

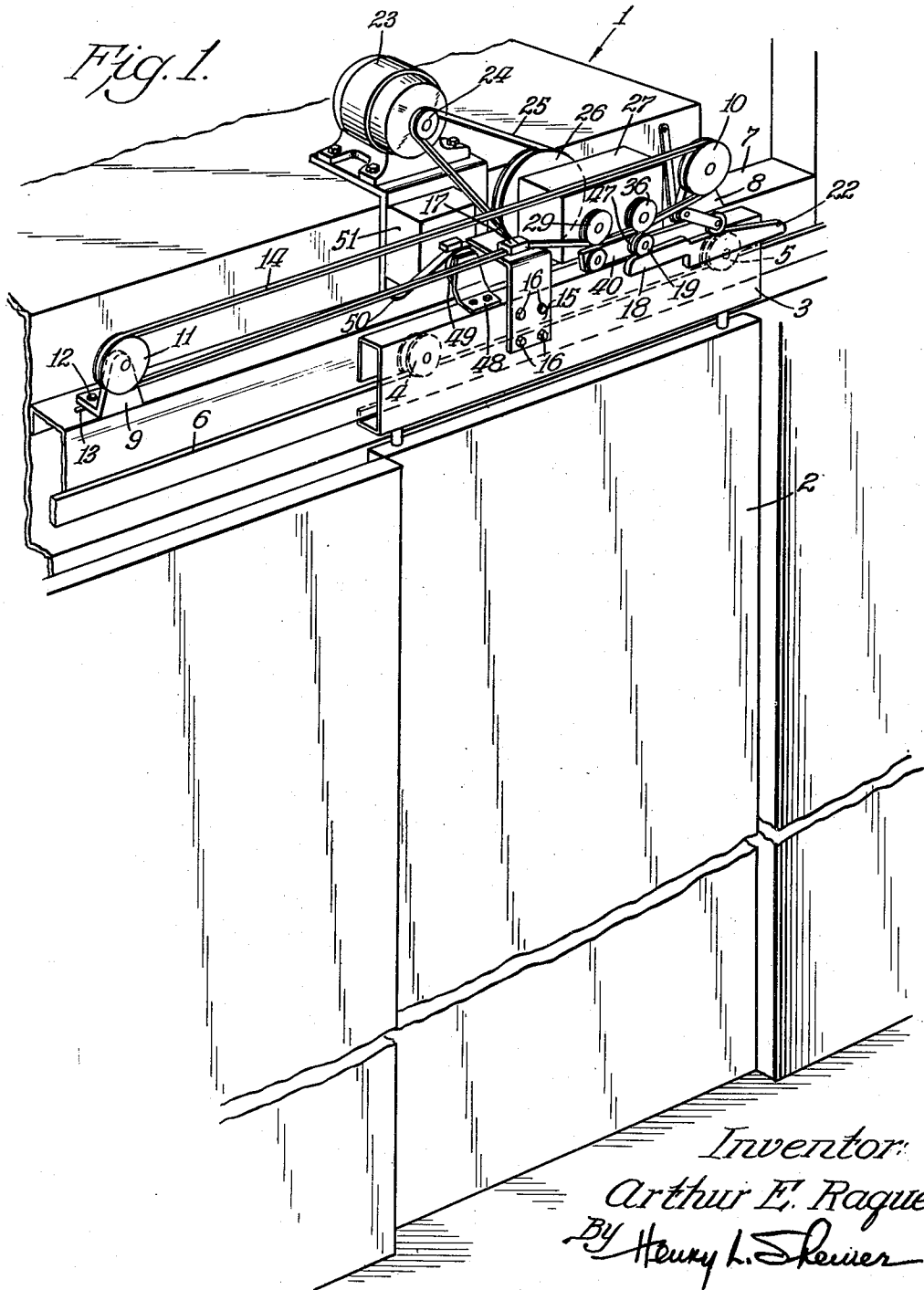
Oct. 17, 1950

A. E. RAQUÉ
ELEVATOR DOOR

2,526,503

Filed May 31, 1946

3 Sheets-Sheet 1



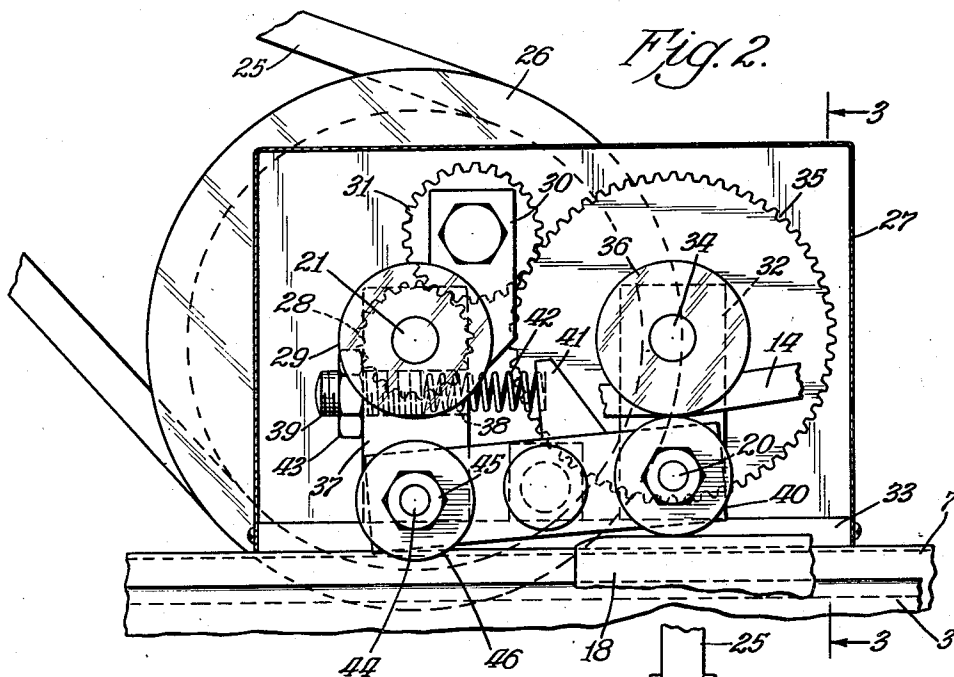
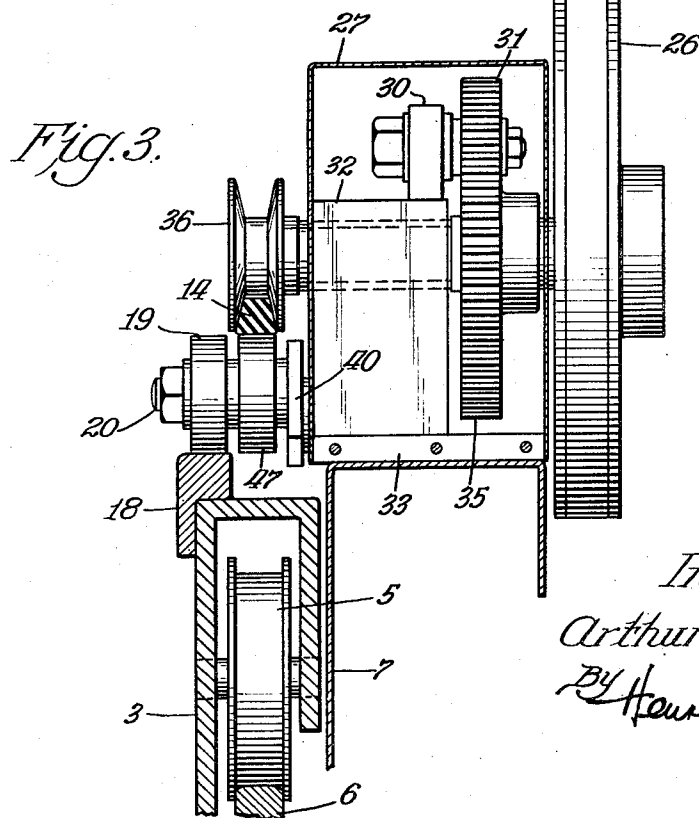
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3 Sheets-Sheet 2



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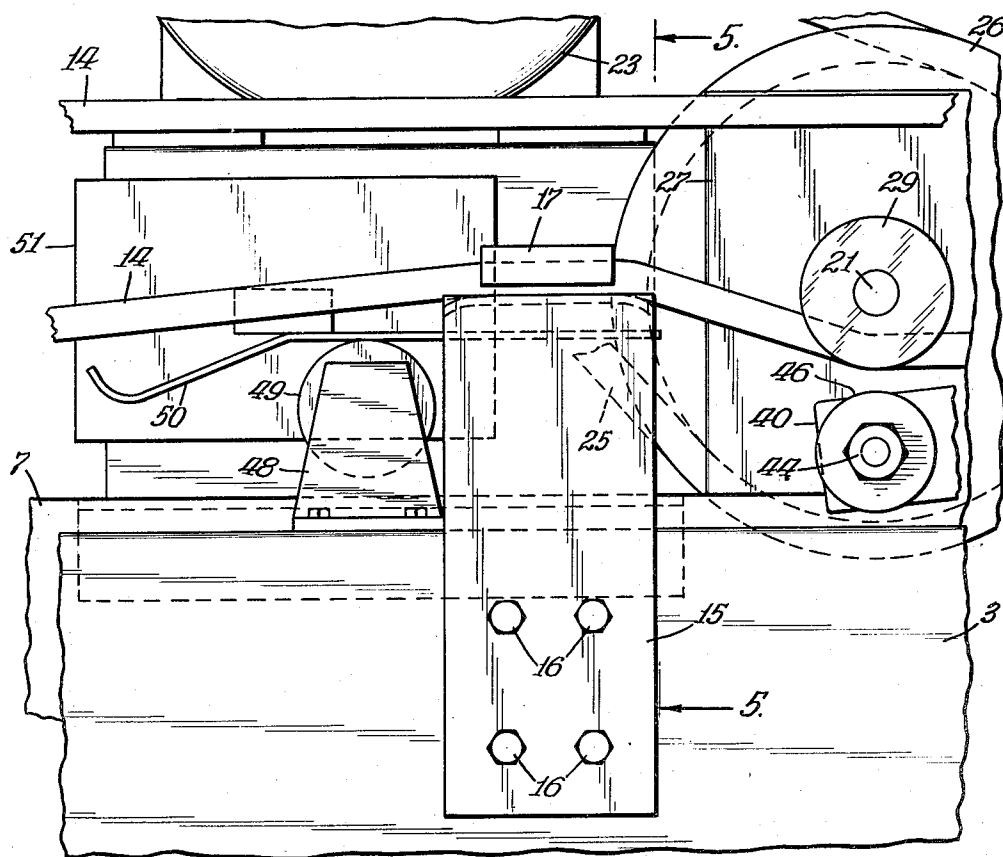
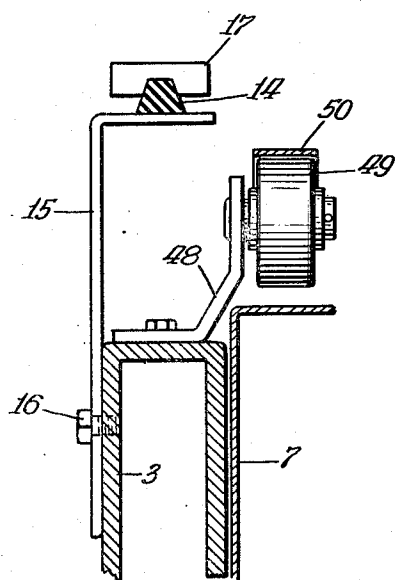
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3 Sheets-Sheet 3



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UNITED STATES PATENT OFFICE

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ELEVATOR DOOR

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7 Claims. (Cl. 268—53)

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My invention relates to elevator doors, and more particularly to means for opening and closing the doors of an elevator, both by hand control and in an automatic electrically controlled elevator.

In elevators it is desirable that the final movement in the closing of the door be effected at relatively slow speed to avoid slamming or bouncing of the door to a stop in closed position. Furthermore, it is of advantage to have the final movement of the door to closed position proceed at a slow speed to avoid accidents and possible injury to passengers. Where the door operating means is positively connected to the door itself, there is likelihood of serious injury if a passenger or a portion of his anatomy accidentally becomes lodged between the door and the door jamb. It is therefore desirable to provide an operating means for the door in which, when the door is accidentally obstructed, an overrun or slippage in the driving mechanism may occur until the obstruction is removed. The construction furthermore should be such that when the obstruction is removed the operation will proceed so that the door may be moved to closed position. These desiderata are especially needed in an electrically controlled elevator which is completely automatic, since in elevators of this type no operator is present who may be in a position to prevent possible accidental injuries. Then too, the initial closing movement may be at a fairly high speed, thus accelerating operation.

One object of my invention is to provide a new and improved operating means for elevator doors.

Another object of my invention is to provide a door operating means in which the door will close first rapidly and then at a reduced speed to move the door smoothly to closed position and thus avoid slamming or bouncing the door to a stop.

Another object of my invention is to provide a door operating means in which the operating mechanism will overrun if movement of the door is obstructed, thereby preventing possible injury, either to passengers in the elevator or to the operating mechanism.

A further object of my invention is to provide an operating mechanism in which the power is transmitted through a friction drive having two speeds and in which the amount of friction may be regulated.

Another object of my invention is to provide a door operating mechanism in which the power is applied through a friction drive whereby when

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the prime mover is stopped the friction will act as a friction brake to hold the door in closed or open position.

Other and further objects of my invention will appear from the following description.

In the accompanying drawings, which form part of the instant specification and which are to be read in conjunction therewith, and in which like reference numerals are used to indicate like parts in the various views:

Fig. 1 is a perspective view of a portion of an elevator cab equipped with my improved door operating means.

Fig. 2 is a front elevation of a detail shown on an enlarged scale showing the speed reduction mechanism with its housing in section.

Fig. 3 is a sectional view taken on the line 3—3 of Fig. 2.

Fig. 4 is a front elevation of a portion of my door operating means shown on an enlarged scale.

Fig. 5 is a sectional view taken on the line 5—5 of Fig. 4.

In general, my invention contemplates the provision of a reversible prime mover such as an electric motor adapted to drive a transmission. The transmission is such that its output rotates two pulleys at different speeds. A reciprocating door is mounted on wheels adapted to roll upon a rail. A portion of the door is connected to an endless belt which is mounted on a pair of sheaves. The door is provided with a cam so that in moving from closed to partially open position, the cam engages the belt with a low speed pulley. As soon as the cam is free of the follower forcing engagement of the belt with the low speed pulley, a spring shifts the engagement of the endless belt to the high speed pulley. Limit switches are provided to stop the motor when the door reaches the fully opened or fully closed position.

Referring now to the drawings, an elevator cab is indicated generally by the reference numeral 1. It is provided with a sliding door 2 which is supported from a door hanger 3. The door hanger carries wheels 4 and 5 which ride on a rail 6 supported from the cab in any suitable manner. A channel 7 is supported by the cab and carries brackets 8 and 9 on which sheaves 10 and 11 are rotatably mounted. The bracket 9 is secured to the channel 7 by bolts 12 which pass through a slot 13. By loosening the bolts 12, the bracket 9 may be adjusted to alter the inter-sheave distance between sheaves 10 and 11. An endless belt

14 is carried by the sheaves 10 and 11. A bracket 15 is secured to the hanger 3 by means of bolts 16. The endless belt 14 is clamped to the bracket 15 by means of clamp 17. Movement of the endless belt 14 to and fro will cause the door 2 to reciprocate. The hanger 3 carries a cam 18 which is secured thereto in any suitable manner and is adapted to engage a follower 19 carried by a shaft 20 which is mounted on a rocker arm 40, as can readily be seen by reference to Fig. 3. The cam 22, as shown in Fig. 1, is the operating cam for actuating the returning mechanism and forms no part of the instant invention.

The motor 23 may be of any suitable design and is of the reversible type. When the motor 23 rotates to drive motor pulley 24 in a clockwise direction, the door 2 will move to open position. When the armature of the motor 23 rotates to drive its pulley 24 in a counter-clockwise direction, the door 2 will move to closed position. The motor pulley 24 is connected by a belt 25 to a sheave 26 of the driving and speed reduction mechanism which is housed in housing 27.

Referring now to Figs. 2 and 3, the sheave 26 is fixedly mounted on a shaft 21 for rotation therewith. Likewise secured to shaft 21 are a pinion 28 and a pulley 29. Rotation of the sheave 26 will rotate the pinion 28 and the pulley 29 in the same direction as the direction of rotation of the sheave 26. Rotatably mounted on a standard 30, I provide a pinion 31 which meshes with the pinion 28. Rotatably mounted in support 32 carried by the base 33 of the transmission I provide a shaft 34. Secured to the shaft for rotation therewith is a gear 35 which meshes with idler pinion 31. The shaft 34 also carries a pulley 36 for rotation therewith. It will be observed that the diameter of gear 35 is much greater than the diameter of pinion 31. The gear ratio is such that pulley 29 will be driven at the speed of the sheave 26, while the pulley 36 will be driven at a much lower speed, due to the speed reducing gearing just described. The shaft 21 is journaled in a member 37 carried by the base 33. The member 37 is provided with a bore 38, one end of which is internally threaded to receive a screw 39. The rocker arm 40 is pivotally mounted on the base 33 adjacent its midpoint, and is formed with a projection 41 which is adapted to engage a compression spring 42, one end of which is lodged in the bore 38. The compression of the spring is governed by the screw 39, which is held in set position by a lock nut 43. The construction is such that the spring 42 biases the arm 40 to rotate in a clockwise direction. The rocker arm 40 carries a shaft 44 and a shaft 20. Rotatably mounted upon shaft 44 and secured by nut 45 I provide a roller 46 directly under the pulley 29. The shaft 20 carries the cam follower roller 19 described above and a roller 47, which is positioned directly under the pulley 36. The position of the sheaves 10 and 11 are such that the endless belt 14 passes adjacent the pulleys 29 and 36. The gears are protected by the housing 27. A bracket 48 is carried by the hanger 3 and supports a roller 49 adapted to cooperate with actuating member 50 of the switch mechanism housed in housing 51. This switch mechanism is adapted to deenergize the motor 23 as the door moves to closed position and conditions the control circuit for operation in the reverse direction to open the door for the next operation. This forms no part of my invention and is described for purposes of clarity.

In operation the control mechanism of any de-

sired nature energizes the motor 23 for rotation of its armature in a clockwise direction. Since in closed position the cam 18 is in contact with the follower 19 to cam the roller arm 40 so that its right end, as viewed in Fig. 2, has moved upwardly, the roller 47 engages the endless belt 14 so that it engages the sides of the pulley 36, as shown in Fig. 3. Raising the right hand side of rocker arm 40 lowers the left hand side of the rocker arm against the action of spring 42 and thus disengages roller 46 from contact with the endless belt 14, permitting it to fall free of friction contact with the sides of pulley 29. Since the pulley 36 is driven through the speed reducing gear train, the door will move to open position at a low speed. As soon as the cam 18 rides free of the follower 19, the spring 42 takes charge, rocking the rocker arm 40 in a clockwise direction and bringing follower 46 into contact with the endless belt 14, seating it in the groove of pulley 29. Pulley 29 is being driven at the higher speed which is the speed of sheave 26. The door then moves to the open position at increased speed until the limit switch (not shown) stops the operation of the motor and conditions the control circuit to operate the motor in the opposite direction to move the door to closed position.

When the control circuit is moved to actuate the motor to move the door to closed position, the motor armature will run in a counter-clockwise direction, thus driving both pulleys 29 and 36 in a counter-clockwise direction. Since in open position the cam 18 is disengaged from follower 19, the high speed pulley 29 will drive the endless belt, moving the door to closed position, at the desired maximum speed. As soon as the leading edge of cam 18 contacts the follower 19, the rocker arm 40 will be rotated in a counter-clockwise direction, bringing roller 47 into engagement with the endless belt 14 and seating it in the groove of sheave 36. At the same time, the motion of the rocker arm against the action of spring 42 disengages the roller 46 from the endless belt 14, allowing it to clear the groove formed in pulley 29. The motion of the door will then continue at the slower speed until the door moves to closed position, at which time the limit switch 51 will be actuated by the roller 49 to deenergize the door operating motor 23.

It will be seen that the final movement of the door is at the reduced speed, permitting the door to move to closed position smoothly and without slamming or bouncing against the door jamb. The drive is frictional, that is, by friction of the endless belt 14 with the groove formed in the driving pulley. If a passenger should accidentally place an arm or a hand between the edge of the door and the jamb, the driving friction is such that it will be overcome, permitting the pulley 36 to rotate without doing injury to the limb of the passenger. The reduction in the speed furthermore insures that the inertia of the movement of the door will not aid in creating a sufficient momentum to do injury. As soon as the obstruction is removed, friction again takes charge and the door closing operation proceeds to complete the cycle. The amount of friction can be readily adjusted by the use of rollers 19 of different sizes, as the roller 19 can be easily removed from the shaft 20 by removing its securing nut and washer. The friction exercised by the high speed pulley can be readily adjusted through adjusting screw 30 which controls the spring compression.

It will be seen that I have accomplished the

objects of my invention. I have provided a new and improved door operating means for elevators in which the final movement of the door will be at a reduced speed, thus enabling the door to be closed smoothly, and without slamming or bouncing to a stop. The door operating means is such that it will overrun if the movement of the door is interfered with and thereafter continue its cycle of operations to move the door to closed position. When the motor is stopped the friction between the operating means and the door acts as a brake to hold the door in its closed or open position. In event of loss of power with the door in closed position, the door can be forced open against the action of friction without injury to any of the parts. The operation of an elevator equipped with my door operating means is accelerated since the door can be made to move fairly rapidly after it has opened and at the rapid speed during the initial portion of the closing movement. The two speeds of reciprocation are obtained simply and independently of the speed of the operating motor, which may run at a constant speed in either direction.

While I have described my invention with respect to a single horizontally sliding door, it is obvious that my invention may be employed for swinging hoistway doors or multiple doors without changing the principle of operation.

It will be understood that certain features and sub-combinations are of utility and may be employed without reference to other features and sub-combinations. This is contemplated by and is within the scope of the claims. It is further obvious that various changes may be made in details within the scope of the claims without departing from the spirit of the invention. It is, therefore, to be understood that this invention is not to be limited to the specific details shown and described.

Having thus described my invention, I claim:

1. An elevator having a door, means for mounting said door for movement to and from open position, an endless belt, a pair of sheaves, means for mounting said sheaves in spaced relation to one another, said endless belt being carried by said sheaves, means for attaching said endless belt to said door, a pair of rotatable members, means for rotating said rotatable members at different angular speeds, means for frictionally engaging said endless belt with the lower speed rotatable member while the door is within a predetermined distance away from closed position, and means for frictionally engaging said endless belt with the higher speed rotatable member while the door is outside of said predetermined distance away from closed position.

2. An elevator having a door, means for mounting said door for movement to and from open position, an elongated member, means for attaching said elongated member to said door, a pair of rotatable members, a prime mover, means operatively connecting said prime mover to one of said rotatable members, a speed reducing transmission driven from said prime mover for driving the other of said rotatable members, means for frictionally engaging said elongated member with the lower speed rotatable member while the door is within a predetermined distance away from closed position, and means for frictionally engaging said elongated member with the higher speed rotatable member while the door is outside of said predetermined distance away from closed position.

3. An elevator having a door, means for mount-

ing said door for movement to and from open position, an elongated member, means for attaching said elongated member to said door, a pair of rotatable members, means for rotating said rotatable members at different angular speeds, a cam carried by said door, a rocker arm, a roller carried by said rocker arm and adapted to engage said elongated member, a cam follower carried by said rocker arm adapted to contact said cam whenever the door is a predetermined distance away from closed position whereby to frictionally engage said lower speed rotatable member with said elongated member, and means for frictionally engaging said elongated member with the higher speed rotatable member whenever the cam follower is out of contact with said cam.

4. An elevator having a door, means for mounting said door for movement to and from open position, an elongated member, means for attaching said elongated member to said door, a pair of rotatable members, means for rotating said rotatable members at different angular speeds, means for frictionally engaging said elongated member with said lower speed rotatable member while the door is within a predetermined distance away from closed position, a rocker arm, a roller carried by said rocker arm adapted to contact said elongated member to move it into engagement with said higher speed rotatable member whenever the door is outside of said predetermined distance away from closed position, and a spring for biasing said rocker arm to move it to frictional engaging position.

5. An elevator having a door, means for mounting said door for movement to and from open position, an elongated member, means for attaching said elongated member to said door, a pair of rotatable members, means for rotating said rotatable members at different angular speeds, means for frictionally engaging said elongated member with the lower speed rotatable member while the door is within a predetermined distance away from closed position, and means for frictionally engaging said elongated member with the higher speed rotatable member while the door is outside of said predetermined distance from closed position, said means for frictionally engaging said elongated member with the higher speed rotatable member including a rocker arm, a roller carried by said rocker arm adapted to contact said elongated member to move it into rotatable member engaging position, a spring for biasing said rocker arm to frictionally engaging position, and means for adjusting the biasing action of said spring.

6. An elevator having a door, means for mounting said door for movement to and from open position, an elongated member, means for attaching said elongated member to said door, a pair of rotatable members, means for rotating said rotatable members at different angular speeds, means for frictionally engaging said elongated member with the lower speed rotatable member while the door is within a predetermined distance away from closed position, and means for frictionally engaging said elongated member with the higher speed rotatable member while the door is outside of said predetermined distance from closed position, said means for rotating said rotatable members at different speeds including a support, a first shaft, means for rotatably mounting said first shaft on said support, a prime mover, means for rotating said first shaft from said prime mover, one of said rotatable members being carried by said shaft for rotation therewith,

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a pinion carried by said shaft for rotation therewith, a second shaft, means for rotatably mounting said second shaft on said support, the other of said rotatable members being carried by said second shaft for rotation therewith, a gear carried by said second shaft for rotation therewith, and an idler gear carried by said support meshing both with said pinion and said gear.

7. An elevator having a door, means for mounting said door for movement to and from open position, an elongated member, means for attaching said elongated member to said door, a pair of rotatable members, means for rotating said rotatable members at different angular speeds, means for frictionally engaging said elongated member with the lower speed rotatable member while the door is within a predetermined distance away from closed position, and means for frictionally engaging said elongated member with the higher speed rotatable member while the door is outside of said predetermined distance from closed position, said means for frictionally engaging said elongated member comprising a rocker arm, means for mounting said rocker arm for pivotal movement about a point adjacent its center, a pair of rollers carried by said rocker arm

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adjacent opposite ends thereof and respective rotatable members, said elongated member being positioned between said rollers and said rotatable members, a spring for biasing said rocker arm for rotation to move one of said rollers toward one of said rotatable members, a cam carried by said door, a cam follower carried by said rocker arm, the construction being such that said cam will coast with said follower to rotate said rocker arm against the action of said spring to move the other of said rollers toward the other of said rotatable members.

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