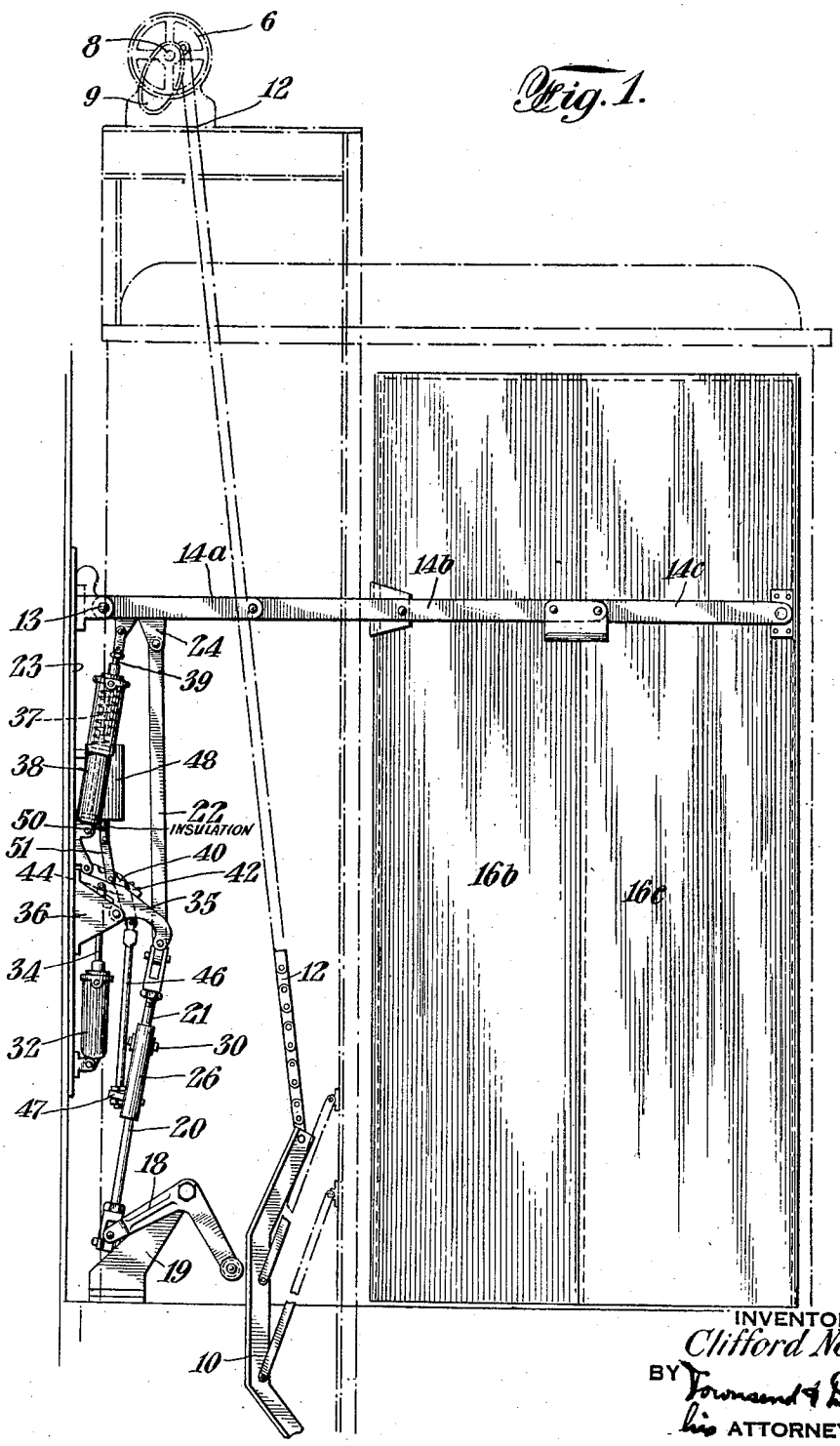
Aug. 9, 1932. C. NORTON 1,871,338

DOOR OPERATOR

Filed Jan. 10. 1929 2 Sheets-Sheet 1

Fig. 1.



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Filed Jan. 10, 1929 2 Sheets-Sheet 2

Fig. 4.

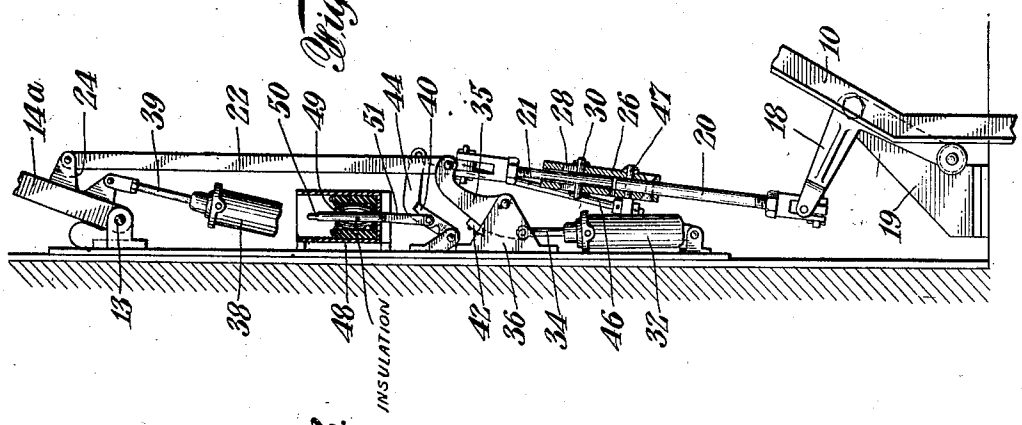


Fig. 3.

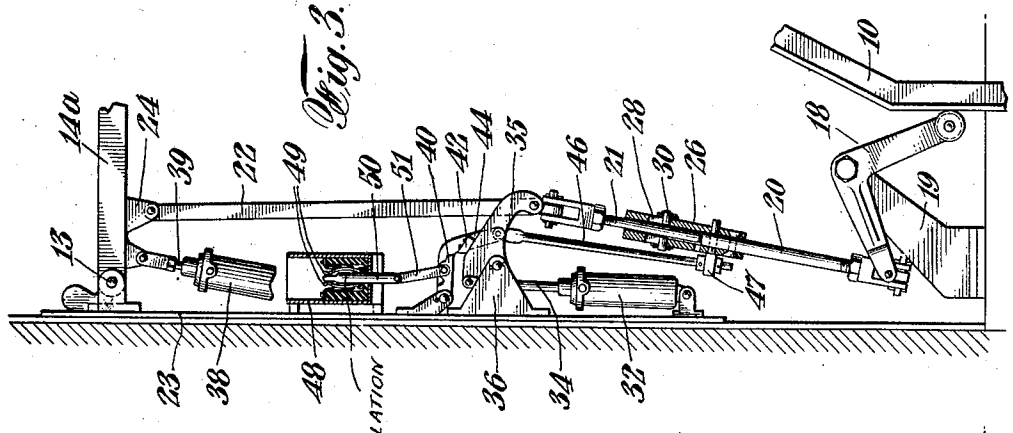
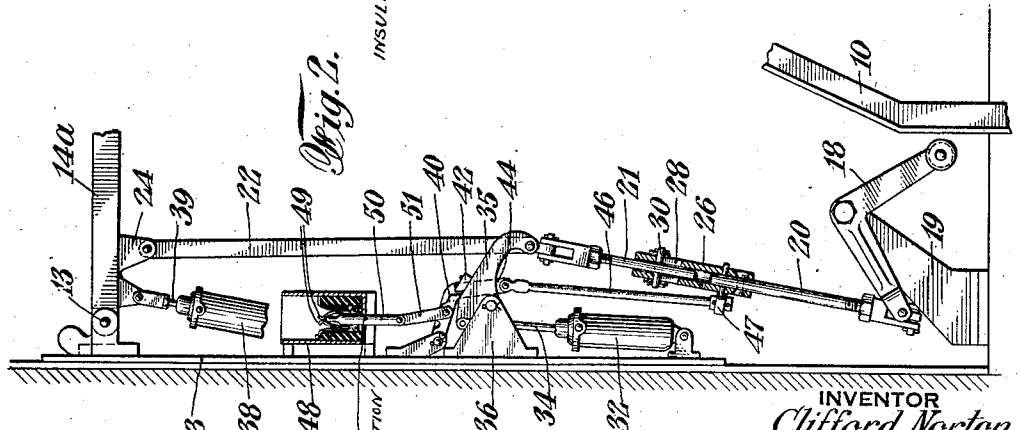


Fig. 2.



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UNITED STATES PATENT OFFICE

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DOOR OPERATOR

Application filed January 10, 1929. Serial No. 331,453.

This invention relates to improvements in door controlling devices.

It is a primary object of the invention to provide a power operating mechanism for doors including devices for controlling an elevator control circuit and door latching mechanism.

More specifically it is an object of the present invention to provide power actuators for doors embodying devices for opening an interlock circuit and door latch and thereafter continuing the same power movement to operate the door.

The present invention is shown as applied to the door through toggle levers, which toggle levers in themselves constitute a door lock. The latching mechanism is shown as applied directly to the door moving levers or toggles thus simplifying the apparatus and resulting in more uniform action.

The above and other features of the present invention will appear more fully from the following description when considered in connection with the drawings in which:

Fig. 1 is an elevation view of one form of apparatus embodying my invention.

Figs. 2, 3 and 4 are detail views of the power transmitting mechanism showing the successive stages in the movement of the power door actuators.

The present invention is shown as applied to power door operators including an electric or other motor 6 connected to the drive shaft 8 through suitable reduction gearing, the shaft 8 being provided with a cam 9 connected to the movable shoe 10 on the car as by means of the chain 12. The motor 6 may be controlled in any suitable manner as by means of a manual pushbutton or by devices operating automatically to energize or deenergize the door motor in coordination with the hoisting motor, such forms of controlling devices being well known in this art.

The invention is shown as applied to devices for moving the elevator shaft doors 16*b* and 16*c*, it being understood that these or other movable doors are positioned at each landing to be served by the elevator, the door moving mechanism for all of the floors being substantially the same.

The door moving mechanism is preferably of the toggle lever type including the three pivotally connected sections 14*a*, 14*b* and 14*c* connected respectively to a wall of the shaft and to the two movable door sections 16*b* and 16*c*. Connection is made between the link 14*a* and the wall of the shaft as indicated at 13 as by means of a bracket mounted upon the face-plate 23. The toggle levers operate in the usual manner so that when the toggle levers are in the traight-line position shown in Fig. 1, the doors are held against opening movement. Upon the breaking of the toggle levers and the application of power to the same the door sections are moved to open position.

The particular mechanism employed herein for transmitting power from the motor 6 to the toggle levers includes a bell crank lever 18 pivotally mounted upon a bracket 19 fixedly supported on the elevator shaft wall and positioned to be engaged by the shoe 10 when the elevator is stopped at or adjacent the corresponding landing. Power is transmitted from the bell crank 18 to the composite link 20, 21, the section 21 of which is pivotally attached to the link 22 which in turn is pivotally connected to the bracket 24 carried by the toggle link 14*a*.

The link section 20 carries a hollow sleeve 26 encircling the link section 21 and slidably disposed with relation to the same. The sleeve 26 is formed with slots 28 and the link section 21 is provided with a transverse pin 30 slidably received within the slots 28 whereby a limited reduction in the length of the composite link 20, 21 is permittted.

Movement of the door in an opening direction is checked by the liquid dashpot 32 pivotally mounted on a bracket carried by the face-plate 23 and sitting in an upright position with its closed end downward to prevent leaking of the liquid from the check. Motion is transmitted to the piston within the check 32 by means of the piston rod 34 and pivotal lever 35, the latter being pivotally mounted upon a bracket 36 carried by the plate 23 and supporting the adjacent ends

of links 21 and 22. It will be understood that the dashpot mechanism 32 includes a one-way valve to cause the dashpot to act only when the rod 34 is being lowered into the casing of the dashpot 32.

The door is moved toward closed position by the spring devices 37 operative when the shoe 10 recedes from the bell crank 18. Closing movement of the door is checked by a dashpot 38 constructed similarly to the dashpot 32 and pivotally mounted upon a bracket carried by the face plate 23, the piston rod 39 being pivotally connected to the toggle link 14*a*. The dashpot 38 operates only when the piston rod is moved inwardly into the dashpot cylinder. Suitable regulating devices may be arranged for the dashpots 32 and 38 as is well understood in this art.

The toggle levers and indirectly the doors are locked against an opening movement by means of the pivoted latch member 40 movable to or from position behind the enlargement or keeper 42 formed on the lever 35. The latch 40 is formed as a projection on the latch lever 44 connected by means of link 46 to the link section 20 as by means of the transverse pin 47.

An interlock switch is shown generally at 48 and includes the two contacting members 49 which when closed permit current to be supplied to the elevator hoisting motor for operating the same but which when separated break the main hoisting motor circuit and prevent movement of the elevator. The function of this interlock circuit is well known in the art. An insulating plunger 50 is connected to the latch lever 44 as by means of the link 51, the parts being so arranged that the plunger 50 will remain below the contacting points of the contact members 49 only when the latch 40 is in latching position behind the lug 42. Upon a very slight movement of the latch 40 toward unlatched position the plunger 50 separates the contact members 49 and prevents operation of the hoisting motor.

The operation of the above mechanism is as follows:

During the time the elevator is remote from any floor the mechanism stands in the position shown in Figs. 1 and 2. Interlock circuit 49 is closed to permit elevator movement, the toggle levers are in a straight-line position maintaining the door closed and the toggle levers are locked against movement by reason of the engagement of the latch 40 behind the keeper 42. The link section 20 remains with the pin 30 in the outer end of the slots 28 so that the link section 20 is in its lowermost position and the bell crank lever 18 is turned to its limit in a counter-clockwise direction.

When the elevator stops at the landing and power is supplied to the motor 6 either automatically on stopping the car or manually through a switch device, operation of the motor 6 causes the shoe 10 to be drawn outwardly into engagement with the free end of the lever 18 for moving the same in a clockwise direction. The first portion of the movement through the lost motion connection 28, 30 elevates the rod 46, latch 40 and moves the plunger 50 to position to open the interlock circuit. Further movement unlatches the latch 40 just before the contacting ends of the rods 20 and 21 engage as the lower ends of the slots 28 approach the pin 30. Thereafter continued movement of the shoe 10 and bell crank 18 operates through endwise pressure of the rods 20, 21 and the linkage shown to break the toggles and open the doors. After the lever 35 has been moved to a very slight extent the keeper 42 rides beneath the latch 40 and thus maintains the interlock circuit open and the latch 40 ineffective to prevent opening of the door until the toggle links 14*a*, 14*b* and 14*c* are in substantially straight-line condition with the doors closed.

The direct connection 46 between the latch operating lever 44 and link section 20 affords a positive operating connection between the bell crank lever 18 and latch 40 and interlock plunger 50 so as to assure uniform and positive operation of latch 40 and interlock 48 at all times. It is thus impossible for the interlock switch to be closed until the link 20 is in its lowermost position and the bell crank lever 18 has been turned to its limit in a counter-clockwise direction. When the shoe 10 is permitted to recede from the bell crank lever 18 by suitable operation of the motor 6 or otherwise, the spring devices shown move the door toward closed position. When the door reaches substantially closed position the links 14*a*, 14*b*, and 14*c* are in straight-line position as shown in Figs. 1 and 2 and the latch 40 is permitted to drop behind the keeper 42 and close the interlock circuit 49. It will be understood that a limited clearance may be provided between the latch 40 and keeper 42 to permit elevator movement before the doors are entirely at rest in their closed position.

Having now described my invention I claim:

1. In combiantion with a movable elevator door, power means for moving said door to open position, said means including door moving mechanism operatively and permanently connected to said door, said mechanism including a door moving element movable in a door closing direction to a point beyond door closed position, an elevator controlling circuit and means controlled by said element for opening and closing said circuit, said means permitting movement of said elevator only when said element is moved in door closing direction beyond closed door position.

2. In combination with a movable elevator

door, power means for moving said door to open position, said means including door moving mechanism operatively connected to said door, said mechanism including a door moving element movable in a door closing direction to a point beyond door closed position, an elevator controlling circuit, means controlled by said element for opening and closing said circuit, said means permitting movement of said elevator only when said element is moved in door closing direction beyond closed door position, a door lock and means for unlocking said lock during the initial movements of said element from its extreme position beyond door closed position.

3. In combination, door moving mechanism connected to said door and including a lost motion connection, power means for operating said mechanism to open said door, an interlock switch, a door lock, and means operatively connecting said switch and lock to said mechanism for opening said switch and unlocking said lock during movement of said mechanism through said lost motion.

4. In combination, door moving mechanism including a lost motion connection, power means for operating said mechanism to open said door, an interlock switch, a door lock, and means operatively connecting said switch and lock to said mechanism for opening said switch and unlocking said lock during movement of said mechanism through said lost motion, said mechanism, switch and lock including means for maintaining said switch open and said lock unlocked until said door reaches substantially closed position.

5. In combination with a movable elevator landing door, door moving mechanism operatively associated with said door and capable of manual operation, a lock for locking said mechanism against manual operation and thereby preventing door opening movement, said lock being maintained by said mechanism out of locking engagement with said mechanism except when the latter is substantially in closed door position and power means carried by said elevator for successively unlocking said lock and applying power to said mechanism to open said door.

6. In combination with a movable door, door moving mechanism operatively associated with said door, a lock for locking said mechanism against door opening movement, said lock being maintained out of locking engagement with said mechanism except when the latter is substantially in closed door position, an elevator controlling switch controlled by said lock and movable to position to render said elevator immovable on movement of said lock to unlocked position and power means for successively rendering said elevator immovable, unlocking said lock and applying power to said mechanism to open said door.

7. In combination with a movable elevator, movable landing doors for admitting passengers to said elevator, means at each landing operatively associated with each of said doors for moving the same, circuit controlling means associated with said door moving means at each landing for controlling the hoisting motor circuit for said elevator, and power means on said elevator for successively moving said circuit controlling means to position to prevent movement of said elevator and thereafter applying power to said door moving means for moving said door.

8. In combination with a movable elevator, movable landing doors for admitting passengers to said elevator, toggle levers operatively associated with said doors for moving the same, circuit controlling means for controlling the hoisting motor circuit for said elevator, a lock for said toggles, and power means on said elevator for successively moving said circuit controlling means to position to prevent movement of said elevator, unlocking said lock and applying power to said toggle levers for moving said door.

9. In combination with a movable elevator, movable landing doors for admitting passengers to said elevator, toggle levers operatively associated with said doors for moving the same, circuit controlling means for controlling the hoisting motor circuit for said elevator, a lock for said toggles, power means on said elevator for successively moving said circuit controlling means to position to prevent movement of said elevator, unlocking said lock and applying power to said toggle levers for moving said door and spring means for closing said door, said toggle levers, circuit controlling means and lock being constructed and associated to permit said hoisting motor circuit to be closed only when said door is closed and locked.

10. In an elevator apparatus, a landing door, toggle levers for opening said door, power devices, means for transmitting power from said devices to said toggle levers, said means including a lost motion connection, and a power controlling switch directly controlled by said lost motion connection.

11. In an elevator apparatus, a landing door, toggle levers for opening said door, power devices, means for transmitting power from said devices to said toggle levers, said means including a lost motion connection, and a power controlling switch directly controlled by said lost motion connection, said lost motion connection serving to open said switch prior to the application of door opening power to said toggle levers.

12. In an elevator apparatus, a landing door, an operating lever for opening said door, power devices, means for transmitting power from said device to said lever, said means including a power supplying element associated with said lever and having limited movement independently of said lever to or

from position to apply power to said lever, means for maintaining said element normally out of power applying relation to said lever, means for maintaining said element in power applying relation to said lever during closing movement of said door, an elevator controlling switch, and means associated with said element for opening said switch upon movement of said element through a portion of its movement independent of said lever.

Signed at New York, in the county of New York, and State of New York, this 9th day of January A. D. 1929.

CLIFFORD NORTON.