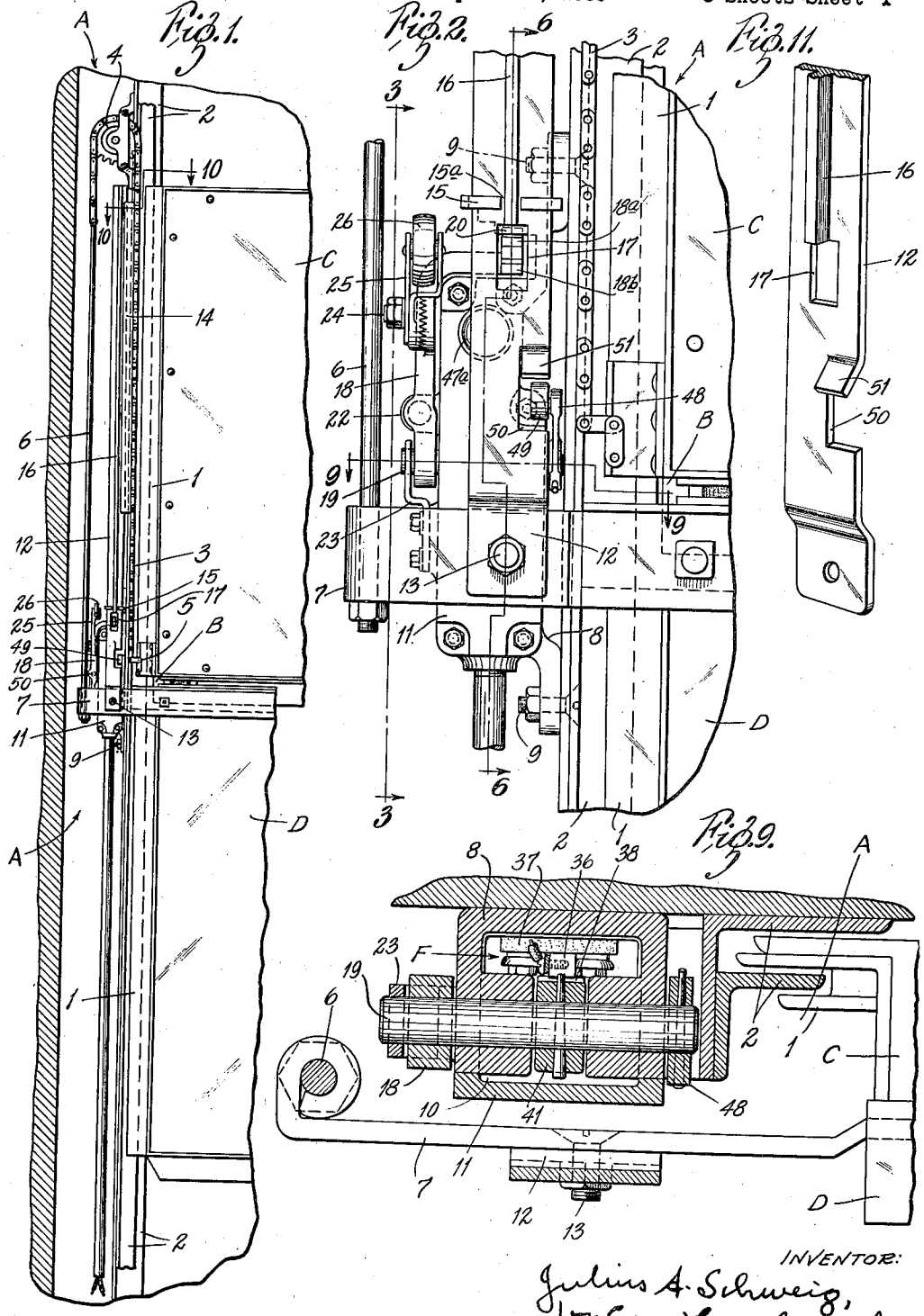
March 4, 1941. J. A. SCHWEIG 2,233,853

LOCK AND SWITCH MECHANISM FOR ELEVATOR SHAFT DOORS

Filed April 24, 1939 3 Sheets-Sheet 1



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March 4, 1941. J. A. SCHWEIG 2,233,853

LOCK AND SWITCH MECHANISM FOR ELEVATOR SHAFT DOORS

Filed April 24, 1939 3 Sheets-Sheet 2

Fig. 3.

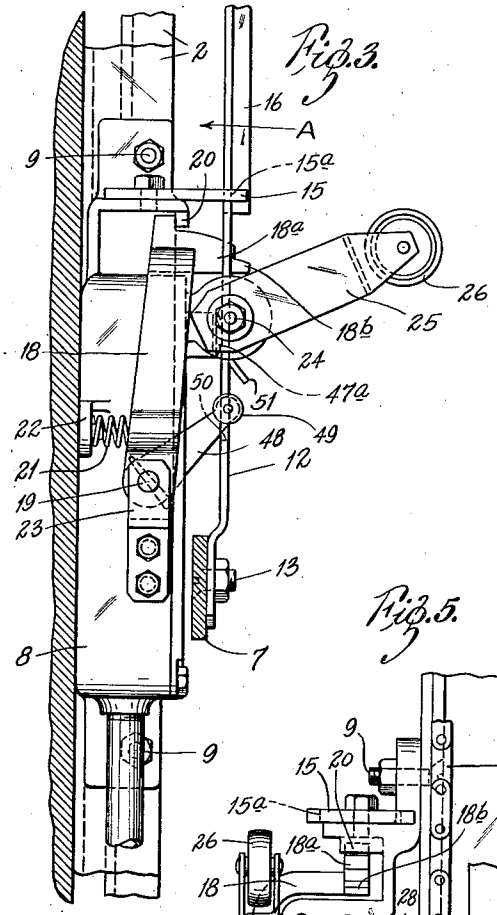


Fig. 4.

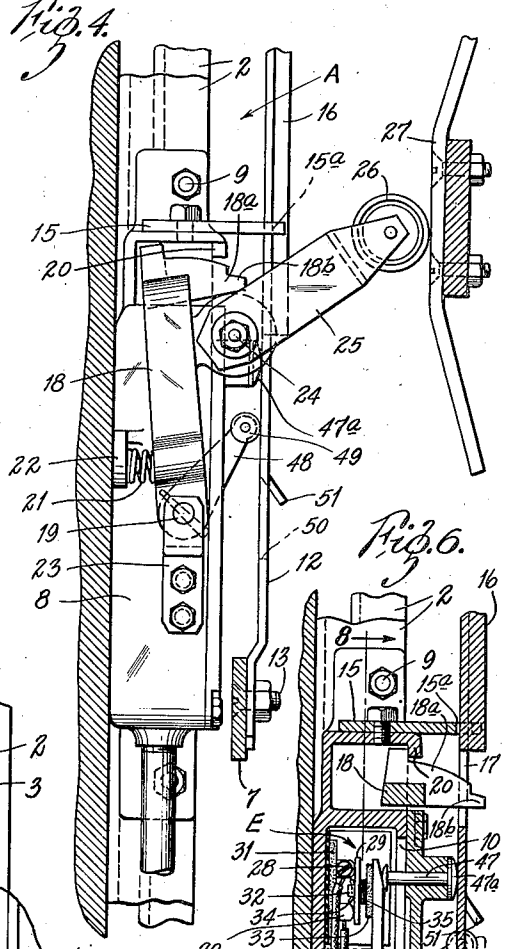


Fig. 5.

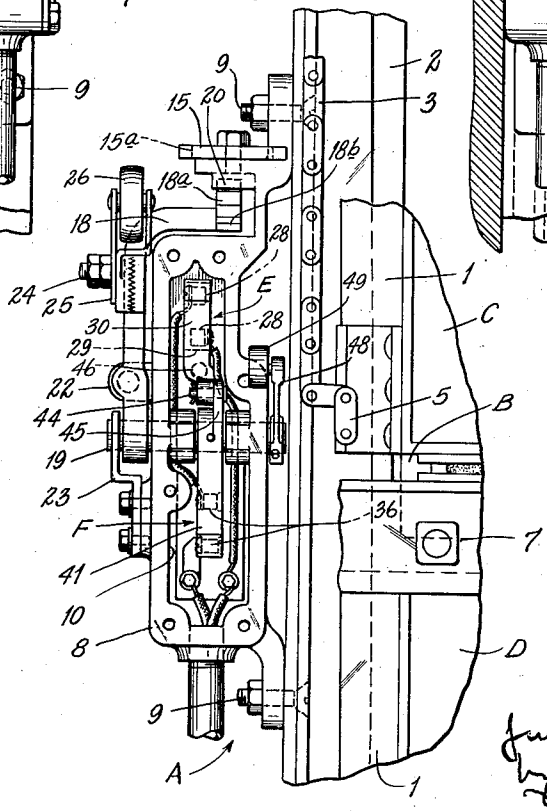
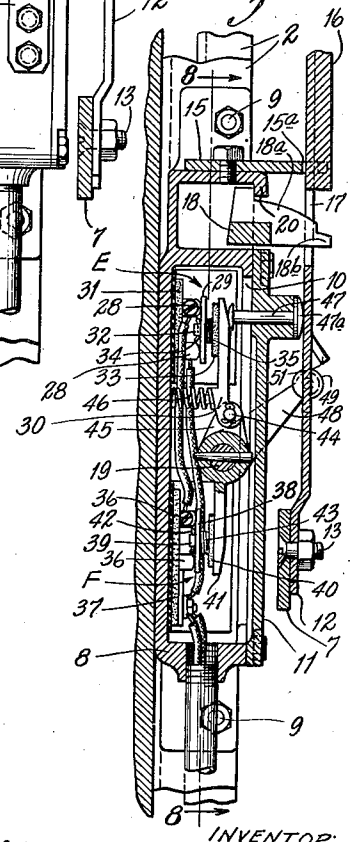


Fig. 6.



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LOCK AND SWITCH MECHANISM FOR ELEVATOR SHAFT DOORS

Filed April 24, 1939 3 Sheets-Sheet 3

Fig. 7.

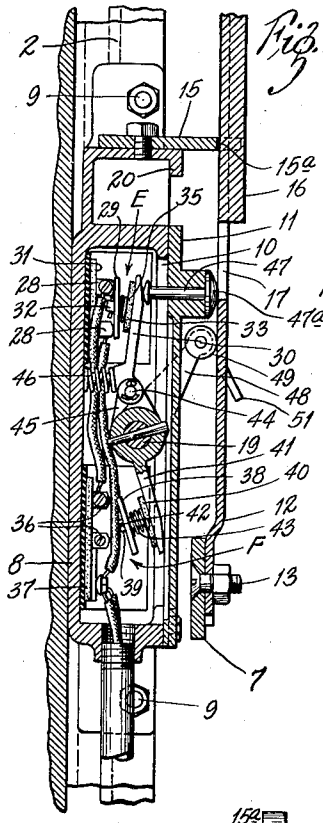


Fig. 8.

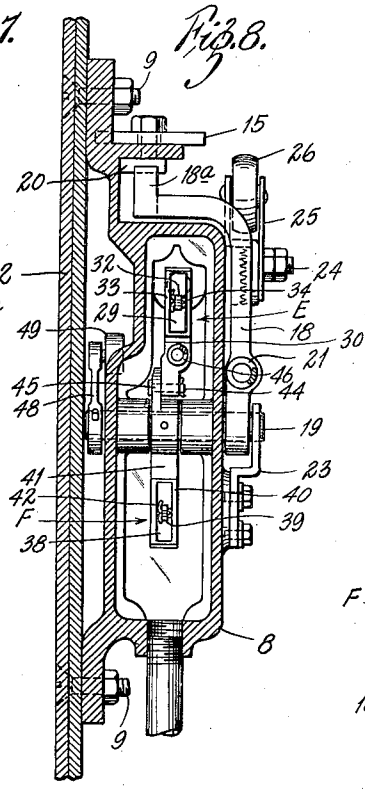


Fig. 10.

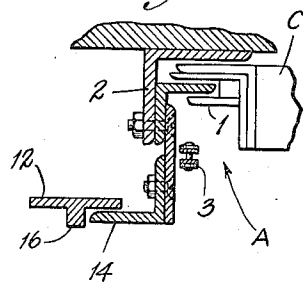


Fig. 14.

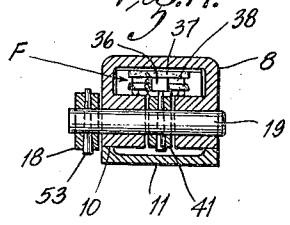


Fig. 12.

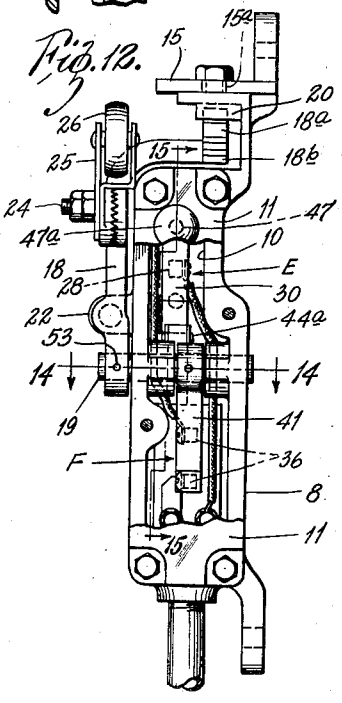


Fig. 13.

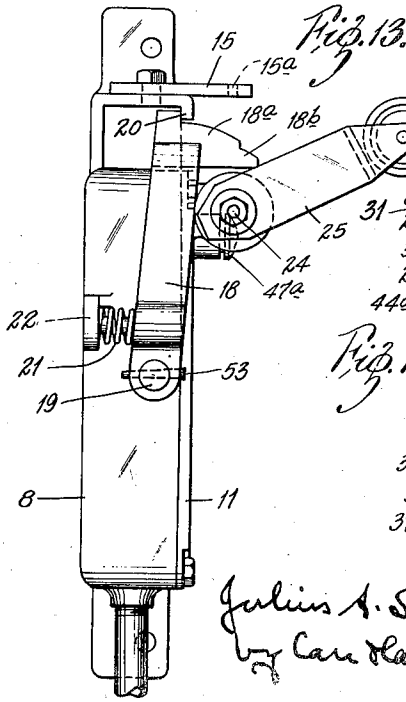
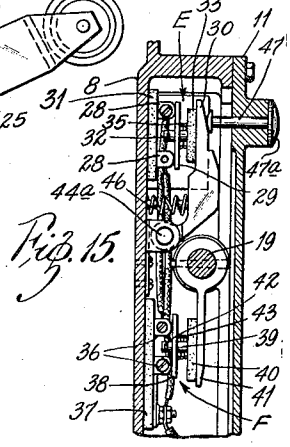


Fig. 15.



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Patented Mar. 4, 1941 2,233,853

UNITED STATES PATENT OFFICE

2,233,853

LOCK AND SWITCH MECHANISM FOR ELEVATOR SHAFT DOORS

Julius A. Schweig, St. Louis, Mo.

Application April 24, 1939, Serial No. 269,585

15 Claims. (Cl. 187—31)

This invention relates to lock and switch mechanisms for the shaft doors of electric elevators. It has for its principal object to devise a simple and efficient lock and switch mechanism that will prevent opening of the shaft doors when the car is not at a landing, that will prevent actuation of the car until the shaft doors are closed and locked and that will prevent actuation of the car when the lock bar of said mechanism is removed to permit inspection or repair thereof. Other objects are to adapt said mechanism for operation by stationary or retiring cams and to provide for cheapness of construction, compactness of design, ease of assembly and installation and easy access to all of the parts of said mechanism. The invention consists in the lock and switch mechanism and in the combinations and arrangements of parts hereinafter described and claimed.

In the accompanying drawings, which form part of this specification and wherein like symbols refer to like parts wherever they occur,

Fig. 1 is a fragmentary view of an elevator shaft at one side of a door thereof provided with a door lock and electric switch mechanism embodying my invention,

Fig. 2 is an enlarged fragmentary view similar to Fig. 1 in the region of said mechanism,

Fig. 3 is a vertical section on the line 3—3 in Fig. 2, showing the free positions of the lock arm and the switch arm parts when the door is locked and the car is not at the landing,

Fig. 4 is a view similar to Fig. 3, showing the positions of said arms when the door is opened and the car is at the landing with the stationary cam carried by said car in engagement with the lock arm,

Fig. 5 is a view similar to Fig. 2, showing the cover plate removed from the housing of said mechanism,

Fig. 6 is a vertical section on the line 6—6 in Fig. 2, showing the door locked and the switches closed,

Fig. 7 is a view similar to Fig. 6, showing the door unlocked and the lower switch opened,

Fig. 8 is a vertical section on the line 8—8 in Fig. 6,

Fig. 9 is a horizontal section on the line 9—9 in Fig. 2,

Fig. 10 is a horizontal section on the line 10—10 in Fig. 1,

Fig. 11 is a perspective view of the lower portion of the lock bar,

Fig. 12 is a front elevation of a combined switch and lock mechanism adapted for actuation by the retiring cam of an elevator car, the cover plate of the housing being shown broken away,

Fig. 13 is a side elevational view of the mechanism shown in Fig. 12,

Fig. 14 is a horizontal section on the line 14—14 in Fig. 12; and

Fig. 15 is a fragmentary vertical section on the line 15—15 in Fig. 12.

In the accompanying drawings, my invention is shown in connection with an electric elevator comprising a shaft A having a door opening B therein that is closed by a vertical sliding door comprising upper and lower counterbalanced door sections C and D, respectively. Each of said door sections is provided along each vertical edge with an angle bar side rail 1 having an outstanding flange slidably arranged between an upright double angle bar door guide 2 secured to the elevator shaft.

On each side of the door opening, the upper door section is hung on a chain 3 that passes over a sheave 4 located within the shaft adjacent to the upper corner of said door opening. One end of the door chain 3 is suitably connected, as at 5, to the adjacent lower corner of the upper door section. The other end of said chain is connected to the upper end of an upright rod 6, whose lower end is secured to the outer end of an arm 7 that projects horizontally from the adjacent upper corner of the lower door section. By this arrangement, one door section serves to counterbalance the weight of the other door section, and the two sections move simultaneously towards and away from each other to close and open the door. The elevator door construction thus far described is well known and it is considered unnecessary to illustrate it in detail.

The door is equipped with a combined lock and switch actuating device comprising a housing or box 8 that is removably secured by bolts 9 to the door guide 2 opposite the arm 7 of the lower door section in the closed position thereof. Access is had to the interior of said housing through an opening 10 in the front thereof that is closed by a removable cover plate 11. An upright lock bar 12 is removably attached at its lower end to the door arm 7 by means of a bolt 13; and a guide angle 14 is bolted to the door guide 2 to hold said lock bar in vertical position as it moves up and down with the lower door section. Said lock bar is further guided in a T-slot 15*a* in the overhanging portion of a plate 15 bolted to the top of the housing 8. The lock bar is stiffened and strengthened by means of a longitudinal medial rib 16 on the front side thereof that is also guided in the T-slot 15*a* in the guide plate 15.

The lock bar 12 has a vertically elongated opening 17 extending horizontally therethrough below the rib 16 thereof adapted, in the closed position of the lower door section, to receive a lug 18a at the free upper end of an upstanding lock arm or keeper 18, whose lower end is rotatably supported on one end of a horizontal rock shaft 19 that is journaled in alined openings provided therefor in the side walls of the housing 8 substantially midway between the top and bottom thereof. The lock arm 18 is located outside of the housing and is yieldably held in locking position against a depending stop lug 20 on the upper guide plate supporting portion of the housing by means of a coil spring 21 interposed between the back of said arm and a laterally extending lug 22 on the adjacent side wall of said housing. The lock arm supporting end of the rock shaft 19 is rotatably supported outwardly of the lock arm in the upper end of a bracket 23 whose lower end is bolted to the adjacent side face of the housing. The slot engaging lug 18a of the lock arm 18 is preferably provided with a reduced outer end portion 18b adapted to enter the slot 17 in the lock bar 12 when the door is not entirely closed and said slot is not in position to receive the entire lug.

Secured to the lock arm 18 by means of a bolt 24 near the upper end thereof is an extension arm 25 which extends into the shaft and has a roller 26 journaled thereon at its outer end adapted to be engaged by a suitable cam 27 rigid with and forming part of the elevator car (not shown). The lock arm extension 25 may be rotated on the bolt 24 to adjust the roller 26 relative to the cam 27 and then locked in the desired position of adjustment by tightening said bolt. By this arrangement, whenever the car passes or stops at the landing, the roller 26 is engaged by the stationary cam 27 on the elevator car and swings the lock arm 18 in a direction which will disengage the lug 18a thereof from the slot 17 in the lock bar 12.

Enclosed within the housing are two vertically spaced electric switches E and F that are both incorporated in the electric circuit (not shown) which controls the operation of the elevator car. The upper switch E comprises a pair of stationary contact posts 28, and a contact plate 29 movable with a pivotal arm 30 into and out of engagement with said contact posts. The stationary contact posts 28 are fixed to a fibre insulating block 31 that is secured to the bottom of the box. The movable contact plate 29 is loosely sleeved on a pin 32 fixed to a fibre insulating block 33 secured to the arm 30. Said contact plate is held on its supporting pin 32 by a cotter pin 34; and a coil spring 35 sleeved on the pin 32 between said plate and the insulating block 33 serves to yieldably hold said plate against said cotter pin. The other or lower switch F is similar to the switch E and comprises a pair of stationary contact posts 36 mounted on an insulating block 37 secured to the bottom of the housing 8, a contact plate 38 mounted on a pin 39 fixed to a fibre insulating block 40 that is secured to an arm 41, a cotter pin 42 for holding said plate on its supporting pin, and a coil spring 43 sleeved on said supporting pin between said plate and the insulating block 40.

The arm 41 is pinned at its upper end on the rock shaft 19 between the side walls of the housing, and the arm 30 is preferably journaled at its lower end on a pin 44 fixed to an upstanding lug 45 on the upper or pivoted end of the arm 41. A coil spring 46 is interposed between the bottom of the housing 8 and the arm 30 near the pivoted end of the latter; and the pressure of said spring against said arm tends to open the switch E. Due to the pivotal connection 44 between the switch arms 30 and 41, the spring 46, which opens the switch E, also tends to close the switch F. The upper switch E is held in closed position by means of the lock bar 12 in all positions of the latter. Said lock bar is in continuous engagement with the exposed headed outer end 47a of a plunger 47 that is slidably mounted in a bore that extends horizontally through the cover plate 11 from front to back thereof. Said lock bar presses said plunger inwardly against the arm 30 of the upper switch and thus holds the same in closed position.

The normally closed lower switch F is opened against the pressure of the closing spring 46 therefor by means of a rock arm 48 that is pinned to the rock shaft 19 exteriorly of the housing on the side thereof remote from the lock arm 18 and has a roller 49 journaled on its free end adapted, when the door is opened, to be engaged by the lock bar 12 to thereby rock said arm and thus open said switch. The lock bar 12 has a notch 50 therein adapted, in the closed position of the door, to accommodate the roller 49 of the switch opening arm 48 and thus relieve said roller of the pressure of said lock bar. The portion of the lock bar at the upper edge of the notch 50 therein is inclined downwardly and outwardly away from the body of said bar to form an inclined lip or cam portion 51 adapted, when said bar moves downwardly at the beginning of the opening movement of the door to bear against the periphery of said roller 49 forwardly of the axis thereof and thus force said roller and the supporting arm 48 therefor rearwardly far enough to rotate the shaft 19 in a direction that will swing the lever 41 pinned thereon outwardly and disengage the contact plate 38 carried thereby from the stationary contact posts 36 of the switch F and thus open the same. Thus, when the door is opened, the switch F is held open by the engagement of the lock bar 12 with the roller 49, thereby preventing operation of the elevator car until the door is completely closed and the notch 50 in said lock bar is in position to receive said roller and permit said switch to close.

The upper switch E is held closed by the lock bar 12 in all positions of the door. However, in the event of repairs that necessitate the removal of the lock bar, such removal removes the pressure of the lock bar on the outer end of the switch closing plunger 47, thereby permitting the spring 46 to open said switch and thus prevent operation of the elevator car until the lock bar is again replaced.

As shown in Figs. 12 to 15, inclusive, the above lock and switch mechanism may be modified for use in an elevator having a car equipped with a retiring cam; that is, a cam (not shown) of the type that is movably mounted on the car and is automatically engaged with the roller 26 to open the lower switch F and unlock the door when the car stops at the landing and is automatically disengaged from said roller when the car is started. In this construction, the lock bar operated switch actuated arm 48 is dispensed with and the lock arm 18 is secured by a pin 53 to the shaft 19 so that the spring 21 serves to hold the lower switch in closed position until the roller 26 carried by said arm is engaged by the retiring cam to rotate said shaft in a direction

which will swing the contact carrying switch arm **41** outwardly and open said switch. As the spring **21** serves to hold the lower switch F in closed position, the pivotal connection **44** between the contact carrying arms **30** and **41** of the upper and lower switches E and F, respectively, is dispensed with and a separate supporting pivot **44***a* is provided in the bottom of the housing **8** for the contact carrying arm **30** of the upper switch. In this construction, the notch **50** and inclined lip **51** of the lock bar **12** may be dispensed with. With this arrangement, the upper switch E is always held in closed position by the engagement of the lock bar with the plunger **47** and the lower switch F is opened and the door unlocked when the retiring cam is moved forward into engagement with the roller **26** at the upper end of the lock arm **18** to thereby swing said arm and thus rotate the rock shaft **19** in a direction that will open said lower switch against the pressure of the spring **21** and break the electric circuit controlling the elevator car.

Obviously, the hereinbefore described arrangement admits of considerable modification without departing from the invention. Therefore, I do not wish to be limited to the precise construction shown and described.

What I claim is:

1. In an electric elevator, a shaft, a door therein, a lock for said door, a switch associated with said lock and adapted to be incorporated in an electric circuit for controlling the operation of a car in said shaft, and a second switch adapted to be incorporated in said circuit, said first mentioned switch being closed when said lock is in locking position and opened in the unlocked position of said lock, and said second switch being closed by an associated part of said lock in all positions thereof and being adapted to open automatically upon removal of said part.

2. In an electric elevator, a shaft, a door therein, a locking device for said door, a switch associated with said locking device and adapted to be incorporated in the electric control circuit for a car in said shaft, a second switch adapted to be incorporated in said circuit, said first mentioned switch being closed when said locking device is in locking position and opened in the unlocked position of said locking device, said locking device including a keeper element adapted in all positions of said door to hold said second switch in closed position, and means associated with said second switch for automatically opening the same when said keeper element is displaced from operative position.

3. In an electric elevator, a shaft, a door therein, a locking device for said door, a switch associated with said door locking device and adapted to be incorporated in an electric control circuit for a car in said shaft, a second switch adapted to be incorporated in said circuit, said first mentioned switch being closed when said locking device is in locking position and opened when said device is in unlocked position, said locking device including a keeper element removably secured to said door and adapted in all positions thereof to hold said second switch in closed position, and means for automatically opening said switch to break said circuit upon removal of said keeper element.

4. In an electric elevator, a shaft having a door opening therein, a door for closing said opening, a locking device for said door comprising a lock bar movable with said door and a lock arm pivoted in said shaft and adapted to move into interlocking engagement with said lock bar in the closed position of said door, a cam adapted to be mounted on a car working in said shaft and to disengage said lock arm from said lock bar when said car is opposite said opening, a normally closed switch adapted to be incorporated in an electric circuit for controlling the operation of said car, said lock bar being adapted to open said switch in the open position of said door, and a second switch in said circuit adapted to be held closed by said lock bar in all positions of said door.

5. In an electric elevator, a shaft having a sliding door opening therein, a door for closing said opening, a locking device for said door comprising a lock bar movable with said door and a lock arm pivoted in said shaft adjacent to said door opening and adapted to move into locking engagement with said lock bar in the closed position of said door, a switch adapted to be incorporated in an electric circuit for controlling the operation of a car working in said shaft, a cam adapted to be mounted on said car for disengaging said lock arm from said lock bar when said car is opposite said opening, and an operative connection between said lock arm and said switch adapted to open the latter when said lock arm is disengaged from said lock bar by said cam, said lock bar being adapted in the open position of said door to hold said lock arm in unlocked position and said switch in open position.

6. In an electric elevator, a shaft having a door opening therein, a door for closing said opening, a locking device for said door comprising a lock bar movable with said door and a lock arm pivoted in said shaft adjacent to said door opening and adapted to move into locking engagement with said lock bar in the closed position of said door, a switch adapted to be incorporated in an electric circuit for controlling the operation of a car working in said shaft, a cam adapted to be mounted on said car for disengaging said lock arm from said lock bar when said car is opposite said opening, an operative connection between said lock arm and said switch adapted to open the latter when said lock arm is disengaged from said lock bar by said cam, and a second switch in said circuit adapted to be held in closed position by said lock bar in all positions of said door.

7. In an electric elevator, a shaft, a door therein, a sliding locking device for said door comprising a housing fixed to said shaft, a lock arm pivoted on said housing, an upright lock bar movable with said door and having an opening therein adapted to be engaged by said lock arm in the closed position of said door, a cam adapted to be mounted on a car working in said shaft and adapted to disengage said lock arm from the opening in said lock bar, a switch enclosed in said housing and adapted to be incorporated in an electric circuit for controlling the operation of said car, said lock arm being operatively connected to said switch for opening the same when said arm is disengaged from the opening in said lock bar, and a single spring means for moving said lock arm into engagement with the opening in said lock bar and for closing said switch, said lock bar being adapted in the open position of said door to hold said lock arm in unlocked position and said switch in open position.

8. In an electric elevator, a shaft, a door therein, a locking device for said door comprising a

housing fixed to said shaft, a lock arm pivoted on said housing, a lock bar movable with said door and having an opening therein adapted to be engaged by said lock arm in the closed position of said door, a cam adapted to be mounted on a car operating in said shaft for disengaging said lock arm from said opening, means for yieldably holding said lock arm in locking position, a switch mounted in said housing and adapted to be incorporated in an electric circuit for controlling the operation of said car, said lock bar being adapted to open said switch in the open position of said door, means for automatically closing said switch in the closed position of said door, and a second switch incorporated in said control circuit and adapted to be held by said lock bar in closed position in all positions of said door.

9. In an electric elevator, a shaft, a door therein, a sliding locking device for said door comprising a housing fixed to said shaft, a rock shaft journaled in said housing, a lock arm journaled on said shaft, a spring for yieldably holding said lock arm in locking position, an upright lock bar movable with said door and having a slot therein adapted to be engaged by said lock arm in the closed position of said door, a switch mounted in said housing and adapted to be incorporated in the electric control circuit of a car adapted to operate in said elevator shaft, a cam carried by said car for moving said lock arm to unlocked position, said switch including a movable contact and a supporting arm therefor fixed to said rock shaft, a spring for urging said contact carrying arm to switch closing position, and an arm fixed to said rock shaft and adapted in the open position of said door to be actuated by said lock bar to thereby move said contact supporting arm against the tension of said spring to switch opening position.

10. In an electric elevator, a shaft, a door therein, a locking device for said door comprising a housing fixed to said shaft, a rock shaft journaled in said housing, a lock arm journaled on said shaft, a spring for yieldably holding said lock arm in locking position, a lock bar movable with said door and having a slot therein adapted to be engaged by said lock arm in the closed position of said door, a switch mounted in said housing and adapted to be incorporated in the electric control circuit of a car adapted to operate in said elevator shaft, a cam supported on said car for moving said lock arm to unlocked position, said switch including a movable contact, and a supporting arm therefor fixed to said lock shaft, a spring for urging said contact carrying arm to switch closing position, an arm fixed to said rock shaft and adapted in the opened position of said door to be actuated by said lock bar to thereby move said contact supporting arm against the tension of said spring to switch opening position, a second spring opened switch mounted in said housing and adapted to be incorporated in said circuit, and an operative connection between said second switch and said lock bar for holding said second switch closed in all operative positions of said lock bar.

11. In an electric elevator, a shaft, a door therein, a locking device for said door comprising a housing fixed to said shaft, a rock shaft journaled in said housing, a lock arm journaled on said shaft, a spring for yieldably holding said lock arm in locking position, a lock bar movable with said door and having a slot therein adapted to be engaged by said lock arm in the closed position of said door, a switch mounted in said housing and adapted to be incorporated in the electric control circuit of a car working said elevator shaft, a cam supported on said car for moving said lock arm to unlocked position, said switch including a movable contact arm and a supporting arm therefor fixed to said rock shaft, a spring for urging said contact supporting arm to switch closing position, an arm fixed to said rock shaft and adapted, when the door is opened, to be actuated by said lock bar to thereby move said contact supporting arm against the tension of said spring to switch opening position, a second switch mounted in said housing and adapted to be incorporated in said circuit, said second switch including a spring opened contact carrying arm, and a plunger slidable in said housing between said last mentioned arm and said lock bar, said lock bar and said plunger holding said last mentioned arm in switch closing position in all positions of said door.

12. In an electric elevator, a shaft, a door therein, a sliding locking device comprising a housing fixed to said shaft, a rock shaft journaled in said housing, a lock arm fixed to said shaft, a lock bar movable with said door and having a slot therein adapted to be engaged by said lock arm in the closed position of said door, a switch mounted in said housing and adapted to be incorporated in the electric control circuit of a car working in said elevator shaft, said switch including a contact carrying arm fixed to said rock shaft, a spring for yieldably holding said lock arm in locking position and said contact carrying arm in switch closing position, and a cam supported on said car and adapted to engage said lock arm to move said lock arm to unlocked position and said contact carrying arm to switch opening position, said lock bar being adapted in the open position of said door to hold said lock arm in unlocked position and said switch in open position.

13. In an electric elevator, a shaft, a door therein, a locking device comprising a housing fixed to said shaft, a rock shaft journaled in said housing, a lock arm fixed to said shaft outside said housing, a lock bar movable with said door and having a slot therein adapted to be engaged by said lock arm in the closed position of said door, a switch enclosed in said housing and adapted to be incorporated in the electric control circuit of a car working in said elevator shaft, said switch including a contact carrying arm fixed to said rock shaft, a spring for yieldably holding said lock arm in locking position and said contact carrying arm in switch closing position, a cam supported on said car and adapted to engage said lock arm to move said lock arm to unlocked position and said contact carrying arm to switch opening position, and a second switch enclosed in said housing and adapted to be incorporated in said circuit, said second switch including a contact carrying arm pivoted in said housing and a spring urging said last mentioned arm to switch opening position, and an operative connection between said lock bar and said last mentioned contact carrying arm for holding the latter in switch closing position in all positions of said door.

14. In an electric elevator, a shaft, a door therein, a locking device comprising a housing fixed to said shaft, a rock shaft journaled in said housing, a lock arm fixed to said shaft outside said housing, a lock bar movable with said door

and having a slot therein adapted to be engaged by said lock arm in the closed position of said door, a switch enclosed in said housing and adapted to be incorporated in the electric control circuit of a car working in said elevator shaft, said switch including a contact carrying arm fixed to said rock shaft, a spring for yieldably holding said lock arm in locking position and said contact carrying arm in switch closing position, a cam supported on said car and adapted to engage said lock arm to move said lock arm to unlocked position and said contact carrying arm to switch opening position, and a second switch enclosed in said housing and adapted to be incorporated in said circuit, said second switch including a contact carrying arm pivoted in said housing, and a spring urging said last mentioned arm to switch opening position, and a plunger slidable in said housing between said last mentioned contact carrying arm and said lock bar, said lock bar and said plunger holding said last mentioned contact carrying arm in switch closing position in all positions of said door.

15. In an electric elevator, a shaft, a door therein, a spring closed switch adapted to be incorporated in an electrical circuit for controlling the operation of a car in said shaft, a member mounted on said door for opening said switch when said door opens and for permitting said switch to close when said door closes, and a second spring opened switch adapted to be incorporated in said circuit, said member cooperating with said second switch for holding the same closed in all positions of said door, and adapted for removal or displacement with relation to said second switch to permit the same to open.

JULIUS A. SCHWEIG.

CERTIFICATE OF CORRECTION.

Patent No. 2,233,853. March 4, 1941.

JULIUS A. SCHWEIG.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 3, second column, line 54, claim 7, strike out the word "sliding" and insert the same before "door" in line 53, same claim; page 4, first column, line 19, claim 9, strike out "sliding" and insert the same before "door" in line 18, same claim 9; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 22nd day of April, A. D. 1941.

(Seal)

Henry Van Arsdale,
Acting Commissioner of Patents.