J. CLOOS.

ELEVATOR SAFETY DEVICE.

APPLICATION FILED OCT. 12, 1908.

925,426.

Patented June 15, 1909.

3 SHEETS—SHEET 1.

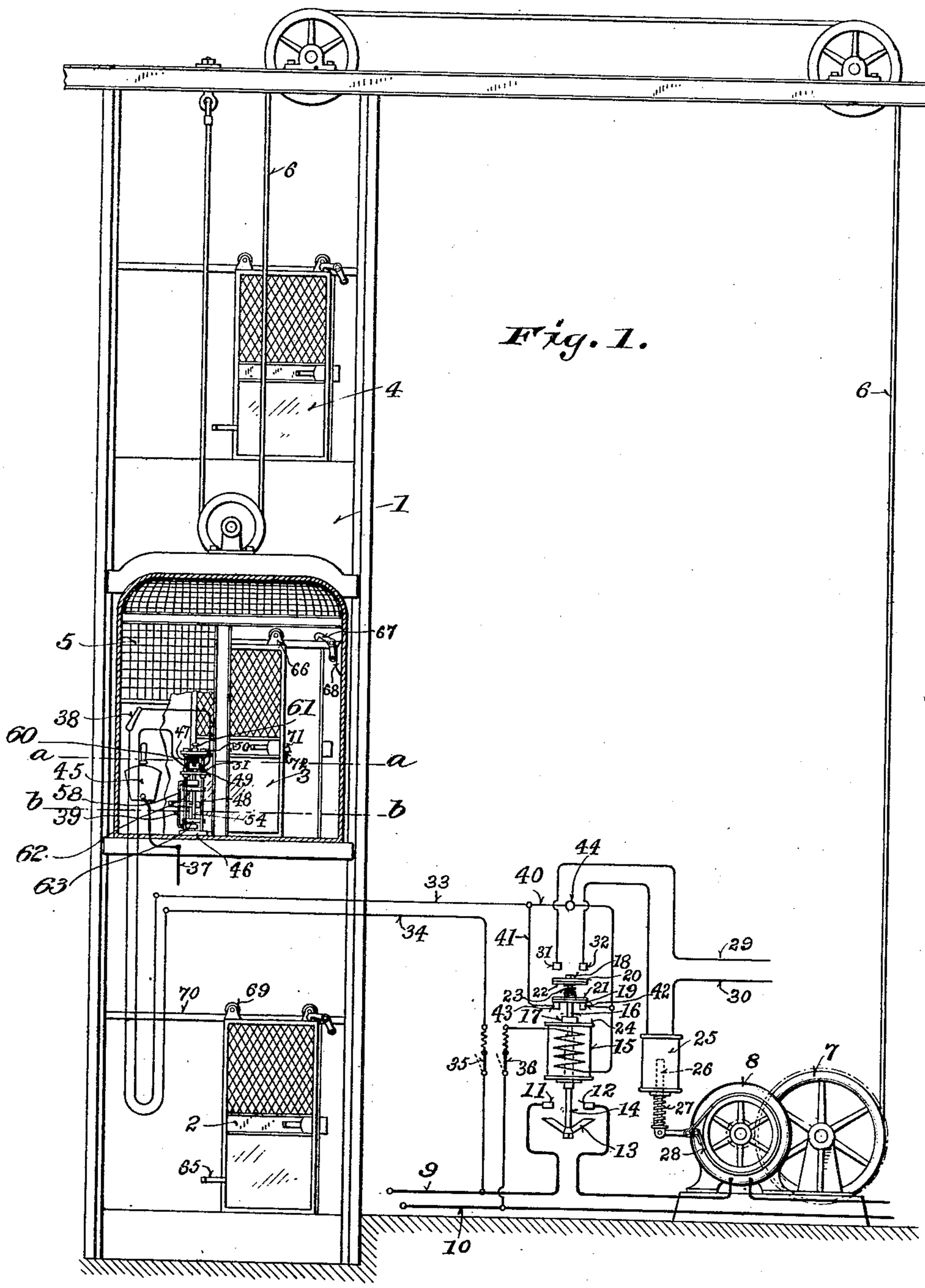

Fig. 1.

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3 SHEETS—SHEET 2.

Fig. 2.

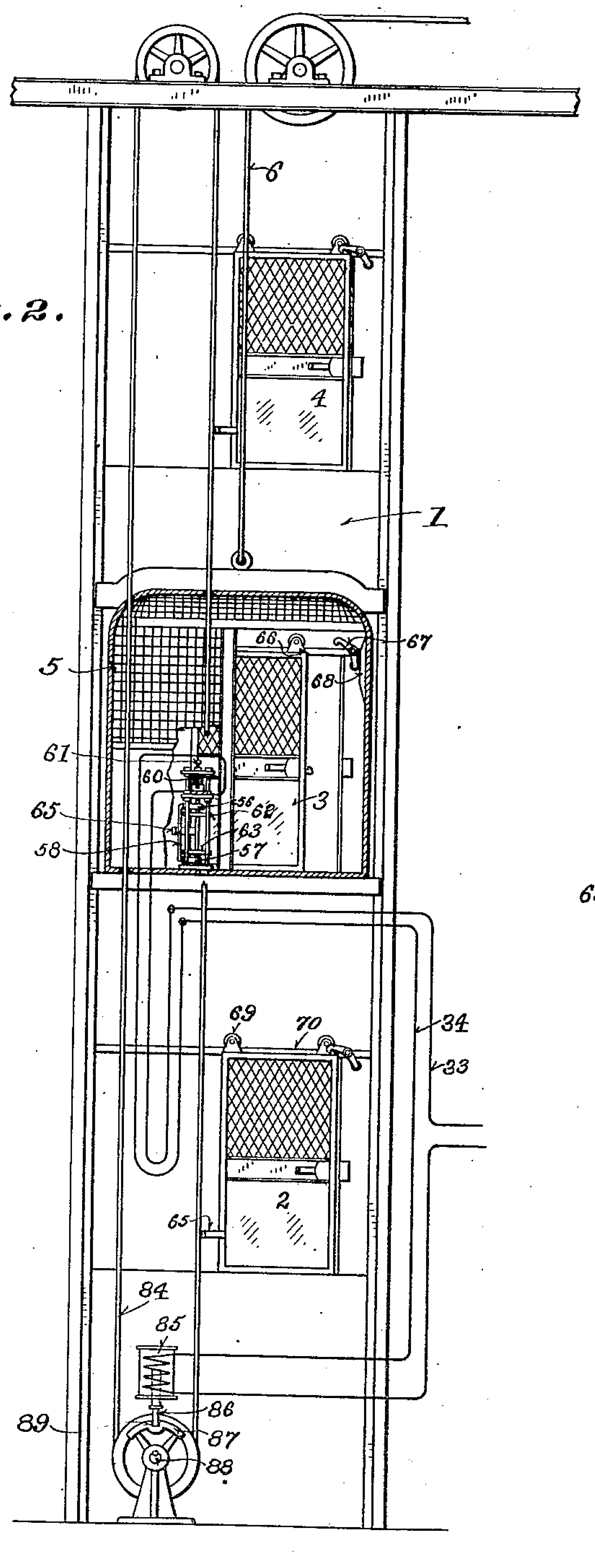


Fig. 5.

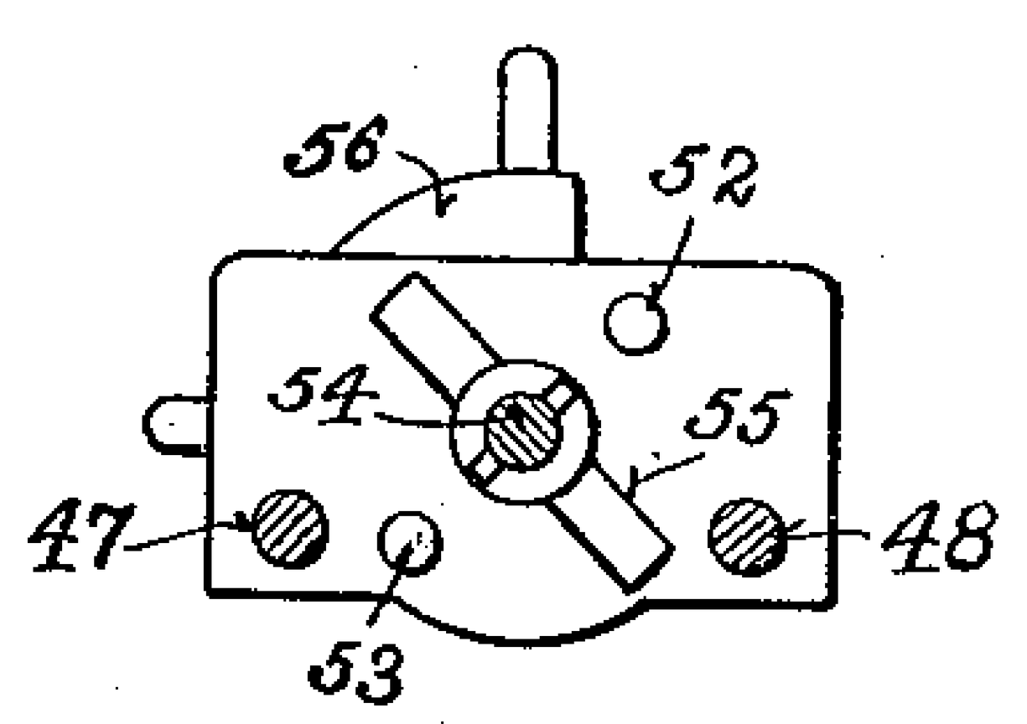


Fig. 6.

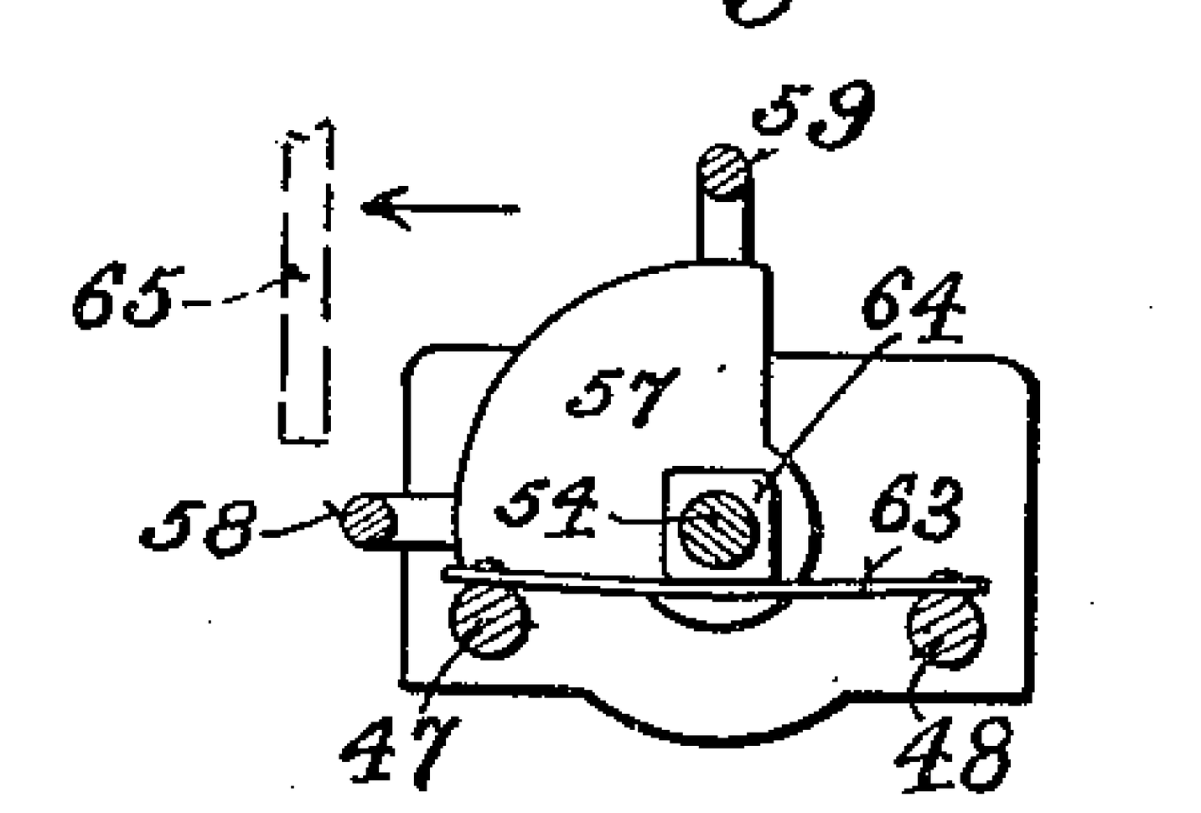
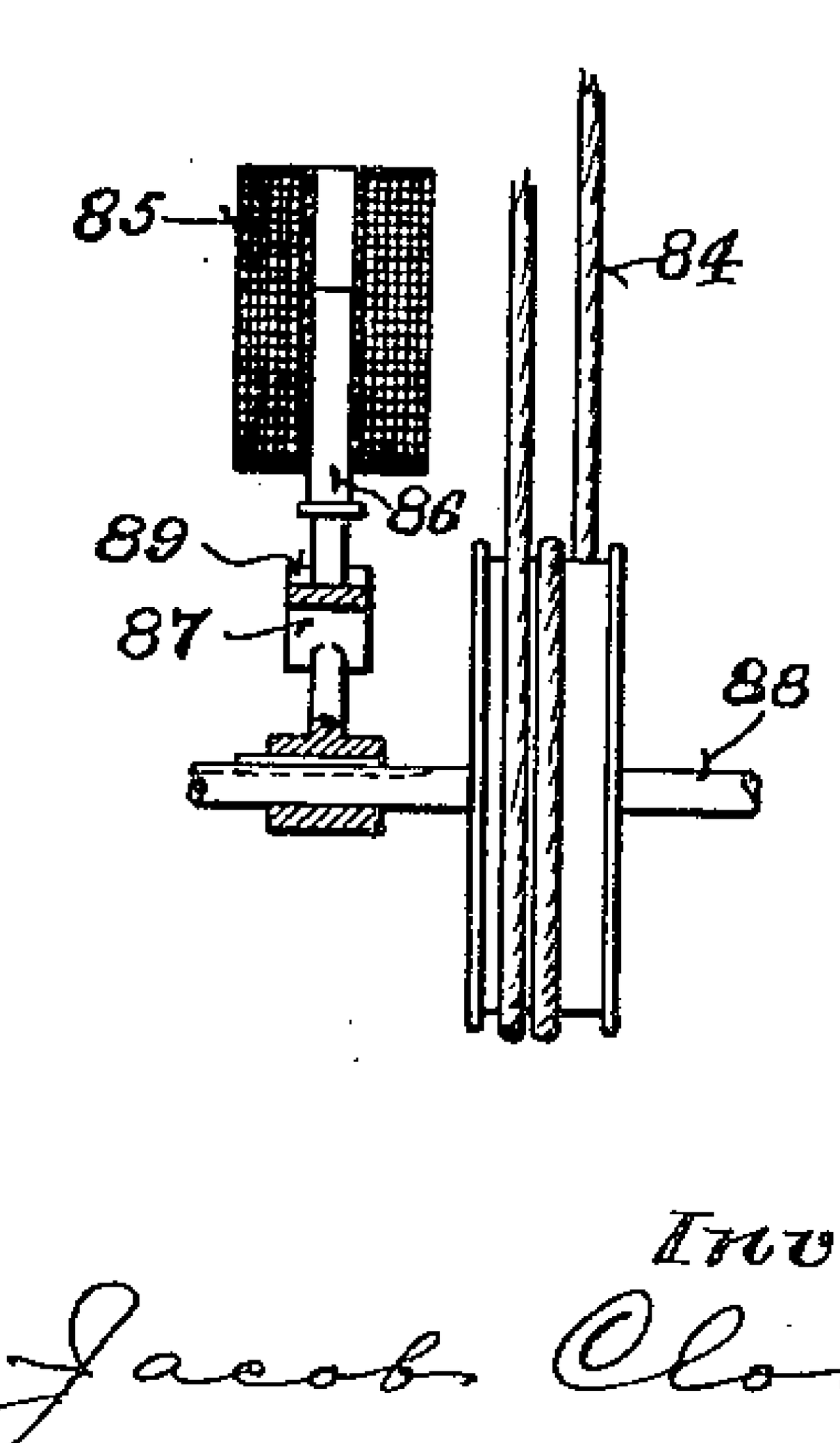


Fig. 4.



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3 SHEETS—SHEET 3.

Fig. 3.

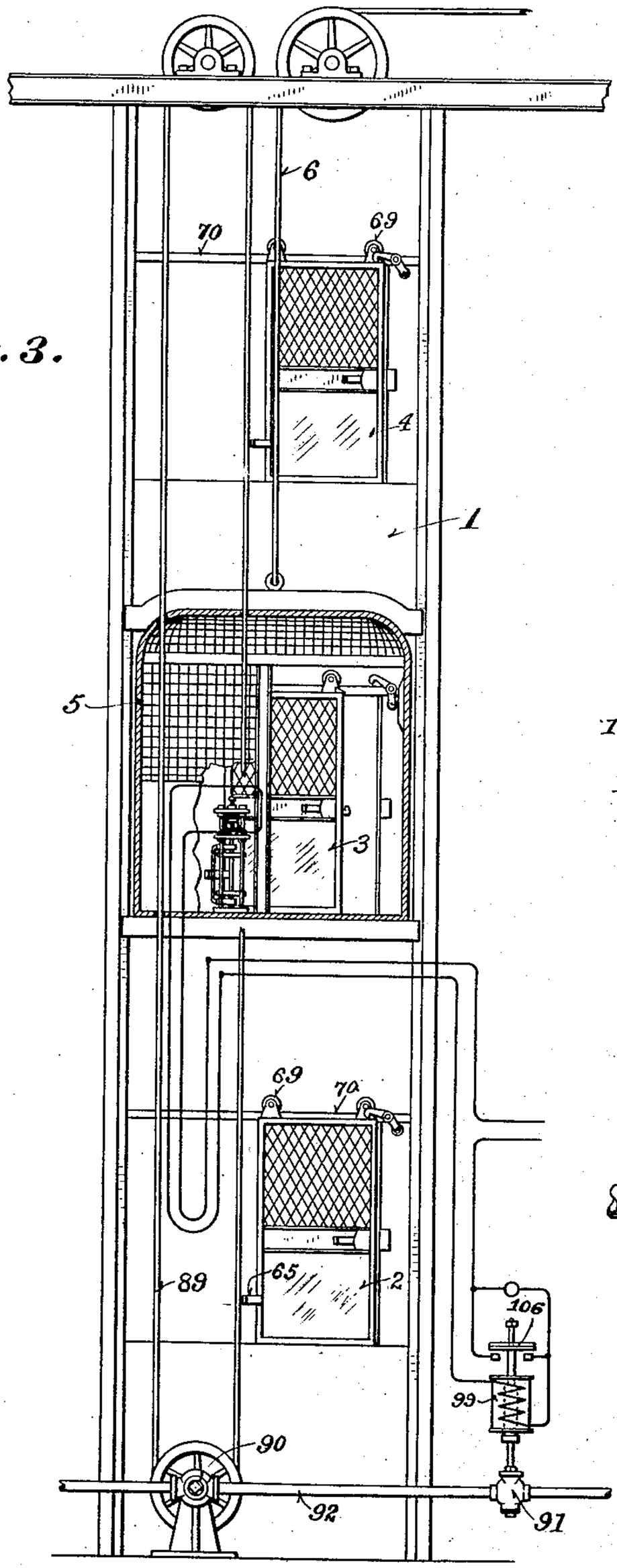


Fig. 8

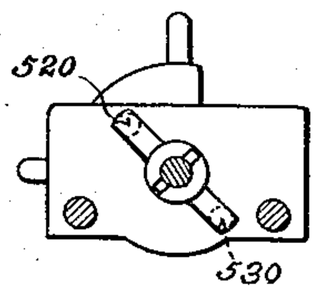
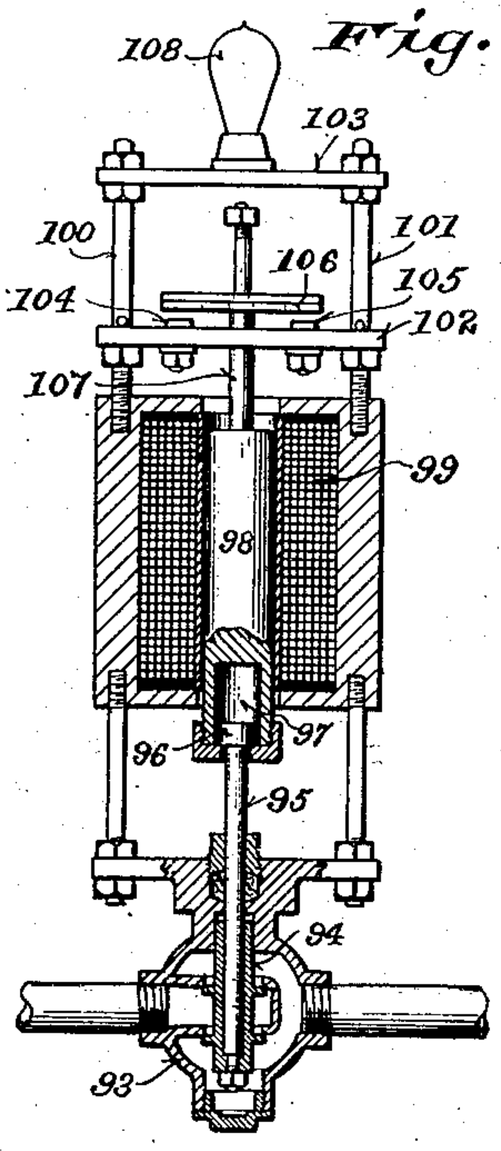


Fig. 7.



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UNITED STATES PATENT OFFICE.

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ELEVATOR SAFETY DEVICE.

No. 925,426. Specification of Letters Patent. Patented June 15, 1909.

Application filed October 12, 1908. Serial No. 457,226.

To all whom it may concern:

Be it known that I, JACOB CLOOS, a citizen of the United States, residing at Milwaukee, in the county of Milwaukee and State of Wisconsin, have invented certain new and useful Improvements in Elevator Safety Devices, of which the following is a specification, reference being had to the accompanying drawing, forming a part thereof.

This invention relates to elevators, and the purpose of the invention is to insure the safety of persons using elevators and persons engaged in duties in or about the same.

This invention relates primarily to the construction and arrangement of controlling apparatus by which accidental or premature movements of the car are prevented, and whereby the elevator car is stopped and held at rest provided any accident occurs to the controlling mechanism, or provided any unauthorized or unexpected interference with said controlling mechanism is consummated. The majority of accidents that occur in connection with passenger elevators are caused by unexpected movements of passengers in attempts to enter or leave the car before the doors are properly closed, or are caused as the direct result of the doors not being properly closed. Accidents happen with both freight and passenger elevators on account of some unexpected and unauthorized movement of the car whenever duty causes employees to enter the shaft or well of the elevator either above or below the car to make repairs or inspections, or for some other purpose.

It is the purpose of this invention to provide an elevator controlling mechanism which will cause the car to be brought to a standstill if in motion, or will prevent its being moved if at a standstill, unless all of the conditions which have been determined upon as conditions precedent to movements of the car, have been strictly complied with.

It is to be understood that this invention includes any and all kinds of elevator devices or hoisting and lowering mechanism, and the terms used throughout this specification and the claims appended thereto, are used in their broadest significance and are not intended to limit the invention disclosed by this specification and the drawings to the specific structures and forms of apparatus disclosed and described, except as such specific structures and forms are included in and made a part of some of the claims.

This invention broadly considered, comprises the combination with an elevator car and its moving mechanism, of an auxiliary independent electric circuit having included therein switches and electro magnetically operated mechanism by which the elevator moving mechanism is rendered inoperative when a switch is opened provided the apparatus is arranged on the closed circuit principle, or when a switch is closed provided the apparatus is arranged on the open circuit principle. Primarily the flow of the electric current through the auxiliary circuit before mentioned is controlled by a door operated switch, but it is to be understood that other switches may be included in said auxiliary circuit, according to the desires and convenience of the user, as for example, the limit switches which are actuated to stop the car at its limits of travel, and a governor actuated switch which is adapted to be opened or closed by variations in the speed or velocity of the car, but as the application of such switches and their use is well known in this art, specific illustration of them has been omitted from the drawings in order that the drawings may be free from all unessential details.

As this invention is adapted to be applied to any of the existing types of elevators and elevator installations, the drawings illustrate in a conventional manner, an elevator car, its well or shaft and operating motor, the specific forms illustrated being adopted on account of their simplicity and for the sake of clearness of disclosure.

Ordinarily passenger elevators are operated in a shaft or well, access to the interior of which is obtained through doors located at the several floors or landings and the elevator car proper may be provided with a door or not, but it is to be understood that wherever in this specification and the claims appended hereto the word "door" is used, it is to be understood as referring either to a door, a gate, or any equivalent device.

Generally speaking, this invention provides means independent of the car operating means, by which through the establishing or disrupting of the circuit in the auxiliary circuit heretofore referred to, the car operating mechanism is capable of being controlled

and started or stopped in the usual manner, or is rendered entirely inoperative, until the predetermined conditions which are conditions precedent for movements of the car, have been complied with.

Referring to the drawings which accompany this specification and form a part thereof, which drawings disclose an embodiment of this invention and on which drawings the same elements are designated by the same reference characters wherever they may appear in each of the several figures, Figure 1 is an elevation of an elevator shaft, car and related mechanism, parts being shown in section, showing the preferred embodiment of this invention; Fig. 2 is an elevation similar to Fig. 1 but showing a modified arrangement of apparatus; Fig. 3 is a view similar to Fig. 1 but showing a further modification; Fig. 4 is an elevation partly in section of the solenoid and associated parts shown by Fig. 2; Fig. 5 is a plan view, parts being shown in section, of the preferred form of switch taken on the line *a a*, of Fig. 1; Fig. 6 is a plan view, parts being shown in section, of the preferred form of switch taken on the line *b b*, of Fig. 1; Fig. 7 is a sectional view of the controller valve and solenoid shown by Fig. 3; and Fig. 8 is a view similar to Fig. 5 showing a modification of the preferred form of switch.

Referring specifically to the drawings, the numeral 1 designates an elevator shaft or well provided with doors 2, 3 and 4, a car 5, operated by the cable 6, winding drum 7 and electric motor 8, all of these parts being of any ordinary or preferred construction. The motor 8 is supplied with electric current by the wires 9 and 10, which in practice lead to a switch board (not shown) whereby they may form a continuous circuit with the source of supply of electrical energy. One of these conductors, as for example 9, is severed and provided with contacts 11 and 12, which are adapted to be bridged by the switch 13, said switch 13 being preferably united to the core or iron armature 14 of a solenoid 15. The iron armature of the solenoid 15 is provided with a brass extension 16, which is provided with a projection or collar 17, and a head or nut 18. Upon the brass extension 16 are carried contact plates 19 and 20, backed by insulation 21 and 22, and a spiral spring 23 is interposed between said plates to force them apart. The brass extension 16 is preferably of a rectangular shape in cross section, and is retained against rotation by passing through a rectangular aperture in the insulating cover 24 of solenoid 15.

The numeral 25 designates a solenoid magnet provided with an armature 26, said armature being normally forced out of said solenoid by the spiral spring 27 to set a brake 28 to prevent the drum 7 from being rotated. The electric current is supplied to solenoid 25 by wires 29 and 30 which lead to the switch board (not shown) or other source of supply for electrical energy, the circuit formed by wires 29 and 30 being interrupted and contact points 31 and 32 being provided and adapted to be bridged by the contact plate 20, whereby the solenoid 25 will be energized and its armature 26 will be drawn in, compressing the spring 27 and releasing the brake 28.

The wires 33 and 34 form the independent auxiliary circuit hereinbefore referred to, and the current of electrical energy for this auxiliary circuit may be obtained from any suitable source of supply, as from the switch board for example, but for the purpose of illustration it is shown as derived from the wires 9 and 10, switches 35 and 36 being provided to make or break the circuit at will as desired. This auxiliary circuit formed by the wires 33 and 34, is led to the car by being attached to the ordinary controlling cable 37, leading to the car, or as a separate cable, as convenience may dictate, and included in this auxiliary circuit on the car is a switch 38 adapted to be manually operated, and a switch 39 adapted to be actuated by the doors (of the elevator shaft for example, as shown). The wire 33 is shown as provided with two branches 40 and 41, the branch 40 being provided with a contact 42, and the branch 41 being provided with a contact 43, which are adapted to be bridged by the plate 19, a lamp or other suitable resistance 44, being interposed in the branch 40, the purpose of this construction being to supply the full current through the branch 41, contact points 43, 42 and plate 19, to the solenoid, to move the switch 13 into contact with the contact points 11 and 12, but when the switch 13 is almost in contact with the points 11 and 12, the collar 17 will contact with plate 19 and interrupt the circuit between contact points 42 and 43, so that the only current that will pass through the solenoid is the current through branch 40, which is diminished on account of the resistance of the lamp 44.

It will be apparent from an examination of Fig. 1 of the drawings that unless the auxiliary circuit is continuous, the switch 13 will remain in the position shown, but if the door 3 is closed the circuit will be completed through the auxiliary circuit (in a manner presently to be described), the solenoid 15 will be energized, its armature 14 will be strongly attracted and the switch 13 will be moved toward the contacts 11 and 12, but before contacting therewith the circuit through branch 41 will be broken by the plate 19 being moved from the contact points 42 and 43 by the collar 17, but enough current will flow through the branch 40 and resistance 44 to complete the closing move-

ment of switch 13 and to hold switch 13 in contact with contact points 11 and 12, whereupon the motor 8 will be responsive to the manipulation of the controller switch 45 in the car, in the usual manner. Before the switch 13 is quite contacted with the contact points 11 and 12, the plate 20 will have contacted with the contact points 31 and 32 (it being understood that plates 19 and 20 are freely movable on the brass extension 16 and are separated by the action of the spring 23), thereby closing the circuit through wires 29 and 30 and energizing the solenoid 25 whereby the brake 28 is released to permit the motor 8 to respond to the controlling movements of the car controlling switch 45. By referring to the same figure it will be seen that if the car 5 is in motion, and the manually operable switch 38 in the car is opened, disrupting the circuit in the auxiliary circuit, switch 13 will fall away from contact points 11 and 12, thereby breaking the circuit through the motor and at the same time plate 20 will drop away from contact points 31 and 32, breaking the continuity of the circuit through wires 29 and 30, causing the demagnetization of solenoid 25 and the setting of the brake 28 by the spring 27. It will also be seen that when the car is opposite a landing and a door, as for example the door 3, is open, the current through the auxiliary circuit represented by the wires 33 and 34 will be disrupted as the result of the opening of the door, provided switch 38 is closed, and the circuit through the motor will be broken and the brake set in the manner just described in connection with the opening of switch 38.

The preferred form of door operated switch 39 comprises a bottom plate 46, carrying two uprights 47 and 48, to which are secured cross pieces 49 and 50, the cross piece 49 being provided with a suitable insulator, as 51, through which project the contact points 52 and 53, which form terminals for the wires 33 and 34 of the auxiliary circuit. A rod 54 is secured in the bottom plate 46 and the member 49, so as to be rotatable, and is provided with a switch 55 which is adapted to contact simultaneously with the contact pieces 52 and 53 in order to complete the circuit through the auxiliary circuit composed of wires 33 and 34, &c., or to interrupt the continuity of the circuit therethrough. Secured to rod 54 are a couple of quadrant shaped members 56 and 57, to which are secured the vertically extending rods 58 and 59, located in planes which are substantially at right angles each to the other.

The numeral 60 designates a spring bearing against rod 54 and adapted to yieldingly retain switch 55 against contact points 52 and 53, the tension of spring 60 being adjustable by means of the set screw 61.

The numerals 62 and 63 designate flat spring pieces which may be secured to rods 47 and 48 and bear against angular shaped members 64 secured to rod 54, the effect of this construction being to cause a quick or snap action of the switch 55 when it is moved on to or away from contact points 52 and 53. The several doors are provided with projecting lugs 65, which are extended so as to contact with either the rod 58 or the rod 59 as the door is opened or closed, this construction being clearly illustrated by the drawings.

In order to further insure the safety of elevators, means are provided for retaining the doors of the shaft normally locked in their closed position, said means being rendered inoperative when the car is opposite a particular landing and in a position to take on or discharge passengers. These means in their simplest form include a lug 66 carried by a door, a pivoted latch 67 adapted to normally rest against said lug, and a cam member 68 carried by the car and adapted to release said latch from said lug. The cam 68 is provided with inclined ends and a vertically disposed portion between said inclined ends of just sufficient length to permit a door to be opened when the floor of the car is within, say, two or three inches above or below exact register with the floor.

The doors to elevator shafts are usually provided with a latch in the nature of a hook with the point of the hook extended downwardly, and these doors moreover, are usually hung by rollers 69, which are adapted to roll upon tracks 70. With doors of this construction it is possible for unauthorized persons to open the doors and gain access to the interior of the elevator well by merely lifting the doors sufficiently so that the hook on the latch is lifted above its retaining plate, when the door can be easily opened.

This invention provides a latch for elevator doors of improved construction, the hook 71 on the latch 72 being extended upwardly instead of downwardly, consequently a door cannot be opened by lifting it, and of course it is impossible to open it by depressing the door, as it is firmly supported by the rail or track 70.

Of course it is to be understood that the drawings accompanying this specification only illustrate diagrammatically and conventionally elevator structures, and it should be understood that the electric wiring shown by the several figures of the drawing is intended to be illustrative merely. For example, the motor connections shown by Fig. 1 will in practice be so connected through a switch board with the source of electrical energy that the auxiliary circuit or safety circuit can be cut out of the system at the switch board in an emergency, as in the case of a fire in the building in which the elevator is located. These arrangements however, are perfectly well understood to persons skilled in the ele-

vator art, and are not illustrated and described in detail, as they form no part of this invention.

The general scheme of an auxiliary circuit which includes safety switches or devices for controlling the operation of the motor heretofore described, is susceptible of various adaptations,modifications and arrangements in different installations. As before stated, limit switches may be included in the auxiliary circuit. A governor actuated switch, a slack cable switch, or any one or more of these or similar devices may be included in the auxiliary circuit, the only objectionable feature encountered in including a large number of separate switches in the auxiliary circuit is due to the fact that unless carefully inspected and attended to, resistance results, which is undesirable.

While it is possible and feasible to introduce in the auxiliary circuit switches of the character just enumerated, it is objectionable to do so, and it is preferred that no such switches be included in the auxiliary circuit other than the door operable switch carried by the car, as switches not only introduce resistance into the auxiliary circuit, but each switch is a danger point menacing the practical and continuous operation of the elevator car, and as many elevators are required to be kept in constant and continuous operation throughout the greater part of the day, and as the elevator capacity of buildings is usually taxed to the utmost, it is absolutely essential to the commercial and practical success of any safety device or mechanism which is to be added to an elevator equipment, that the liability of loss of use of the elevator while under the control of the safety device or mechanism, shall be reduced to a minimum. By including in the auxiliary circuit only a door operable switch carried by the car and a circuit breaking switch, as for example, the switch 38, carried by the car, the danger points are reduced to a minimum in the circuit and those points are always under the eye of the operator of the car, so that if any trouble occurs at those points the source of the trouble can be readily detected and removed without throwing the car out of commission.

Fig. 2 illustrates an application of this invention to an elevator provided with a cable 84, to control the operation of the elevator no matter what the motive power may be, whether steam, water or electricity, the cable 84 being grasped by the operator of the car and moved up or down as the case may be, to cause the elevator to move up or down, and the auxiliary circuit formed by the wires 33 and 34 in this case includes a solenoid 85 provided with an armature 86, or any equivalent form of electro-magnetic mechanism, a sector 87 being provided on the shaft 88, which shaft is rocked by the cable 84 and controls the action of the motive power to move the elevator car. The sector 87 is provided with a recess 89, into which the lower end of the armature 86 is adapted to drop, whereby the armature 86 serves as a detent or pawl and prevents the shaft 88 being rocked by the cable 84. In an installation of this specific character it is advisable that the solenoid be placed above the sector, as shown by Fig. 2 of the drawings, so that the armature 86 will drop by gravity and engage in recess 89 if any accident happens to the auxiliary circuit, and with the parts so arranged it will be observed that the circuit through the auxiliary circuit must be established and maintained while the doors are closed, as in an installation of the character shown by Fig. 1 of the drawings.

Fig. 3 illustrates another specific installation provided with this invention, in this case the elevator being a hydraulic elevator and the movements of the car being controlled by the cable 89 and pilot valve 90, the pilot valve being of any preferred or ordinary type.

The numeral 91 designates a stop valve interposed in the pipe 92, the thoroughfare through which pipe is controlled by the pilot valve 90. This stop valve 91 may be of any suitable or preferred construction, and is shown as provided with a shell 93, a valve plug 94 and valve stem 95, the end of the stem 95 being preferably provided with a head 96 inclosed within a cavity 97 formed in the end of the armature 98 of the solenoid 99, the cavity 97 being of greater length than the length of the head 96, to provide for relative movement of the armature with respect to the head 96, whereby a hammer blow is given to the valve stem 95 when the armature 98 is moved to open or close the valve.

The solenoid 99 is preferably provided with supports 100, 101, which carry plates 102, 103, the plate 102 being provided with contact points 104, 105, adapted to be bridged by the switch 106 carried by a brass extension 107 secured to the armature 98. The plate 103 supports a lamp or other suitable resistance 108, similar to and for the same purpose as the lamp or resistance 44 above referred to. With this specific installation as shown by Figs. 3 and 7, the circuit in the auxiliary circuit must be closed when the doors are open, so that the contacts of the switch 39 will be arranged as shown by Fig. 8.

The switch shown by Fig. 8 is the same as that shown by the other figures of the drawing (see Fig. 5) except the contacts 52 and 53 (Fig. 5) have each been moved through an arc of 90°, as will be readily apparent from an inspection of these two figures, the contacts being designated 520 and 530 respectively on Fig. 8. So that with the switch thus modified, when a door is opened the

auxiliary circuit will be closed, and when the door is closed the auxiliary circuit will be opened causing the stop valve 91 to be opened and permitting the water to flow through pipe 92 to pilot valve 90.

It will be readily understood from an inspection of Fig. 7 of the drawings, that the switch 106 carried by the brass extension 107 of the armature 98, is loosely supported by the brass extension 107, being reduced so as to form a shoulder, and also being provided with a nut whereby the extent of movement of the switch 106 with respect to the contacts 104, 105, is small as compared with the total stroke of the armature 98. The switch 106, Figs. 3 and 7, is provided for the same purpose and operates in the same manner as the plate 19, Fig. 1, to permit the full current to pass through the solenoid 99 to realize the maximum pull of the solenoid, and when the armature has nearly completed its movement to break the circuit to diminish the strength of the current by shunting it through the lamp or resistance indicated by the circle Fig. 3, which corresponds with the element designated by the numeral 44 on Fig. 1. It is also to be understood that the sector 87 or its equivalent, and the shaft 88, may be carried directly by the car, as is common in some installations, instead of being placed at the bottom of the elevator well or shaft, as shown.

I claim:

1. The combination with an elevator car, its moving mechanism and the landing doors, of an auxiliary electric circuit, a switch in said auxiliary circuit carried by the car and adapted to be operated by said landing doors, and an electro-magnetic device controlled by said switch for controlling the operation of the car moving mechanism.

2. The combination with an elevator car, its moving mechanism, means for controlling said moving mechanism to operate the car, landing doors, an auxiliary electric circuit, a switch in said auxiliary circuit carried by the car and adapted to be operated by said landing doors, and electro-magnetic mechanism controlled by said switch and adapted to control said car moving mechanism independently of said car moving mechanism controlling means.

3. The combination with an elevator car, its moving mechanism and means for controlling said moving mechanism to operate the car, a landing door, an auxiliary electric circuit, a switch carried by the car and included in said auxiliary circuit, said switch being adapted to be opened and closed by means of said door, and electro-magnetic mechanism also included in said auxiliary circuit adapted to control said car moving mechanism independently of said car moving mechanism controlling means.

4. The combination with an elevator car, its moving mechanism and means for controlling said moving mechanism to operate the car, of a landing door, an auxiliary electric circuit, a switch carried by the car and included in said auxiliary electric circuit, said switch being adapted to be opened and closed by means of said door, and electro-magnetic mechanism also included in said auxiliary circuit and adapted to render said car moving mechanism inoperative independently of said car moving mechanism controlling means.

5. The combination with an elevator car, its moving mechanism and means for controlling said moving mechanism to operate the car, a brake for said moving mechanism and electro-magnetic means for controlling the operation of said brake, of movable landing doors, an auxiliary electric circuit, a switch carried by said car and included in said circuit and adapted to be opened or closed by movements of said doors, and electro-magnetic mechanism also included in said circuit and adapted to render said car moving mechanism inoperative independently of said car moving mechanism controlling means and to control the electro-magnetic brake controlling means to set the brake when the car moving mechanism is rendered inoperative.

6. The combination with an elevator car, its moving mechanism and means carried by the car for controlling said moving mechanism to operate the car, of landing doors, an auxiliary electric circuit, a switch included in said auxiliary electric circuit and carried by the car and adapted to be operated by said doors, and electro-magnetic mechanism adapted to render said car moving mechanism inoperative independently of said car moving mechanism controlling means.

In witness whereof I hereto affix my signature in presence of two witnesses.

JACOB CLOOS.

Witnesses:

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FRANK E. DENNETT.