Dec. 9, 1947. J. DI GIOVANNI 2,432,293

ELEVATOR CAR DOOR CONTROL MECHANISM

Filed Aug. 19, 1944 5 Sheets-Sheet 1

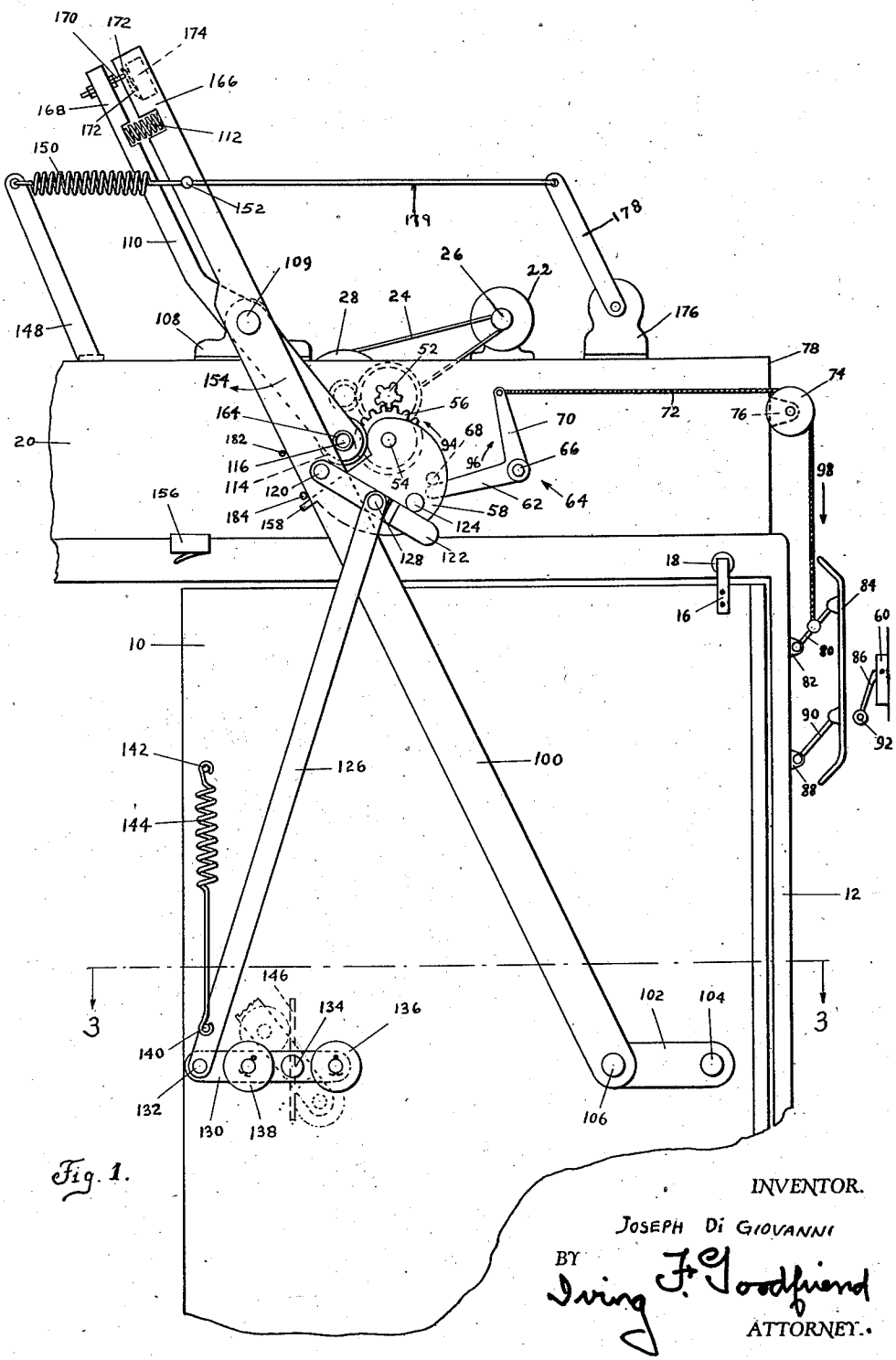

Fig. 1.

INVENTOR.

JOSEPH DI GIOVANNI

BY Irving F. Goodfriend

ATTORNEY.

Dec. 9, 1947. J. DI GIOVANNI 2,432,293

ELEVATOR CAR DOOR CONTROL MECHANISM

Filed Aug. 19, 1944 5 Sheets-Sheet 2

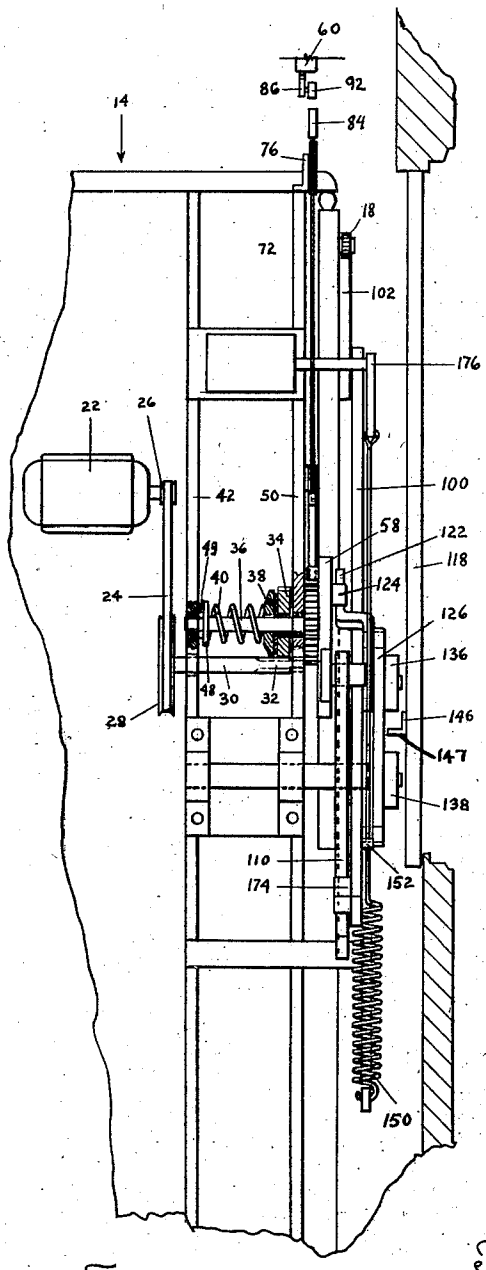

Fig. 2.

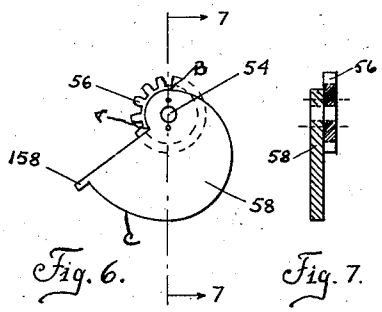

Fig. 6.

Fig. 7.

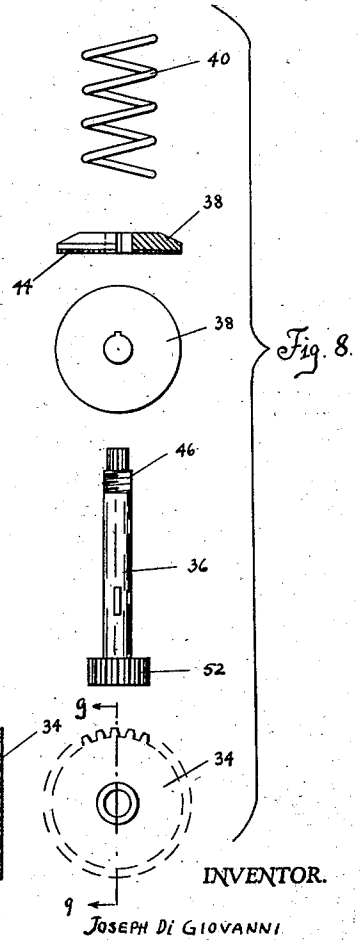

Fig. 8.

Fig. 9.

INVENTOR.
JOSEPH DI GIOVANNI
BY Irving F. Goodfriend
ATTORNEY.

Dec. 9, 1947. J. DI GIOVANNI 2,432,293

ELEVATOR CAR DOOR CONTROL MECHANISM

Filed Aug. 19, 1944 5 Sheets-Sheet 3

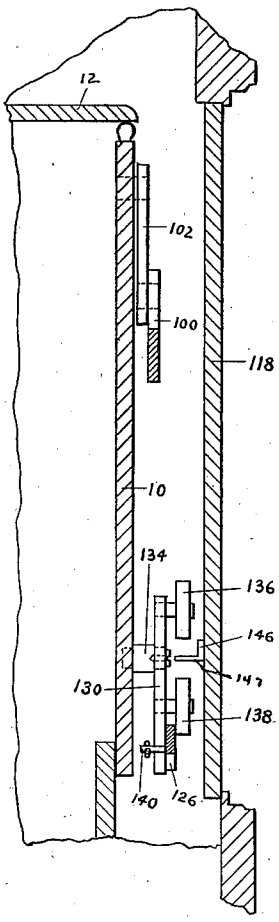

Fig. 3.

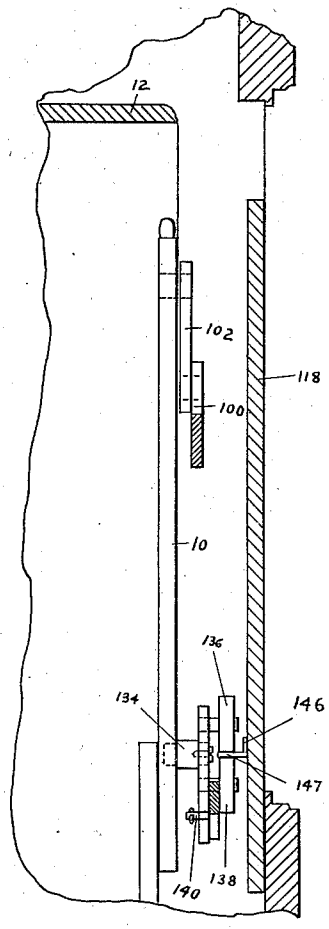

Fig. 4.

INVENTOR.
JOSEPH DI GIOVANNI
BY Irving F. Goodfriend
ATTORNEY

Dec. 9, 1947. J. DI GIOVANNI 2,432,293

ELEVATOR CAR DOOR CONTROL MECHANISM

Filed Aug. 19, 1944 5 Sheets-Sheet 4

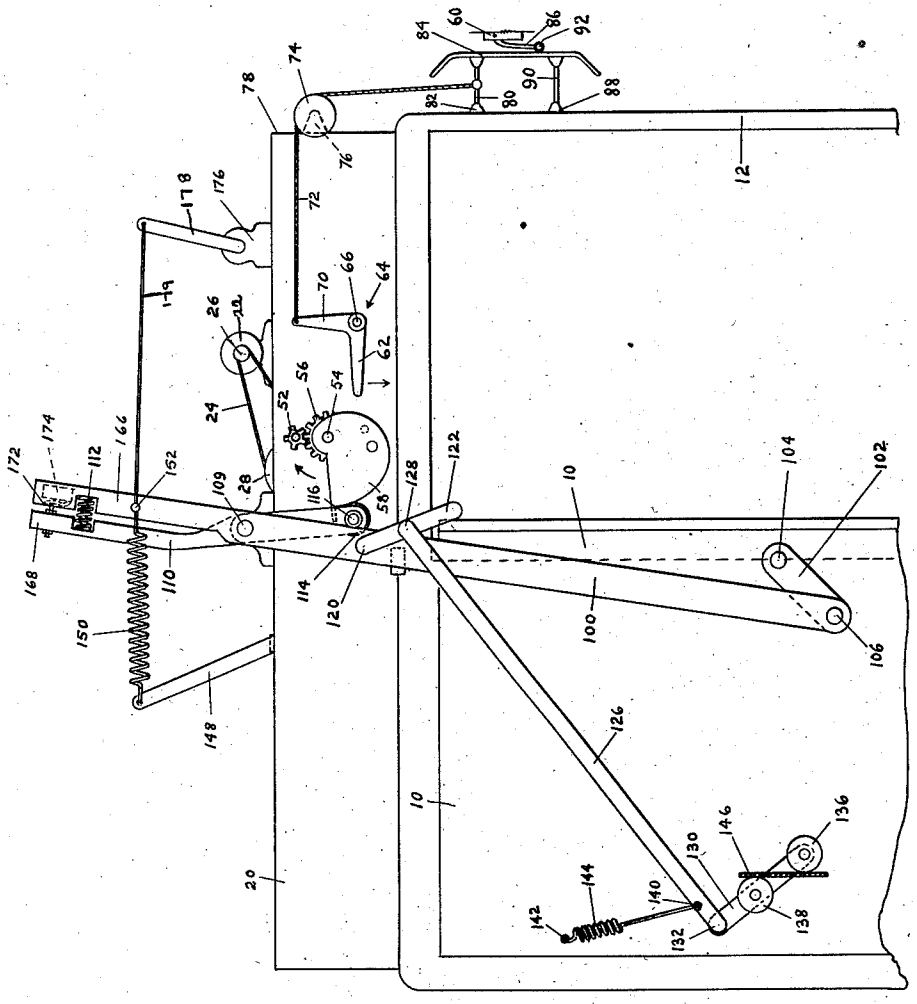

Fig. 5.

INVENTOR.
JOSEPH DI GIOVANNI
BY Irving F. Goodfriend
ATTORNEY.

Dec. 9, 1947. J. DI GIOVANNI 2,432,293

ELEVATOR CAR DOOR CONTROL MECHANISM

Filed Aug. 19, 1944 5 Sheets-Sheet 5

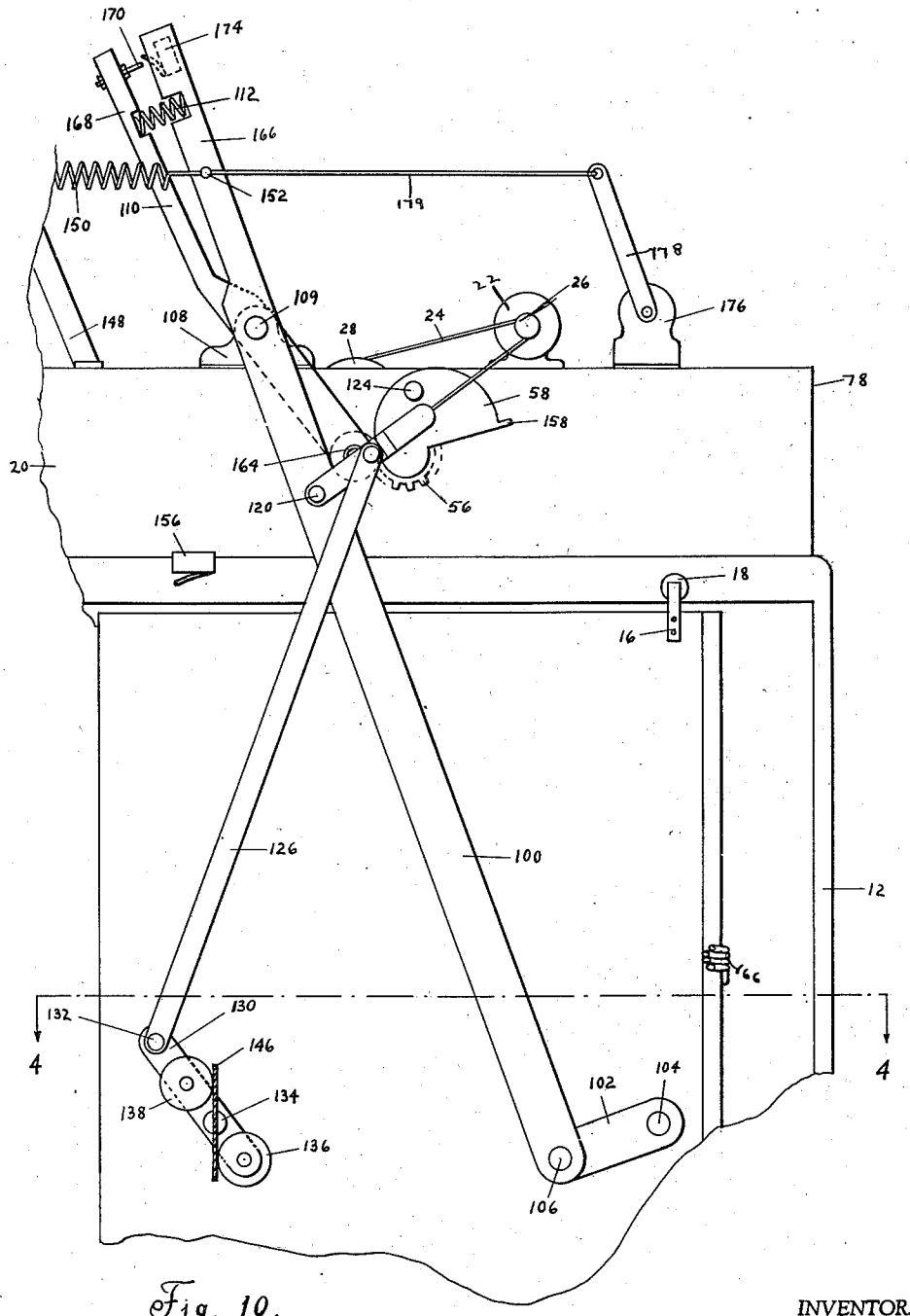

Fig. 10.

INVENTOR.
JOSEPH DI GIOVANNI.
BY Irving H. Goodfriend
ATTORNEY

Patented Dec. 9, 1947

2,432,293

UNITED STATES PATENT OFFICE

2,432,293

ELEVATOR CAR DOOR CONTROL MECHANISM

Joseph Di Giovanni, Fairview, N. J., assignor to United Elevator Service, Inc., New York, N. Y.

Application August 19, 1944, Serial No. 550,217

7 Claims. (Cl. 187—52)

1

The present invention relates to means for opening and closing the doors leading to an elevator car and the shaftway therefor, particularly, for example, to a mechanism for operating the sliding doors with which automatic push button or passenger controlled elevator installations are equipped.

Heretofore in order to provide safe operation for the passenger, such automatic installations have included some means, for example, that known as a "safety edge," which will cause the door to stop and reverse its direction of movement should the passenger come between it and the edge of the car or hatchway.

This safety edge usually comprised a short strip of rubber, mounted on metal pivoted on the door between the car and hatchway doors and arranged to operate a reversing switch for the motor which controlled the opening and closing of the door.

Prior safety means have not been fully satisfactory because they have, at times, caused the elevator motor to stall and thereby seriously slow down the operation of the elevator. Further, with the prior devices, there is always an attendant danger that passengers may become injured when, in an attempt to prevent closing of the elevator and hatchway doors, they fail to engage such safety edge or other safety means and they therefore become caught between the hatchway or car door edge and either door post, which former, since it is positively driven by the motor operator thereof, continues its unstopped movement against them.

The present invention contemplates the provision of a safety means, which is designed and constructed to cause the car and hatchway doors or either of them to automatically reverse in direction of movement and move away from the passenger should either door be touched or pulled upon, independently of engagement by the passenger of a safety edge or other means arranged on the door itself.

Further with the safety means used in present installations, despite opening the switch thereof, circuit of the motor operating the door may nevertheless remain closed and continue the positively driven movement of the door or doors toward or against the passenger, which continued positively driven movement may cause damage to the mechanism and injury to the passenger.

The present invention further contemplates the provision of a coupling means between the door and its operating motor of construction and arrangement such that, upon obstruction of the door, the operating motor therefor is automatically disengaged therefrom and therefore the door or doors cannot be positively driven against the passenger or obstruction irrespective of the proper operation of the switch designed to open the motor circuit.

2

The present invention still further contemplates the provision of a switch for the door operating motor that is automatically operated by closing movement of the doors and the imposition of an obstruction to such movement to reverse the door operating motor and leave free for the passenger entrance to or exit from the car.

The present invention still further contemplates the provision of positive drive means constructed and arranged to open and close the doors uniformly, gradually and slowly at the commencement and finish and so without jar or damage to the mechanism or danger to the passenger upon closing the door, this is accomplished independently of the operation of the door motor, in the event of failure of the switch to reverse the motor when the movement of the door is obstructed and the obstruction removed.

With present automatic elevator installations, a coupling mechanism is provided for concurrently opening and closing the car and hatchway doors. The hatchway doors are each provided with a member or arm, which is engaged by a link or lever secured to the door, which latter must be sufficiently close to the hatchway door member or arm to, at the correct time, engage it and so properly open and close the hatchway door concurrently with and under the influence of the car door but yet have sufficient clearance between the two so that they will not strike or rub against each other as the car moves past each normally closed hatchway door.

The present invention therefore still further contemplates the provision of a coupling means on the car door, arranged and constructed to automatically engage and grip a member or arm on the hatchway door just prior to opening the car door, so that when the latter door is fully and firmly closed and the hatchway door locked, the door operator motor nevertheless continues operation to thereby cause the coupling mechanism to be positioned at such distance from the hatchway door member or arm as will allow the car to travel past those doors without striking the members or arms or in any way interfering with the electrical or mechanical door contacts.

Present automatic installations include a hatchway door lock which is retired somewhat

in advance of the door closing position or in which a separate device is used to retire the cam lock after the door is closed.

The present invention contemplates the provision of means constructed and arranged to move the doors firmly and gently to the closed position whereat they are held before the door locking mechanism is operated by the same means to securely lock the hatchway door, whereby the concurrently operated hatchway door coupling and engaging means is coordinated with operation of the door lock so that shock and strain on the doors or the door interlock are thereby avoided.

With present automatic installations, under certain conditions, the door operator motor may drive the door or doors against the door posts and door locks thereby causing damage to the door interlock mechanism and sometimes alarming the passengers by the resulting jar.

The present invention contemplates the provision of means through which the door or doors are comparatively rapidly operated during the intermediate portions of their travel but are gradually slowed down with a smooth or even movement as they approach full open or closed position whereat they are stopped slowly and uniformly without jar in their opened or closed position all this so accomplished even though a short circuit or other electrical derangement may cause the motor to continue its operation after the doors have been fully opened or closed and locked.

With present automatic elevator construction, there may be provided a construction for operating the doors manually after they have been unlocked with a suitable key. Should the doors remain unlocked in open position, serious damage may result from a draft caused thereby in the thus opened hatchway in the event of a fire in the building.

The present invention therefore also contemplates the provision of a door construction which may be opened manually but which will automatically close the doors in the event that the operative power therefor should be cut off.

These, other and further objects and advantages of the present invention will be clear and become apparent from the description which follows and the drawings appended thereto, in which drawings, schematically made,

Fig. 1 is an elevation of a door operating mechanism according to my invention applied to an elevator door, shown in closed position and broken away to condense the drawing,

Fig. 2 is a plan view thereof,

Fig. 3 is a section on the line 3—3 of Fig. 1,

Fig. 4 is a section on the line 4—4 of Fig. 10, mechanism in coupled position,

Fig. 5 is an elevation similar to Fig. 1, with the door and door operating mechanism in fully open position,

Fig. 6 is a plan view of the operating cam and associated pinion,

Fig. 7 is an edge view thereof,

Fig. 8 is an exploded view of the friction coupling used in my invention, a plan view of the friction plate thereof being included,

Fig. 9 is a section on the line 9—9 of Fig. 8,

Fig. 10 is an elevation illustrating the position assumed by the safety mechanism upon obstructing closure of the elevator door.

Referring now to the drawings, the apparatus is described in detail as applied to an operatorless elevator of the automatic push button or passenger controlled type, wherein the car is moved

to a floor in response to the initiation of the elevator operating mechanism by the passenger, whereupon both the car door and hatchway door are automatically opened to permit the passenger to enter and in which by suitable operation of the controls by the passenger the doors are automatically closed and the elevator moved to the selected floor and the doors again opened.

In the drawings only so much of the conventional elevator installation, schematically illustrated, as is required for an understanding of my invention is shown. Since the automatic controls are conventional, they need not be illustrated or an electrical circuit for operation of the elevator shown for an understanding of my invention.

In the specific embodiment shown herein, my inventive door operating mechanism opens and closes the door 10 which is suspended for sliding movement on the frame 12 of the car, generally indicated by the reference character 14, as by means of the bracket 16 and roller 18.

The car door operating mechanism is mounted on the super structure 20 which is mounted above the car ceiling and includes a conventional reversible motor 22, which through the belt 24 and pulleys 26 and 28 operates the shaft 30.

Keyed to the driven pulley shaft 30, I provide the pinion 32 which meshes with the driven gear 34 mounted on the friction drive shaft 36. The driven gear 34 is mounted on the shaft 36 for free rotation thereon in order to provide, for the purposes described below, a frictional coupling with the coupling plate 38 keyed to the shaft 36 and which plate is held against the face of the gear 34 by means of the expanding coil spring 40, one end of which spring is mounted against the wall 42 of the superstructure 20 and the other end of which is mounted against the friction plate 38, the shaft 36 passing through the coil spring.

It will be apparent that, if for any reason, the shaft 36 is held against rotation, the gear 34, since it is positively driven by the pinion 32, will rotate on the shaft 36, but will slip past the friction plate 38, the shaft 36 to which the plate is keyed, having been held in stationary position.

In order to provide sufficient friction between the plate 38 and the gear 34 so that they will normally be coupled together, I arrange on each suitable bands of friction material 44 and 45 (Fig. 8).

In order to take up wear that may be incurred on the bands of friction material 44 and 45, I provide on the shaft 36 the threads 46 on which is arranged the internally threaded washer 48 and lock nut 49, which may be adjusted against the spring to force the plate firmly against the gear, should the bands wear thinner or greater spring pressure be desired.

On the outer end of the shaft 36, at the outside of the wall 50 of the superstructure 20, I mount the pinion 52 which drives the cam shaft 54 through the gear 56.

Referring now to Fig. 1, the operating cam 58 (which is shown in detail in Figs. 6 and 7) is there shown in the position normally assumed by it when the elevator door is closed. In this position the door lock 60 which is of the conventional electro-mechanical type for locking the hatchway door and concurrently closing the elevator hatchway door interlock circuit whereby the elevator is placed in condition for further operation, has been closed and the arm 62 of the bellcrank, generally indicated by the reference character 64, rotated about its pivot 66 arranged on the wall 50 of the superstructure 20

and held down in that position against a tension means, included in the bellcrank mounting, by the pin 68 extending from one side of the cam 58.

Extending from the other arm 70 of the bell-crank 64, I provide the cable or chain 72, passing over the guide pulley 74 mounted on the bracket 76 secured to the front wall 78 of the superstructure 20, and which cable or chain at its other end is secured to the pivoted arm 80 carried by the bracket 82 on the elevator frame 12.

The other end of the arm 80 is pivoted to the lock arm engaging plate or cam 84, which latter, in normal position, when the cable 72 is pulled upwardly under the action of the bell crank arm 62 and pin 68 into the position illustrated in Fig. 1, is held out of engagement with the pivoted arm 86, extending from the lock 60 and which pivoted arm extends in the hatchway in the path of the plate or cam 84, against a tension means carried on the bracket 82.

In order to make the action of the engaging plate or cam 84 against the arm 86 of the door lock 60 more uniform and positive, I prefer to pivot, by means of the bracket 88, a second arm 90 the other end of which is similarly pivoted to the plate or cam 84. The arms 80 and 90 are of equal size and move in parallelism with each other so that the plate 84 will be moved horizontally thereby against the roller 92 on the arm 86 to thereby close the door lock 60 in the manner and for the purposes that I shall hereinafter describe.

When the door is to be opened the motor operator 22 is energized by conventional means, which therefore need not be described here, to rotate the shaft 54 and cam 58 through the frictional coupling and transmission gearing that I have described above, the cam rotated in the direction of the arrow 94 (Fig. 1).

The pin 68 is thereby positively moved away from the arm 62 to permit the bell-crank 64 to oscillate into normal position (Fig. 5) in the direction of the arrow 96 (Fig. 1). This movement also permits the arms 80 and 90 to pull the cable downward in the direction of the arrow 98 to push the plate 84 into engagement with the roller 92 on the arm 86, the door lock engaging plate 84 and corresponding members assuming the position illustrated in Fig. 5 to permit the door 10 to be opened by the mechanism which I shall describe.

As I shall in greater detail point out the engaging plate or cam 84 is moved in synchronism with and sufficiently in advance of the door opening mechanism so that there will be no damaging force or impact applied to the lock.

In order to open the door by means of the cam 58, I secure the lever 100, at its lower end, to the link 102, which latter is pivoted at one end 104 to the door 10 and at its other end 106 to the lever 100.

On the superstructure 20, I arrange the bracket support 108 on which is carried the pivot or bearing 109 on which pivot or bearing the lever 100 is mounted.

For purposes which I shall further describe, I secure intermediate its ends the lever 110 on the common pivot or bearing 109. The upper end of the lever 110 tends to be moved away from out of contact with the upper end of the arm 100 by the expanding spring 112, which is normally compressed as will be described, and has mounted on its lower end the roller 114 which turns freely on the shaft 116 and which roller rides on the face or edge of the cam 58.

As the cam 58 is rotated for the door opening operation in the direction of the arrow 94 (Fig. 1), no force, during the first part of the cam movement is exerted on the roller 114, since the radius off the cam from its starting point A to point B is the same throughout. As a result as the cam is rotated from A to B, which I term the neutral cam face, the lever 100 remains stationary, and so the elevator door, through this distance of cam travel does not move open.

However the pin 68 moves away from the arm 62 thereby permitting the arms 80 and 90 to move into the horizontal position illustrated in Fig. 5 causing the plate 84 to engage the roller 92 and move the arm 86 from its normal position illustrated in Fig. 1 to unlock the door lock 60. The length of cable 72 and size of the arms 80 and 90 are proportional to the distance on the cam from A to B so that when point B on the cam is brought into engagement with the roller 114 as the cam 58 is rotated, the door is unlocked at that point.

In order to couple the elevator door 10 to the hatchway door 118 so that they will be concurrently opened after the hatchway door has been unlocked, I provide the mechanism linkage that I shall now describe.

Secured to the lever 100, adjacent the cam 58, as by the pivot 120 I provide the link 122, which as will be described, is held against the stop pin 124 extending from a side of the cam 58. Pivoted intermediate the link 122, I provide the arm 126, which at its upper end is secured to the link 122 by the pivot 128 and at its lower end to the roller support 130 by the pivot pin 132.

The roller support is secured to the elevator car door by means of the pivot 134, the rollers 136 and 138 being spaced equally therefrom. Secured to the pin 140 at one end and at its other end to the pin 142, I provide the spring 144, which normally pulls the roller support 130 upward about its pivot 134 to thereby hold the link 122 against the stop pin 124. Each hatchway door 118 is provided with an engaging or coupling means 146, preferably in the form of an L iron riveted thereto.

The rollers 136 and 138, which are preferably rubber covered, are spaced such distance that the flange 147 of the engaging means 146 will pass therebetween as the car moves in the hatchway so that they will always clear it as the car moves past a closed hatchway door.

When the car door 10 is normally closed the pin 124 forces the link 122 downward against the tension of the spring 144 so that the roller support is normally held in the substantially horizontal position illustrated in Fig. 1, whereat the rollers 136 and 138 are spaced and clear the flange 147 (see Fig. 3).

As the cam is moved through the distance A to B, the pin 124 is moved away from the link 122 which follows it under the influence of the spring 144 thereby rotating the support 130 into the position illustrated in Fig. 4, thus bringing the rollers into gripping engagement with the flange 147 to couple the car door to the hatchway door.

This coupling function is accomplished just prior to or concurrently with the unlocking of the door switch 60 described above and movement of the car door 10, as will be described hereinbelow, that is, when the point B on the cam 58 is brought against the roller 114.

Extending up from the roof of the superstructure 20, I provide the tension support arm 148 to which is secured one end of the spring 150, the

upper end of the spring being secured in the opening 152 at the upper end of the arm 100.

Tension of the spring 150 holds the lever 100 at the angular position illustrated in Fig. 1 against the lever 110 to compress the spring 112 and it also urges the roller 114 against the face of the cam 58 to thereby hold the car door 10 in closed position. The radius of the cam face from the center 54 of the cam gradually increases from the point B to the point C (see Fig. 6) so that, as the cam is rotated by the operator motor 26, the roller 114 will be pushed toward the left as viewed in Fig. 1 to swing the lever 100 about its pivot 109 in the direction of the arrow 154.

The radius of the cam from B to C increases gradually, then rapidly and then gradually again so that the door 10 is first opened slowly, then rapidly during its intermediate movement and then again slowly as full opening of the door is completed.

This operation moves the door into open position shown in Fig. 5. The arm 126 is concurrently rotated about its pivot 128 by the movement of the lever 100 acting through the link 122 which swings about its pivot 120, the mechanism assuming the position illustrated in Fig. 5.

The support 130 acting through the rollers 136 and 138 which grip the flange 147 concurrently pulls open the hatchway door 118.

As the elevator door moves into fully open position the roller 18 engages the switch 156 arranged at the upper part of the car frame 12 to thereby open the motor operator 26 circuit and so stop rotation of the cam 58.

From the point C on the face of the cam 58 to the finger 158, the radius of the cam remains the same so that the door is without jar brought to a stop at its full open position with no possibility of damage to the motor or mechanism.

The doors are held open until operation of the motor is again initiated by conventional means and the cam rotated thereby in a clockwise direction. This operation of the motor brings the face of the cam away from the roller 114, the arm 100 being returned to its normal door closing position by the contraction of the expanded spring 150.

Closing motion of the door is comparatively slow at the start as the cam is removed from the finger 158 to beyond the point C, relatively rapid from thereon to a point slightly in advance of B, and then slow again, the door having reached its fully closed position under the influence of the spring 150 when the point B on the cam surface reaches the roller 114.

At this point the hatchway door 118 is also closed by means of the coupling formed by the rollers and the engaging means 146. At this point of cam travel the arms 80 and 90 are still in the horizontal position illustrated in Fig. 5 and the support at an angular position to the engaging means 146, as illustrated in dotted lines in Fig. 1.

As the cam 58 is rotated from point B to point A, the pin 68 engages the arm 62 to rotate the bell-crank 64 and move the plate 84 away from the roller 92 to thereby close the lock 60, the arm 86 returning to its original position.

Concurrently the link 122 is brought home about its pivot 120 by the pin 124 to move the support 136 into the horizontal position illustrated in Fig. 1, whereby the rollers are brought out of engagement with the flange 147.

It will now be apparent that the elevator car will not move in the shaftway until the elevator door and the hatchway door are completely closed, since the door lock is itself not completely latched until this condition is attained.

Further it will be apparent that the elevator car will not move until the means coupling its door and the hatchway door have been completely disconnected, which operation can only be performed after both doors are closed and concurrently with locking the door lock.

It will be further apparent that both of these operations are positively performed only after both hatchway and car doors are closed and without possibility of attendant jar or impact.

Referring now to Fig. 10, I have there illustrated the position assumed by a car and the operating mechanism according to my invention when the door is prevented by an obstruction imposed between the edge 160 of the door and the frame 12.

As illustrated in Fig. 10, the door at such time has been traveling from left to right and the cam 58 in a clockwise direction as viewed in that figure, as indicated by the arrow 162.

As previously pointed out the levers 100 and 110 are both fulcrumed on the pivot 109, the lever 100 being held by the spring 150 against the lug or ear 164 extending from the lever 110 to hold the roller bearing 114 against the face of the cam 58. When movement of the door is prevented by an obstruction in its path, such as the hand 166, the tension of the spring 150 is no longer transmitted to the lug 164 to hold the roller bearing against the cam.

Expansion of the spring 112 urges the arm 110 about its pivot 109 so that the roller bearing continues to engage the cam surface. Since the lever 100 remains stationary or swings in a clockwise direction about its pivot 109 under the impact of the obstruction, the upper portions 166 and 168 of the lever 100 and arm 110 will separate with a scissor movement under the influence of the spring 112.

This movement brings the finger 170 on the portion 168 away from the resilient contact 172 of the switch 174, which opens the circuit for the gate closing relay (not shown) to thereby reverse the operation of the motor 26.

The motor circuit is conventional and so arranged that when the gate closing relay circuit is opened and the relay drops, the circuit for the gate opening relay is thereupon completed to operate the gate opening relay to reverse the door operator motor and open the door.

In the event the hatchway door 118 is alone obstructed, closing movement of the elevator door 10 is prevented through the coupling means 146 and the rollers 136 and 138 which are connected to the lever 100 by means of the support 130, arm 126 and link 122.

The switch 174 is similarly opened by the resulting movement of the portion 168 away from the part 166 as I have just described.

In the event that the car and hatchway doors are suddenly pulled back against the tension of the spring 150 and immediately thereafter released before reversing of the door operator 26 permits the cam 58 to take up the load imposed thereby, the doors will not rebound and strike against the passenger or the lever 100 or roller bearing 114 strike against the cam 58 because of the action of the conventionally constructed retarding mechanism 176 arranged on the roof on the superstructure 20, the arm 178 of which is connected to the opening 152 by means of the

rod 179. The retarder 176 opposes or counterbalances the action of the spring 150 thereby permitting the doors to close slowly and gently under the action of the spring 150.

In the event that all power is turned off and the car stalled at a floor with the doors closed the lock 60 may be unlatched with a conventional key and the doors manually opened against the tension of the spring 150 and held in that position by suitable force applied thereto. When this force is released, the doors will return automatically to closed position under the action of the spring 150 in opposition to the retarding mechanism 176.

In the event that the cam 58 should continue to rotate under the momentum of the motor 22 or for some other reason to bring it beyond the position which it would assume when the door is completely opened the finger 158 will be brought against the stop lug 182 on the superstructure to thereby prevent further movement of the cam.

Continued operation of the motor 26 therefore will not cause derangement to operaton of my mechanism or damage it because the plate 38 would under these conditions slip on the face of the gear 34 until the motor stops operating or is reversed.

In the same way, should the motor continue operation after the cam 58 is brought home into final door closing position, the finger 158 will engage the other stop lug 184 to hold the cam stationary, whereupon the friction coupling comprising the plate 38, gear 34 and spring 40 will likewise function.

It will now be apparent that I have provided a mechanism whereby the opening and closing of the elevator car and hatchway door is performed by positive movement of a cam, the profile of which will cause the doors to move slowly and gradually accelerate to then gradually decelerate and so come to a stop in either direction of movement without any jar or impact.

Because of this operation it will be further recognized that the doors cannot travel beyond a certain position, no matter how the mechanism functions, so that they cannot damage door posts or locks by impact therewith.

It will be further recognized that I have provided a mechanism, the operating parts of which will not function until after the car and hatchway doors have been first unlocked and all operating mechanism arranged in proper position. It will be further apparent the doors conversely will be brought to fully closed position before the door lock is latched and before the door coupling means is disengaged. All these functions are accomplished by a positive drive of the operating mechanism of my invention.

It will be further apparent that, if, for any reason the mechanism positively driving the construction of my invention is for any reason impeded, the operating means will continue its operation but will be disengaged from the other moving mechanism.

It will be further recognized that I have provided a safety mechanism that will cause no damage to the operating parts or possible injury to a passenger whenever it is brought into operation.

While my invention has been described in detail with specific examples, such examples are illustrative and are not given as limitations since other modifications within the spirit and scope

of the invention will be apparent to those skilled in the art.

Hence, the invention is to be understood as limited only as indicated in the appended claims in which the intent is to set forth all the novelty over the prior art.

I claim:

1. In an elevator installation, an elevator car movable in a hatchway, a door for said elevator car, a normally closed hatchway door, and operating mechanism for said doors comprising a motor, a cam driven by said motor, a frictional coupling for said cam and motor, a lever pivoted on the car superstructure and pivotally connected at its lower end to the elevator door, tension means connected to said lever to normally position said lever about its pivot to hold said elevator door in closed position, actuating means for a door lock for the hatchway door, and connected to an element in engagement with said cam for holding said actuating means normally in inoperative position to normally lock the hatchway door, said actuating means movable from said inoperative position to unlock the door lock, a coupling member secured to the hatchway door, a pair of rollers, when the said doors are closed, normally arranged to receive said coupling member between them, a member carrying said rollers and pivoted to said elevator door and linkage connecting said lever to said roller carrying member, said linkage normally held in engagement with said cam for normally positioning said rollers to receive said coupling member therebetween, said tension means normally holding said lever in engagement with said cam, the face of said cam in engagement with said lever being provided with an arcuate surface of equal radius therethroughout from the center of the cam, motion of said cam through said arcuate surface moving said cam away from said element to permit said actuating means to move from inactive positon to unlock said door lock and away from said linkage to dispose the rollers in engagement with said coupling member, the face of said cam continuing from said first surface into a second surface gradually increasing in radius from the center of the cam for moving the lever from normal position about its pivot to open the doors.

2. In a mechanism for controlling the operation of an elevator car door and hatchway door, means affixed to said hatchway door and extending away therefrom, a member pivoted to said car door, a pair of engaging elements on said member spaced from said pivot, said elements positioned to receive said means therebetween upon movement of the elevator car into alignment with the hatchway door and means for rotating said member about its pivot to bring said elements into gripping engagement with said means automatically in advance of moving the elevator car door into open position.

3. In a mechanism for coupling an elevator hatchway door to an elevator car door, a member affixed to the hatchway door and extending outwardly therefrom, a pair of spaced roller bearings, means pivoted to the elevator car door for carrying said roller bearings, said rollers positioned to receive said member therebetween upon movement of the elevator car bringing said doors into alignment with each other, means for operating the elevator car door and linkage connected to said elevator door operating means for rotating said carrying means about its pivot to grip said member between said roller bearings in

advance of opening the elevator door by the operating means.

4. In a mechanism for coupling an elevator car door and hatchway door together, means for opening the elevator door, spaced roller bearings, means for carrying said roller bearings pivotally secured to the elevator car door, means secured to the roller carrying means for connecting said carrying means to the elevator door opening means and a member extending outwardly from the hatchway door, said rollers positioned to receive said member therebetween upon movement of the elevator car to bring said doors into alignment with each other, initial actuation of said elevator door opening means through the connecting means moving said rollers on the carrying means to grip said member therebetween.

5. In a mechanism for coupling an elevator car door to the hatchway door, a lever for opening the elevator car door pivoted to the elevator car, a cam, tension means for holding said lever against the face of said cam, a pin extending from said cam, means movably mounted on said car door for carrying a pair of spaced roller bearings, linkage connecting said lever to said roller carrying means, said linkage in engagement with said pin and a member extending from the hatchway door and normally positioned relatively between the rollers, said rollers positioned to receive said member therebetween upon movement of the elevator car to bring said doors into alignment with each other, upon initial movement of said cam, said pin movable away from said linkage and said roller carrying means movable into position to grip said member between said roller bearings and continued movement of said cam moving said lever to open said elevator car door.

6. In a mechanism for coupling an elevator car door to the hatchway door, a cam, a lever pivoted above the door and at its lower end linked to said door, said lever normally held in door closing position against said cam, a member on the hatchway door, means for coupling the elevator car door to said member and linkage connecting said lever to said coupling means, said linkage normally held in engagement with said cam to position said coupling means in disengagement with said member, initial movement of said cam arranging said linkage to move said coupling means into engagement with said member and concurrently retaining said lever in normal door closing position, further movement of said cam moving said lever about its pivot to open said door.

7. The mechanism of claim 6 and including a door lock held in closed position when said lever is normally positioned to close said elevator door, and means for unlocking said door lock connected to said cam to permit said door lock to open upon initial movement of said cam.

JOSEPH DI GIOVANNI.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,696,328	Rosentreter	Dec. 25, 1928
1,705,803	Brush et al.	Mar. 19, 1929
1,778,459	Markwich	Oct. 14, 1930
1,823,962	Walker et al.	Sept. 22, 1931
1,909,064	McCormick	May 16, 1933
1,961,938	Norton	June 5, 1934
2,009,342	Nielsen	July 23, 1935