J. E. BOYCE.

DOOR LOCK.

APPLICATION FILED JULY 11, 1905.

1,047,160.

Patented Dec. 17, 1912.

2 SHEETS—SHEET 1.

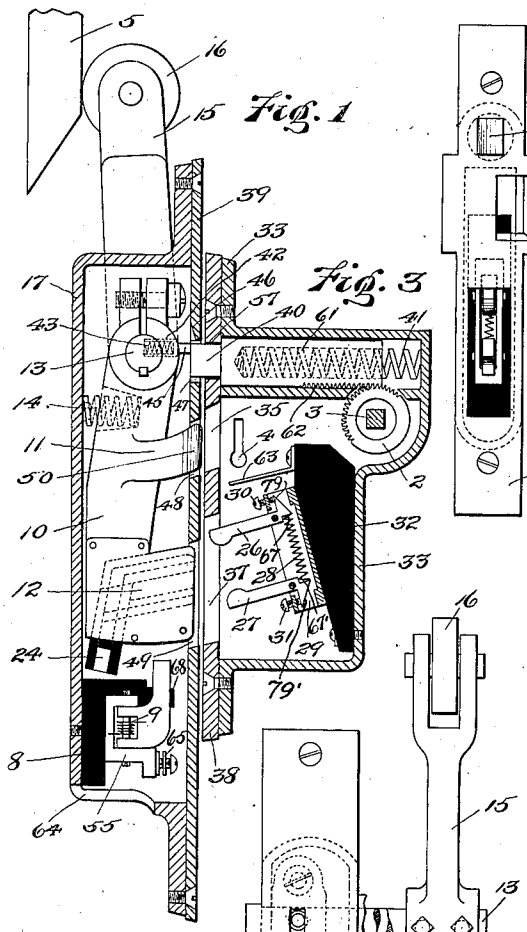

Fig. 1

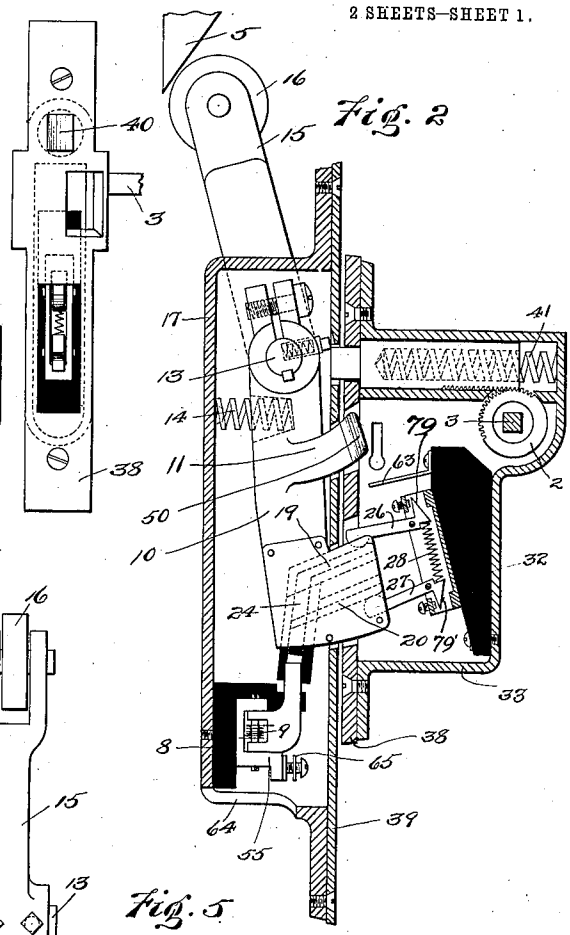

Fig. 2

Fig. 3

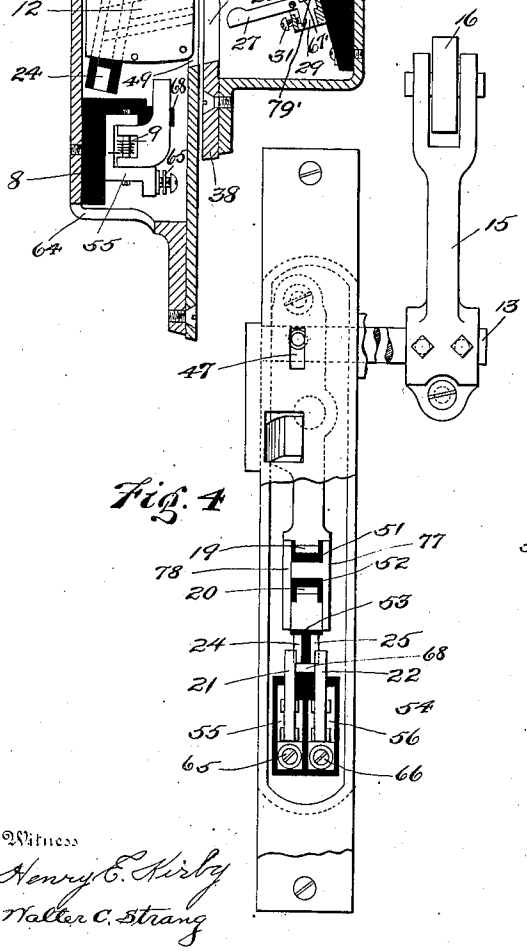

Fig. 4

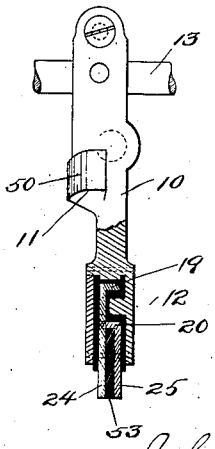

Fig. 5

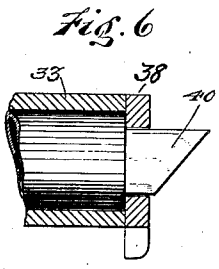

Fig. 6

Witness

Henry E. Kirby

Walter C. Strang

Inventor

John E. Boyce

By Charles M. Nissen

Attorney

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2 SHEETS—SHEET 2.

Fig. 7

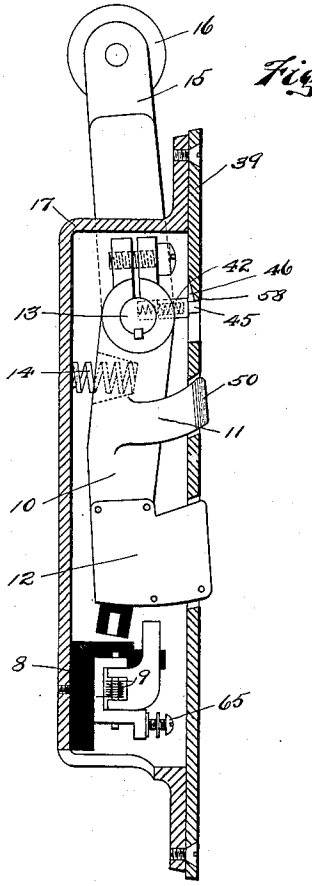


Fig. 8

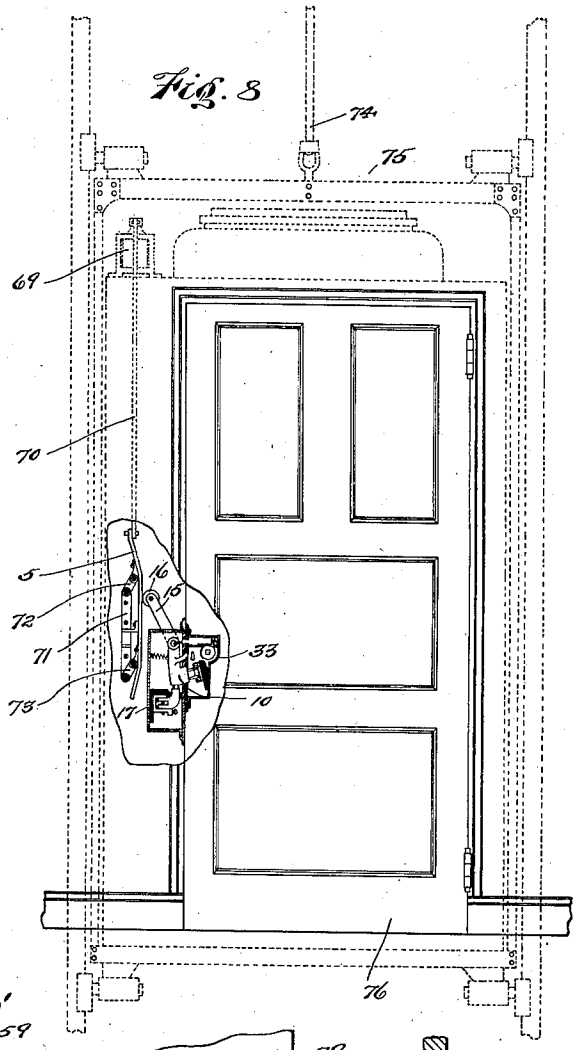
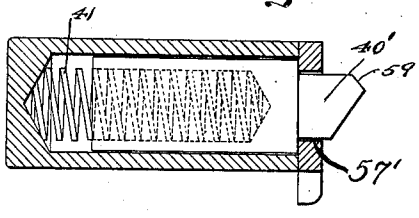


Fig. 9



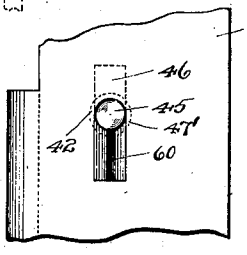


Fig. 10

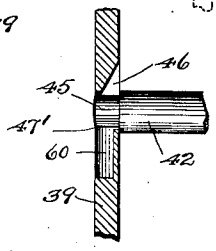


Fig. 11

Witness

Henry E. Kirby

Walter C. Strang

Inventor

John E. Boyce

By Charles M. Nissen

Attorney

UNITED STATES PATENT OFFICE.

JOHN E. BOYCE, OF NEW YORK, N. Y., ASSIGNOR TO OTIS ELEVATOR COMPANY, OF JERSEY CITY, NEW JERSEY, A CORPORATION OF NEW JERSEY.

DOOR-LOCK.

1,047,160. Specification of Letters Patent. Patented Dec. 17, 1912.

Application filed July 11, 1905. Serial No. 269,182.

To all whom it may concern:

Be it known that I, JOHN E. BOYCE, a citizen of the United States, residing at New York city, in the county of New York and State of New York, have invented a new and useful Improvement in Door-Locks, of which the following is a specification.

My invention relates to locks for doors but particularly to door locks for elevators and has for its object to provide an improved, safe and efficient door lock.

A further object of my invention is the provision of a lock which shall be positive in its action both as to locking the door and the closing of the circuits with which it is combined.

Other objects of the invention are to provide a lock which shall have flexibility of parts so as to allow shrinkage of the doors and casing or settling of the same and which shall be free from exposed energized contacts at all times.

Another object of my invention is to provide means for locking the door before the door circuit is closed and for opening said circuit before the door is unlocked.

A further object is to provide such a lock for elevator doors which can be opened manually by means of a key if desired.

Other objects of the invention will appear hereinafter, the novel combinations of elements being pointed out in the appended claims.

Referring to the drawings, Figure 1 represents a longitudinal section of my improved locking device in its unlocked position; Fig. 2 is a similar view showing the lock in its locking position; Fig. 3 is an elevation of the keeper casing; Fig. 4 is an elevation of the lock casing having a portion of the face plate broken away to show parts of the circuit closer; Fig. 5 is a detail view of the contact device; Fig. 6 is a detail view of the preferred form of latch; Fig. 7 is a sectional view in elevation showing the locking device in its intermediate position and one of the circuit closers in open position; Fig. 8 shows an elevator car with a magnet cam mounted thereon for operating the door lock; Fig. 9 is a detail view of a modified latch; and Figs. 10 and 11 show modifications in the locking device when the modified form of latch is used.

Although the locking device is illustrated as adapted to swinging doors it may with slight modifications be used equally as well with sliding doors. For example, with a sliding door all the parts as shown could be changed to positions at right angles to their present positions, in which case the only material change would be in the proportion of parts to prevent interference with the car.

In Figs. 1, 2 and 7 is shown a rock shaft 13 mounted in the upper portion of the lock casing 17. To this shaft is keyed or otherwise rigidly secured the locking lever 10. The rock shaft 13 extends outwardly from the lock casing into the elevator well and has secured to its outer end the lever 15 which is provided at its upper end with the roller 16. This roller is adapted to coöperate with the cam 5 carried by the car as best illustrated in Fig. 8. Normally the strong spring 14 shown between the back of the lock casing 17 and the recess in the lever 10 near its pivoted end tends to move said lever to its locking and circuit closing position as shown in Fig. 2. But this movement is limited when the door is open by the pin 45 striking against the upper edge 58 of a rectangular slot 47 in the lock plate 39 of the lock casing 17. The locking lever 10 is thereby held in its intermediate position and both of the circuit closers will consequently be in their open positions. The advantage of this arrangement is that if the cam 5 should be moved to releasing position while the door is open the contacts on the lower end of the locking lever and which are exposed to view shall be deënergized, so no one by touching the exposed contacts could receive an electric shock. Rigidly connected with the lever 10 or made integral therewith between the shaft 13 and the contact device 12 is a locking dog 11 extending to the right from said lever through an opening 48 in the face plate 39. This locking dog is constructed upon an arc of a circle with the shaft 13 as a center so as to allow the opening 48 to be made smaller. The outer end of the locking dog 11 is rounded or beveled at 50 on the side toward the keeper casing 33 so that when the parts are in the positions shown in Fig. 7 the door may be closed and locked and the circuit closers are also closed. This is accomplished by the striking plate 38 of the keeper casing 33 striking against the rounded portion 50 and forcing back the lever 10 until the pin 45 is moved from its frictional engagement

with the edge 58. In this instance the pin 45 is the reduced outer end of the barrel 42 which is slidable in a recess and contains a portion of the spring 43. Immediately thereafter, but substantially at the same time, the latch 40 which can be moved inwardly against the action of the spring 41 snaps into the rectangular slot 47 and forces back the pin 45 against the spring 43 until the outer end of said pin reaches the inclined recess or cut away portion 46 on the inner side of the face plate 39 when the spring 14 acts to move the locking dog 11 to its locking position and the circuit closer to its closed position. (See Fig. 2.) The projecting portion of the contact device does not interfere with the closing of the door from its position shown in Fig. 2 for the reason that the bolt 11 is set to the left farther as viewed in Figs. 4 and 5.

In Figs. 9, 10 and 11 are shown modifications of the means for holding the lever 10 in its intermediate position and releasing the same therefrom. In place of a rectangular slot 47 I have provided a circular opening 47′ and a vertically beveled recess 60 in the outer side of the face plate 39 and adjacent said opening. I have also changed the latch 40 to that shown at 40′ in Fig. 9, an additional beveled portion 59 being provided for the latch so that the end of the latch shall fit into the beveled recess 60 and also be able to force back the pin 45 until it can slide up the inclined recess 46. The lock casing 17 may be placed in the jamb of the door casing or secured in a suitable manner to the outside of the casing while the keeper casing 33 is placed in the movable part, so that when the door is closed the parts will assume the positions shown in Fig. 2. The knob spindle 3 when turned rotates the pinion 2 which meshes with the rack 62 on the tubular bolt 61 in which the spring 41 is placed and to the outer end of which the latch 40 is secured. The latch can therefore be positively actuated. In the case of a rectangular slot 47 the turning of the knob is necessary to open the door when the cam 5 has moved the locking dog 11 to its unlocking position as shown in Fig. 1. But when the lock is provided with the details shown in Figs. 9, 10 and 11 the door may be pulled open if desired without turning the knob. In both cases the door may be slammed shut without manipulating the knob. It is to be noted that the slot 47 as to length does not make a close fit with the latch 40, nor do the openings 35 and 37 make a close fit with the locking dog 11 and contact device 12 which move respectively through the same. This is purposely so for the reason that it is desired that the parts shall properly coöperate even though either the door or casing may shrink or sag. For instance, in Fig. 1 the keeper casing 33 with its striking plate 38 could be lowered to a distance less than the diameter of the pin 45 and the lock would still be operative. Furthermore, with enlarged openings as shown a very fine adjustment of parts is not required when the lock is to be secured in position. The openings 48 and 49 are made only a little larger than the dog 11 and contact device 12, respectively, which move through the same as the relation between these parts is almost constant.

In order to be able to open any door at any and all times regardless of the position of the elevator car in the elevator well, I provide an opening 4 in the keeper casing for the insertion of a master key. This key is adapted to engage the locking dog 11 and force it into the position shown in Fig. 1, that is, to its unlocking position, whereupon the door may be opened by means of the knob on the spindle 3. To prevent the key from coming in contact with any part of the circuit closer I have mounted a small piece of sheet metal 63 on the upper portion of the base 32 of insulation so as to extend over the circuit closer which is placed in the keeper casing.

Having described the mechanical parts of the lock, I will now describe the electric features thereof. The contact device 12 mounted at the lower end of the lever 10 comprises two contacts 19 and 20 insulated from each other by means of the insulation 51 and 52 but electrically connected, respectively, to the contacts 24 and 25 at the extreme lower end of the contact device. In this instance the contact 19 is integral with the contact 24 and the contact 20 is integral with the contact 25. The contacts 24 and 25 are insulated from the lever 10 by the non-conducting strips 53. It will be seen that the surfaces of the contacts 19 and 20 are parallel and slightly inclined but almost horizontal, while the surfaces of the contacts 24 and 25 are also parallel but arranged almost vertically. Adapted to coöperate with the contacts 19 and 20 are contact legs 26 and 27 which are pivotally connected to the support 29. This support is rigidly secured to the inclined surface of the base 32 of insulation. A compression spring 28 forces the contact levers 26 and 27 together by pressing against the heels 67, 67′ of said levers but the movement of said levers is limited by the set screws 30, 31 which engage the toes 79, 79′ thereof.

Upon inspection of Fig. 2 it will be seen that when the circuit closers are in closed position the spring 28 will be further compressed and the toes 79, 79′ disengaged from the set screws 30, 31, but since the support 29 as well as the contact levers and their pivotal connections is made of good con-

ducting material the continuity of the circuit is easily established at this point. With this construction involving spring-pressed contact levers the continuity of the circuit may be maintained or in other words the circuit closer may be operated through a wide range of variation of the relative position of parts to meet the condition of the door's shrinking.

On the lower side of the lock casing 17 are mounted the independent frames 55 and 56 on a base of insulation 8. On each frame is a binding post, 65, 66, to which the electric controlling circuits for the elevator hoisting apparatus are connected. A hole 64 is provided in the casing 17 for the passage of the wires. Pivotally mounted on these frames are laterally movable contact fingers 21 and 22 adapted to be engaged by the contacts 24 and 25, respectively, of the contact device 12. These fingers are pressed inwardly by the spiral springs 9, the inward movement of the same being limited by the extension 68 of the insulating base 8. The distance between the fingers when in their normal position is less than the distance between the outside surfaces of the contacts 24, 25 so that a good rubbing contact shall be secured when the circuit closers are operated. In Fig. 2 both circuit closers are shown in their closed positions so that the circuit may be traced from binding post 65 to and through contact finger 21, contact strips 24 and 19, contact finger 26, support 29, contact finger 27, contact strips 20 and 25, contact finger 22, frame 56, to the other binding post 66. The contact device 12 serves also as an additional locking bolt as the side plates 77 and 78 are made strong and securely fastened to the locking lever 10 at the lower end thereof. This can be seen from Fig. 2 where the additional bolt is shown in its locking position in the opening 37 in the striking plate 38 of the keeper casing 33. It will also be seen that the parts are so proportioned that both the locking bolt 11 and the additional bolt will lock the door in closed position before the terminals 65 and 66 are electrically connected with each other through the contact device and the circuit closer in the keeper casing.

In Fig. 8 I have shown an elevator car 75 suspended by a cable 74 opposite a door 76 of the elevator well. The lever 15 with the roller 16 can be moved only from inside the hatchway, except by means of the master key, since said lever extends inwardly. Mounted on top of the car is an electromagnet 69 to the armature of which is connected the cam 5 by means of the rod 70. The cam 5 is pivotally connected by means of the links 72 and 73, to the strip 71 which is secured to the car. While the car is traveling the magnet is energized to hold the cam in the position shown so that the roller 16 shall not be in its path of travel. It is evident that at no other position of the car than that shown, that is, with the car opposite a door could the lock be operated. But in the position shown with the cam opposite the roller 16, the lock may be moved to open position by the deënergization of the magnet 69 when the cam 5 will fall and force the lever 15 toward the right and the locking lever 10 toward the left. The contact device 12 will operate to break the door circuit before the door is unlocked. Conversely when the lever 10 is released the door will be locked before the door circuit is closed. This will be seen from Figs. 2 and 7 since only a slight outward movement of the locking dog 11 is necessary to lock the door but a greater movement is necessary to close the door circuits also.

The circuits and connections of an automatic electric elevator system wherein it is imperative that the door circuits be all closed before the elevator can start and wherein is shown the magnet cam and lock herein disclosed and which can be released only when the car has stopped opposite an elevator door, are disclosed and claimed in a co-pending application filed by me on July 11, 1905, Serial No. 269,183, for an improvement in an automatic push-button controlled electric elevator system.

Having thus fully described my invention and without limiting myself to the precise details of construction or arrangement of parts herein disclosed, what I claim and desire to have protected by Letters Patent of the United States is:—

1. The combination with a fixed member and a movable member, of a locking member for locking said fixed and movable members together, means rigidly connected to said locking member for positively actuating the latter to unlocking position, a resilient device for automatically moving said locking member to locking position, and means for preventing the locking member being moved to locking position when the said fixed and movable members are separated.

2. The combination with a lock-casing, of a locking member, means for actuating said locking member, and means comprising a latch and a portion of the face plate of said lock-casing acting as a catch to prevent the outward movement of said locking member to locking position when the keeper-casing is not opposite said lock-casing.

3. The combination with a lock-casing and a keeper-casing of a door lock, of a locking bolt having a rounded or beveled end, means for actuating said bolt, and means for limiting the outward movement of said bolt to an intermediate position when the door is open, the intermediate position of said locking bolt when the door is open

being such as to allow the door to be closed against said rounded or beveled end of the bolt.

4. The combination with a lock-casing comprising a face plate, of a keeper-casing comprising a striking plate, a locking bolt passing through an opening in said face plate and having its exposed end rounded or beveled, means for actuating said locking bolt, means for retaining said locking bolt in an intermediate position such that the striking plate upon engaging said rounded portion of the locking bolt shall move the same inwardly until an opening in the striking plate registers with the bolt opening in the face plate when the bolt shall be automatically moved to full locking position by said actuating means.

5. The combination with a lock-casing having a face plate, of a keeper-casing having a face plate, a single movable locking member arranged to pass through registering openings in said face plates, said keeper-casing having a key hole for the insertion of a key to bear directly against said locking member and move said locking member to unlocking position, and means for automatically returning said locking member to locking position upon the withdrawal of the key.

6. The combination with a lock-casing, of a locking member pivoted thereto, a spring-pressed member at the pivotal point for engaging an edge of an opening in the face plate of said lock-casing to retain the locking member in an intermediate position, a keeper casing having a striking plate arranged to strike the outer rounded portion of the locking member to force the same to its unlocking position, and means for automatically locking the door when the opening in the face plate of the lock casing registers with an opening in the striking plate.

7. The combination with a lock-casing having a face plate, of a locking member, a spring-pressed pin movable with said locking member and arranged to engage an edge of an opening in said face plate to hold said locking member in an intermediate position, a keeper-casing, a latch in said keeper-casing arranged to engage said pin to release said locking member, and means for moving said locking member to locking position.

8. The combination with a lock-casing having a face plate, of a locking member pivoted to said casing, a spring-pressed pin adjacent the pivotal point and movable with said locking member, said pin being arranged to engage an edge of an opening in said face plate to retain said locking member in an intermediate position, a keeper-casing, a latch in said keeper-casing to engage said pin to release the same and allow it to ride up a recess on the inner side of said face plate, and means for automatically moving said locking member to locking position upon the release of said spring-pressed pin.

9. The combination with a door-casing, of a lock-casing secured thereto, a locking member pivotally connected to said lock casing, a spring pressed pin adjacent the pivotal point and movable with said locking member, a door, a keeper-casing secured to said door, a spring-pressed latch for said keeper-casing and engaging said pin when the door is in closed position to release the pin from engagement with an edge of an opening in the face plate of said lock casing which retains said locking member in an intermediate position, the outer end of said locking member being beveled to co-act with the striking plate of said keeper-casing when the door is closed to effect the inward movement of said locking member until the latch releases the pin, and means for automatically actuating the locking member to locking position when the latch releases the pin.

10. The combination with a lock-casing having a face plate, of a keeper-casing having a striking plate, a locking lever in said lock-casing, a locking bolt rigidly connected to said locking lever and arranged to pass through registering openings in said lock-casing and keeper-casing, a rock shaft rigidly connected with said locking lever and extending outside said lock-casing, a lever rigidly connected to the extension of said rock shaft, means for engaging said lever for moving the locking bolt to unlocking position, automatic means within the lock for moving the locking bolt to locking position, a spring-pressed pin adjacent the rock shaft for engaging an edge of an opening in the face plate to retain the locking bolt in an intermediate position, a spring-pressed latch in the keeper-casing for engaging said pin to release the locking bolt, the outer end of said locking bolt being beveled to coöperate with the striking plate to move the locking lever inwardly and the said pin from engagement with the edge of the said opening before the latch engages the pin to cause the same to be moved in a recess in the back of the face plate as the bolt moves outwardly through openings in the face plate and striking plate to locking position.

11. The combination with a fixed member and a movable member of a locking mechanism, of a single locking member for locking said fixed and movable members together, automatic means rigidly connected with said locking member for actuating the same, and means co-acting with said locking member for operating a circuit closer when the locking member is moved to locking position.

12. The combination with a lock-casing, of a keeper-casing, a single locking member, automatic means for moving said lock-

ing member to unlocking position, insulated contacts carried by said locking member, spring-pressed contact levers in said keeper-casing for connecting said insulated contacts, and terminals for engaging said contacts when the locking member is in locking position and said contacts are in engagement with said spring-pressed levers.

13. The combination with a lock-casing, of insulated electric terminals mounted therein, a locking member, a keeper-casing to coöperate with said locking member, a circuit closer mounted within said keeper-casing, and means connected with said locking member and movable therewith for co-acting with said terminals and circuit closer to electrically connect said terminals only when the locking member is in locking position with respect to the keeper-casing.

14. The combination with a lock-casing, of a keeper-casing, a single locking member, insulated electric terminals, and means co-acting with said locking member for electrically connecting said electric terminals only when the locking member is in full locking position and locked with respect to said keeper-casing.

15. The combination with an elevator door, of a lock-casing secured to the door casing, a keeper-casing secured to the door, a locking member, insulated electric terminals connected to said lock-casing, electric contacts connected to said locking member to move therewith and engage said terminals when the locking member is in full locking position, and means for preventing said contacts from engaging said terminals when the door is in open position.

16. The combination with a lock-casing, of a single locking member pivoted thereto, a keeper-casing, insulated electric terminals in the lock-casing, insulated contacts on the end of said locking member, a circuit closer in the keeper-casing and comprising spring-pressed levers for connecting said contacts, and means for actuating said locking member to full locking position and locked to effect an electrical connection between said terminals through said contacts and circuit closer.

17. The combination with a door, a door casing, a lock casing secured to said door, a locking member, means for moving said locking member to unlocking position, automatic means in the lock casing for actuating said locking member to locking position, insulated electric terminals in the lock casing, insulated contacts carried by said locking member for engaging said terminals, a circuit closer in the keeper-casing for electrically connecting the said terminals through said contacts, and means for preventing said contacts from being connected with said terminals when the door is in open position.

18. The combination with a door, a door casing, a locking member secured to the door casing, an arm rigidly connected to said locking member, a keeper-casing secured to the door, an electro-magnet, a cam, connections between said magnet and cam for operating the latter to effect a movement of said locking member to its unlocking position, and circuit closing mechanism operated by said locking member to close the circuit after the door is locked and to open said circuit before the door is unlocked.

19. The combination with a lock-casing, of a single locking lever pivotally mounted therein, a locking bolt projecting therefrom, an additional locking bolt, a contact device connected with said additional locking bolt, a keeper-casing, electric terminals, and means co-acting with said contact device for connecting said terminals after the door has been locked by both locking bolts.

20. The combination with a lock-casing, of a keeper-casing, a single locking lever in said lock-casing, a plurality of locking dogs connected with said lever, a contact device carried by one of said dogs, an insulated circuit closer in said keeper-casing, insulated terminals in the lock-casing, and means for actuating said locking lever to bring said locking dogs into their locking positions and effect the connection of said electric terminals.

21. The combination with a lock-casing, of a keeper-casing comprising a face plate, a locking member arranged to pass through an opening in said face plate, a contact device movable with said locking member and arranged to pass through an additional opening in said face plate, said openings being of sufficient length to allow for sagging of the door to which the keeper-casing is secured, circuit closing mechanism co-acting with said contact device, means for actuating said locking member to its unlocking position, and automatic means for returning said locking member to its locking position upon the release of said actuating means.

In testimony whereof, I have signed my name to this specification in the presence of two subscribing witnesses.

JOHN E. BOYCE.

Witnesses:
CHARLES M. NISSEN,
WALTER C. STRANG.