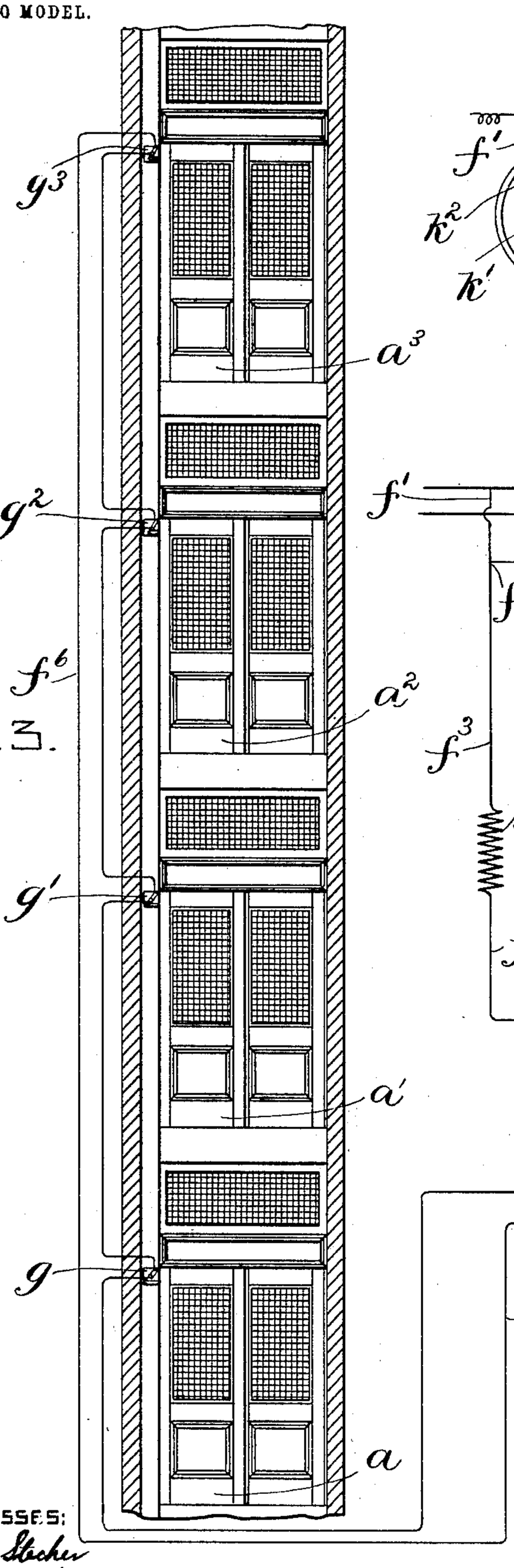


FIG. 3.

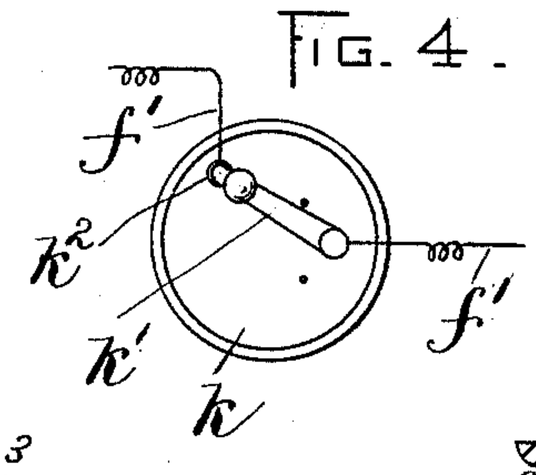


FIG. 4.

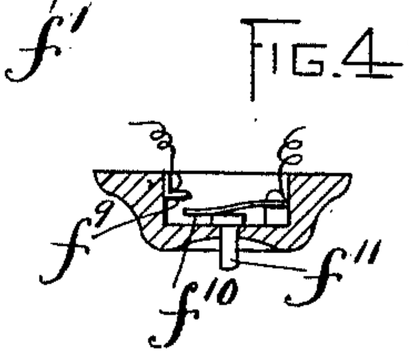
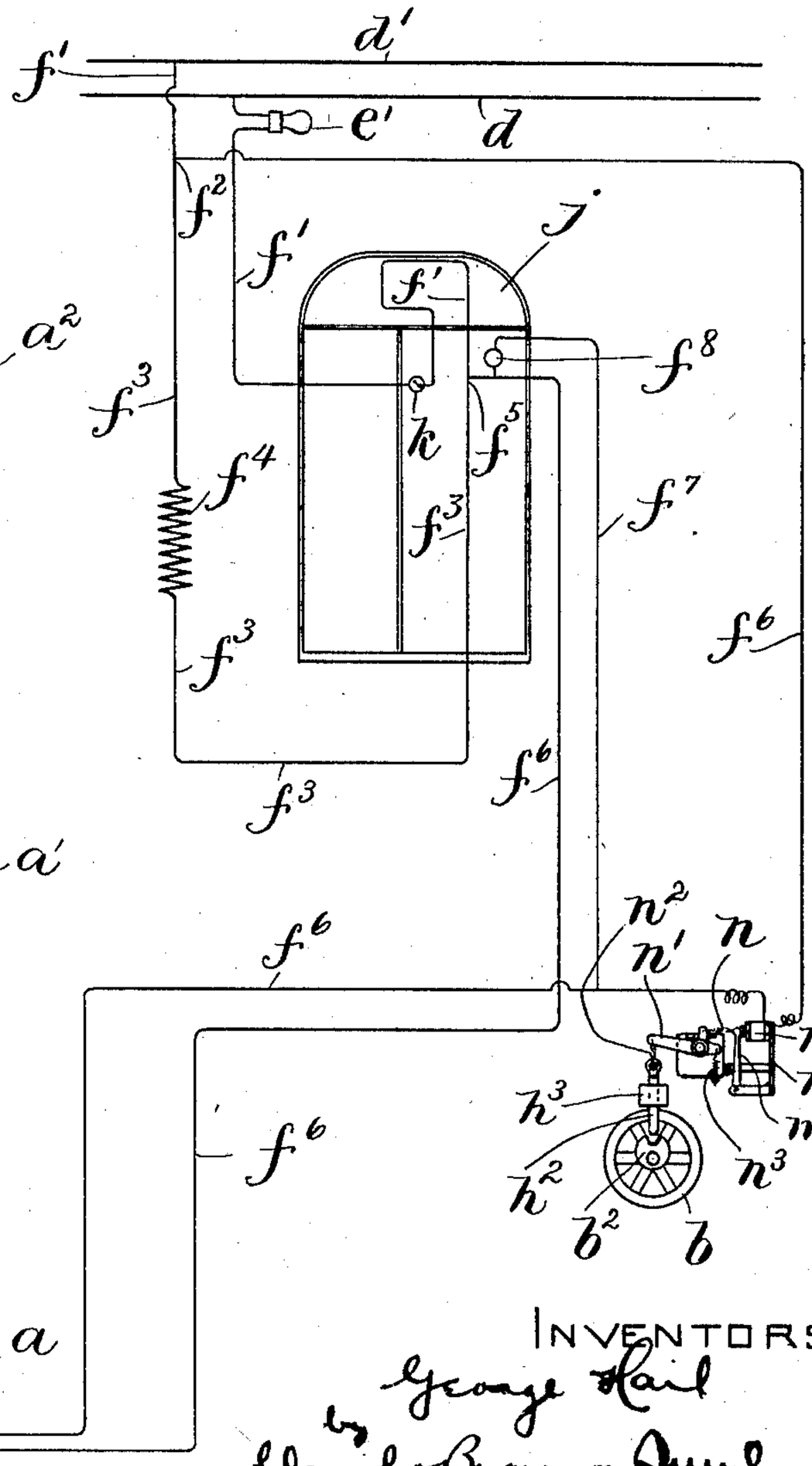


FIG. 4a.



WITNESSES:
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NO MODEL. 4 SHEETS—SHEET 3.

FIG. 5.

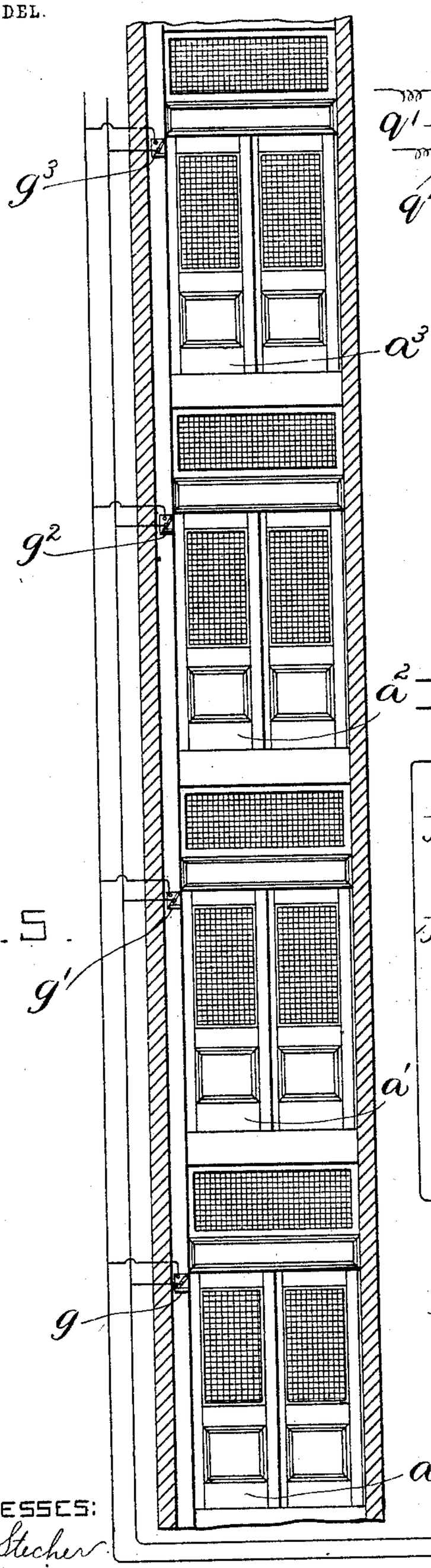


FIG. 6.

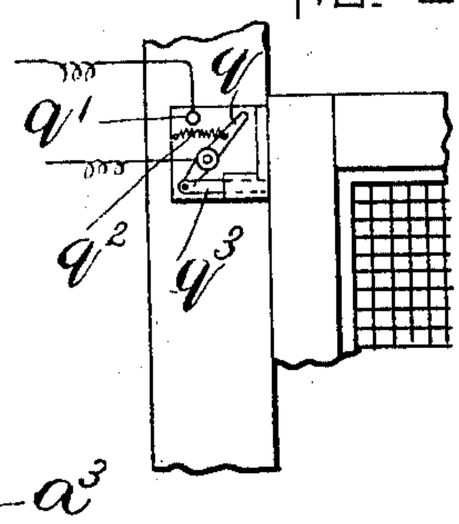
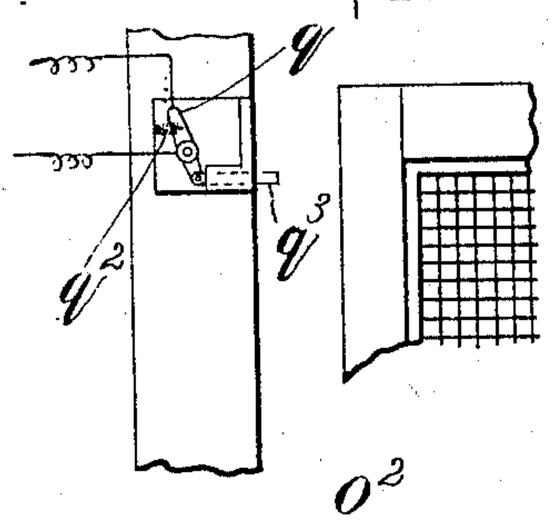


FIG. 7.



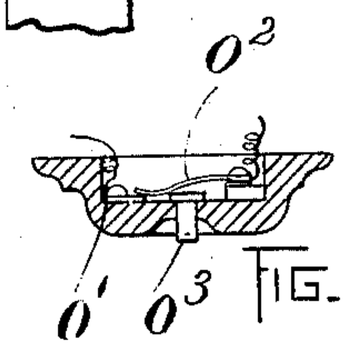
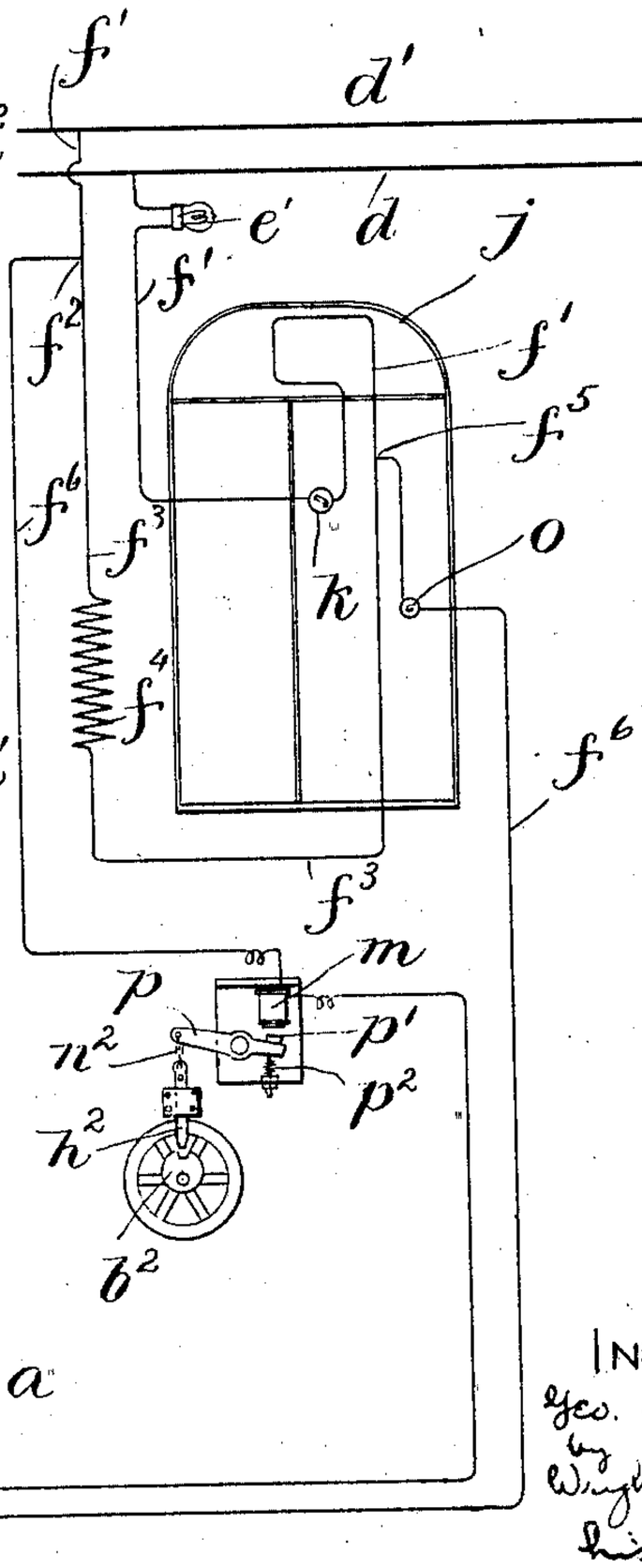


FIG. 8.



WITNESSES:
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No. 719,463. PATENTED FEB. 3, 1903.

G. HAIL.

ELECTRIC SYSTEM FOR ELEVATOR SAFETY APPLIANCES.

APPLICATION FILED APR. 8, 1902.

NO MODEL. 4 SHEETS—SHEET 4.

FIG. 9.

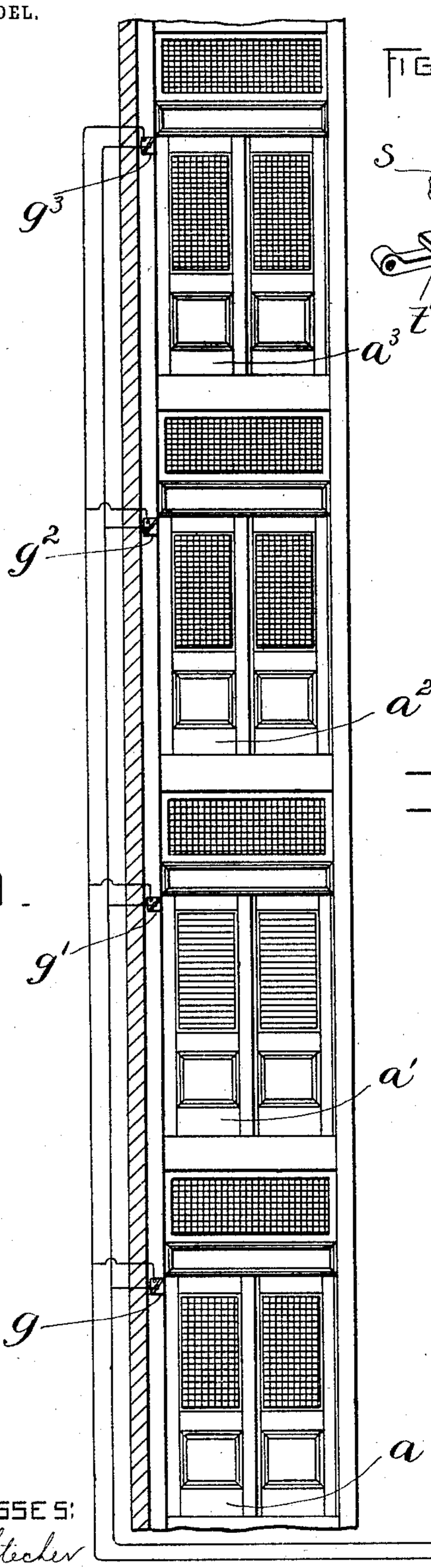


FIG. 10.

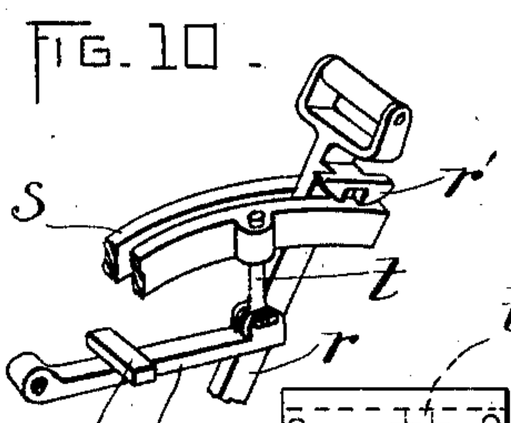
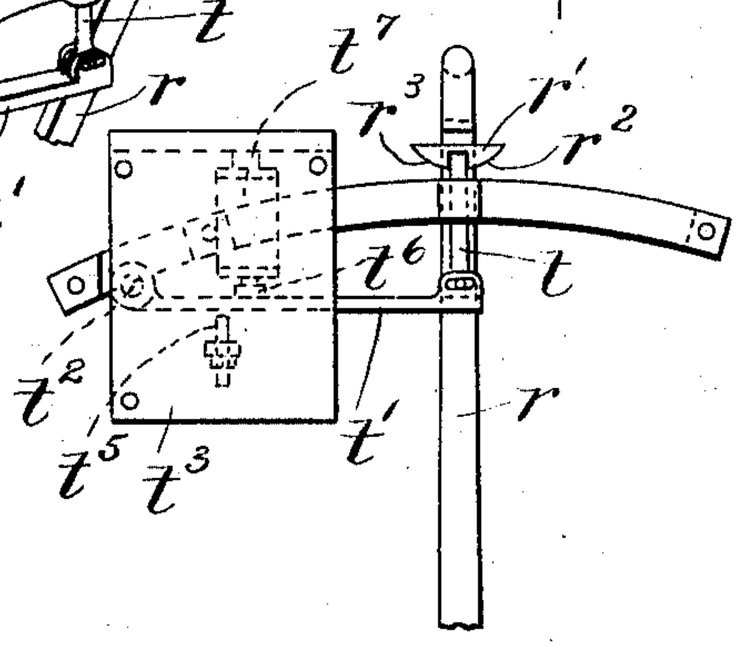
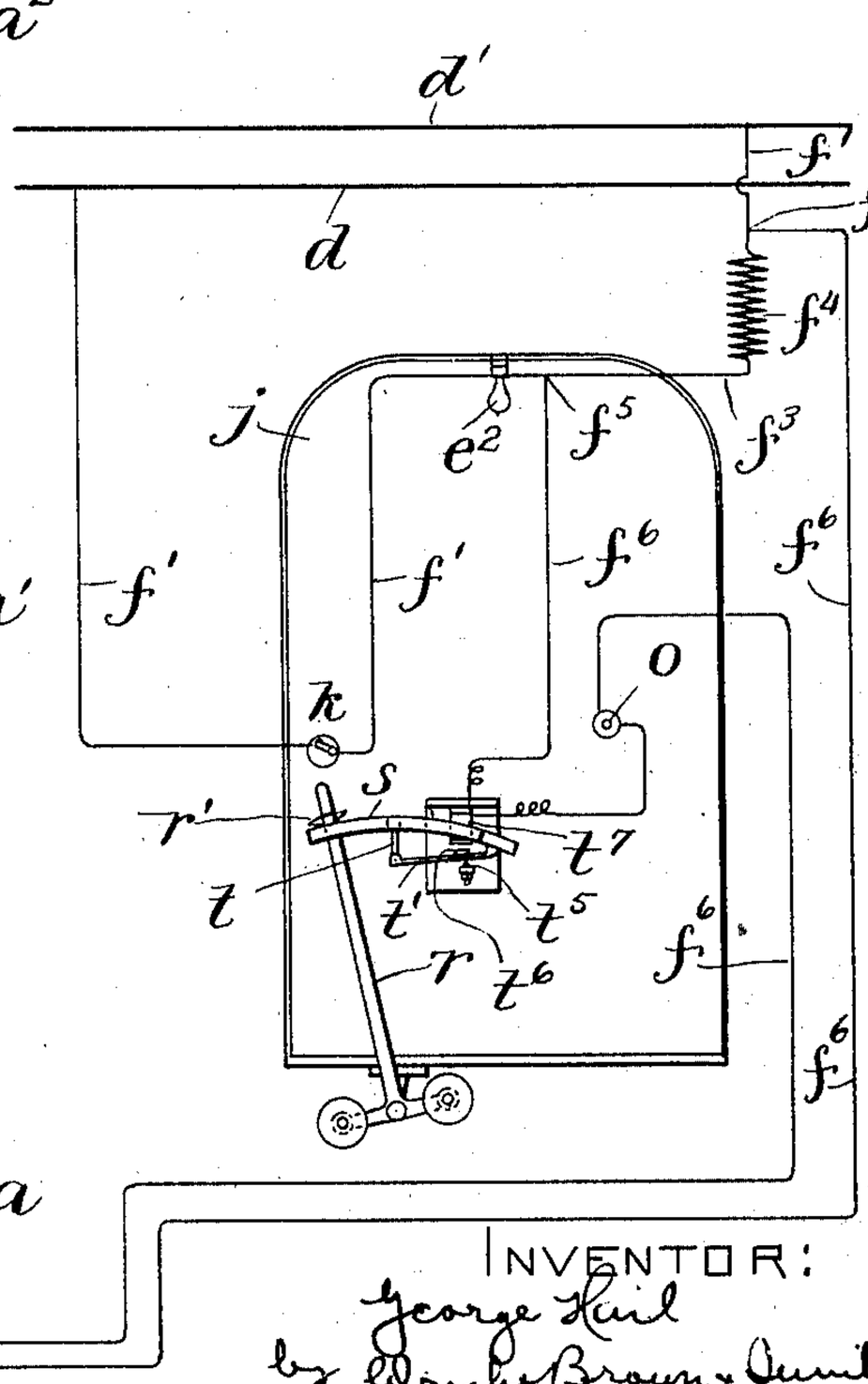


FIG. 11.





WITNESSES:
C. C. Stecher
A. D. Harrison

INVENTOR:
George Hail
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UNITED STATES PATENT OFFICE.

GEORGE HAIL, OF PROVIDENCE, RHODE ISLAND.

ELECTRIC SYSTEM FOR ELEVATOR SAFETY APPLIANCES.

SPECIFICATION forming part of Letters Patent No. 719,463, dated February 3, 1903.

Application filed April 8, 1902. Serial No. 101,922. (No model.)

To all whom it may concern:

Be it known that I, GEORGE HAIL, of Providence, in the county of Providence and State of Rhode Island, have invented certain new and useful Improvements in Electric Systems for Elevator Safety Appliances, of which the following is a specification.

This invention has relation to electric systems for that class of elevator safety mechanisms in which provision is made for preventing the starting of the car while the landing-door is open. Such safety appliances usually comprise an electric circuit having door-controlled switches, an electromagnet and its armature, and a lock or other device connected to the armature for effecting either directly or indirectly the locking of the elevator controlling or hoisting mechanism. They are highly desirable, owing to the ease with which they may be installed, their compactness, and the low cost of their construction and installation. There has been, however, more or less objection to the employment of such electrical appliances, owing to their cost of maintenance, either where an electric generator in the form of a battery or else the street-lighting current is depended upon for supplying current to the mechanism.

The object of this present invention is to provide an electric system for safety appliances of the character referred to which will receive its current from the ordinary lighting system usually installed in office-buildings, factories, and other places where elevators are used.

Referring to the accompanying drawings, Figure 1 represents diagrammatically a system embodying the invention in which a closed electric circuit is employed. Fig. 2 represents a form of locking device which may be employed in connection therewith. Fig. 3 is a diagrammatic view representing another embodiment of the invention. Fig. 4 represents a main switch on the car for controlling the safety system. Fig. 4^a represents a normally open spring-switch. Fig. 5 represents a diagrammatic view of another embodiment of the invention in which a normally open circuit is employed. Figs. 6 and 7 represent the door-controlled switches for closing the electric circuit when the door is open and for breaking the circuit when the door is closed. Fig. 8 represents what may be termed an "automatically-closing" switch arranged in a circuit in the car and which is used to break the circuit for the purpose of unlocking the controlling devices in case the door becomes accidentally opened. Fig. 9 represents another embodiment of the invention in diagrammatic view. Figs. 10 and 11 represent the device for locking the controlling mechanism.

Referring first to Figs. 1 and 2, it will be observed that there is shown a series of four landing-doors (indicated at a, a', a^2, and a^3) past which the elevator-car may travel and which are opened to permit access to the car.

b indicates a portion of the controlling devices, which in this case may be a valve-wheel, as indicated, or a wheel connected to the mechanism which directly controls the hoisting apparatus whether it be in the form of a hydraulic motor, a mechanical motor, or an electric hoisting device.

c indicates a dynamo by which current is supplied to the main lighting-circuit, (indicated at d.) Arranged in multiple in this circuit are the usual lamps e e', inserted in the branch circuits f f'. These lamps are depended upon for lighting the building in which the lighting system is installed, and it is with one of these branch circuits that the electric circuit is connected for controlling the elevator safety mechanism. The circuit f' branches at the point f^2, one branch f^3 including a rheostat or resistance-coil f^4 and again uniting with the circuit f' at f^5. The other branch f^6 includes a series of make-and-break devices or switches, (indicated at g g' g^2 g^3,) each of which is controlled by one of the doors. Any suitable form of switch may be employed for the purpose provided it breaks the circuit when the door is moved from its closed position. The circuit f^6 likewise includes the coils of the solenoid h, the core h' of which is connected to a locking-bolt h^2. The solenoid is arranged vertically and the bolt slides in a guide h^3, the solenoid and guide being of course attached to some suitable stationary support. (Not shown.) To assist the solenoid in lifting the bolt h^2, a lever h^{10} and weight h^{11} are arranged, as shown

in Fig. 2, to partially counterbalance the bolt and the core of the solenoid.

To the shaft b' of the wheel b is attached an eccentric b^2, having a notch b^3, into which the beveled end of the locking-bolt may drop when the circuit through the solenoid-coils is broken, and thereby lock the controlling mechanism and prevent the starting of the car. In case the circuit is broken when the wheel and eccentric are not in position or the notch is not in position to receive the end of the bolt the rotation of the wheel will cause the eccentric to force up the bolt until the notch b^3 registers therewith, whereupon the bolt will drop thereinto.

The resistance of the rheostat f^4 and of the solenoid-coils is such that the current will pass through the solenoid and energize it to hold the core in an inoperative position, and when the circuit through the branch f^6 is broken all of the current will necessarily pass through the rheostat. The resistance of both the coils and the rheostat, however, is light and does not tend to greatly diminish the brilliancy of the lamp e'. It will be observed, however, from this that the maintenance of the safety system will cost practically nothing, in view of the fact that the lamp e' is doing its customary work in lighting some dark portion of the building in which the system is installed. In almost every building it is essential that an electric lamp should be continuously burning at some portion thereof where light is excluded—as, for instance, in the basement or subbasement—and it is in the branch circuit of this light that the safety system is installed.

It may be stated in passing that the bolt h^2 is equipped with a stop h^4 to limit its downward movement, said stop engaging the guide h^3.

It is desired in many cases to control the lighting branch circuit at some point within the car, and in Fig. 3 I have illustrated diagrammatically the system in which this is accomplished. This figure likewise illustrates another form of locking device. The main circuit $d\ d'$ is similar to the one described, and the branch lighting-circuit f' has the lamp e', as before. The branch f^3 has a rheostat f^4. The conductor of the circuit f' is connected by a suitable cable with the elevator-car j, and in said car is placed a switch k. This switch is provided with the lever k', adapted to engage the contact k^2 to close the circuit through the lighting branch f', and consequently through the branches f^3 and f^6. The controlling device for the motor is provided with the wheel b, as before described, which has the notched member b^2, with which is adapted to engage the bolt h^2. The bolt slides in the guide h^3, as before described, and is normally held out of engagement with the notched member by the normally closed circuit f^6, hereinbefore referred to. The said circuit includes the coils of the electromagnet m and the door-switches $g\ g'$, &c.

The magnet m is of the horseshoe type and is mounted upon a support m', to which is pivoted an arm m^2, carrying on its free end the armature of the magnet. The end of the said arm is connected by a chain or other flexible connection n with the shorter arm of a bell-crank lever n', the longer arm of which is flexibly connected by a chain or other device n^2 with the bolt h^2. The movement of the armature of the magnet is necessarily small, and hence by employing the bell-crank shaft with the short and the long arms a relatively long movement of the bolt is secured. The weight of the bolt is counterbalanced by a spring n^3, attached to a third arm on the bell-crank. The bell-crank, with its flexible connections, serves as a device for multiplying the movement of the armature. It is evident, however, that in lieu of the horseshoe-magnet m the solenoid-magnet, such as shown in Fig. 2, can be employed with the core connected to the connection n. Both of these systems as thus explained have operated on a normally closed circuit. There is danger, however, in operating with such a circuit through the shunt-circuit f^6 that upon the opening of a landing-door and the breaking of said circuit the elevator may be locked against movement by the engagement of the bolt h^2 with the notched member b^2, since the breaking of said circuit f^6 causes the magnet to release the armature on the arm m^2. Therefore at a point near the locking mechanism the shunt-circuit f^7 is taken from the circuit f^6 to the circuit f' or taken from circuit f^6 and returned to said circuit. In this shunt f^7 is placed a normally open switch f^8, which may be closed by the pressure of the finger, but which will automatically open as soon as the pressure is relieved. Now from this it will be apparent that if by chance one of the doors should be open and the circuit through the electromagnetic safety device be broken the circuit therethrough may be restored by the switch f^8. The said switch is shown at Fig. 4^a, and it has the stationary contact f^9, the spring-contact f^{10}, and the push-piece f^{11}.

In Fig. 5 there is shown a system operating with the normally open circuit, the closing of the circuit being effected by the opening of one of the landing-doors. In this system there is employed also what may be termed a "self-closing" switch, by means of which the branch circuit may be broken in case one of the doors is opened when a car is midway between two landings for permitting the release of the controlling device. The branch circuit for the lamp e' is provided with the shunt-circuit f^3, having the rheostat f^4 and the shunt-circuit f^6, including the door-controlled switches and the locking devices, said shunts being in multiple with each other and in series with the lamp e' in the branch circuit f'. Said branch circuit f' has a main switch k, as previously described, mounted on the car j. Likewise placed upon the car there is a self-closing switch o, arranged in the shunt-circuit f^6.

This switch has the stationary contact o', the movable spring-contact o^2, and the push-piece o^3, by which the spring-contact may be momentarily moved away from the stationary contact, but which permits the return of the spring-contact to normal position upon the removal of the hand or finger from the push-piece. The function of this switch will be subsequently explained. The bolt h^2 is connected by a chain n^2 with the longer end of a two-armed lever p, which carries upon its shorter end the armature p' for the horseshoe-magnet m. A spring p^2 normally holds the bolt h^2 out of engagement with the notched member b^2. The parts are normally in the position shown in Fig. 5, at which time the circuit through the shunt f^6 is normally broken by the switch shown in Fig. 6. This switch is provided with a lever q, adapted to be drawn into engagement with the stationary contact q' by a spring q^2, but normally held in inoperative position when the door is closed by the engagement of a door with a rod q^3. Upon the opening of the door the spring q^2 moves the lever q to operative position and closes the circuit through the shunt f^6, and therefore through the coils of the magnet m, whereupon the armature p' is attracted to the magnet and the bolt h^2 is permitted to drop in the notch of the member b^2 of the controlling mechanism.

As it might happen that a door should be accidentally opened when the car is midway between the landings and the bolt is caused to engage the member b^2, the switch o is provided in order that the circuit through the shunt f^6 may be temporarily broken to permit the car to proceed upon its way or to approach the open door for the attendant to close it.

In lieu of a better term I have called the switch o the "automatic" switch in the sense that it returns automatically to initial position when released by the attendant, and thereby distinguish it from the main switch k, which remains in either position to which it is moved.

It will be observed that the same multiplication of movement is effected by the lever p, as is secured in the lever n' in the apparatus shown in Fig. 3.

Thus far the lock has been illustrated as engaging the member b^2 on the wheel b; but it is evident that a hand lever or wheel on the car might be locked without departing from the invention.

In Fig. 9, r indicates a hand-lever which through a proper connection (not shown) controls the motors by which the elevator-car is raised or lowered. This lever moves in a curved guide s and is provided with a notched locking member r', as shown in Fig. 10. Passed through an aperture in the curved guide s is a locking-pin t, adapted when raised to enter the notch in the member r'.

It will be observed from Fig. 11 that the member r' is curved or beveled, as at r^2, on either side of the notch r^3, so that if the lever should be moved toward the member or bolt t when the latter is raised the beveled portion r^2 of the member r' would force it down until it registers with the notch r^3. Loosely connected to the lower end of the bolt or member t is a lever t', fulcrumed at t^2 on a plate t^3, secured to the interior of the car and resting against an adjustable stop t^5. Secured to the said lever is the armature t^6 of an electromagnet t^7, inserted in the shunt-circuit f^6, which includes the door-actuated switches. The shunt-circuit f^6 includes the self-closing or automatic switch o, as previously described, and the circuit f' includes the main switch k, both switches being located upon the car.

In lieu of the lamp e', as described, the system illustrated diagrammatically in Fig. 9 includes a lamp e^2 in the circuit f', which lamp is placed in the top of the car and is employed for lighting the car itself.

Like the system illustrated in Fig. 5, the shunt-circuit f^6 is normally open, so that when one of the landing-doors is opened the electric current will flow through the shunt-circuit f^6 and by energizing the electromagnet t^7 effect the locking of the lever r.

It will be understood that where any part of the circuits includes apparatus on the elevator-car the conductors will pass to said car through suitable cables attached thereto.

In all of the different embodiments of the invention there is preserved the main circuit $d\,d'$, the branch circuit f', including a lamp upon which it is dependent for lighting some dark place in the building, two shunt-circuits in multiple with each other and in series with the lamp, one shunt-circuit including a rheostat or other resistance and the other including the locking portion of the safety device, and the door-controlled switches.

By the system as thus described there is utilized a small amount of power from an illuminating-lamp circuit. This small amount of power is sufficient without materially diminishing the illumination of the lamp to operate the elevator safety device or any other mechanism requiring a small amount of power, such as a phonograph, or to recharge a storage battery. As previously stated, the lamp may be situated wherever continuous illumination is required or is beneficial, as in a boiler-room, basement, stairway, or in the elevator-car itself. In every case the breaking of the shunt-circuit f^6, whether said circuit be normally opened or closed, causes the current to flow through the shunt-circuit f^3, so that the main circuit f' remains unbroken at all times except when broken by the switch k.

The rheostat is practically in constant electrical connection with the lamp, whereas the circuit, including the door-switches and the

electromagnet, is in intermittent electrical connection with said lamp. In employing the term "intermittent" I do not thereby mean to imply that there is necessarily a regular or unvarying periodicity of electrical connection or disconnection, but that the circuit through said magnet is opened or closed at either regular or irregular intervals, according to the exigencies of the case.

I do not herein claim the elevator safety device *per se*, as it forms the subject-matter of the copending application of myself and Edward L. Hail, Serial No. 100,958, filed April 1, 1902.

Having thus explained the nature of the invention and described a way of constructing and using the same, although without attempting to set forth all of the forms in which it may be made or all of the modes of its use, it is declared that what is claimed is—

1. The herein-described electric system including a main lighting-circuit, a branch circuit including an electric lamp, said branch circuit also having two shunt-circuits, in multiple with each other and in series with the lamp, one of said shunt-circuits having a rheostat or resistance placed therein in constant electrical connection with the lamp, and the other having included therein an electrically-actuated device in intermittent electrical connection with the lamp.

2. The herein-described electric system including a main circuit, a branch lighting-circuit having an electric lamp therein, said branch circuit having two shunt-circuits in multiple with each other and in series with the lamp, one shunt-circuit including a rheostat or suitable resistance in constant electrical connection with the lamp, and the other including a switch, and an electromagnet having an intermittent electrical connection with the lamp for governing an electrically-actuated device.

3. The herein-described system for electric lighting and for electrically actuating a safety device for elevators, the same including a main circuit, a branch lighting-circuit having an electric lamp therein, said branch circuit also having two shunt-circuits in multiple with each other and in series with said lamp, one shunt-circuit including a rheostat or suitable resistance, the other including an electromagnet for governing the safety device.

4. The herein-described system for electric lighting and for electrically actuating a device for elevators, the same including a main circuit, a branch lighting-circuit having an electric lamp therein, said branch circuit having two shunt-circuits in multiple with each other and in series with the lamp, one shunt-circuit including a rheostat or suitable resistance in constant electrical connection with the lamp, and the other including a switch, and an electromagnet having an intermittent electrical connection with the lamp for governing the said elevator device.

5. The herein-described system for electric lighting and for electrically actuating safety devices for elevators, the same including a main circuit, a branch lighting-circuit having an electric lamp therein, said branch circuit having two shunt-circuits in multiple with each other and in series with the lamp, one including a rheostat or suitable resistance, and the other including door-controlled switches, and an electromagnet for governing the safety devices.

6. The herein-described system for electric lighting and for electrically actuating safety devices for elevators, the same including a main circuit, a branch lighting-circuit having an electric lamp therein, said branch circuit having two shunt-circuits in multiple with each other and in series with the lamp, one including a rheostat or suitable resistance, and the other including door-controlled switches, an electromagnet for governing the safety devices, and a switch on the car for breaking said branch circuit.

7. The herein-described system for electric lighting and for electrically actuating safety devices for elevators, the same including a main circuit, a branch lighting-circuit having an electric lamp therein, said branch circuit having two shunt-circuits in multiple with each other and in series with the lamp, one including a rheostat or suitable resistance, and the other including door-controlled switches, an electromagnet for governing the safety devices, and a switch on the car for breaking said branch circuit, said last-mentioned shunt-circuit being normally open and being provided with an automatically-closing switch on the car for temporarily breaking the circuit through the said magnet when the said circuit is closed by the opening of a door.

8. The herein-described system for electric lighting and for electrically actuating safety devices for elevators, the same including a main circuit, a branch lighting-circuit having an electric lamp therein, said branch circuit having two shunt-circuits in multiple with each other and in series with the lamp, one including a rheostat or suitable resistance and the other including door-controlled switches, and an electromagnet for governing the safety devices, said last-mentioned shunt-circuit being normally closed and having a normally open electrical connection with the said branch circuit first mentioned, said last-mentioned electrical connection including a self-opening switch located on the car.

In testimony whereof I have affixed my signature in presence of two witnesses.

GEORGE HAIL.

Witnesses:
HENRY A. GREENE,
AUGUSTA ALLEN.