A. MAGNUSON.

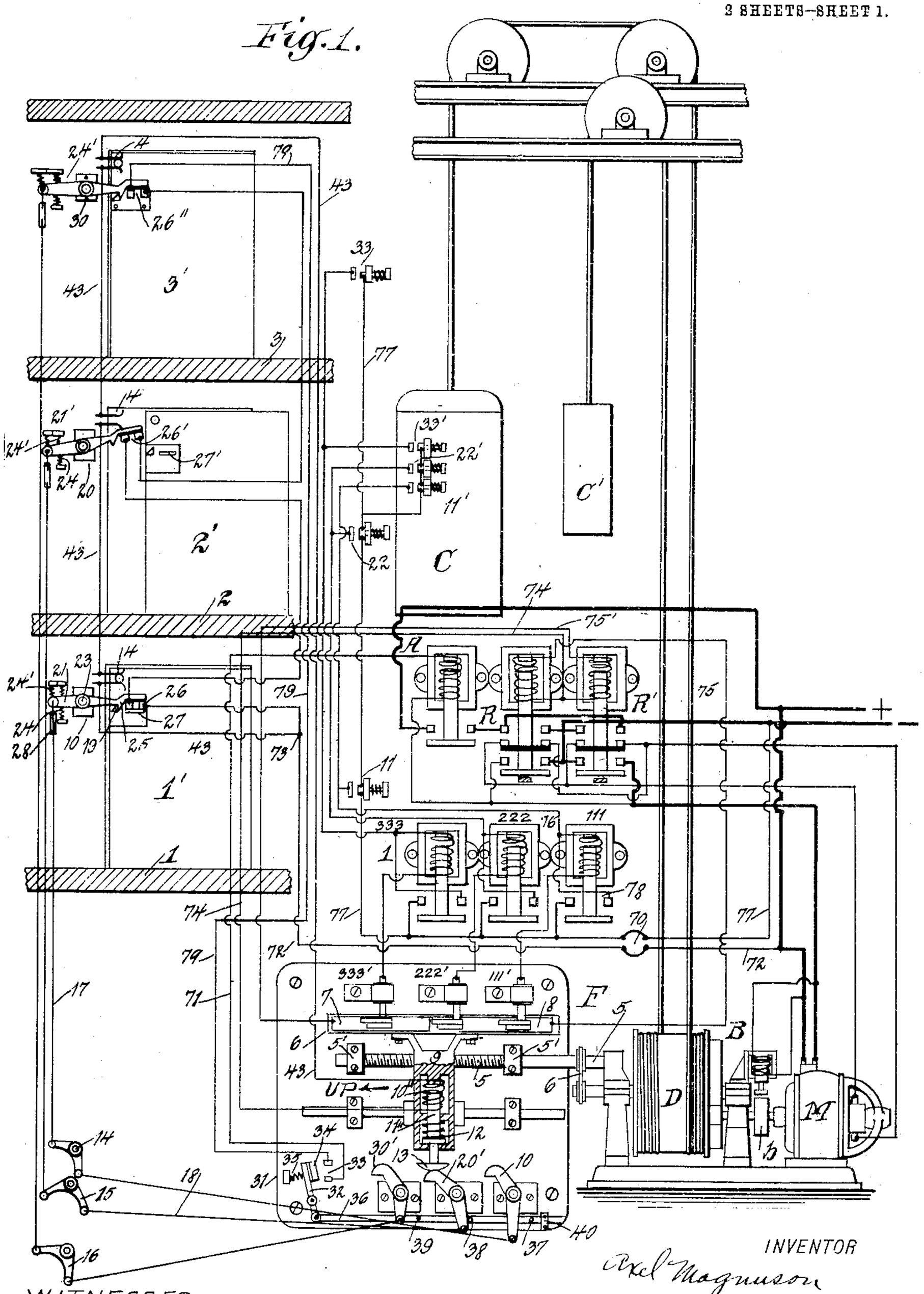
DOOR LOCK OPERATING APPARATUS.

APPLICATION FILED NOV. 14, 1907.

998,624. **Patented July 25, 1911.**

2 SHEETS—SHEET 1.

Fig. 1.



WITNESSES:

J. L. Rochon

James G. Bethell

INVENTOR

Axel Magnuson

BY

C. M. Nissen

ATTORNEY

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2 SHEETS—SHEET 2.

Fig. 3.

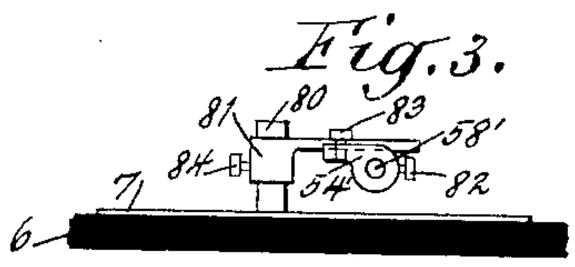

Fig. 2.

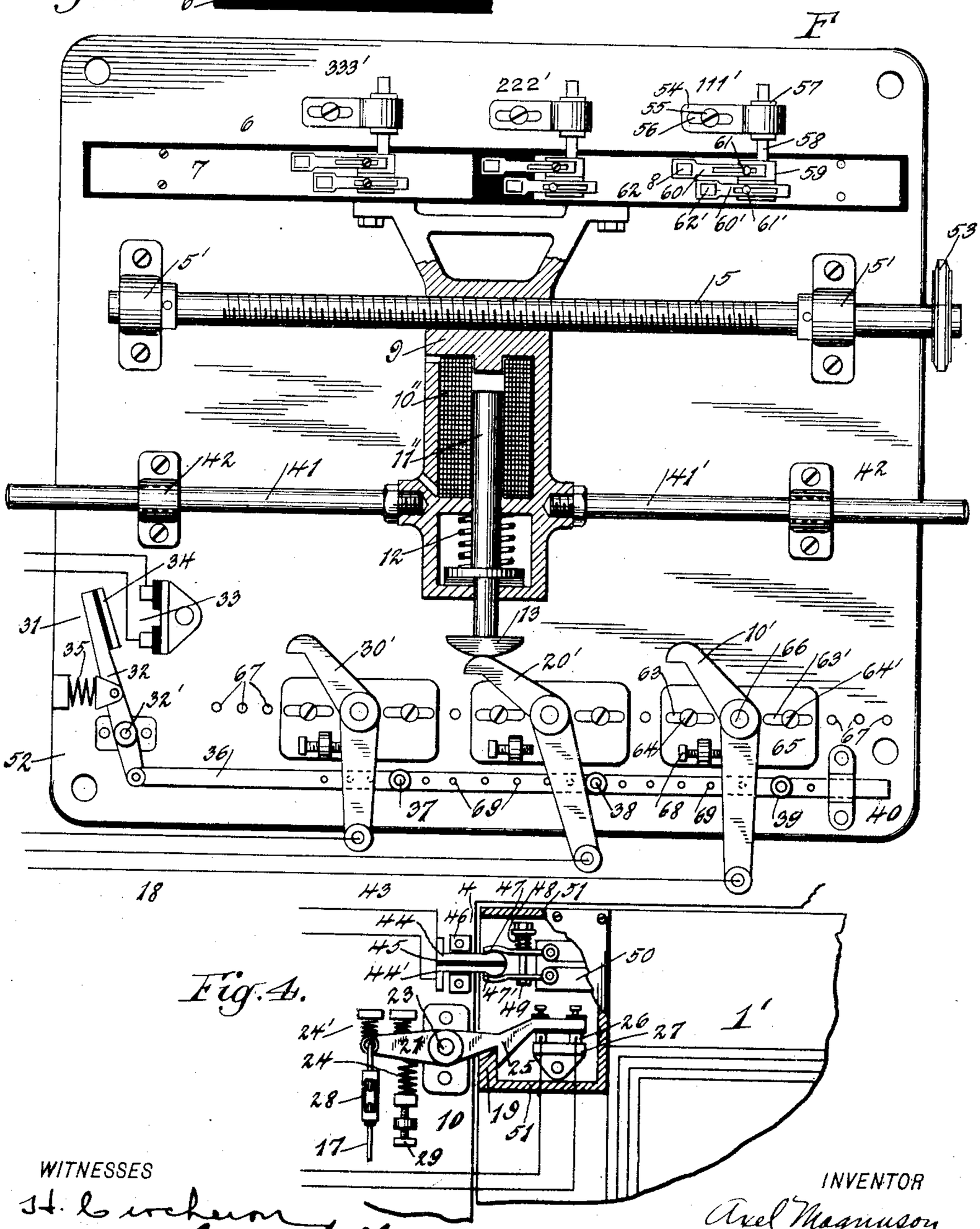

Fig. 4.

WITNESSES

H. L. Corbett

James G. Bethell

INVENTOR

Axel Magnuson

BY

C. M. Nissen

ATTORNEY

UNITED STATES PATENT OFFICE.

AXEL MAGNUSON, OF NEW YORK, N. Y., ASSIGNOR TO OTIS ELEVATOR COMPANY, OF JERSEY CITY, NEW JERSEY, A CORPORATION OF NEW JERSEY.

DOOR-LOCK-OPERATING APPARATUS.

998,624. Specification of Letters Patent. Patented July 25, 1911.

Application filed November 14, 1907. Serial No. 402,067.

To all whom it may concern:

Be it known that I, AXEL MAGNUSON, a citizen of the United States, residing in New York, in the county of New York and State of New York, have invented a new and useful Improvement in Door-Lock-Operating Apparatus, of which the following is a specification.

My invention relates to door lock operating apparatus especially adapted for use in automatically controlled elevator systems.

One of the objects of the invention is to cheapen and simplify the construction and instalment of the lock-operating mechanism. In apparatus of this character at present in use the locks for the doors at the different floor landings are operated by means of one or more cams carried by the elevator car. There is often insufficient space in the elevator hatchway for these cams, which necessitates cutting in the hatchway to permit the cams to pass. The doors are usually out of alinement, which requires expensive cutting and fitting for each door to bring the latches into proper adjustment with the operating cam. My invention avoids these objections by dispensing with the cams on the elevator car and operating the latches by mechanism located in proximity to the elevator hoist and operated positively therefrom, and mechanical connections between said mechanism and the latches.

Another important object of the invention is to positively do away with the noise incident to the operation of the cams and the cam-operating mechanism placed on the car, by locating the operating mechanism in the basement, or away from the car.

Still other objects of the invention are to make this part of the elevator system more reliable in operation than heretofore, to have the latch-operating mechanism near the motor, where it will be convenient of access for care and repairs, and where it may be made more powerful in operation than devices now in common use.

Other objects of the invention will appear hereinafter, the novel combinations of elements being set forth in the appended claims, which define the scope of the invention.

Figure 1 is a diagrammatic view of apparatus embodying my invention; Fig. 2 is an enlarged view, partly in section; of the floor controller; Fig. 3 is a modified detail thereof; Fig. 4 illustrates, in part section, the hatchway door contacts and the door locking device.

Referring to the drawings, M represents a motor, shown as a shunt wound electric motor.

C represents an elevator car or cage, and C′ the usual counterbalance weight, connected to a hoisting drum D, which may be operated by the motor directly or through any suitable connections, such as gearing.

B designates the usual friction brake which is normally applied to the periphery of a brake pulley *b* and is released from engagement therewith by electrical means.

In order to operate the motor and to control its direction of rotation for moving the car upward or downward the reversing switches R and R′ are used. They may be of any suitable character, and in the present instance are shown as magnetic switches of the well known solenoid type.

A designates an electrically operated main line switch at which the motor circuit is closed.

1, 2 and 3 represent floor landings, of which there may be any desired number, opening, as is usual, upon the elevator hatchway. At each floor are shown push buttons 11, 22 and 33, and push buttons 11′, 22′ and 33′ are shown on the car, while electrical connections are made between the push buttons at each floor and on the car and the motor-controlling devices.

111, 222 and 333 are relays which are connected to corresponding push buttons at each floor and on the car, and are adapted to be operated upon closing the proper circuit by means of the corresponding push button.

The hatchway doors are provided with door contacts 4 which are connected in series with each other and included in a controlling circuit which is only maintained when the hatchway doors are all closed. The preferred construction of these door contacts is shown at Fig. 4, in which two contacts 44 and 44′, between which is insulation material 45, are rigidly held in proper position upon the door casing by an insulated bracket 46. A metallic box 51 with a removable cover, is mounted upon the hatchway door, and contains two spring-pressed swinging contact clips 47 and 47′ which are

pivoted to a suitable piece 50 insulated from the box 51. These contact clips 47 and 47′ are so placed with regard to the fixed contacts 44 and 44′, respectively, on the door casing as to be in electrical engagement therewith when the door is in its closed position. The spring 48 carried by the bolt 49 insures a firm electrical contact between the fixed contacts and the clips when the door is closed, and the engaging faces of the fixed contacts are rounded as shown so as to readily enter the clips upon closing the door.

10, 20 and 30 are combined door locking and contact closing devices, and the preferred construction is shown in Fig. 4. Each hatchway door is provided with one of these devices, and, since they are similar in every respect, I will describe the one shown upon the first floor, and designated by 10. A locking lever 21 is pivoted at 23 to a suitable fixture mounted upon the door casing. This lever is provided with a latch 25 which is arranged to coöperate with a keeper 19 which may be formed integral with the box 51 and so lock the door in its closed position. The latch lever carries at one end two electrical contacts 26 which are adapted to engage, or come into electrical contact with, a bridging contact 27 which is suitably mounted upon a bracket carried by the box 51 and insulated therefrom, whenever the latch lever 21 is in its locking position. A spring 24, whose tension may be regulated by means of a screw 29, tends to maintain the latch lever in its locking position. A spring or springs 24′ may also be provided in addition to or in place of the spring 24, such springs being desirable to support the weight of the wires 17 and connected parts and insure the return of the latch lever to locking position. The left-hand end of the latch lever is provided with a turnbuckle 28 which is connected by a cord 17 to a bell crank 14. Other cords 17 connect the locking devices 20 and 30 to similar bell cranks 15 and 16, respectively, and these bell cranks 14, 15 and 16 are connected through the cords 18 to bell crank levers 10′, 20′ and 30′ forming part of the floor controller apparatus F.

The detail construction of the floor controller is clearly illustrated in Fig. 2, and it comprises a suitable base or support 52, upon which is rotatably mounted a screw-threaded rod 5 carried in the bearings 5′, and provided at one end with a sprocket wheel or pulley 53. This latter is suitably connected by sprocket chain, belt, or other means to the elevator car or to some rotating part of the hoisting apparatus, such as the drum shaft, in such manner that it is caused to revolve at a speed proportional to that of the hoisting apparatus and also proportional to the speed of the elevator car. A magnet casing 9 is screw-threaded upon the rod 5 and is carried along in one direction or the other guided by the rods 41, 41′ in the bearings 42, depending upon the direction of rotation of the rod 5 corresponding to an upward or downward movement of the elevator car C. This magnet frame 9 is securely bolted to an insulation strip 6 to which are attached conducting strips 7 and 8. Arranged adjacent to the path of movement of the insulation strip 6, and contact strips 7 and 8 carried thereon, are stationary contacts 111′, 222′ and 333′, similar in construction and each comprising a slotted supporting bracket 54 secured to the base 52 by a screw 55′ which passes through the slot 56. This construction provides means for adjusting the position of the bracket 54 on its supporting base 52. The bracket 54 is provided with a bushing 57 in which is securely fastened a rod 58 having a flattened portion 59 to which are connected flexible contact holders 60 and 60′ carrying contacts 62 and 62′, respectively. The contact holders 60 and 60′ are screwed to the flattened portion 59 by screws 61 and 61′, and the slots provided in each contact holder permit the latter to be adjusted in proper position. The magnet frame 9 contains a solenoid winding 10″, adapted when energized to raise a magnet core 11″ which is normally held in its downward position by means of a spring 12. The magnet core 11″ has connected to its outer end a head 13 which is adapted under certain conditions to engage one of the bell cranks 10′, 20′ or 30′. These bell cranks are similar in construction and each crank lever is pivoted at 66 to a fixture 65 which is slotted at 63 and 63′ and held in proper position on the support 52 by the screws 64 and 64′. The slots 63 and 63′ permit a limited horizontal adjustment and this adjustment may be widely varied by transferring the screws 64 and 64′ to other holes 67. A set screw 68 limits the movement of the bell crank in one direction. A rod 36 guided at one end by a guide 40 lies directly behind the long arms of the bell cranks 10′, 20′ and 30′ and is connected at its other end to a switch lever 32. Rollers 37, 38 and 39 are secured to the bar 36 at suitable positions and adapted to engage the long arms of the corresponding bell cranks 10′, 20′ and 30′ adjacent thereto.

The switch 31 comprises a switch lever 32 pivoted at 32′ to a bracket secured to the support 52, and carries upon its upper portion an insulated contact 34 which is adapted to bridge or close an electrical circuit between fixed contacts 33 when the switch lever 32 is in its right-hand or closed position. The opening of the switch 31 is effected whenever the bar 36 is moved to the right, by one of the bell cranks 10′, 20′ or 30′ engaging a corresponding roller 37,

38 or 39, respectively. A spring 35 tends to maintain the switch 31 in its right-hand or closed position.

As shown in Fig. 1 the elevator car C is at rest adjacent to the second floor landing 2, and the hatchway door 2′ is unlocked and partially open. The door locking means 20 is in its raised or released position due to the operation of the floor controller acting through the spring-pressed piece 13, bell crank 20′, cord 18, bell crank 16, and cord 17. The switch 31 is in its open position, thereby preventing a circuit through the contacts 33, which, as will be pointed out later, include the winding of the main line magnet switch A and designate a suitable source of electrical supply.

In order to show the operation of the present embodiment of my invention, let it be supposed that all of the hatchway doors are closed, and the operator in the car desires to bring the car to the first floor landing 1. The car button 11′ corresponding to the desired floor is pressed and a circuit is established which may be traced as follows: From the + main by wire 72 and fuses 70 to a junction 73, thence by wire 43 through the contacts 4 of each door and to the magnet winding 10″ of the floor controller. The other terminal of this magnet winding is connected by wire 74 to the common terminal of the magnet windings of the reversing switches R and R′. The circuit continues through the winding of switch R and by wire 75 to the contact strip 8 on the floor controller, thence through winding of relay 111 by way of contact 111′, and by wire 76 through the push button 11′ to the — main by wire 77. It is thus seen that by pushing the car button 11′ a circuit is closed including the door contacts 4, winding 10″ of the floor controller, winding of the reversing switch R, floor controller contact 111′, winding of relay 111 and push button 11′. The winding 10″ of the floor controller is now energized to raise its core 11″ together with the head 13 connected therewith, and the spring 24′ operates to bring the locking lever 21′ in locking position, securely locking the door 2′ and carrying the contacts 26′ into electrical engagement with the stationary contact 27′. The bell crank 20′ will be moved into a position corresponding to the bell cranks 10′ and 30′, thereby allowing the spring 35 to move the switch 31 to the right and electrically connect the stationary contacts 33. The reversing switch R is also energized at this time to raise its core and connected contacts, and thus arrange the motor connections in such manner that when the motor receives current from the main line the same will revolve in the proper direction to cause the elevator car to descend. It is not deemed necessary to point out the motor circuits since the usual method of reversing the motor by altering or reversing its armature connections by means of reversing switches is well known in the art. The relay 111 is also included in the circuit just traced and it will operate to raise its core and connected contact plate, thereby bridging or bringing into electrical contact the stationary contacts 78. This latter operation closes a self-holding circuit to the terminal of the relay 111 by wire 77 and contacts 78, which is in parallel to the push button 11′, therefore after the relay has operated it is no longer necessary to keep the push button 11′ pressed in order to maintain the various circuits. As before pointed out, one terminal of the winding of the main line switch A was open-circuited at the contacts of switch 31 when the latter was in its open position. The other terminal of this winding was also open-circuited at the lower contacts of the reversing switches R and R′. Since by pressing the push button 11′ the switches 31 and R have both operated to close their respective contacts, a circuit to the winding of the main line switch A is also closed and it may be traced as follows: From the + main at the junction 73, locking lever contacts 26, 26′ and 26″, wire 79, contacts 33, wire 71 to and through the winding of switch A, lower contacts of reversing switch R, to the — main. The main line switch is now energized to raise its core and so close the motor circuit, and at the same time a circuit to the magnet brake B and the motor is enabled to operate in the usual manner to cause the elevator car to descend. Owing to the connections between the motor and the floor controller, as before described, the latter, or rather the screw-threaded portion 5 thereof, will also revolve proportionally in such direction as to carry the magnet frame 9 and connected parts, including the insulation 6 and contact strips 7 and 8 carried thereon, in a right-hand direction, until finally as the contact strip 8 moves out of engagement with the contact 111′, the circuit through this contact, including the winding of relay 111, winding of reversing switch R and winding 10″ of the floor controller is broken. The apparatus included in this circuit at once becomes deënergized and returns to their normal position. The deenergization of the reversing switch R interrupts the motor and brake circuits and the motor and car come to rest, the car being automatically stopped at the first floor landing. The deënergization of the reversing switch R operates to interrupt the circuit through the winding of the main line switch A at the lower reversing switch contacts, and the latter becomes deënergized and drops its core. The operation of the hoisting apparatus in bringing the car from the second floor to the first floor causes the

magnet frame 9 to assume a position such that the head 13 of the magnet core 10″, upon being thrust downward by the spring 12, engages the short arm of the bell crank 10′ and forces it downward. The long arm of this bell crank will engage the roller 7 carried upon the bar 36 and move the latter to the right, opening the switch 31. This movement of the bell crank 10′ will exert a downward pull upon the locking lever 21, acting through the cord 18 and 17 and bell crank 14, and the locking lever 21 will be raised out of locking position and at the same time opening any possible circuit between the contacts 26. The door 1′ may now be opened if desired, which will break the main operating circuit through the wire 43 and door contact 4 and rendering it impossible to operate the elevator until the door has again been closed and the door contact 4 restored to its closed circuit position.

If it is desired to bring the car to the upper or third floor landing 3 by an operator at the third floor landing and the hatchway doors are all closed, the push button 33 is pressed. A circuit is now closed through the relay 333 corresponding to the third floor, the floor controller contact 333′, contact strip 7, reversing switch R′, and floor controller magnet 10″. The reversing switch R′ is thereby energized to connect the motor in such manner that it will operate to raise the elevator car when the motor circuit is closed by the main line switch A. The energization of the magnet 10″ raises the head 13 out of engagement with the bell crank 10′ and thus the spring 24 is enabled to force the locking lever 21 into locking position and also short circuit or electrically connect the contacts 26. The spring 35 is also free to close the switch 31 and thus a circuit is now established including the contacts 26, 26′ and 26″ of the locking devices, switch contacts 33, magnet switch A, and the lower contacts of the reversing switch R′. The energization of switch A, as before pointed out, closes the motor and brake circuits and the car travels upwardly. Just as the car reaches the third floor landing the contact strip 7 in the floor controller, which in the meanwhile has been moving to the left, passes from under the contact 333′, breaking the operating circuit and allowing the reversing switch R′ to open its contacts, thereby stopping the motor. The deënergization of the magnet 10″ on the floor controller allows the spring 12 to force the head 13, which has at this time arrived at a proper position to engage the bell crank 30′ down against the bell crank, thereby unlocking the door 3′ at the third floor and allowing the same to be opened. As before described, the floor controller contacts 111′, etc., comprise two contacts 62 and 62′, which may be separately adjusted so that the circuit including these contacts may be interrupted on both the up and down travel of the elevator car at the proper time so that the car will come to rest on a level with the desired floor landing. The controlling circuit is broken to stop the car at the upper contact 62 when the elevator car is ascending, while the controlling circuit is broken at the lower contact 62′ when the car is descending. Thus by properly adjusting the position of these contacts the car will always stop level with any floor landing regardless of the direction of car travel.

Referring to Fig. 3, a modified form of floor controller contact holder is shown in side elevation. An upright 80 is secured to the support or base 52 which carries a supporting piece 81 arranged at right angles thereto. Upon this latter is slidably mounted a holder 54′ having a hole 58′ adapted to receive the contact supporting rod 58 shown in Fig. 2. The supporting piece 81 is vertically adjustable on the upright 80 and may be locked against movement by a set screw 84. The holder 54′ is horizontally adjustable along the arm of the supporting piece 81 and is locked in position by means of the set screw 83, while the contact supporting rod 58 is firmly held in proper position in the hole 58′ by the set screw 82. By slightly turning the rod 58 in the holder 54′, the tension or pressure with which the contacts 62 and 62′ bear down upon the contact strips 7 or 8 of the floor controller may be varied at will.

While I have shown but three floor landings and the various relays, push buttons, door contact devices, and arrangement of the floor controller, are all suitable for an elevator system having three floor landings, my invention is equally adapted to an elevator system having any desired number of floor landings, the additional floor landings merely requiring a duplication of parts heretofore described in connection with a three-floor installation. In order to operate the car after the same has come to rest at any desired floor landing it is necessary to energize the switch A and thereby close the motor circuit. Since the winding of switch A is in series with the contacts 26, 26′ and 26″ of the door locking means, it follows that all of the doors must be closed and securely locked before it is possible to close a circuit through the locking lever contacts and winding of switch A. Furthermore, this circuit includes the contacts of switch 31 and the contacts of either one of the reversing switches R and R′, and in order to complete this circuit one of the reversing switches must be previously operated to close its contacts and the switch 31 must likewise be closed so that its contacts 33 are in electrical engagement. In order to operate

either of the reversing switches R or R′ the door contacts 4 must all be closed, since the door contacts are included in the circuit which operates to energize either of the reversing switches. Also the floor controller magnet 10″ must be energized to allow the switch 31 to electrically connect its contacts 33 before it is possible to complete a circuit to the winding of switch A. The winding of the floor controller magnet 10″ is also inclined in the door contact circuit. Thus it is seen that there is no possibility of operating the car unless the hatchway doors are all closed and securely locked. The magnet 10″ on the floor controller operates to unlock the particular door at the floor landing at which the car has come to rest, and this door cannot be unlocked unless the car has stopped adjacent to this particular floor landing, since the floor controller or rather the moving part 13 thereof, which travels proportionally with the elevator car, must be in proper position relative to the bell crank levers 10′, 20′ or 30′ in order to make it possible for the magnet 10″ to release the door locking means at the floor landing at which the elevator car has come to rest, the other doors remaining securely locked except at such times as the car has come to rest adjacent thereto.

The coöperation of the various parts of the system and the electrical circuits therefor do not depend for their operation upon any one particular device or set of electrical contacts, since the various safety features provided to insure the closing and locking of all of the hatchway doors before the car can be moved away from any floor landing, and to insure that the car has come to rest adjacent to any floor landing before it is possible to open the corresponding landing door, are so interlocked both mechanically and electrically that a false operation is absolutely impossible. Thus a safety feature is provided whereby all accidents due to the opening of hatchway doors when the car is in motion or at some other floor landing, or when the car is started and the hatchway doors are not all closed and securely locked, are obviated.

Various changes may be made in the apparatus shown and described, by those skilled in the art, without departing from the spirit and scope of my invention, and, while I have chosen a well known type of push button operated elevator apparatus for purposes of illustration and easy comprehension thereof, I do not desire to be limited to the specific construction and arrangement of parts as shown. Furthermore, my invention is adapted to electric elevator systems of all kinds, or any other well known operating devices. My invention is equally adapted to direct, alternating or intermittent current; the only changes which would be necessary are well known to those skilled in the art and form no part of the present invention.

What I claim as new and desire to protect by Letters Patent of the United States is:—

1. In an elevator system, the combination with a motor, a car, and a door, of a latch, a latch-operating device separate from the car, and means for automatically operating said device when the car is opposite the door.

2. In an elevator system, the combination with a hoist, a car, and a door, of a latch, a latch-operating device remote from the car, mechanical connections between the latch and said device, and automatic means for operating said device when the car is opposite the door.

3. In an elevator system, the combination with a hoist, a car, and a door, of a latch associated with the door, and means independent of the car for automatically operating the latch only when the car is opposite or near the door.

4. In an elevator system, the combination with a car, a hoisting device, and a door, of a door lock, an operating device therefor separate from the car, means for bringing said device into operation when the car is opposite the door, and mechanical connections between the lock and said device.

5. In an elevator system, the combination with a car, a hoisting device, and doors at the several floor landings, of latches for the doors, mechanical operating connections extending from the latches, a latch-operating device separate from the car, and means for moving it in unison with the car into positions to operate the latches through said connections.

6. In an elevator system, the combination with a car, a hoisting device, and doors at the floor landings, of locks for the doors, a lock-operating device located in proximity to the hoisting device and geared thereto for movement in unison with the car, and separate mechanical connections between each of the latches and said device.

7. In an elevator system, the combination with a car, a hoisting device, and doors at the floor landings, of a latch for each door normally closed when the door is closed, a latch-releasing device located in proximity to the hoisting device, separate mechanical connections between said device and each of the latches, and means for operating said device through said connections to release a latch when the car is opposite the corresponding floor landing.

8. In an elevator system, the combination with a hoisting drum, a car, and doors at the floor landings, of a lock for each door, a lock-releasing device located in proximity to the hoisting drum and geared thereto for movement in unison with the car, independent mechanical operating connections ex-

tending from the locks to positions in which they may be engaged and operated by said releasing device when the car is opposite the corresponding door.

9. In an elevator system, the combination with an electric motor, a car, and driving connections between the motor and the car, of doors opposite the floor landings, a latch for each door normally holding the door closed, push button motor-controlling circuits, a device separate from the car controlled by said circuits for releasing the latches, and means for moving said device in unison with the car into positions to be operated to release each latch when the car is opposite the corresponding door.

10. In an elevator system, the combination with an electric motor, a car, and driving connections, of a door at each floor landing, a latch associated with each door and normally holding the door closed, a latch-releasing device separate from but movable in unison with the car, and means for operating said device to release a latch when the car is opposite the corresponding door.

11. In an elevator system, the combination with an electric motor, a car, and driving connections, of doors at the floor landings, a latch associated with each door and normally holding the door closed, a latch-releasing device separate from but movable in unison with the car, means for stopping the motor with the car at a floor landing, and means for automatically operating said releasing device when the motor is stopped to release the corresponding door.

12. In an elevator system, the combination with a motor, a car, and driving connections, of a door at each floor landing, a locking device for each door, a releasing device separate from the car, means for moving the releasing device in unison with the car, and means to automatically operate the releasing device when the car is stopped.

13. In an elevator system, the combination with a car, a hoisting device, and a door, of a latch, a latch-operating device located in proximity to the hoisting device, a latch-operating connection extending from the latch to a position to be operated by said operating device, and means to effect the operation of the latch operating device when the car is opposite the door.

14. In an elevator system, the combination with a car, a hoisting device, and a door, of a latch, an electrically controlled latch-operating device separate from the car, and wire connections between said device and the latch.

15. In an elevator system, the combination with a car, a hoisting device, and doors at the floor landings, of locks for the doors, a lock-releasing device separate from the car, and independent wire connections between each lock and the releasing device.

16. In an elevator system, the combination with a car, a hoisting drum and motor located below the path of travel of the car, and doors at the floor landings, of locks for the doors, an electrically controlled lock-operating device located below the car and geared to the hoisting drum, and mechanical connections between the locks and lock-operating device.

17. In an elevator system, the combination with a car, a hoisting device, and doors at the floor landings, of a lock associated with each door, an electro-magnet separate from the car and geared to the hoisting device for movement in unison with the car, means for automatically effecting the operation of the magnet armature when the car is brought to rest opposite a floor landing, and mechanical connections extending from the locks to positions to be operated by the armature when the car is opposite the corresponding door.

18. In an elevator system, the combination with a car, a hoisting device, and doors at the floor landings, of latches associated with the doors, a bodily movable electro-magnetic latch-operating device separate from the car, means for operating said latch-operating device, and mechanical connections between the latches and said device.

19. In an automatic elevator system, the combination with a motor, a car, and doors at the floor landings, of means for automatically bringing the car to rest opposite any predetermined floor, a latch associated with each door, mechanical devices extending from the latches to positions remote from the doors, and means operating through said devices for automatically releasing the latch corresponding to the floor opposite which the car is brought to rest.

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

AXEL MAGNUSON.

Witnesses:
W. H. STOKES,
JAMES G. BETHELL.