ELEVATOR CONTROL SYSTEM AND SHAFT DOOR LOCK

Fig. 1

Fig. 2

Fig. 3

Fig. 4

Fig. 5

Fig. 6

INVENTOR.

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ELEVATOR CONTROL SYSTEM AND SHAFT-DOOR LOCK.

Application filed November 12, 1921. Serial No. 514,587.

To all whom it may concern:

Be it known that I, JOHN J. WAY, a citizen of the United States, residing at Edgeworth, in the county of Allegheny and State of Pennsylvania, have invented certain new and useful Improvements in Elevator Control Systems and Shaft-Door Locks, of which the following is a specification.

This invention is for an elevator door lock and control system, and relates particularly to a door lock for elevator shaft doors adapted to be used in conjunction with an automatic controller handle of the type disclosed in my co-pending application Serial No. 470,588, filed May 18, 1921.

In my said application, I have described a safety device for controllers, particularly designed for use on elevators so arranged that operation of the car cannot be effected when a circuit, which is in series with switches arranged to be closed upon the closing of elevator shaft doors, is broken, without making use of an emergency button.

The present invention contemplates the provision of a door locking mechanism arranged to normally prevent the doors from being opened except when the elevator is at the floor level, and which door locking mechanism may also actuate switches to be connected in circuit with my controlling device as above.

The invention has for its principal objects to provide an improved door locking mechanism for normally preventing the door from being opened, except when the elevator is at the floor level, but which will be ineffectual when emergencies arise that cut off the supply of electricity for the locking circuit, so that, for instance, in the event of fire or other accident, cutting off the supply of electricity, the doors may be opened.

Further important objects are to provide a locking device which is fool-proof, and which cannot be tampered with by the operator, and which is positive in its action, and to provide means in the car operable in an emergency for opening doors under abnormal conditions when the car is not at floor level.

These and other objects are attained by my invention as hereinafter more fully explained in connection with the accompanying drawings, which illustrate somewhat diagrammatically my invention, and in which:

Fig. 1 is a front elevation showing a part elevation of an elevator shaft door with my improved locking means and circuit closing device attached thereto;

Fig. 2 is a diagrammatic view of an elevator shaft showing the door lock controlling circuits;

Fig. 3 shows a detail view of a switch and means on the elevator for actuating it;

Fig. 4 is a detail view of a controller equipped with the safety device described in my said co-pending application;

Fig. 5 is a modification showing the safety device applied to a hydraulic elevator control mechanism, an end view of the mechanism being shown;

Fig. 6 is a top plan view of the mechanism shown in Fig. 5.

In the drawings, 3 and 5a represent the two door sections of a well known type of door for elevator shafts, showing the doors in closed position. In this type of door, both of the sections are arranged to move in the direction of the arrow shown in Fig. 1, when the door opens, but the section 5 is so arranged or geared, in a manner not shown but well known, that it moves twice as fast as section 5a, whereby the two sections overlap and reach the closed position at about the same time.

Positioned above the doors and secured to the building structure, is a suitable framework or casing 7. Pivotied in the casing at 8 is a locking member or lever 9 having its opposite ends projecting through slots in the casing 8 and having a hook or latch portion 10 on one end adapted to engage the edge of the door section 5, as shown in Fig. 1, or to otherwise engage a part of the door section to normally hold it against movement in the direction of the arrow to open position. Inasmuch as sections 5 and 5a are concomitantly movable, as hereinbefore explained, section 5 cannot be moved while section 5a is held against movement. Lever 9 is so pivoted that the end 9a overbalances the other end carrying the latch portion 10.

Within the casing 8 and secured thereto is an electro-magnet 11 having its pole arranged to contact with a part 12 of the lever 9 when the lever 9 is in locking position.

Any suitable means may be employed for raising the lever 9 to locking position. As shown in the drawings, this means com-
prises a second locking lever 15 pivoted at 16 between its ends to the door section 5. One end of this lever 15, designated at 15a, is arranged to normally extend under the outer end 9a of the lever 3 and to engage the casing 8, as shown. On the opposite end of lever 15 is a depending operating rod 17 which is vertically reciprocable in guide members 18 on the door section 5.

When the rod 17 is lifted, the lever 15 is rocked so that the end 15b disengages the casing 8, and if the latch 10 is released, the door may be opened by then pulling on the rod 17. The rod 17 acts as a spring to return the end 15a of lever 15 to the normal raised, locked position.

In operation, magnet 11 serves to hold the lever 9 in raised position, that is, locked position, as long as it is energized. Therefore, even though the operator raises rod 17 to move lever 15 to unlocked position, the door cannot be opened. If, however, the magnet is de-energized when or after the end 15a of lever 15 has been rocked down, it will release lever 9 and the end 9a being heavier will drop, raising the latch 10 out of locking position, and the door may be opened. When the door sections are again closed, end 15a of lever 15, being raised by the weight of rod 17, lifts up on the end 9a of lever 9. It will, therefore, be seen that the doors may only be opened when the magnet 11 is de-energized. Means, hereinafter described, are provided for normally de-energizing the magnet 11 only when the car is at the floor level.

Also mounted in the casing 8 is a switch block having a contact 20 thereon. On the arm 9 is a second contact member 21 arranged to close a circuit when the lever arm 9 is in locking position, but to open it when the lever is in unlocked position.

On the controller or some part of the controller mechanism, is an electro-magnetically operated safety device of the type shown in my co-pending application hereinafter referred to. As shown in Fig. 4, it comprises the usual controller for electric elevators, consisting of a casing 22 containing the usual contact mechanism operated upon rotation of a shaft 23. Crank 24 is provided for transmitting motion from the crank to the shaft through a reciprocable pin 25 normally held into a recess in the shaft 26 by a light spring 26a and an electromagnet 27 mounted to move with the handle.

If the crank is moved when the magnet 27 is de-energized, pin 25 will lift out of the recess in the shaft against the compression of spring 26 due to the shaft 26 being held in neutral position by springs. When the magnet 27 is energized, the shaft and crank may be moved together, the magnet functioning to hold the pin 25 against movement so as to keep the end of the pin in the recess in the shaft, and thereby hold the shaft and crank against relative movement. In Fig. 4, I have illustrated diagrammatically a circuit for the magnet 27, the door lock magnet circuits or the safety switch not being shown, the complete wiring diagram being present in Fig. 2.

In Fig. 2, A, B, C and D represent doors at different floors in a building, and above each door is the locking means hereinbefore described. E is the elevator having a controller which is provided with a safety mechanism just described. Two current supply lines are designated by 30 and 30'. Line 30 is connected by line 31 to the controller safety coil 27a and from the other side of the coil is a wire 32 leading through a normally closed switch 33 of the push button type, thence through line 34 into the first of the door safety locks at door A.

The door lock coils 11 and the door lock controlled switches 20-21 are all connected in series by wires 35, and the circuit is completed to line 30' through wire 36. A resistance, which may be a rheostat, may be included in the circuit, as at 37, to properly regulate the flow of current through the circuit. This is important where the building has but few floors and the supplied voltage is high. With the circuit described, the car cannot normally be moved if any door is open.

An emergency circuit is provided for enabling the car to be moved when one or more of the doors are open. This comprises a line 38 connecting on line 34 near switch 33 which is in the car, push button 39 and line 40 connecting to wire 39'. When the push button is pressed, the door lock circuit is shunted, but the magnet 27 is in circuit, and the car may be moved. In the elevator shaft at each floor is a switch 41 arranged to be closed by suitable means, such as a roller 42 on the car, which roller pushes in on a switch operating surface 43. This switch is so positioned that it is closed only when the car is at the floor level. The switch is connected by wires 44 and 45 to the line 34 at each side of the magnet 11, so that the closing of the switch de-energizes magnet 11 by shunting the circuit around it, allowing the door to be opened as hereinbefore explained.

It is contemplated that the switch 41 might be so arranged that it would not close unless the car were brought to a stop. Such an arrangement is illustrated in Fig. 3, in which the roller 42 is carried on a reciprocable rod 42'. A spring 42a serves to hold the roller in a normally retracted position, in which position it will not engage the shoe 43. An electromagnet 42b is provided, however, to project the roller into operating position. This magnet may be connected in a suitable circuit with a con-
Controller operated switch indicated at 42, and which is closed only when the controller is moved to neutral position at the floor level for stopping the car.

When switch 33 is opened, the circuit through all the magnets 11 is broken, so that the doors can be opened when the car is not at floor level, but when this switch is opened, magnet 27 being on the same circuit is also de-energized and the car cannot be moved. The switch 33, therefore, provides a safe means for opening the door when the car is not at floor level, but is useful only in emergencies, such as when inspecting or repairing the doors, and is so positioned as to be inconvenient to the operator for normally running the car.

The car is operated in the usual manner. When the floor at which the car stops is reached, the operator returns the control lever to its neutral position to bring the car to a stop. If the car stops at the floor level, the doors may be opened upon the operator pulling down on rod 17 and then pulling the door sideways to open it. Once the door has opened, the car cannot be moved without closing the door to close switch 20—21, or without pressing the emergency button 39, which is also conveniently positioned for ordinary running.

Since lever 15 cannot raise the end of lever 9 until the door section 56 is in fully closed position, the switch 20—21 will not be closed until the door is locked, and the operator cannot ordinarily move the car, or throw the controller into an on position until the door has been locked. Neither can the switch 20—21 be closed until the door has been closed by reason of the latch 10, since engaging the arm 19 in such manner as to prevent movement thereof until the latch has dropped over the edge thereof into locking position. As the electro-magnets 11 act only to hold the latch from releasing while the current is passing therethrough, while the parts are returned to locking position mechanically, the action of the lock is positive. Furthermore, in the event of any accident by which the circuit through the locks might become broken, the doors may be opened, and passengers need not be trapped.

The electro-magnetic connection between the controller handle and controller, as explained in connection with Fig. 4, may be applied also to hydraulic elevators, as shown, for instance, in Figs. 5 and 6. In these figures, 50 is a supporting member having a shaft 51 journaled therein. On the shaft is a hub or sleeve 52, on which is lever or arm 53 for operating the pilot valve of the elevator operating mechanism. A cross arm 54 is secured to the sleeve, and connected with the ends of this cross arm are springs 55, which normally hold the sleeve in such position that the arm 52 is in neutral position, and in this position the springs are not under pressure or tension. The shaft 51 is rotated in any known or preferred way, as by a sheave 56, around which passes a cable 56, the cable being so arranged that it cannot slip relatively to the wheel. The cables are moved up and down to rock the shaft in a manner well understood in the art. Mounted on the hub 52 is an electric magnet 57, and 58 is a reciprocable pin having its inner end normally engaged in a recess in shaft 51, a light spring 59 also being provided for urging the pin into the recess in the shaft. When the shaft is rotated, however, and the coil 57 is not energized, the pin is forced outwardly, due to the resistance offered by springs 54 to the rotation of sleeve 52. If the magnet is energized, the sleeve will rotate with the shaft to effect the operation of the elevator. The operation is identical with the one described in connection with an electric elevator, the only difference being the difference of location of the magnetically operated pin.

While I have shown and described a particular embodiment of my invention, it will be obvious that changes and modifications may be made within the contemplation thereof, and within the scope of the appended claims.

What I claim is:

1. The combination with an elevator shaft door, of a locking device therefor comprising a pivoted lever, locking means thereon, means for moving the lever and locking means into locking position when the door is closed, and an electro-magnet for holding said lever against movement to release the door as long as the magnet is energized.

2. The combination with an elevator shaft door, of a locking device therefor comprising a lever pivoted between its ends, locking means for co-operating with the door on one end of the lever, the other end of the lever being over-balanced to normally urge said locking means out of locking position, means for moving said lever into locking position upon closing the door, and electro-magnetic means for normally holding the lever in locked position.

3. The combination with an elevator shaft door, of a locking device therefor comprising a vertically movable locking means arranged to be gravitated out of locking position, means for moving said locking means into locking position upon closing the door, and means operable by an elevator releasing said locking means.

4. The combination with an elevator shaft door, of a locking device therefor comprising a vertically movable locking means arranged to be gravitated out of locking position, means for moving and holding the
locking means into locking position, and electro-magnetic means for preventing the release of said locking means as long as said electro-magnetic means is energized.

5. The combination with an elevator shaft door, of a locking means for normally preventing the door from being opened, said means comprising a casing, a lever pivoted therein and having one end heavier than the other, locking means on the lighter end of the lever arranged to cooperate with the door when in locked position, vertically movable means on the door arranged to be normally held in raised position to engage said casing and the heavier end of the lever to hold the door locked, means for moving said vertically movable means downwardly to disengage the casing and lever, and an electro-magnet for holding said lever in locked position as long as the magnet is energized.

6. The combination with an elevator shaft door, of a locking device therefor comprising a vertically movable locking means arranged to be gravitated out of locking position, means for moving and holding the locking means into locking position, electro-magnetic means for preventing the release of said locking means as long as said electro-magnetic means is energized, and means adapted to be controlled by the position of an elevator for de-energizing the electro-magnetic means.

7. The combination with an elevator shaft door, of a locking device therefor comprising a vertically movable locking means arranged to be gravitated to released position, means for moving the locking means into locking position, an electro-magnet for holding the locking means in locked position as long as the magnet is energized, and a switch operated by the movement of the locking means.

8. The combination with an elevator shaft door, of a locking device therefor comprising a vertically movable locking means arranged to be gravitated to released position, means for moving the locking means into locking position, an electro-magnet for holding the locking means in locked position as long as the magnet is energized, and a switch operated by the movement of the locking means and in circuit with the electro-magnet.

9. The combination with an elevator shaft door, of a locking device therefor comprising a vertically movable locking means arranged to be gravitated to released position, means for moving the locking means into locking position, an electro-magnet for holding the locking means in locked position as long as the magnet is energized, a circuit for shutting the electro-magnet, and a switch adapted to be operated by suitable means on an elevator for closing the shunt circuit.

10. The combination with an elevator shaft door, of a locking device therefor comprising a vertically movable locking means arranged to be gravitated to released position, means for moving the locking means into locking position, an electro-magnet for holding the locking means in locked position as long as the magnet is energized, a switch operated by the movement of the locking means to open when it moves to unlocking position and to close when it moves to locked position and in circuit with the magnet, a normally open circuit for shutting around the magnet, and another switch adapted to be operated by suitable means on an elevator for closing the shunt circuit to de-energize the magnet.

11. The combination with an elevator shaft having an elevator therein, and a plurality of doors therein, of locking means for each door, electro-magnets for each locking means for preventing the release of said locking means as long as the magnets are energized, and means for de-energizing the magnets operated by the elevator, said means being so positioned as to effect de-energizing of the magnets only when the elevator is in a proper position relatively to the door to be opened.

12. The combination with an elevator operable in a shaft, of doors in the shaft, locking means for each door, said locking means including a lock member which is moved when the door is closed into locking position, said means being held against movement until the door is closed, a switch operated by said movable lock member, said switch being closed when the member moves to locking position, a controller for the elevator including an operating member and an operated member, and an electro-magnet for operatively connecting the operating and operated member only when it is energized, said electro-magnet being in circuit with said lock operated switch.

13. The combination with an elevator operable in a shaft, of doors in the shaft, locking means for each door, said locking means including a lock member which is moved when the door is closed into locking position, said means being held against movement until the door is closed, a switch operated by said movable lock member, said switch being closed when the member moves to locking position, an electro-magnet for preventing the movement of said lock member to releasing position as long as it is energized, a second switch controlled by the position of the elevator for de-energizing the magnet, said switch being so positioned as to effect the de-energization of the magnet only when the elevator is properly positioned relatively to the doors, a controller for the elevator including an operating member and an operated member, and an electro-magnet for operatively connecting
the operating and operated member only when it is energized, said electro-magnet being in circuit with said lock operated switch. 

14. The combination with an elevator operable in a shaft, of doors in the shaft, locking means for each door, said locking means including a lock member which is moved when the door is closed into locking position, said means being held against movement until the door is closed, a switch operated by said movable lock member, said switch being closed when the member moves to locking position, an electro-magnet for preventing the movement of said lock member to releasing position as long as it is energized, a second switch controlled by the position of the elevator for de-energizing the magnet, said switch being so positioned as to effect the de-energization of the magnet only when the elevator is properly positioned relatively to the doors, a controller for the elevator including an operating member and an operated member, an electro-magnet for operatively connecting the operating and operated member only when it is energized, said electro-magnet being in circuit with said lock operated switch, and an emergency means on the elevator whereby the lock controlling magnets may be de-energized irrespective of the position of the elevator. 

15. The combination with an elevator operable in a shaft, of doors in the shaft, locking means for each door, said locking means including a lock member which is moved when the door is closed into locking position, said means being held against movement until the door is closed, a switch operated by said movable lock member, said switch being closed when the member moves to locking position, an electro-magnet for preventing the movement of said lock member to releasing position as long as it is energized, a second switch controlled by the position of the elevator for de-energizing the magnet, said switch being so positioned as to effect the de-energization of the magnet only when the elevator is properly positioned relatively to the doors, a controller for the elevator including an operating member and an operated member, an electro-magnet for operatively connecting the operating and operated member only when it is energized, said electro-magnet being in circuit with said lock operated switch, an emergency means on the elevator whereby the lock controlling magnets may be de-energized irrespective of the position of the car, and another emergency means for enabling the controlling means to be operated irrespective of whether the door lock operated switches are closed or open.

16. The combination with an elevator shaft having an elevator therein and provided with doors, of a locking means for each door, an electro-magnet for each locking means for preventing the release of the doors as long as the magnet is energized, means for each door for de-energizing the magnet operated by the elevator and so positioned that the elevator will render it effective only when the elevator is in proper position relatively to the door which said means controls, and means whereby said means will be operated only when the elevator is brought to a stop in proper position relatively to the door.

17. The combination with an elevator operable in a shaft, of doors in the shaft, locking means for each door including a lock member which can be moved when the door is moved to locking position only to locked closed position, said means being held against movement until the door is closed, a controller for the elevator, and means actuated by said locked member for normally rendering said controller inoperative until said member has been moved into locked position.

18. The combination with an elevator operable in a shaft, of doors in the shaft, locking means for each door including a lock member which is moved to locking position only when the door reaches fully closed position, a controller for the elevator, and electro-magnetic means actuated by said lock member for normally rendering said controller inoperative until said lock member has been moved to locked position.

19. The combination with an elevator shaft door, of a locking device therefor comprising a movable locking member arranged to be urged out of locking position, means for moving said member into locking position upon closing the door, electro-magnetic means for normally holding the locking member against movement from locked position, and means for rendering said electro-magnetic means ineffective.

20. The combination with an elevator shaft door, of a locking device therefor comprising a movable locking member normally urged out of locking position, means for moving the locking means into locked position upon closing the door, an electro-magnet for normally holding the locking member against movement from locked position while the magnet is energized, means for rendering the electro-magnet ineffective, and a switch operated by the movement of the locking member.

In testimony whereof I affix my signature.

JOHN J. WAY.