

Feb. 14, 1950

N. R. GUILBERT, JR., ET AL

2,497,080

OPERATING MEANS FOR SLIDING ELEVATOR DOORS

Filed April 19, 1946

3 Sheets-Sheet 1

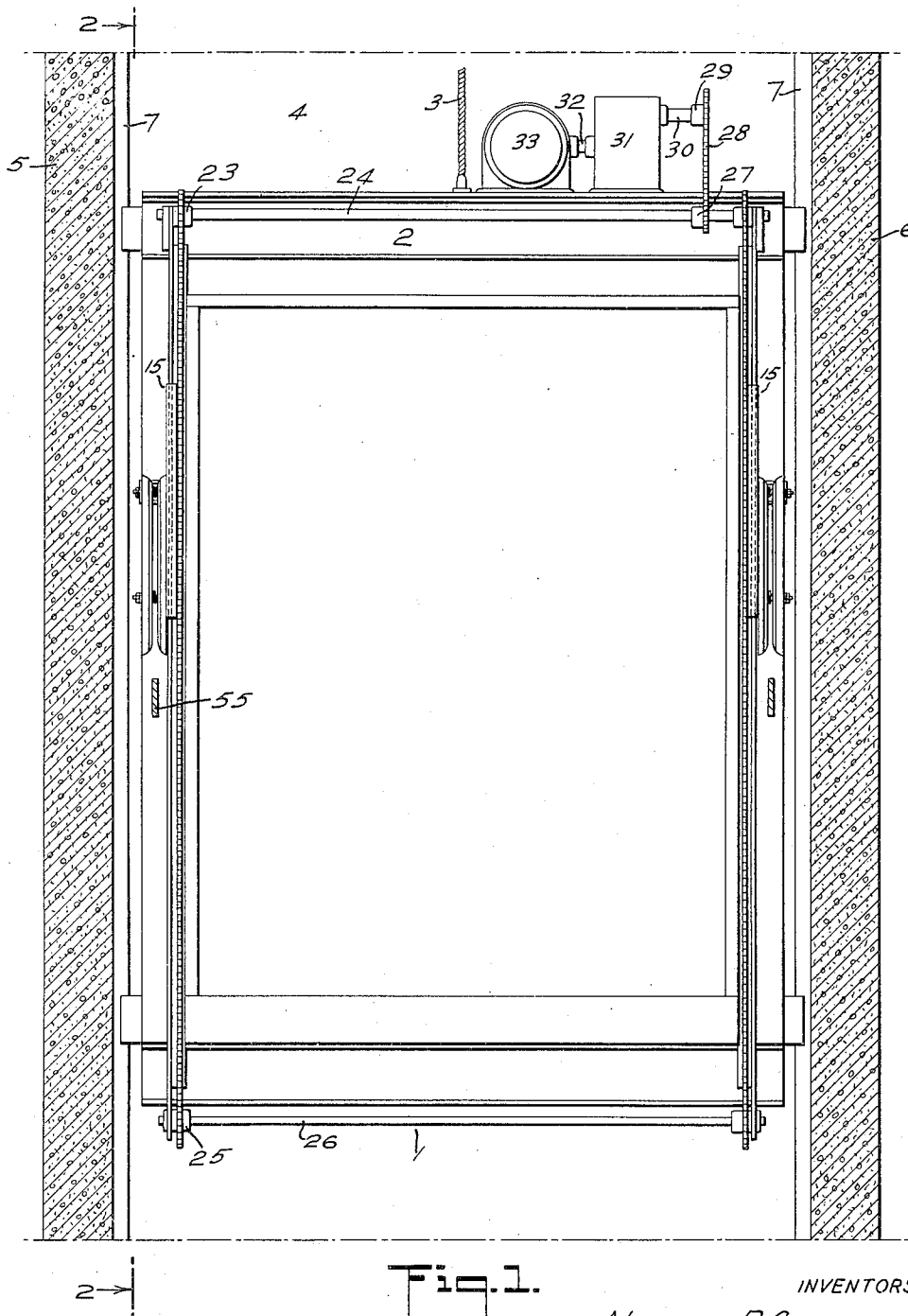


Fig. 1.

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3 Sheets-Sheet 2

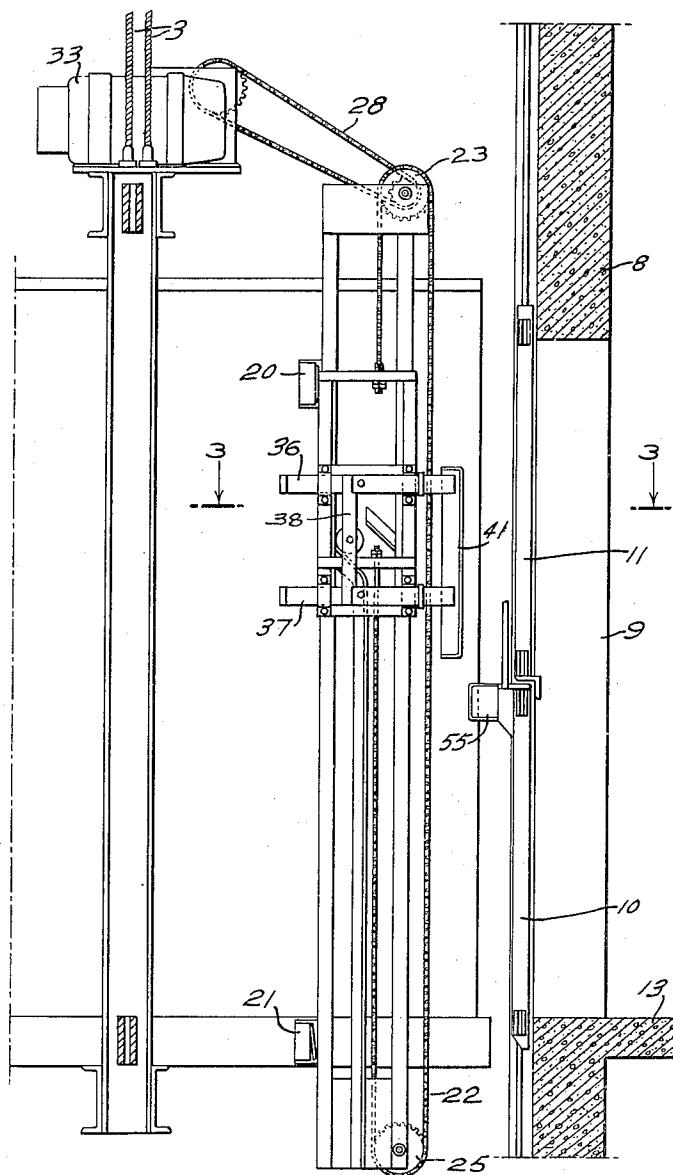


Fig. 2.

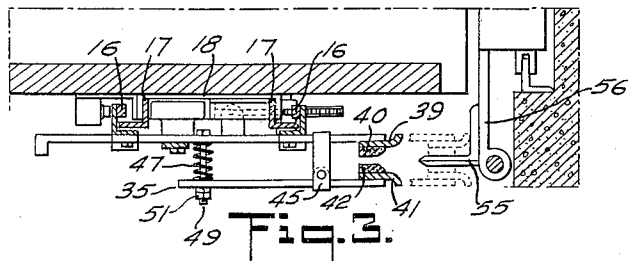


Fig. 3.

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3 Sheets-Sheet 3

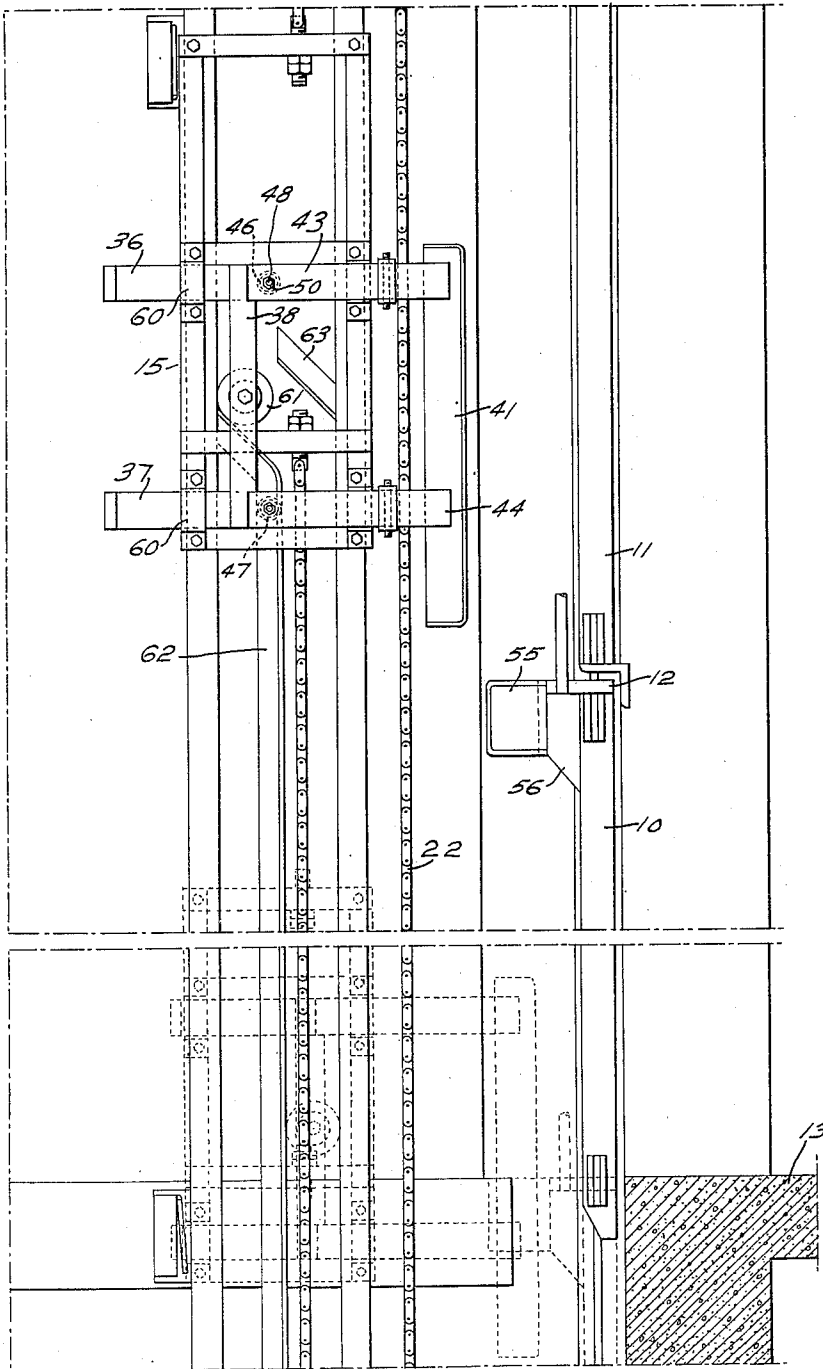


Fig. 4.

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OPERATING MEANS FOR SLIDING
ELEVATOR DOORS

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ors, by direct and mesne assignments, to Guil-
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Application April 19, 1946; Serial No. 663,508

10 Claims. (Cl. 187—52)

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This invention relates to power-operated hatchway doors for elevators and the like and is especially directed to the provision of means for operating doors of the bi-parting type comprising a pair of mutually counterbalanced, vertically slidable panels or leaves at each floor entrance to the hatchway.

Doors of this type are now in general use for freight elevators and are usually operated either manually or by power-driven mechanism located at each floor and controlled from or independently of the elevator cab, but such installations necessitate the positioning of a motor adjacent each door with the necessary controls therefor and are consequently relatively expensive and involve considerable complication.

It has therefore been proposed to employ but a single actuating motor located on the elevator cab in conjunction with mechanism designed to open any desired door in the hatchway when the cab is in proximity thereto but as far as we are aware the installations of this type which have heretofore been made do not in practice operate smoothly, again involve considerable complication, tend to get out of order under the duty imposed on them, and are otherwise not fully satisfactory.

It is therefore a principal object of our invention to provide improved operating means for sliding elevator doors of the general class to which we have just referred and thus comprising but a single actuating motor preferably carried by the cab in operative combination and association with means whereby the power supplied by the motor when energized is utilized for the actuation of other instrumentalities effective to bring about the opening of any desired door in the hatchway when the cab is proximate thereto.

More specifically the invention contemplates the provision of means associated with a freight elevator cab or the like and operative when actuated to slidably engage a part such as a bracket attached to the hatchway door and thereafter move the latter from one position to another and subsequently return it to the first position in response to manipulation or other operation of the energizing means of a motor likewise carried by the cab.

A further object is to provide elevator door operating means especially adapted for employment with variable speed motion transmitting mechanism such as disclosed in a copending application for United States Letters Patent filed March 5, 1946 by Nicholas R. Guilbert, Jr., Serial No. 652,052, now abandoned, for Motion trans-

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mitting mechanism, whereby upon manipulation of suitable controls, or automatically upon arrival of the elevator cab in proximity to a selected floor, the hatchway door thereat is promptly and rapidly opened, and is similarly closed prior to departure of the cab from that floor.

Still another object of the invention is to provide door operating mechanism of the character described which is effective to open the selected door irrespective of the exact alignment of the elevator cab with the floor, whereby if the cab stops a little above or below it the door is nevertheless opened sufficiently to prevent its being damaged when a loaded truck is moved into or out of the cab.

Other objects, purposes and advantages of the invention will hereinafter more fully appear or be understood from the following description of a preferred embodiment of it illustrated in the accompanying drawings, in which:

Fig. 1 is a diagrammatic front elevation, taken from inside the elevator hatchway, or an elevator cab of more or less conventional character equipped in accordance with the invention;

Fig. 2 is a fragmentary vertical section in the hatchway on line 2—2 in Fig. 1;

Fig. 3 is a fragmentary enlarged horizontal section on line 3—3 in Fig. 2; and

Fig. 4 is a similarly enlarged detail of a part of Fig. 2, showing in dotted lines portions of the door operating mechanism in extended position.

In the several figures like characters are used to designate the same parts.

Referring now more particularly to the drawings, it will be understood the elevator cab 1 may be of substantially any specific type, suspended from a horizontal beam 2 carried by main cables 3 extending to the elevator operating mechanism (not shown) at the top of the hatchway. The latter is defined by a back wall 4, side walls 5, 6 supporting guide rails 7—7, and a front wall 8 in which the opening 9 is normally closed by a bi-parting door comprising a vertically slidable lower leaf 10 and a complementary upper leaf 11, mutually counterbalanced by mechanism (not shown) whereby as the lower leaf is depressed to bring its trucking sill 12 into alignment with the building floor 13 the upper leaf concurrently rises to fully open the doorway.

The elevator cab and hatch structure heretofore described is thus typical of those now in general use and so merely illustrative of a freight elevator installation with which the mechanism of our invention may be advantageously employed; the use of the invention is in no way

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restricted or confined thereto, however, as it may be employed with equal advantage if desired for the operation of elevator doors of other character and, in fact, with slidable elements generally whether associated with elevators or other devices.

The said mechanism as shown in the drawings comprises two cooperative door operating units, one at either side of the elevator cab, but as they are substantially similar in construction and operation it is only requisite to describe but one herein in detail.

Each unit comprising a substantially rectangular frame or "cam car" 15, having guide shoes 16 embracing vertical guide rails 17 secured by brackets 18 to the sides of the elevator cab, the cam car being thus slidable vertically along the rails within limits determined by limit switches 20, 21 positioned on the cab respectively adjacent the upper and lower ends of the rails and connected by leads (not shown) with the cam car operating mechanism now to be described.

This mechanism comprises a sprocket chain 22, the ends of which are respectively secured to the top and bottom of the cam car which passes over a sprocket 23 supported from a shaft 24 at the top of the cab and a similar sprocket 25 carried on a shaft 26 below the cab floor. Shaft 24 is driven by a sprocket 27 and endless chain 28 from another sprocket 29 on a shaft 30, which is the driven shaft of suitable motion transmitting mechanism 31 preferably constructed substantially in accordance with the disclosure of said copending application and actuated through a drive shaft 32 from a motor 33 or other prime mover located, preferably, on the top of the elevator cab and so unitarily movable therewith.

Control means of any suitable or conventional character are provided for motor 33 whereby the latter is energized, either manually or automatically, when the door is to be opened or closed, but as said means form no part of the present invention illustration or specific description thereof is not required.

It will be understood, however, that motor 33 when energized to open or close a door acts to reciprocate the cam car vertically along rails 17 and the car and associated mechanism, to which reference will now be made, are therefore directly instrumental in attaining the desired results. More particularly, the cam car supports a movable friction unit 35 comprising horizontally slidable rails 36, 37 interconnected by a vertical bar 38, each rail carrying at its end nearest the front wall of the hatchway a shoe 39 provided with a friction lining 40 while a similar complementary shoe 41 and friction lining 42 are supported from each of arms 43, 44 pivoted on brackets 45 projecting laterally from rails 36, 37. Springs 46, 47 surrounding studs 48, 49 bias arms 43, 44 about their pivots, while nuts 50, 51 on the studs limit the approach of shoe 41 toward shoe 39 under the influence of the springs and thus provide a positive minimum for the spacing of friction linings 40, 42, whose separation away from this minimum is yieldably resisted by the springs. The primary function of the shoes is to engage and grip an element associated with one of the leaves of the door, preferably the lower leaf 10, and so to slide it vertically with respect to the elevator cab and hatchway by operation of motor 33, and to this end a "door iron" 55 is secured to the usual wing arm 56 carried by the leaf in such manner that it extends into the plane of the space between the shoes so that when the cam car is operated

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to project the shoes forwardly they embrace and yieldably grip the door iron, the beveled edges of which insure its smooth interengagement with the shoe linings.

To enable the shoes to be thus projected, their supporting rails 36, 37 are horizontally movable with respect to the cam car, being slidable in staples 60 on the car frame, and bar 38 connecting rails 36, 37 carries a roller 61 engageable with a cam guide 62 during downward movement of the cam car and with a second cam guide 63 during upward movement, cam guide 62 extending angularly forward and downward near its upper end and then vertically parallel to rails 17, and the second cam guide 63 extending upwardly and rearwardly parallel to, but a little above, the angular portion of cam guide 62. It results that when the cam car moves downward from the position indicated in full lines in Fig. 4 the roller 61, engaging cam guide 62, first moves the entire friction unit forward relatively to the cam car and then keeps it in projected position during further travel of the latter to the position indicated in dotted lines in said figure. Accordingly, when the elevator is stopped at a floor, and the cam car moves downward by energizing motor 33, the friction shoes first engage and embrace the door iron and thereafter carry it, and hence the lower leaf of the door, downward with them until movement of the cam car is stopped by operation of lower limit switch 21.

Desirably the parts are so proportioned and arranged as to insure substantially full face-to-face engagement of the shoes and door iron at least soon after the shoes have been fully projected forward by the operation of roller 61 and cam guide 62, and the doors, and the nuts 50—51 controlling the tension of springs 46—47, are so adjusted that the frictional engagement between the shoes and the door iron will cause them to move the latter without appreciable slippage, under normal conditions after they have gripped it and until the door has been fully opened.

Limit switch 21 is so positioned with respect to rails 17 that under said conditions it will be actuated by the cam car to stop the movement of the latter at or about the position indicated in dotted lines in Fig. 4 which corresponds to full opening of the door when the elevator cab stops at the floor level. If, however, because of an overload or some other unusual condition, it stops somewhat below that level the cam car can continue its downward travel relatively to the cab until it actuates the switch and deenergizes motor 33, the yielding character of the connection between the friction shoes and the door iron allowing the former to slip along the latter after further separation of the door leaves is prevented by the usual stops limiting their travel. Thus irrespective of whether the cab stops in proper alignment with the floor or a little below it, the cam car can always actuate the limit switch to deenergize motor 33 and so bring itself to rest after the door has been fully opened.

Should the elevator stop above the floor level the movement of the cam car conversely may not be sufficient to bring the trucking sill farther than to or just below the level of the cab floor and thus perhaps slightly above the building floor level. In such case, however, the sill is fully protected from damage, for any material weight upon or vertical pressure against it, as when a truck is moved across it, merely forces the door down until the sill reaches the floor level, the door iron slipping between the friction shoes as the leaf 10 moves.

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When motor 33 is reversed preparatory to departure of the cab from the floor it raises the cam car, causing the friction shoes to lift the lower leaf of the door from whatever position it may have assumed until the door is fully closed, after which further upward travel of the car brings roller 61 into engagement with cam guide 63 to retract the shoes from the door iron and permit the cab thereafter to move in either direction to another floor. Thus except when being operated to open or close a door, or while at rest holding a door open, the friction shoes remain fully retracted and do not engage the door irons of doors at intermediate floor while the cab is passing them but are projected to door iron engaging position only when motor 33 is energized after the cab has stopped at or near a selected floor level. The electrical connections necessary for so energizing the motor to open a door either automatically as the elevator is brought to a stop or manually at the will of the operator, and for reversing it to subsequently close the door, are well understood and form no part of the invention; they thus may be of any nature suitable for performing their respective functions.

Moreover and as hitherto indicated, we prefer to employ means of the character disclosed in said compending application for driving our door operating mechanism from motor 33 as by so doing we may cause the cam car to start gradually and to come to a stop slowly at or near the limits of its travel but to move relatively rapidly immediately thereof, the said means automatically affording speed and power variations in the drive suitable for accomplishing this purpose, but it will be understood conventional constant speed driving mechanism may be employed or speed and/or power variations in the drive between the motor and cam car may be otherwise derived if desired.

Finally, while we have herein described with considerable particularity one embodiment of the invention well suited for the operation of bi-parting freight elevator doors, it will be understood we do not desire or intend to limit or confine ourselves thereto in any way, as mechanism constructed in accordance with the invention may be used for operating other types of elevator doors or other reciprocable elements and changes and modifications in the form, construction and relationships of the several parts herein shown and described will readily occur to those skilled in the art and may be made if desired without departing from the spirit and scope of the invention as defined in the appended claims.

Having thus described our invention, we claim and desire to protect by Letters Patent of the United States:

1. In combination with an elevator cab and a slidable door for its hatchway, an element carried by the door for movement therewith along a rectilinear path, a friction element carried by the cab adapted to yieldingly embrace the first element, and means for successively projecting the friction element substantially into the path of and into engagement with the first element, reciprocating it during such engagement to open and close the door and finally retracting it from said path.

2. In combination with an elevator cab and a slidable door for its hatchway, an element carried by the door for movement therewith along a rectilinear path, a friction element having opposed substantially parallel friction faces carried by the cab engageable with the first element, means for projecting the friction element angu-

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larly into the path of the first element in a plane substantially parallel to said faces and into engagement therewith and operative to move the friction element parallel to said path successively in opposite directions while engaging said first element to open and close the door, and means for retracting the friction element in said plane angularly from said path and out of engagement with the first element after the door is closed.

3. In mechanism of the character described, means defining rectilinear ways, a cam car reciprocable along the ways, means for reciprocating the cam car, a cam adjacent the ways having a surface disposed at an angle thereto and a surface extending in parallelism therewith, a second cam having a surface paralleling said angular surface, a friction element, means carried by the cam car reciprocable relatively thereto along a path normal to said ways, supporting the friction element and comprising an element engageable with said cam surfaces whereby during movement of the cam car along the ways in one direction the friction element and its supporting means are successively moved in one direction relatively to the cam car and maintained in displaced position relatively thereto, and during movement of the cam car in the opposite direction the friction element and said means are moved in the opposite direction relatively thereto.

4. In mechanism of the character described, a friction element comprising a pair of shoes having friction linings on opposed faces thereof adapted to engage and embrace a reciprocable element, means comprising relatively movable arms supporting the shoes, yieldable means biasing the arms to urge one shoe toward the other, means for adjustably limiting the approach of said shoe toward the other, and means for moving the element successively angularly into engagement with the reciprocable element, substantially along the path of reciprocation thereof, and angularly out of engagement therewith.

5. The combination with an elevator cab in a hatchway having an entrance and a slidable door therefor, of a motor, a movable element carried by the cab, means interconnecting said element and motor whereby when the motor is energized the element is moved relatively to the cab, a member supported from the door for movement therewith, a friction shoe adapted to engage said member, and means operable through movement of the element to project said shoe into engagement with the member whereby to open and close the door in correspondence to subsequent movement of the element.

6. The combination with an elevator cab in a hatchway having an entrance and a bi-parting slidable door therefor, a motor, a movable element carried by the cab, means interconnecting said element and motor whereby when the motor is energized the element is moved relatively to the cab, a member supported from one of the leaves of the door for movement therewith, a pair of friction shoes adapted to grip said member, and means operable through movement of the element to project said shoes into alignment with said member for engagement therewith whereby to open and close the door in correspondence to subsequent movements of the element, said shoes being adapted to slip relatively to the member should the door offer greater than normal resistance to its opening movement.

7. The combination with an elevator cab in a hatchway having an entrance and a bi-parting slidable door therefor, of a motor, a movable

element carried by the cab, means interconnecting said element and motor whereby when the motor is energized the element is moved relatively to the cab, a member supported from the door for movement therewith, a shoe adapted to frictionally engage said member, means operative to yieldingly press the shoe against the member sufficiently when so engaged to cause the member to move unitarily with the shoe under normal operating conditions, and means operable through movement of the element to bring the shoe into engagement with the member whereby to open and close the door thereafter in correspondence to movement of the element.

8. In combination with an elevator and a slidable door for its hatchway, an element carried by the door and reciprocal therewith along a rectilinear path parallel to that of the elevator, friction means operative to engage the element, and means for projecting the friction means outwardly of the elevator substantially in the plane of and into frictional engagement with a surface of the element and operative subsequent to such projection to move the friction means with said element along said rectilinear path.

9. In combination with an elevator and a slidable door for its hatchway, an element carried by the door and reciprocal therewith along a rectilinear path parallel to that of the elevator, friction shoes projectible in planes parallel to opposed faces of the element to frictionally embrace the latter, shoe supporting means carried

by the elevator movable in a path parallel to the path of the element, and means adapted to effect projection of the shoes while the supporting means are moving in their path.

10. In combination with an elevator and a slidable door for its hatchway, an element carried by the door and reciprocal therewith in a rectilinear path parallel to that of the elevator, friction shoes projectible in planes parallel to opposed faces of the element to embrace the latter in frictional engagement therewith, shoe supporting means carried by the elevator movable in a path parallel to that of the element, and means carried by the elevator adapted to successively project the shoes into engagement with the element, maintain the shoes in engagement therewith and finally retract the shoes from engagement with the element during reciprocation of the supporting means along its path.

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