April 17, 1962
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3,029,900
ELEVATOR DOOR LOCK
Filed July 10, 1957
6 Sheets-Sheet 4

Fig. VII

Fig. VI

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This invention relates to locks for elevator doors.

Landing door interlocks are conventionally provided in elevator systems to lock the hall doors against movement when the elevator cars are not in positions to receive loads so that no person or object can fall into an elevator shaft through accidentally opened hall doors, and also to control the car doors and motors so that the former are energized and the latter are de-energized when the elevator cars are in positions at the landings to receive or discharge loads. When an elevator car is so positioned at a landing, the landing door interlock automatically unlocks the corresponding hall door and simultaneously energizes the car door motor and de-energizes the lift motor. Such an arrangement, however, is unsatisfactory if it is desired to prevent entrance to the landing of unauthorized persons in elevator systems having elevator cars which open directly into offices, i.e., in order to utilize all available space, many offices are built right up to the elevator landing doors and, therefore, have no doors other than the landing doors which can be locked, for example, at night when the office personnel have gone home.

It is, accordingly, the principal object of this invention to provide locks for elevator doors.

Another object of the invention is to provide, in an elevator system having a landing door, ajar position, and a door operating means, a mechanical lock for one of the doors and means selectively to lock the mechanical lock and disable the door operating means while the car is at a floor.

A further object of the invention is to provide, in an elevator system having door locks, remotely operated means for locking the locks.

Another object of the invention is the provision of means for locking the landing door interlocks in elevator systems.

A still further object of the invention is to provide, in elevator systems having landing door interlocks, remotely operated locks for locking the interlocks.

More specific objects and advantages are apparent from the following description of the invention.

Preferred embodiments of the invention are illustrated in the accompanying drawings in which:

FIGURE I is a simplified schematic view of a landing door at an elevator shaft, the landing door being connected through mechanical linkage to an interlock;

FIGURE I-A is a simplified schematic view of an elevator car which is located in an elevator shaft above the landing door which is illustrated in FIGURE I;

FIGURE II is a greatly enlarged end elevational view, as seen from a position to the right of the interlock which is illustrated in FIGURE I looking toward the interlock, of the interlock at a time when the elevator car shown in FIGURE I is in juxtaposition with the landing door also shown in FIGURE I;

FIGURE III is an enlarged front elevational view of the landing door interlock which is illustrated in FIGURES I and II with its cover plate removed to reveal inner parts;

FIGURE IV is a vertical sectional view taken along the line IV—IV of FIGURE III;

FIGURE V is a vertical sectional view taken along the line V—V of FIGURE III;

FIGURE VI is an enlarged front elevational view of a lock for the landing door interlock, the lock being indicated generally by means of broken lines in FIGURE I to show its location relative to the interlock;

FIGURE VII is an end elevational view of the lock which is illustrated in FIGURE VI;

FIGURE VIII is an enlarged plan view of the lock which is illustrated in FIGURES VI and VII;

FIGURE IX is a schematic view of a modified elevator door lock;

FIGURE X is a schematic wiring diagram of an electrical circuit for operating the modified lock and for disabling the door operating motor while the car is at a floor;

FIGURE XI is a front elevational view of the lock shown in FIGURE VI showing it in its unlatched position; and

FIGURE XII is a front elevational view of the lock showing it in its latched position.

These specific figures and the accompanying description are intended merely to illustrate the invention and not to limit its scope.

Referring to FIGURE I-A, an elevator car 1 is guided, according to usual practice, by hatchway rails 2 running vertically along the sides of the hatchway and engaging guide shoes 3 attached to the car 1. The car is supported by cables 4 running up the hatchway to drive equipment, not shown.

The elevator car 1 is equipped with a door operating mechanism 5 that includes a pivoted lever 6 connected through a link 7 to a first door 8 and through a second link 9 to a second door 10. Since the distance from the fulcrum of the lever 6 to the links 7 and 9 is different the travel of the doors 8 and 10 is different. This allows the doors to overlap each other in open position and close in slightly overlapping position to close the entire door opening of the elevator car 1. The fast moving car door 10 carries a pair of rollers 11 in position to embrace vertically extending vanes 12 one of which is fixed to each hatchway or landing door 13. Only one landing door 13 is shown for simplicity of illustration, it being understood that there is a plurality of landing doors 13 and a plurality of vanes 12 which are embraced by the rollers 11 during travel of the elevator car 1. The rollers 11 and their mounting means are generally conventionally and, therefore, are shown in more or less schematic fashion in FIGURE I-A, a detailed explanation of the rollers being shown and described in copending application Serial No. 490,188 filed February 24, 1955, now Patent No. 2,839,835 granted November 11, 1958. Whenever the elevator car reaches a hatchway entrance from either direction, and a lock 14 for that entrance is unlocked and a landing door interlock 15 for that entrance is unlatched as hereinafter described, movement of the fast moving car door 10 carries a roller 11 against the vane 12 that is fixed to the landing door 13 so that the landing door moves to the left, as viewed in FIGURE I, in unison with the car door 10.

The elevator car 1 is also equipped with an ordinary solenoid-operated retiring cam 16 in position to cooperate during travel of the car with a lock roller 17 on an arm 18 secured to a rock shaft 19 that is rotatably mounted in the landing door interlock 15, it being understood that there is a landing door interlock 15 for each landing door 13 in the elevator system so that the retiring cam 16 may cooperate during travel of the car with a plurality of rollers 17. Normally the cam 16 is in its retired position, as shown in solid lines in FIGURE II, so that during travel of the car 1 it does not touch the roller 17; however, the cam 16 is operated by well-known means so that it is projected and cooperates with a roller 17, as shown in broken lines in FIGURE II, whenever the car 1 is in leveled position at the corresponding floor. Means for operating the retiring cam 16 is not shown because it forms
no part of the invention, an example of a retiring cam-operated elevator door lock being shown and described in U.S. Patent No. 2,484,679 issued on October 11, 1949, to J. J. H. Borden.

Movement of the roller 17 from its position shown in FIGURE II to its position shown in broken lines in FIGURE II rocks the shaft 19 in a direction to turn the lock arm 20 secured to the shaft 19 about the axis of the shaft in a clockwise direction as viewed in FIGURE IV. This, as hereinafter described, automatically unlocks the landing door 13 and simultaneously permits energization of the motor for the drive equipment that is connected to the cables 4. Horizontal movement of the landing door 13 to the left, as viewed in FIGURE I, then is permitted, such horizontal movement driving a lock bar 30, operatively connected to the landing door by pivotally mounted links 22, 23 and 24, in a vertical direction as indicated by the double-ended arrow in FIGURE II.

Referring to FIGURES III-V, the landing door interlock 15 includes a box-like casting 26 having integrally formed sides 27 and a removable cover plate 28. A milled slot 29 in the casting 26 functions as a track for the slide bar 31 mounted lock bar 30 which is pivotally connected at 31 to the upper end of the link 22. Normally, the path of the lock bar 30 is obstructed by a head 32 on the lower end of the lock arm 20, as best shown in FIGURE IV, the head 32 being received in operative position in a cooperating part 33 of the lock arm 20. A stationary cushion 34 in the cooperating part 33 absorbs the shock of the head 32 moving into its locking position.

Movement of the lock roller 17 from its position shown in solid lines in FIGURE II to its position shown in broken lines in FIGURE II rocks the shaft 19 in a direction to turn the lock arm 20 secured to the shaft about the axis of the shaft in a clockwise direction, as viewed in FIGURE IV, to remove the obstructing head 32 from the cooperating part 33 of the lock bar 30 in opposition to a return spring 35 that is compressed between the upper end of the lock arm 20 and the bottom of the casting 26. Removal of the head 32 from its obstructing position permits the lock bar 30 to move upward and the landing door 13, operatively connected to the lock bar 30, can be opened. One of the functions of the landing door interlock 15 is to prevent accidental movement of the landing door 13 when the elevator car 1 is not in position to receive loads to guard against a person or an object falling through such accidentally opened landing door into the open elevator shaft. Without the lock roller 17, it is possible for the elevator car 1 away from the lock roller 17, the landing door 13 already being automatically shut by the car door 10 at such time, the return spring 35 urges the head 32 on the lock arm 20 into its obstructing position, the lock bar 30 being moved to its lowestmost position, i.e., the one shown in FIGURES III and IV, by means of its operative connection to the now closed landing door 13. With the head 32 on the lock arm 20 held in obstructing position by the spring 35, no one, for example, by leaning on the landing door 13, can open the door.

Should the lock bar 30 somehow get broken, a safety pin 36 in the lock bar 30 will catch on a boss 37 in the casting 26 and prevent the lock bar 30 from falling out of the slot 29 down the hatchway, an angle bracket 38, attached to the boss 37 by screws 39, limiting movement of the lock bar 30 in the slot 29 transverse to the vertical path of the member. Total movement of the lock bar 30 from its lowestmost position, shown in FIGURES III and IV, to an arbitrary 40 integral with the casting 26 which abutment functions additionally to journel the rock shaft 19.

In addition to mechanically locking the landing door 13, the landing door interlock 15 functions to electrically lock the doors 8 and 10. This is accomplished by means including a switch operator 41 that is attached, adjacent the head 32, to the lock arm 20 by a plate 42, contacts 43 on the switch operator 41 connecting with contacts 44 on a switch 45 when the lock arm 20 is in locking position, i.e., the position which is illustrated in FIGURE V. When the switch contacts 44 are closed, the electrical circuit to the motor for the drive equipment that is connected to the cables 4 is completed to energize such motor. Hence, when the lock roller 17 is in its position shown in solid lines in FIGURE I so that the head 32 on the lock arm 20 is in its obstructing position and so that the switch operator 41 contacts 44 are closed, the electrical circuit for the lift motor for the drive equipment that is connected to the cables 4 is completed to energize such motor. Hence, when the lock roller 17 is in its position shown in FIGURE I so that the head 32 on the lock arm 20 is in its obstructing position and so that the switch operator 41 contacts 44, the elevator car doors 8 and 10 cannot be moved. This prevents movement of the elevator car doors 8 and 10 while the car 1 travels between floors and while the landing doors 13 are mechanically locked to interlock the elevator doors 8 and 10 and the landing doors 13.

The landing door interlock 15 insofar as it has been described is satisfactory in elevator systems that are installed in buildings having hallways and ordinary office doors between the offices and the elevators so that such office doors can be locked, for example, at night when the offices are not in use. The design is such as to allow the use of the elevator system in an office floor in order to utilize all available space, many offices are built right up to the elevator landing doors and, therefore, having no doors other than the landing doors which can be locked. In such cases, it is desirable to provide a lock for the landing door interlock, especially one that can be operated from remote stations, such as elevator car control panels, hall landing control panels, and dispatcher's control panels. Such a lock, suitable for locking the landing door interlock 15 to prevent entrance to the landings of unauthorized persons in elevator systems having cars which open directly into offices, is shown generally at 14 in FIGURE I and in detail in FIGURES VI-VIII and XI-XII.

Referring to FIGURES VI-VIII and XI-XII, the lock 14 is mounted on an angle bracket 46 which is mounted in turn on a second angle bracket 47 that is attached by means of screws 48 to the vertical side of the casting 26 of the landing door interlock 15 remote from the lock roller 17 and immediately below an end of the rock shaft 19 which extends from the interlock 15 as shown in FIGURE VI. The lock 14 includes a lever arm 49 fixed to the end of the rock shaft 19 so that it moves about the axis of the rock shaft as one with the rock shaft and an over-center, toggle-operated locking pin 50 which is held by a toggle spring 51 and in the rockable lever arm 49 and in the stationary bracket 47, respectively, to prevent movement of the rock shaft 19 and, therefore, to prevent unlatching of the landing door interlock 15.

The locking pin 50 is driven by a solenoid-operated, over-center toggle 55 which includes an inverted T-shaped member 54 that is pivotally mounted on an angle bracket 55, secured to the bracket 46, by means of a screw 56, the screw 56 being threaded into the bracket 55 and extending through a hole in the T-shaped member 54 in a loose fit. Movement of the bottom of the T-shaped member in a horizontal direction is limited by means of washers 57 and 58 between the head of the screw 56 and the T-shaped member 54 and between the T-shaped member and the bracket 55, respectively. The upper end of the inverted T-shaped member 54 is attached to a coupling block 59 by means of a bolt 60, the bolt 60 extending through the coupling block 59 is a loose fit so that the coupling block is permitted to rotate in the bolt 60. A nut 61, separated by a spacer 62a, which surrounds the bolt 60 in sleeve-like fashion and which extends through the hole in the coupling block 59, from the coupling block holds the inverted T-shaped member 54 and the coupling block together. The bolt 60 also functions to support a toggle spring 62 which is pinned between washers adjacent the head of the bolt, a spacer 63
spacing the spring from the upper end of the T-shaped member. The lower end of the spring 62 is secured to the bracket 55 by means of a screw 64 which is threaded into the bracket, the end of the spring 62 being pinned between a pair of washers 65 which are spacer from the bracket 55 by means of a spacer 66.

A stationary guide block 67 secured to the bracket 47 functions to guide the locking pin 59 adjacent the aperture 51 and 52, the pin 59 being easily slidab in a horizontal hole in the block 67. Movement of the coupling block 59 to the right, as viewed in FIGURE VI, drives the pin 59 to the right because the coupling block 59 is always kept in abutting position against a ring 68 fixed on the pin 59. Such abutting position of the coupling block 59 is maintained by means of a shock absorbing spring 69 which surrounds the pin in sleeve fashion and which is compressed between the coupling block 59 and a short transverse pin 70 that is carried by the locking pin 59. Movement of the coupling block 59 to the left, as viewed in FIGURE VI, moves the spring 69 and, thus, the locking pin 59 to the left, such movement being limited by an abutment face 71 on the guide block 67.

The respective ends of the arms of the inverted T-shaped member 54 are pivotally connected by cotter pinned pins 72 to the armatures 73 of a lock solenoid 74 and an unlock solenoid 75, which solenoids are mounted on the bracket 46. Energization of the lock solenoid 74 occurs when a key-operated switch 76 is operated to close switch contact 77 so that current flows through lead 78 to the solenoid from a suitable source. Energization of the unlock solenoid 75 occurs when the key-operated switch 76 is operated to close switch contact 79 so that current flows through lead 80 to the solenoid. Return leads 81 and 82 from the solenoids are suitably grounded.

In operation to lock the lock 14, a key is inserted into the key-operated switch 76 and turned counterclockwise, as viewed in FIGURE VI, to momentarily close contact 77 and, thus, to momentarily energize the lock solenoid 74. The key then may be turned clockwise to its original position and may be removed. The momentarily energized lock solenoid 74 draws its armature 73 downward which pivots the T-shaped member 54 counterclockwise about the axis of the screw 56. This, through the connection of the T-shaped member 54 to the locking pin 59 by means of the coupling block 59, drives the locking pin 59 up the aperture 51 and FIGURE XII and prevents the lever arm 49 from turning. As soon as the spring 62 of the over-center toggle 53 gets past center position, i.e., the center position shown in FIGURE VI, the spring drives and holds the locking pin 59 in the apertures 51 and 52 even though the lock solenoid 74 is deenergized. The rock shaft 19 of the landing door interlock 15 then cannot be turned and the interlock 15 and, thus, the landing door 13 is locked. When the landing door interlock 15 is locked, the retarding cam 16 is unable to move the lock roller 17 and is pushed back by the roller against its conventional resilient mounting.

To unlock the lock 14, the key is inserted into the key-operated switch 76 and turned counterclockwise, as viewed in FIGURE VI, to momentarily close contact 79 and, thus, to momentarily energize the unlock solenoid 75. The key then may be turned counterclockwise and may be removed for projecting the retarding cam 16 downward in its armature 73 downward which pivots the T-shaped member 54 clockwise about the axis of the screw 56. This withdraws the locking pin 59 from the apertures 51 and 52 and permits the lever arm 49 to turn. As soon as the spring 63 of the over-center toggle 53 gets past its stop, the locking pin 59 in its withdrawn position even though the unlock solenoid 75 is deenergized as shown in FIGURE XI.

The key-operated switch 76 can be and ordinarily is remotely located relative to the lock 14. For example, it may be located on the control panel in the elevator car 1, or on a control panel in one of the hall landings, or on a dispatcher's control panel. If the key-operated switch 76 is located in the car 1, for example, a person to leave the office entered by means of the landing door 13 may lock the landing door while he travels in the elevator car.

Alternatively, the elevator door operating motor 5 selectively can be disabled and the elevator doors selectively locked mechanically by the mechanism shown in FIGURE IX AND XI while the car 1 is at a floor to prevent entrance to such floor of unauthorized persons.

Referring to FIGURE IX in particular, a door drive bar or vane 83, which is operatively connected to the pair of rollers 11 (FIGURE I-A), is adapted to carry a horizontally extending latch bar 84, the framework 85 at the top of the car 1 being suitably arranged to permit the latch bar 84 to extend through an opening in the framework so that the latch bar 84 ordinarily is free to travel with the door drive bar 83 from one side of the car 1 to the other.

In order to lock the car doors 8 and 10 selectively while the car is at a floor, an obstructing lever arm 86, which is part of a mechanical lock 87 for the doors 8 and 10, is pivoted at 88 in the lock 87 and functions to obstruct the path of the latch bar 84 and, thus, selectively to prevent opening of the door 10 and the door 8 which moves in unison therewith.

The lock 87 is suitably mounted on the framework 85 in position such that, if it were mounted on the car 1 as shown in FIGURE I, it could not be seen in FIGURE I because it would be on the other side of the framework 85 as indicated in FIGURE IX. The lock 87 includes a folumar stand 89 for the lever arm 86 and a solvent 90 which, when its coil is energized, pivots the lever arm 86 counterclockwise, as viewed in FIGURE IX, so that a finger 91 on the lever arm 86 is moved into obstructing position relative to the latch bar 84. When the finger 91 is in such obstructing position, the latch bar 84 contacts the finger 91 preventing movement of the door drive bar 83 to the left, as viewed in FIGURE I, and, thus, preventing opening of the car doors 8 and 10. The interlock 15, as hereinbefore described, functions to prevent opening of the landing door 13 while the car 1 is between floors.

Pivotal movement of the lever arm 86 is limited by a bumper 92 at one end of its path and by the solvent 90 at the other end of its path. Should the supply of current to the coil of the solvent 90 fail at a time when it is desired to have the lock 87 locked, the weight of the finger 91 and the lever arm 86 is such that the device will fail safe, i.e., the lever arm 86 automatically will swing under gravitational force to the position shown in FIGURE IX upon deenergization of the coil of the solvent 90. In such position, the lever arm 86 operates a microswitch 94 which functions to actuate an alarm indicating failure.

A simplified circuit which is generally conventional, except for key-operated contacts 95, floor lock relay 96 and floor lock contact 97, is shown in FIGURE X; it includes the usual floor selector brush 98 carried by the car 1 and floor selector contacts 99, one for each floor in the elevator system. When the car 1 is at a floor and a floor call is registered, the means, hereinbefore referred to, for projecting the retarding cam 16 (shown in FIGURE XI) includes a retarding cam relay (not shown), is operated to cause deenergization of the retarding cam relay. Deenergization of the retarding cam relay, when the car is at a floor and when a call is registered, causes retarding cam contact 100 to close so that normally, without contacts 95 and 97 and relay 101, the circuit from lead 101 through brush 98, a floor selector contact 99 and retarding cam contact 100 to the coil of door operator relay 102 which controls the door operating motor 5 (FIGURE I-A), the relay 102 being con-
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interlock, and means for preventing all load transfer between said car and a given landing comprising a lock for superseding all interlock releasing means and for maintaining said landing door interlock in its locking condition while said car door is in registry with the landing door controlled by said interlock.

2. In an elevator system having a car carrying an elevator door serving a plurality of floors each equipped with a landing door, in combination, a landing door interlock for each landing door for mechanically preventing movement of the landing door when in its locking condition, means releasing each interlock from its locking condition when said car door is in registry with the landing door controlled by said interlock, and means for preventing all load transfer between said car and a given landing comprising a lock for superseding all interlock releasing means and for maintaining said landing door interlock in its locking condition while said car door is in registry with the landing door controlled by said interlock.

3. In an elevator system having a car carrying an elevator door serving a plurality of floors each equipped with a landing door, in combination, a landing door interlock for each landing door for mechanically preventing movement of the landing door when in its locking condition, a member for each interlock which is mechanically displaceable while the car door is in registry with the hall door controlled by said interlock to release said interlock from its locking condition, and means for preventing all load transfer between said car and a given landing comprising a lock barring mechanical displacement of said member from said interlock locking condition for superseding all interlock releasing means and for maintaining said landing door interlock in its locking condition while said car door is in registry with the landing door controlled by said interlock.

4. In an elevator system having a car carrying an elevator door and serving a plurality of floors each equipped with a landing door, in combination, a landing door interlock individual to each of the landing doors for mechanically preventing movement of the landing door while the car travels between floors, said interlocks each comprising a pivotally mounted shaft and an arm pivoted to the shaft to move about the axis of the shaft as one within the shaft, and locking means for maintaining at least one of the landing door interlocks locked while the car has stopped at the landing associated therewith, the arm of said lockable interlock being pivotally attached to a stationary member adjacent the arm of said lockable interlock, the aperture in the arm being aligned with the aperture in the stationary member while the car travels between floors, and a selectively operated pin which is moveable into the aligned apertures to prevent movement of the axis and maintain said interlock in its locked condition.

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