Nov. 11, 1958 J. H. BORDEN 2,859,835

MECHANISM FOR OPENING AND CLOSING ELEVATOR CABS AND HATCHWAYS

Filed Feb. 24, 1955 3 Sheets-Sheet 1

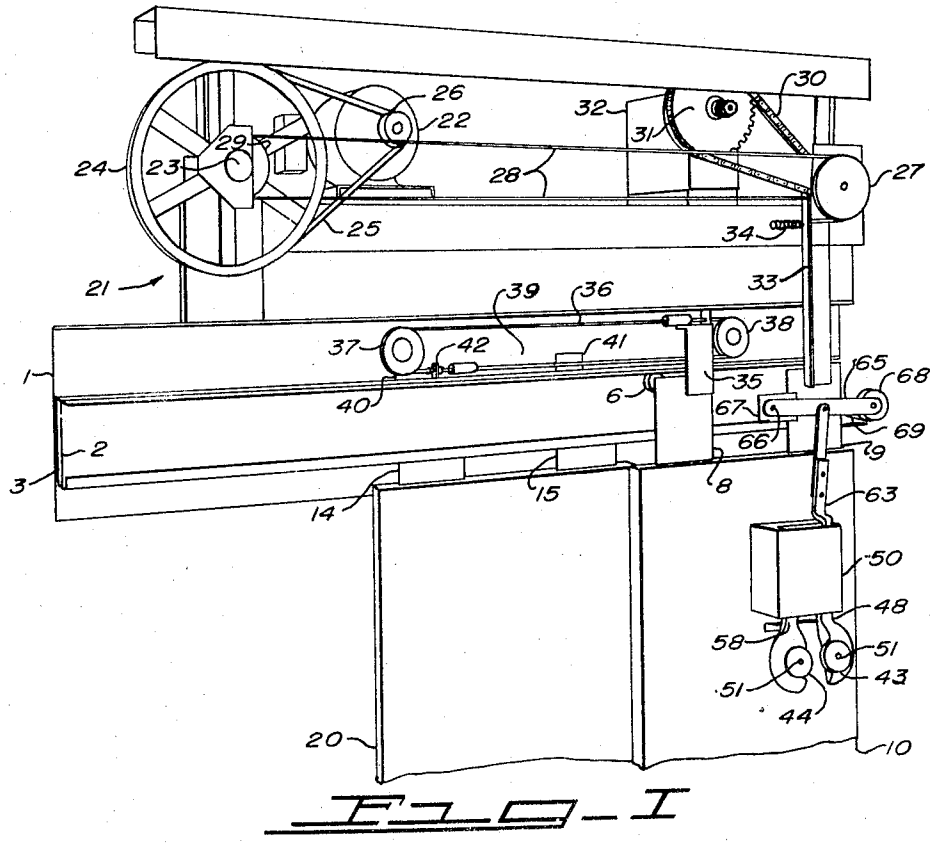


FIG. I

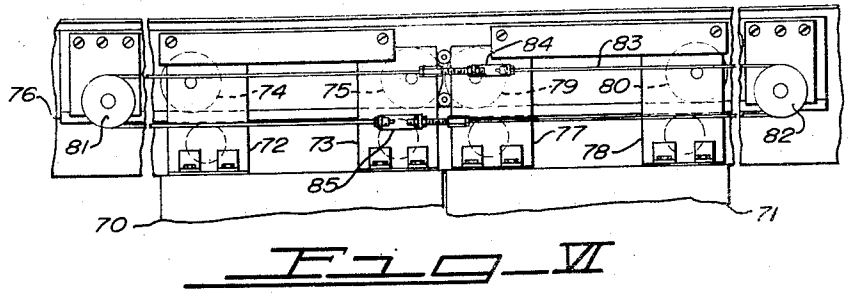


FIG. VI

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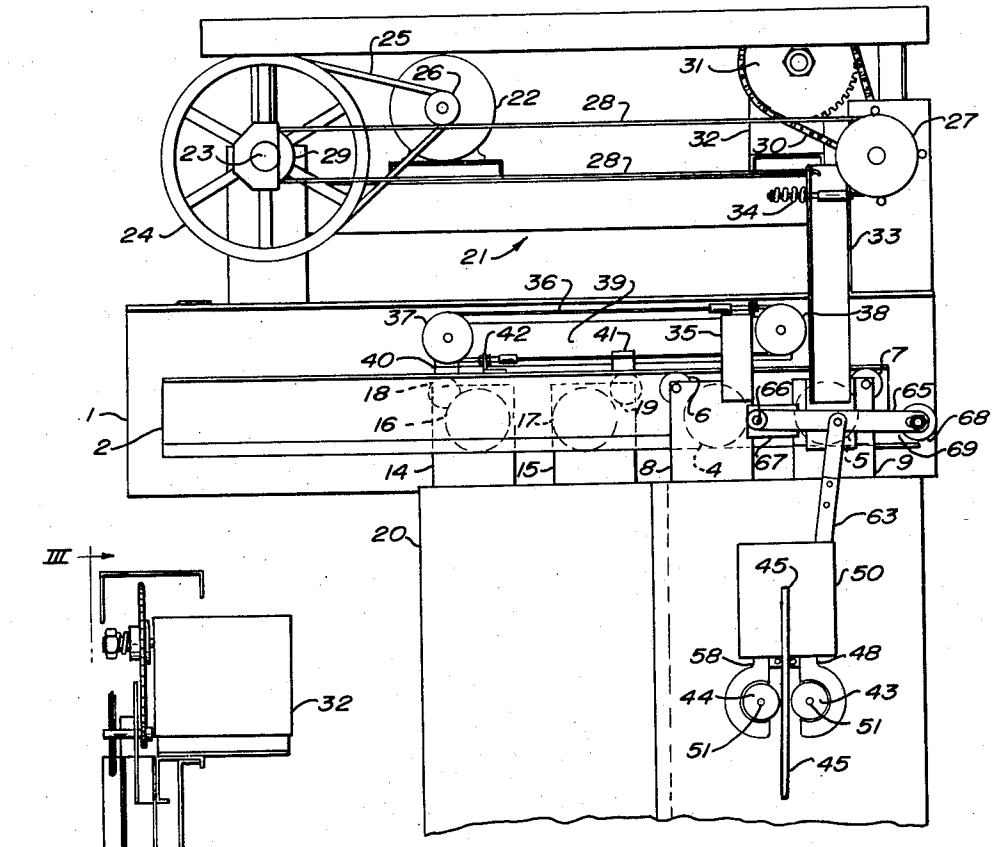


FIG. III

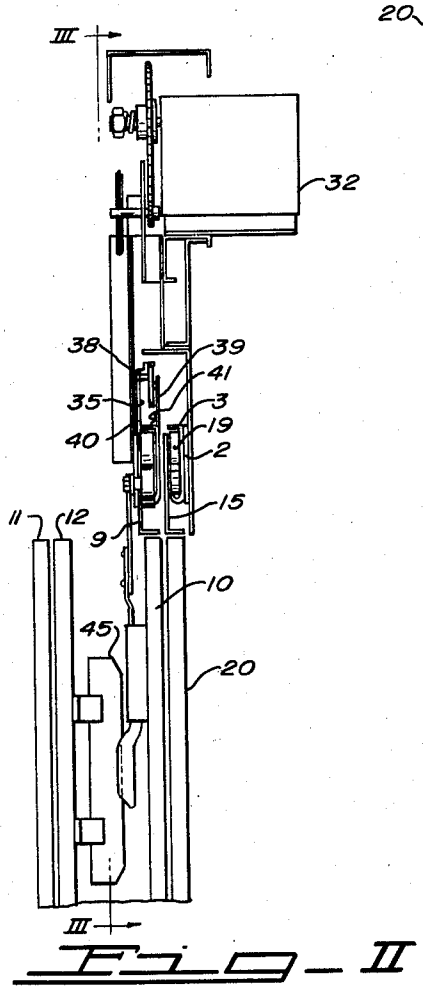
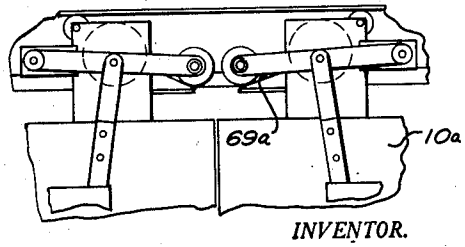


FIG. II

FIG. VII



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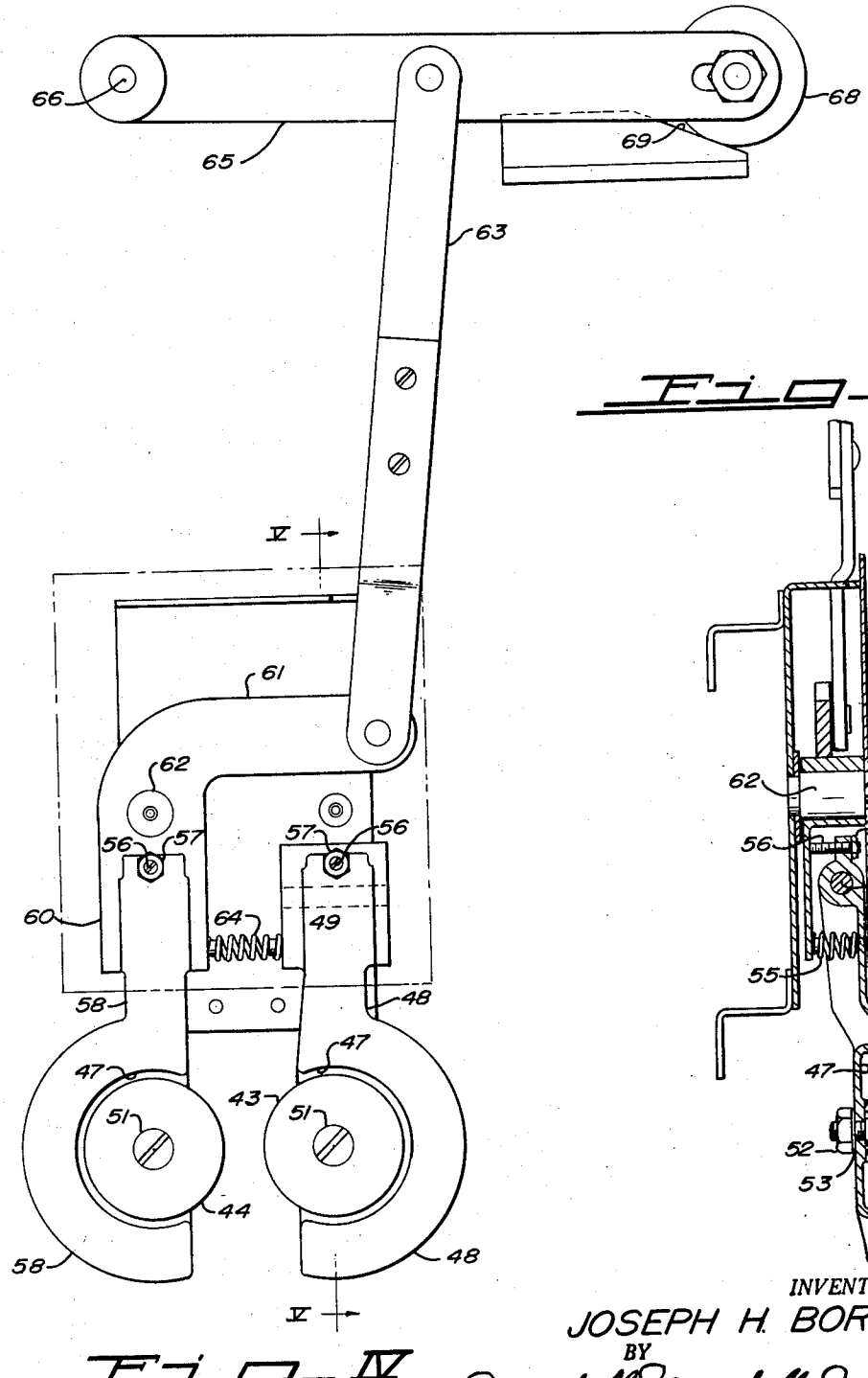


Fig. IV

Fig. V

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MECHANISM FOR OPENING AND CLOSING ELEVATOR CABS AND HATCHWAYS

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Application February 24, 1955, Serial No. 490,188

8 Claims. (Cl. 187—52)

This invention relates to passenger systems and particularly to means for closing and opening the doorways of cabs and the entrances to hatchways.

Some objects of the instant invention are:

To provide improved mechanism for accurately and smoothly operating overlapping fast moving and slow moving doors;

To provide improved differential mechanism for causing a slow moving door to move at half the speed of an overlapping fast moving door;

To provide improved mechanism for causing elevator cab doors and corresponding hatchway doors to move in unison;

To provide mechanism for automatically clutching elevator cab doors to corresponding hatchway doors at initial opening movements of the cab doors and to declutch the doors from each other near completion of closing movements of the cab doors.

Other objects and advantages will be apparent from perusal of the following specification illustrated by the accompanying drawings in which:

Fig. I is a view in perspective showing the mechanism of my invention incorporating side opening doors of an elevator cab, the cab not being shown, and the doors being shown in closed position;

Fig. II is a side elevational view of the mechanism illustrated in Fig. I, hatchway doors also being shown, the lower parts of the doors being broken away.

Fig. III is a view taken as indicated by the line III—III of Fig. II;

Fig. IV is an enlarged front elevational view showing in detail parts of mechanism for coupling the hatchway doors to the cab doors;

Fig. V is a view in section taken as indicated by the line V—V of Fig. IV;

Fig. VI is an elevational view taken from within a hatchway showing mechanism for causing center opening hatchway doors to move in opposite directions, and

Fig. VII is a fragmentary front elevational view showing part of such coupling mechanism modified for application to center opening doors not operatively connected together.

These drawings and the following description are exemplary only and are not intended to impose limitations on the scope of the invention.

The opening and closing mechanism is carried by a beam 1 which is fixed across the front of an elevator cab (not shown). Fixed to the face of the beam 1 are front and rear tracks 2 and 3 which are channel shaped. A pair of wheels 4 and 5 travel along the lower flange of the front track 2 and a pair of rollers 6 and 7 travel along its upper flange, the wheels and rollers being journaled upon stub axles projecting from hanger brackets 8 and 9 from which is hung a door 10. Fig. II also shows overlapping hatchway doors 11 and 12. The tracks 2 and 3 are spaced apart so that hanger brackets 14 and 15 may move freely between them. Journaled upon axles projecting from the brackets 14 and 15 are wheels

16 and 17 which travel along the lower flange of the channel shaped track 3 and rollers 18 and 19 which travel beneath the upper flange of the track 3. The brackets 14 and 15 are fixed to and support a door 20. Erected upon the beam 1 is a frame 21 which supports a motor 22 and a pulley shaft 23 upon which is keyed a large pulley 24 that is connected by means of a belt 25 to a small pulley 26 which is keyed upon the motor shaft. A second shaft is journaled in the frame 21 and has fixed thereto a driven sheave 27 around which is looped a cable 28 that also is looped around a driving sheave 29 fixed upon the pulley shaft 23. A chain 30 and sprocket 31 driven from the shaft serve to operate electric devices (not shown) that are housed within a control box 32. Such electric devices start, stop, reverse and otherwise control the action of the motor 22 and may be connected into the elevator operating system.

The cable 28 is fastened to an upright arm 33 preferably through a spring take up 34 which keeps the cable taut. The upright arm 33 is rigidly secured to the bracket 9 from which the door 10 is hung. When the motor 22 acts to turn the pulley 24 and the sheave 29 in a clockwise direction the upright arm 33 will be pulled to the left and the door 10 will be moved to the left to open the doorway. When the motor acts to turn the pulley 24 and the sheave 29 counterclockwise the arm 33 will be pulled to the right and the door 10 will be moved to the right to close the doorway.

The doorway that is opened and closed by the doors 10 and 20 extends across nearly two-thirds of the front of the cab. When the doorway is opened wide the doors 10 and 20 are overlapped at the side of the cab. Whenever the doorway is opened or closed the door 10 must move twice as far and twice as fast as the door 20. To accomplish this differential movement accurately, smoothly and silently the fast moving door 10 is connected through the hanger bracket 8 and an extension 35 to the upper lay of a cable 36 which takes over sheaves 37 and 38 journaled upon an elongated plate 39 which is rigidly mounted upon tabs 40 and 41 extending upwardly from the hanger brackets 14 and 15 of the slow moving door 20. The lower lay of the cable 36 is fastened by means of a bracket 42 to the upper flange of the channel shaped track 3.

When the upper lay of the cable 36 is pulled in either direction as the fast moving door 10 moves to close or open the doorway the sheaves at the bights of the cable will be translated at half speed and the slow moving door 20 will be taken with them. Thus the doors will overlap or "fold" to open the wide doorway and will "unfold" to close it.

Differential movement of the hatchway doors also may be accomplished by a cable connected to a fast moving hatchway door and a nonmoving track or frame member and taking over sheaves connected to a slow moving door in the manner described above. Instead of employing a motor at each hatchway doorway, however, the fast moving hatchway door is coupled to and uncoupled from the fast moving cab door upon arrival of the cab and operation of the cab doors.

As shown in Figs. I, II, III and IV a pair of rollers 43 and 44 is carried with the fast moving cab door 10 in position to embrace vertically extending vanes 45 one of which is fixed to each fast moving hatchway door. The roller 43 is journaled on a bushing 46 which is positioned within a socket 47 formed in the lower end of a pendant 48 the upper end of which is pivoted on a pintle 49 within an open bottomed casing 50. The bushing 46 is held in place by a shouldered screw 51 and a lock nut 52 and washer 53. The socket 47 has a beveled rim 54 which upon engaging a small obstruction will cause the pendant 48 to swing back on the pintle 49 against the

elastic pressure of an expansive spring **55**. The extent to which the spring **55** can hold the pendant **48** forward may be adjusted by turning a threaded post **56** and locking it in place by means of a nut **57**. The socket rim **54** is cut away at one side to permit the edge of the roller **43** to project therefrom.

The roller **44** is carried by a pendant **58** that is a mirror image of the pendant **48**. But, instead of being pivoted on an axis that is fixed within the open bottomed casing **50**, the pendant **58** is pivoted upon an arm **60** of a bell crank lever **61** which may be swung counterclockwise about a fulcrum **62** by an upward pull on a link **63**, or swung clockwise about the fulcrum **62** by the elastic force of an expansion spring **64**.

The link **63** connects the bell crank lever **61** to the approximate center of a straight lever **65** the fulcrum pivot **66** of which is carried by an ear **67** that sticks out from the hanger bracket **9** from which the fast moving door **10** is hung. The remote end of the straight lever **65** is equipped with a cam roller **68** which, whenever the door **10** starts to open the cab doorway, is pulled up a short incline **69** formed at the end of the lower flange of the channel shaped track **2**, and thence along the top of the flange.

Operation

Whenever the elevator cab reaches a hatchway entrance from either direction the rollers **43** and **44** move on either side of the vane **45** that is fixed to the fast moving hatchway door at that entrance. Neither roller touches the vane until the motor **22** begins to turn and acting through the pulley **24**, the sheave **29** and the cable **28** begins to pull the upright arm **33** and consequently the fast moving door **10** away from its doorway closing position. Initial movement of the door carries the roller **43** against the vane **45** and also pulls the cam roller **68** up the short incline **69** so that the straight lever **65**, the link **63**, the bell crank lever **61** and the pendant **58** function to engage the roller **44** with the vane **45** which thus is clamped between the rollers **43** and **44**. After the fast moving cab door **10** moves initially for ¼ inch more or less from its complete doorway closing position the corresponding hatchway door opens in unison with it.

The respective cab door and hatchway door differential mechanisms, each comprising the cable **36**, fastened through the extension **35** to the fast moving door hanger bracket, and translating the sheaves **37** and **38** and the elongated plate **39** at half speed cause the slow moving cab door and the slow moving hatchway door to open in unison.

When the motor **22** revolves counterclockwise and the doors **10** and **20** close the cab doorway in fast and slow motion the corresponding hatchway doors close the hatchway entrance in unison with the closing cab doors, though the rollers **43** and **44** relax their clamping grip upon the vane **45** as the cam roller **68** rolls off of the incline **69**. The fast moving cab door continues its closing movement for ¼ inch more or less after the hatchway door engages its jamb. The rollers **43** and **44** separate sufficiently to permit the cab to ascend and descend and the rollers **43** and **44** to pass vanes **45** at the several hatchway entrances without touching the vanes.

In elevator systems having cabs and hatchway entrances equipped with center opening doors, the doors can be made to open and close in unison by employing mechanism such as is illustrated in Fig. VI which shows a pair of center opening hatchway doors **70** and **71**, the door **70** being supported by hanger brackets **72** and **73** upon which are mounted wheels **74** and **75** that travel along the stationary track **76**, and the door **71** being supported by hanger brackets **77** and **78** upon which are mounted wheels **79** and **80** that travel along the stationary track **76**.

Mounted on axes fixed with respect to the track **76** are pulleys **81** and **82** around which passes a cable **83**. The

hanger bracket **77** of the door **71** is secured to the upper lay of the cable **83** by means of a suitable fastener **84** while the hanger bracket **73** of the door **70** is secured to the lower lay of the cable **83** by means of a suitable fastener **85**. Hence, when the door **70** moves toward open position the cable runs clockwise around the pulleys and its upper lay moves the door **71** toward open position. Similarly, when the door **70** moves toward closed position the cable **83** runs counterclockwise around the pulleys and its upper lay moves the door **71** toward closed position.

The hatchway door **70** may be coupled to a corresponding cab door by the coupling mechanism described above and illustrated in Figs. IV and V.

Alternatively in elevator systems having cabs and hatchway entrances equipped with center opening doors the hatchway doors can be caused to open and close in unison by employing dual sets of vanes and vane clutching devices. The vanes and vane clutching devices of each set are identical with the vane and vane clutching device described above except that a right hand and a left hand arrangement is employed, as is indicated in Fig. VII. In this arrangement the incline **69*a*** slopes upwardly to the right, since the door **10*a*** moves to the right in opening.

Other variations and modifications may be made within the spirit and scope of the subjoined claims.

Having described the invention, I claim:

1. Mechanism for opening and closing an elevator cab and an elevator hatchway, said mechanism comprising, in combination, a reversible motor mounted upon said cab, a sheave operatively connected to said motor, a cable passing around said sheave and pulled in one direction when said motor is turning clockwise and in the opposite direction when said motor is turning counterclockwise, a fast moving cab door connected to said cable and thereby moved in one direction when said motor is turning clockwise and in the opposite direction when said motor is turning counterclockwise, a slow moving cab door, a pair of sheaves mounted upon said slow moving door, a cable passing around said pair of sheaves and having one lay connected to said cab and another lay connected to said fast moving door, said pair of sheaves and said cable thus constituting differential means whereby said slow moving door is caused to move in the same direction as that in which said fast moving door is moved but at half the speed of said fast moving door, said mechanism also comprising fast moving and slow moving hatchway doors corresponding to said fast moving and slow moving cab doors, a vertically extending vane carried by the hatchway door corresponding to the fast moving cab door, a pair of rollers which embrace said vane without touching said vane when said fast moving cab door is completely closed and means for causing said pair of rollers to grip said vane upon initial opening movement of said fast moving cab door, said means including an incline fixed upon said cab, a straight lever having a fulcrum movable with said fast moving door, a cam roller movable up said incline, and a bell crank lever carrying one of said pair of rollers and linked to said straight lever to move the roller carried thereby toward the other roller of the pair as said cam roller ascends said incline.

2. Mechanism for opening and closing an elevator cab and an elevator hatchway, said mechanism comprising, in combination, a reversible motor mounted upon said cab, a fast moving cab door moved in one direction when said motor is turning clockwise and in the opposite direction when said motor is turning counterclockwise, a slow moving cab door, a pair of sheaves mounted upon said slow moving door, a cable passing around said pair of sheaves and having one lay connected to said cab and another lay connected to said fast moving door, said pair of sheaves and said cable thus constituting differential means whereby said slow moving door is caused to move

in the same direction as that in which said fast moving door is moved but at half the speed of said fast moving door, said mechanism also comprising fast moving and slow moving hatchway doors corresponding to said fast moving and slow moving cab doors, a vertically extending vane carried by the hatchway door corresponding to the fast moving cab door, a pair of rollers which embrace said vane without touching said vane when said fast moving cab door is completely closed and means for causing said pair of rollers to grip said vane upon initial opening movement of said fast moving cab door, said means including an incline fixed upon said cab, a straight lever having a fulcrum movable with said fast moving door, a cam roller movable up said incline, and a bell crank lever carrying one of said pair of rollers and linked to said straight lever to move the roller carried thereby toward the other roller of the pair as said cam roller ascends said incline.

3. Mechanism for opening and closing an elevator cab and an elevator hatchway, said mechanism comprising, in combination, a reversible motor mounted upon said cab, a sheave operatively connected to said motor, a cable passing around said sheave and pulled in one direction when said motor is turning clockwise and in the opposite direction when said motor is turning counterclockwise, a fast moving cab door connected to said cable and thereby moved in one direction when said motor is turning clockwise and in the opposite direction when said motor is turning counterclockwise, a slow moving cab door, differential means whereby said slow moving door is caused to move in the same direction as that in which said fast moving door is moved but at half the speed of said fast moving door, said mechanism also comprising fast moving and slow moving hatchway doors corresponding to said fast moving and slow moving cab doors, a vertically extending vane carried by the hatchway door corresponding to the fast moving cab door, a pair of rollers which embrace said vane without touching said vane when said fast moving cab door is completely closed and means for causing said pair of rollers to grip said vane upon initial opening movement of said fast moving cab door, said means including an incline fixed upon said cab, a straight lever having a fulcrum movable with said fast moving door, a cam roller movable up said incline, and a bell crank lever carrying one of said pair of rollers and linked to said straight lever to move the roller carried thereby toward the other roller of the pair as said cam roller ascends said incline.

4. Mechanism for opening and closing an elevator cab and an elevator hatchway, said mechanism comprising, in combination, a reversible motor mounted upon said cab, a fast moving cab door moved in one direction when said motor is turning clockwise and in the opposite direction when said motor is turning counterclockwise, a slow moving cab door, differential means whereby said slow moving door is caused to move in the same direction as that in which said fast moving door is moved but at half the speed of said fast moving door, said mechanism also comprising fast moving and slow moving hatchway doors corresponding to said fast moving and slow moving cab doors, a vertically extending vane carried by the hatchway door corresponding to the fast moving cab door, a pair of rollers which embrace said vane without touching said vane when said fast moving cab door is completely closed and means for causing said pair of rollers to grip said vane upon initial opening movement of said fast moving cab door, said means including an incline fixed upon said cab, a straight lever having a fulcrum movable with said fast moving door, a cam roller movable up said incline, and a bell crank lever carrying one of said pair of rollers and linked to said straight lever to move the roller carried thereby toward the other roller of the pair as said cam roller ascends said incline.

5. Mechanism for opening and closing an elevator cab and an elevator hatchway, said mechanism comprising, in combination, a reversible motor mounted upon said cab, a fast moving cab door moved in one direction when said motor is turning clockwise and in the opposite direction when said motor is turning counterclockwise, a slow moving cab door, differential means whereby said slow moving door is caused to move in the same direction as that in which said fast moving door is moved but at half the speed of said fast moving door, said mechanism also comprising fast moving and slow moving hatchway doors corresponding to said fast moving and slow moving cab doors, a vertically extending vane carried by the hatchway door corresponding to the fast moving cab door, a pair of rollers which embrace said vane without touching said vane when said fast moving cab door is completely closed, the axes of said rollers lying approximately in the same horizontal plane and means for causing said pair of rollers to grip said vane approximately in such horizontal plane upon initial opening movement of said fast moving cab door, said means including an incline fixed upon said cab, a bell crank lever carrying one of said pair of rollers, a cam movable up said incline and linked to said bell crank lever to move the roller carried thereby toward the other roller of the pair as said cam ascends said incline.

6. Mechanism for opening and closing an elevator cab and an elevator hatchway, said mechanism comprising, in combination, a reversible motor mounted upon said cab, a fast moving cab door moved in one direction when said motor is turning clockwise and in the opposite direction when said motor is turning counterclockwise, a slow moving cab door, a pair of sheaves mounted upon said slow moving door, a cable passing around said pair of sheaves and having one lay connected to said cab and another lay connected to said fast moving door, said pair of sheaves and said cable thus constituting differential means whereby said slow moving door is caused to move in the same direction as that in which said fast moving door is moved but at half the speed of said fast moving door, a vertically extending series of hatchway doors and means for automatically coupling said fast moving cab door to an adjacent hatchway door of said series said means including an incline fixed upon said cab, a straight lever having a fulcrum movable with said fast moving door, a cam roller movable up said incline, and a bell crank lever carrying one of said pair of rollers and linked to said straight lever to move the roller carried thereby toward the other roller of the pair as said cam roller ascends said incline.

7. Mechanism for opening and closing an elevator cab and an elevator hatchway, said mechanism comprising, in combination, a reversible motor mounted upon said cab, a cab door moved in one direction when said motor is turning clockwise and in the opposite direction when said motor is turning counterclockwise, a hatchway door corresponding to said cab door, a vertically extending vane carried by the hatchway door, a pair of rollers which embrace said vane without touching said vane when said cab door is completely closed, and means for causing said pair of rollers to grip said vane upon initial opening movement of said cab door, said means including an incline fixed upon said cab, a straight lever having a fulcrum movable with said cab door, a cam roller movable up said incline, and a bell crank lever carrying one of said pair of rollers and linked to said straight lever to move the roller carried thereby toward the other roller of the pair as said cam rollers ascends said incline.

8. Mechanism for opening and closing an elevator cab and an elevator hatchway, said mechanism comprising in combination, a cab door, a hatchway door corresponding to said cab door, structure surrounding each of said doors with respect to which said doors move, means to move one of said doors in one direction from a closed to an open position and in the opposite direction from an open to a closed position, a vertically extending vane on one

of said doors, a pair of rollers on the second of said doors which embrace said vane without touching said vane when said second door is in a first position, and means for causing said pair of rollers to grip said vane when said second door is in a second position, said means including an incline fixed to said surrounding structure of said second door, a bell crank lever carrying one of said pair of rollers, a cam movable upon said incline and linked to said bell crank lever to move the roller carried thereby toward the other roller of the pair as said cam enters upon said incline.

References Cited in the file of this patent

UNITED STATES PATENTS

1,534,210	Griffith et al.	Apr. 21, 1925
1,937,029	McCormick	Nov. 28, 1933
1,950,150	Norton et al.	Mar. 6, 1934
1,960,860	Allen	May 29, 1934
2,077,659	Bancroft	Apr. 20, 1937
2,432,293	Di Giovanni	Dec. 9, 1947