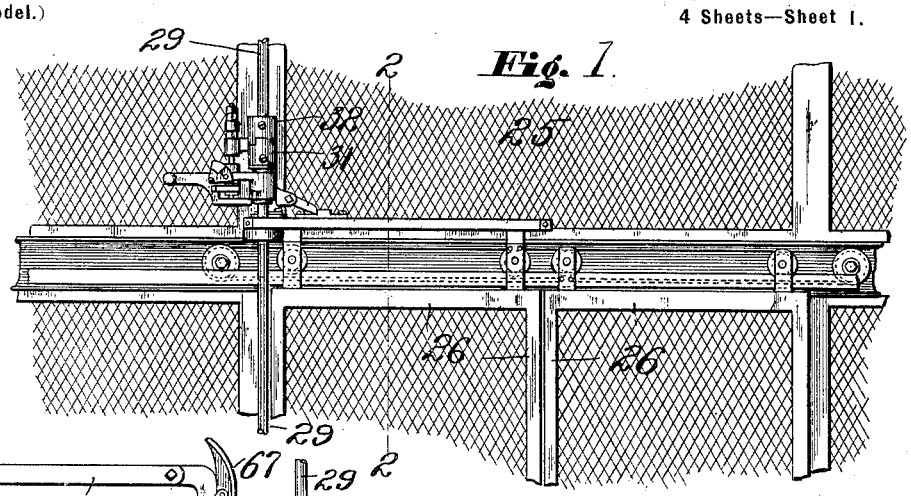
No. 649,662. Patented May 15, 1900.

F. K. FASSETT.

ELEVATOR.

(Application filed July 10, 1899.)

(No Model.) 4 Sheets—Sheet 1.



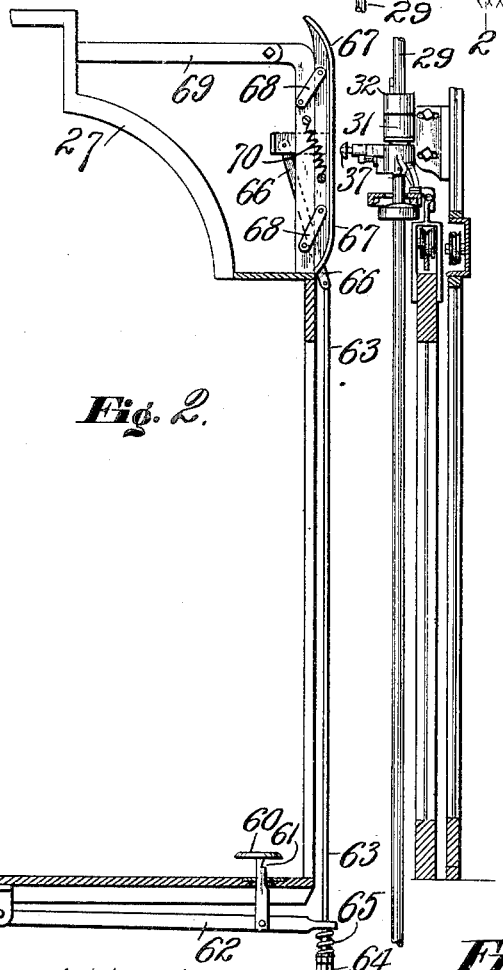
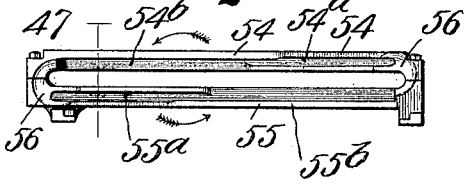
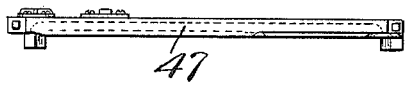
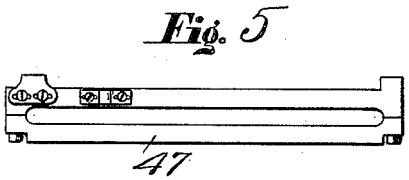


Fig. 2.







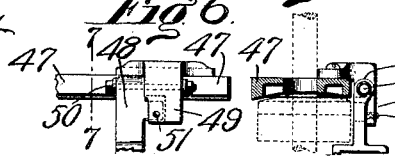


Fig. 7.

Attest:
Jno. H. Scott.
A. D. Gray.

Inventor:
Francis K. Fassett
by
Baker, Wright & Connell
his attys

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F. K. FASSETT.

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Fig. 8.

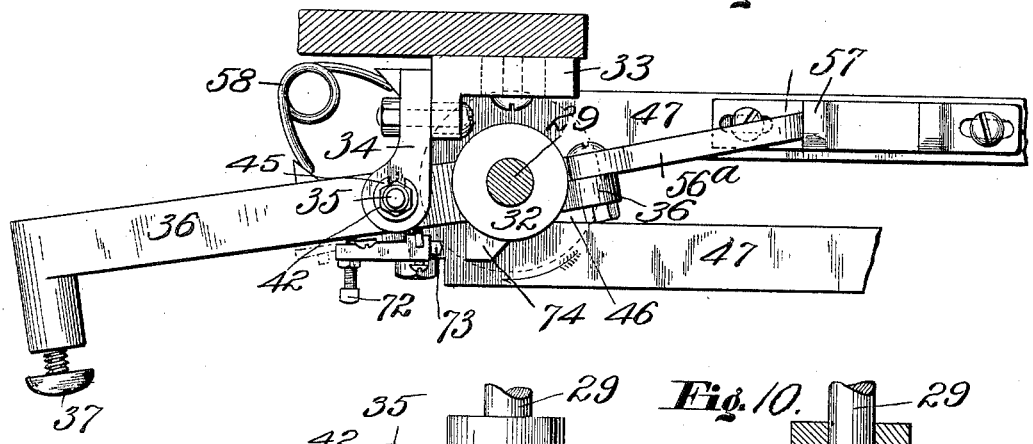


Fig. 9.

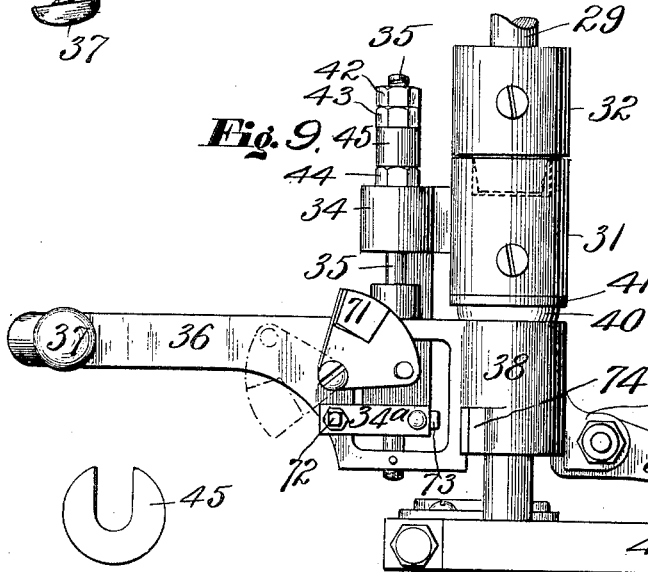


Fig. 10.

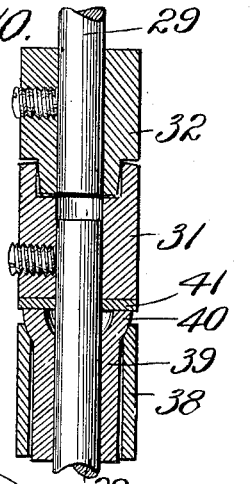
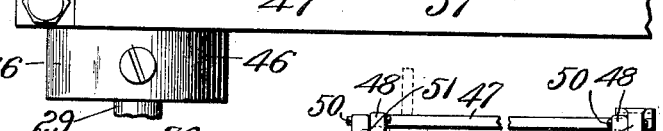


Fig. 11.



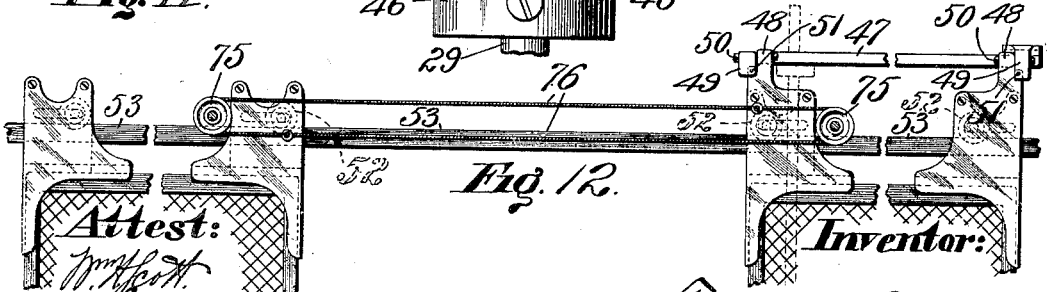


Fig. 12.

Attest:
Wm. H. Coit.
A. D. Gray.

Inventor:
Francis K. Fassett
by Baketwell & Cornwall
his attys

No. 649,662. Patented May 15, 1900.

F. K. FASSETT.

ELEVATOR.

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Fig. 14.

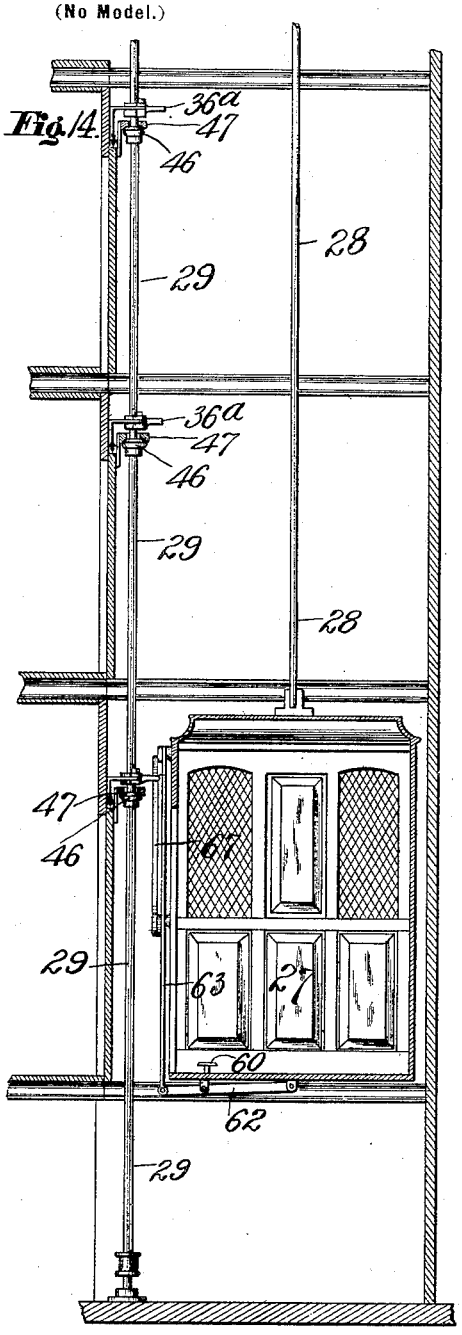
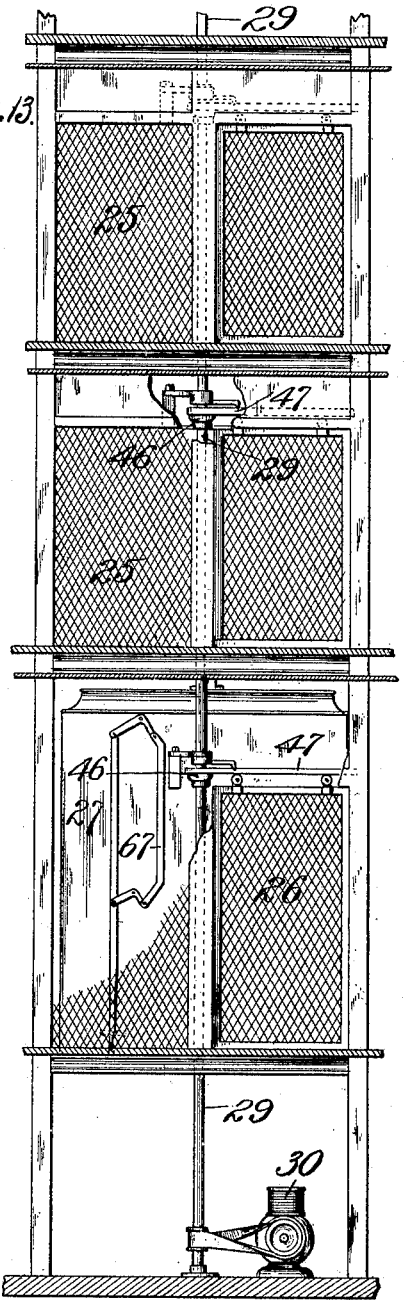


Fig. 13.



Attest:
Wm. H. Coe
A. D. Gray.

Inventor:
Francis K. Fassett
by Bakewell & Cromwell
his attys.

No. 649,662. Patented May 15, 1900.

F. K. FASSETT.

ELEVATOR.

(Application filed July 10, 1899.)

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Fig. 15.

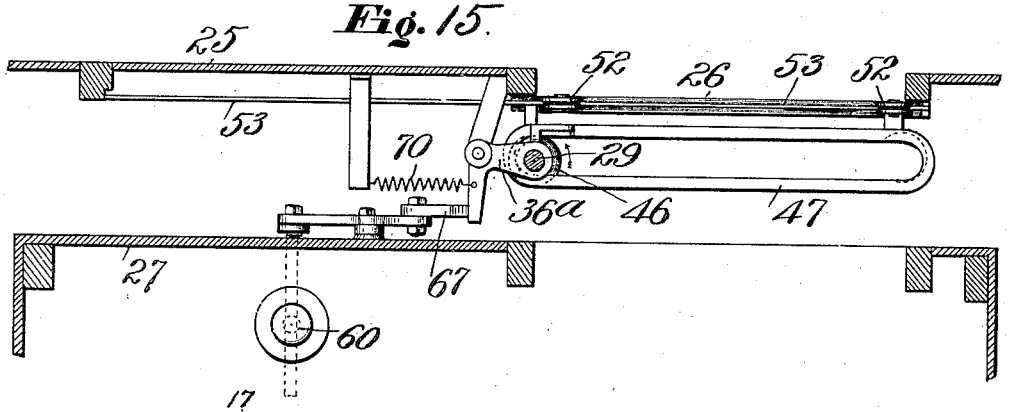


Fig. 16.

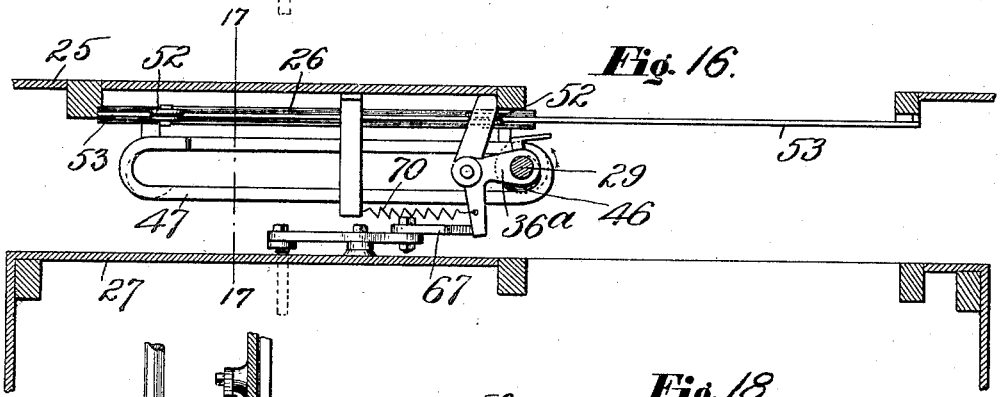


Fig. 17.

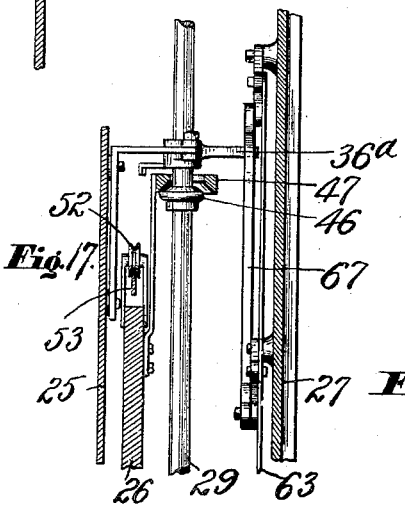


Fig. 18.

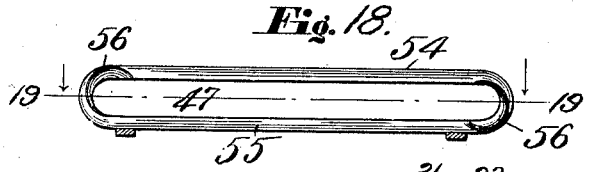


Fig. 19.

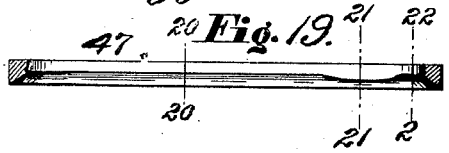


Fig. 20.

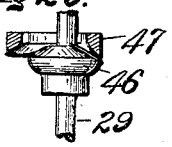


Fig. 22.

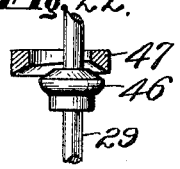
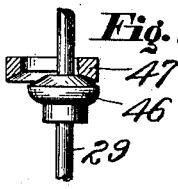
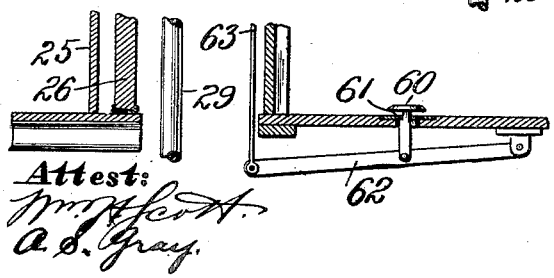


Fig. 21.





Attest:
M. M. Scott.
A. S. Gray.

Inventor:
Francis K. Fassett
by Baldwin & Cornwall
his attys.

UNITED STATES PATENT OFFICE.

FRANCIS K. FASSETT, OF ST. LOUIS, MISSOURI, ASSIGNOR TO LEO EHRLICH, OF SAME PLACE.

ELEVATOR.

SPECIFICATION forming part of Letters Patent No. 649,662, dated May 15, 1900.

Application filed July 10, 1899. Serial No. 723,358. (No model.)

To all whom it may concern:

Be it known that I, FRANCIS K. FASSETT, a citizen of the United States, residing at the city of St. Louis, State of Missouri, have invented a certain new and useful Improvement in Elevator-Doors, of which the following is a full, clear, and exact description, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, forming part of this specification, in which—

Figure 1 is a side elevational view as seen from the inside of a shaft, showing my improved door-operating mechanism. Fig. 2 is a sectional view through the same on line 2 2, Fig. 1, showing the door and elevator-car. Fig. 3 is an inverted plan view of the rails which coöperate with the constantly-revolving coned wheel. Fig. 4 is a side elevational view of said rails. Fig. 5 is a top plan view of said rails. Fig. 6 is an enlarged elevational view of one end of said rails, showing the manner of mounting the same on the door. Fig. 7 is a sectional view on line 7 7 of Fig. 6. Fig. 8 is a top plan view, enlarged, of the operating mechanism. Fig. 9 is an elevational view, as seen from the inside of the shaft, of said mechanism. Fig. 10 is a vertical sectional view illustrating the coupling-sections between the shafts. Fig. 11 is a plan view of a washer used in connection with the adjustment of the swinging bracket. Fig. 12 is a detail view, in side elevation, as seen from the inside of the shaft, illustrating my improved method of operating two doors in unison in opposite directions. Fig. 13 is a vertical sectional view through the several floors of a building, showing an elevator-shaft in said building as seen from the door or entrance side of said shaft with the inclosing casing shown in position except at certain places where it is broken away to reveal the elevator-car and the mechanical operating mechanism for the doors in said inclosing casing. Fig. 14 is a similar section taken through the elevator-shaft and elevator-car in a vertical plane at right angles to that of the section in Fig. 13. Fig. 15 is a detail horizontal sectional view of a part of the elevator-car and a part of the front or entrance door of the elevator-shaft casing looking down upon the top of one of the elevator-shaft doors and the mechanical operating mechanism for opening and closing the same, the said door being shown in the closed position. Fig. 16 is a similar sectional view to that of Fig. 15, only with the elevator-shaft door shown in the open position. Fig. 17 is a detail vertical section taken on the dotted line 17 17 of Fig. 16. Fig. 18 is a detail plan view of the under or lower surface of a pair of parallel rigid beveled rails which are attached to the door and through the instrumentality of which the said door is opened and closed when the coned wheel coöperates with one or the other of said rigid rails, according as it is desired to open or close the said door. Fig. 19 is a vertical section taken on the dotted line 19 19 of Fig. 18 looking in the direction of the arrows shown in Fig. 18. Fig. 20 is a detail sectional view taken on the dotted line 20 20 of Fig. 19, showing the above-mentioned coned wheel engaging at its greatest diameter or base with one of the above-mentioned rails at a point between its extremities. Fig. 21 is a detail sectional view taken on the dotted line 21 21 of Fig. 19, showing the above-mentioned coned wheel engaging at its least diameter or apex with the beveled lower or under surface of the said rail near one of its extremities. Fig. 22 is a detail sectional view taken on the dotted line 22 22 of Fig. 19, showing the said coned wheel disengaged from the said rails, as occurs whenever the said wheel is located at either of the extremities of said parallel rails.

This invention relates to a new and useful improvement in mechanism for operating elevator-doors, the object being to provide a simple, cheap, effective, reliable, and durable method of mechanically opening and closing elevator-doors, the opening being effected automatically upon the arrival of the elevator-car at the level of the floor at which a stop is to be made, and the closing being likewise effected automatically when the car is about to leave any floor at which it has stopped.

The foregoing objects I attain through the instrumentality of the mechanism illustrated in the accompanying drawings, forming part

of this specification, wherein similar characters refer to similar parts throughout the several views.

In the drawings, 25 indicates the inclosing casing of the elevator-shaft, which may be of ordinary construction. 26 represents the doors in said shaft, of which, as shown in Figs. 1 and 12, there are two at each floor.

27 indicates the elevator-car, 28 the actuating-cable for said car, and 29 a constantly-revolving shaft vertically disposed and preferably consisting of several sections, as will hereinafter be more fully described. The source of power for driving this shaft may be a motor 30. (Shown in Fig. 13.)

Shaft 29, as before stated, is made up of a number of sections flexibly coupled, each of said sections preferably being of a length corresponding to the height of the different floors of the building. These sections are coupled together at their ends by interlocking clutch members 31 and 32, the former being secured to the upper end of a section and engaging with the latter, which is secured to the lower end of the next adjacent section above. In the drawings one coupling member is provided with a tongue engaging in a groove in the other coupling member. The object in so forming the shaft in sections through the intermediacy of such couplings is to render each section of the shaft capable of a slight lateral displacement at one end with respect to its axial alinement and at the same time constantly drive all the sections of said shaft and also to compensate for expansion and contraction.

Secured to the framework of the casing of the elevator-shaft are a number of supports for the constantly-revolving shaft heretofore described, and as these supports are practically duplicated at each floor of the building with their associate parts I will describe but one, referring more particularly to Figs. 8 and 9.

33 indicates a bracket adjustably mounted on the framing, which bracket carries a bearing 34, which is likewise preferably adjustable with respect to the bracket 33, so that all of the bearings 34 in the building can be arranged in vertical alinement. Bearing 34 is provided with an opening at its forward end, in which is arranged a pivot rod or bolt 35, said rod or bolt carrying a lever 36, fixed thereon, which lever at one end, termed the "free" end, is provided with a rubbing-knob 37, adjustably mounted therein, as shown in Fig. 8. The other end of lever 36 is formed or provided with a socket-eye 38, in which is supported a bushing 39, said bushing being free to rotate in the eye of the lever and being provided with an enlarged spherical head 40, seated in the socket-eye of the lever. The upper end of a section of the constantly-revolving shaft is passed through the bushing or sleeve 40 and has clamped thereon a clutch member 31, between which and the bushing 39 is interposed a leather or other suitable gasket 41. (See Fig. 10.) The recess in the upper end of the bearing-sleeve 39 is for the reception of a lubricant, for the introduction of which lever 36 may be dropped from its normal position, so as to enable the operator to have access to said recess. The method of lubricating the sections of the shaft and at the same time maintaining the adjustment of the lever, so that the same may be restored to its normal position, is as follows: The pivot-bolt 35 is extended upwardly beyond the bearing 34 a suitable distance and threaded, so as to receive adjusting-nuts. Two of these nuts 42 and 43 act practically as jam-nuts to maintain permanent adjustment, while the third, 44, is for the purpose of primarily adjusting the parts, after which said nut 44 becomes an idler. As the lever is fixed to its pivot-bolt and said pivot-bolt is vertically movable in the bearing 34, the nut 44 is first introduced on the upper end of the pivot-bolt, so as to engage the bearing 34 and adjust the lever vertically to its proper position. After this adjustment is made a washer 45 is introduced on the pivot-bolt above the nut 44, and nut 43 is then turned down to hold the washer in position. Jam-nut 42 is likewise employed in connection with nut 43 for obvious reasons. When it is desired to lubricate a section of the shaft, the nut 44 is turned down sufficiently to permit the removal of the washer 45, which, as shown in Fig. 11, is formed with an open-ended slot, after which the nut 44 is turned back to permit the lever and its associate parts to settle by gravity. The nuts 42 and 43 are not disturbed. As the lower end of the section whose bearing it is desired to lubricate will be supported by the section immediately beneath, it follows that the lever and its sleeve or bushing 39 will be permitted to settle down as far as the nut 44 is turned back. This gives access to the interior oil-cup of the bushing, so that a lubricant can be introduced, which lubricant is preferably in a semisolid condition. When the lubricant is introduced, the nut 44 is turned down, so as to raise the lever 36 and its associate parts, after which the washer 45 is placed in position on the pivot-bolt and the nut 44 turned back until the washer is clamped firmly in position. This leaves the lever and its associate parts in the position they occupied before the shaft was lubricated. In fact, the adjustment of said lever may be said not to have been disturbed, although the lever was temporarily displaced.

Each section of shaft carries a wheel 46, coned on its upper face, as shown more clearly in Figs. 2 and 7, said coned wheel being preferably vertically adjustable on the shaft-section for obvious reasons.

47 indicates a pair of rigid parallel rails, forming a frame, beveled on their under or lower faces and attached to one of the elevator-doors, if there be a pair of said doors, and

preferably to the roller bracket-hangers of said elevator-door, as shown in Fig. 1. These bracket-hangers, as shown more clearly in Fig. 12, are provided with upward extensions 48, while the parallel rails or "slotted frame," as it might be called, is provided with lugs 49, secured to the projections 48 by bolts 50. The rail-frame is thus pivotally supported in position and may be adjusted through the instrumentality of set-screws 51, passing through the lugs 49 and bearing against the projections 48, as shown more clearly in Figs. 6 and 7. The roller-hangers of the door carry the ordinary rollers 52, which ride upon a track or rail 53 and serve in this case simply to guide and balance the door during the operation of mechanically opening and closing said door by means of my system. The beveled under or lower surfaces of the parallel rails of frame 47 are marked 54 and 55, of which 54 indicates what I will designate the "opening-rail," inasmuch as this is the rail which is called into action when the door is being opened, and 55 the "closing-rail," inasmuch as this is the rail which is called into action when the door is being closed. 56 represents a reduced portion or cut-out place at each end of each rail to provide for automatically disengaging said rail from the coned wheel at said points. Each rail 54 and 55 is provided with what I have termed "high" parts marked 54^a and 55^a and "low" parts 54^b and 55^b, respectively. These high and low parts are so arranged relative to the coned wheel that the speed of the movement of the door near the end of its run in opening or closing is considerably decreased, thus avoiding any slam, shock, or jar and its injurious effects.

56^a indicates a locking device attached either directly or indirectly to the bell-crank lever 36 and adapted by the movement of the latter to be disengaged from and reëngaged with the frame 47—as, for instance, with the projection 57, arranged on said frame.

58 is a spring for holding or returning the lever 36 in its normal position, which normal position is shown in Fig. 8.

I will now describe the mechanism arranged on the car for coöperating with lever 36 and moving the same so as to effect the opening or closing of the door.

60 is a button, preferably arranged in the bottom of the car, adapted to be depressed by the operator's foot whenever it is desired to open the door, said button being released when it is desired to effect the closing movement of the door. This button is provided with a notch 61 for engagement with the floor of the car, whereby it may be held in its depressed position.

62 is a lever pivoted under the floor of the car, to which the button 60 is attached through the intermediacy of its shank, said lever 62 having an eye in its outer end, through which passes a rod 63, said rod carrying nuts 64 on its lower end, between which and the end of the lever 62 is interposed a spring 65, so as to make a yielding connection between lever 62 and said rod 63.

66 represents a link secured to the upper end of rod 63 and connected at its other end to a shoe 67, said shoe being pivotally secured to links 68, which find bearings on a suitable bracket-frame 69, extending from the car. A spring 70 tends at all times to return the shoe to its normal or closed position—that is, out of the path of the button 37 at the free end of lever 36. Whenever the operator depresses the button 60 in the elevator-car, the shoe 67 is thrown outwardly from the car and, if opposite a lever 36, will engage said lever and rock the same on its fulcrum, so as to laterally displace the end of the shaft-section carried thereby and force the coned wheel on said shaft-section into engagement with the opening-rail 54, the high part of said rail engaging the coned wheel near its periphery until the low part of said rail engages the apex of the cone, when the speed of the movement of the door will be reduced. The movement of the door will continue until the coned wheel has driven the door to such position that said coned wheel will occupy one of the cut-out spaces 56, when said coned wheel will be automatically disengaged from the frame 47 and the movement of the door will cease. Immediately that the operator releases the engaging mechanism on the elevator-car the spring 70 will retract the shoe 67 out of engagement with the lever 36, when spring 58 will force said lever 36 back to its normal position, in which normal position the coned wheel carried on the section of the shaft supported by said lever will be automatically thrown into contact with the closing-rail of frame 47 and return said door to its closed position. The normal position of the lever 36 places the locking device 56^a in the path of the projection 57, over which it rides when the door is closed, said locking device falling behind said projection 57 and preventing the door from being opened from outside the elevator-casing. When the door is closed, the coned wheel will occupy the cut-out spaces 56 at the other end of the frame and will have ceased to have any effect on the frame 47. The tendency of the coned wheel both in opening and closing the door is to raise said door and support part of its weight, and therefore the weight of the door greatly assists the frictional contact between said coned wheel and the rails.

It is sometimes desired to keep the door in an open position after the elevator has left the floor. Under ordinary conditions when the engaging device on the car releases the lever the spring behind said lever forces the coned wheel into engagement with the closing-rail and the door is closed automatically. For the purpose of keeping the door open under certain circumstances, as when a freight-cage is used under the car or a per-

son wishes to get on top of the car, a pivoted wedge 71 is arranged on the lever 36, which when said lever is forced out of its normal position is designed to be thrown down therebetween and an adjusting-screw 72, mounted in an extension 34ª of the bearing 34, so as to hold said lever in an abnormal position or in a position wherein the door will remain open and will not automatically close, as above described. The adjusting-screw 72 (shown more clearly in Figs. 8 and 9) is for adjusting the inward movement of the lever, while an adjusting-block 73, coöperating with a lug 74 on the eye of the lever, is for limiting the movement of said lever in the opposite direction.

In Figs. 1 and 12 I have shown double doors for closing the opening in the elevator-casing, said doors being provided with roller-hangers whose rollers ride on the rail 53, as above described. In order to operate the doors in unison and in opposite directions, I arrange pulleys or sheaves 75 on the elevator-casing, over which passes an endless cord or chain 76. This cord or chain is attached at opposite sides of the pulleys 75 to the hangers of different doors, so that upon the movement of one of said doors an opposite movement will be communicated to the other of said doors through said cord or chain—as, for instance, when the door-carrying frame 47 is opened a corresponding movement is communicated to its companion door, but in the opposite relative direction, and when the door-carrying frame 47 is closed its companion is likewise closed through said cord or chain 76.

In Figs. 13 to 22 I have shown a construction wherein the lever 36ª is in the form of a bell-crank lever, through one member of which passes the constantly-revolving vertical shaft carrying coned wheels engaging with and being disengaged from parallel rails of a frame secured to the door of the elevator-casing. The construction and operation herein shown are substantially the same as that heretofore described, with the exception that the mechanism mounted on the elevator-car instead of moving an engaging shoe outwardly and inwardly with respect to the car moves said shoe laterally, so as to engage the free end of the bell-crank lever heretofore described.

It will be seen from the above that when the elevator-car has approached near the level of the floor at which it is desired to stop the elevator and open the elevator-door for the ingress or egress of passengers the operator presses his foot upon the push-button 60, which, through the instrumentality of the levers described, projects the shoe 67 into contact with the free end of lever 36ª, swinging said lever on its fulcrum, so as to laterally displace the section of the constantly-revolving vertical shaft carried thereby with respect to its axial alinement with its companions and throws the coned wheel on said section into engagement with the beveled under surface of the rail 54, thus lifting said rail upon said coned wheel, whereupon the said rail is caused to travel along on the upper or coned surface of said wheel until it reaches the opposite end of said rail, where said coned wheel rotates freely and idly in one of the cut-out portions 56 out of engagement with said rail. The rail being attached to the door of course carries said door with it and the weight of the door has been practically lifted from off the ordinary rollers in the bracket-hangers, which latter merely serve to balance and guide the movement of the door. It will also be observed that the first action of the movement of the lever 36ª is to disengage the locking device 56ª from its point of engagement with the frame 47, thus allowing said frame to travel freely along over the coned wheel. When the door has been thus completely opened and it is desired to reclose it, the operator releases the button 60, when spring 70 returns the shoe 67 out of engagement with the lever 36 and the spring 58 forces the lever 36 to its normal position, and thus restores the sections of the shaft affected by the movement of said lever to axial alinement with their companions and causes the coned wheel to engage the opposite rail and effect the closing of the door. It will be observed that the beveled surfaces of the rails which travel on the coned wheel are so shaped that at the beginning of travel in one direction and for some distance throughout the same the contacting rail engages with the greatest diameter or base of the cone of the wheel, thus giving the door its greatest speed, while near and at the end of the run or travel of the rail the latter is caused to engage only with the least diameter or apex of the cone, which results in a slackening of the speed of the movement of the door near the end of its run. Furthermore, the rail is so cut out at its end, corresponding to the end of the run of travel, as to be completely disengaged from contact with the coned wheel.

I am aware that minor changes in the construction, arrangement, and combination of several parts of my device can be made and substituted for those herein shown and described without in the least departing from the nature and principle of my invention.

Having thus described my invention, what I claim, and desire to secure by Letters Patent, is—

1. A mechanism for mechanically operating elevator-doors, consisting of a constantly-revolving vertical shaft carrying a coned wheel, a movable door, a friction-rail connected to said door, and means for throwing the coned wheel into and out of engagement with said rail; substantially as described.

2. A mechanism for mechanically operating elevator-doors, consisting of a constantly-revolving vertical shaft, a coned wheel mounted on said shaft, a movable door, a rail secured to said door, and means for engaging the coned

wheel with said rail in such manner that the door is lifted and carried by the coned portion of said wheel; substantially as described.

3. A mechanism for mechanically operating elevator-doors, the same comprising a constantly-revolving shaft, a coned wheel carried by said shaft, a friction device arranged on the door, and means on the elevator-car for causing engagement and disengagement between said coned wheel and said friction device on the door; substantially as described.

4. A mechanism for mechanically opening and closing elevator-doors consisting of a constantly-revolving vertical shaft carrying a coned wheel, a pair of rigid parallel rails fastened to said door, and adapted to be engaged with and carried by the coned portion of said wheel, one rail being arranged upon each side of the center of said wheel and normally out of engagement therewith, means for engaging said coned wheel with one or the other of said rails, according as the door is to be opened or closed, and means for revolving said shaft; substantially as described.

5. A mechanism for mechanically opening elevator-doors, consisting of a constantly-revolving vertical shaft carrying a coned wheel, a rigid rail fastened to the elevator-door and adapted to be engaged with and carried by the coned portion of said wheel, but normally out of engagement therewith, means for engaging and disengaging said wheel with said rail, and means for revolving said vertical shaft; substantially as described.

6. A mechanism for mechanically opening elevator-doors, consisting of a constantly-revolving coned wheel, a rigid rail fastened to the elevator-door and adapted to be engaged with and carried by the coned portion of said wheel, but normally out of engagement therewith, means for engaging and disengaging said coned wheel with said rail, and means for revolving said coned wheel; substantially as described.

7. In a mechanism for mechanically opening elevator-doors involving a constantly-revolving coned wheel and a rigid beveled rail fastened to the elevator-door and adapted to be engaged with and carried by the coned portion of said wheel, a rigid beveled rail therefor, so shaped that at the commencement of said travel it will engage with the base or greatest diameter of the cone of said wheel, while near and at the end of said travel it will engage only with the least diameter or apex of said cone; substantially as described.

8. The combination with an elevator-door, of a sectional shaft, clutch-couplings between the sections of said shaft, a wheel carried by one of said shaft-sections, and a friction device on the door for coöperating with said wheel; substantially as described.

9. The combination with a constantly-revolving shaft composed of a plurality of sections, connected together by clutch members, a wheel mounted on one of said sections, a door, a rail on said door for coöperating with said wheel, and means for laterally displacing one or more shaft-sections to engage the wheel with said door-rail; substantially as described.

10. The combination with a shaft composed of sections, of clutch members between said sections, a movable door, a friction-rail carried by said door, a wheel on a shaft-section for coöperating with the rail on the door, an elevator-car, and means on said car for laterally displacing one or more sections of said shaft to engage the wheel with the rail on the door; substantially as described.

11. The combination with a sectional shaft, of levers for independently supporting individual sections, wheels arranged on said sections, doors carrying rails for coöperating with said wheels, an elevator-car, means on said car for coöperating with said levers for laterally displacing the sections of the shaft, and causing different wheels to open or close different doors by the engagement between said wheels and their coöperating door-rails; substantially as described.

12. The combination with an elevator-car, of shaft-casing, doors arranged to close the openings in said casing, the doors at different landings being provided with friction devices, a sectional shaft arranged in juxtaposition to said friction devices on the various doors, wheels on different sections of said shaft for coöperating with said friction devices on the doors, levers for supporting said sections and moving the sections of the shaft laterally so as to cause the wheels mounted on the sections so moved to engage with the friction devices on the doors, and open or close said doors, and means on the elevator-car for operating said levers; substantially as described.

13. A mechanism for mechanically operating elevator-doors, consisting in the combination of a constantly-revolving shaft, a coned wheel on the shaft, a movable door, a friction-rail connected to said door and adapted to cooperate with said coned wheel, a lever for throwing the shaft and its coned wheel laterally into and out of engagement with said rail, and means for adjustably limiting the stroke of said lever in either direction.

14. The combination with a shaft, of a lever for supporting and moving the same laterally, a bearing in which said lever is pivoted, and means arranged on the pivot-bolt of the lever for dropping the same independently of the shaft; substantially as described.

15. The combination with a sectional shaft, of a lever carrying a bearing at one end for supporting a section of said shaft, a pivot-bolt on which said lever is fulcrumed, bearings for said pivot-bolt, nuts 42, 43 and 44, and a washer 45, arranged on said pivot-bolt above its bearing; substantially as described.

16. The combination with an elevator-door, of a friction-rail carried thereby, a constantly-revolving shaft, a wheel on said shaft, adapted to coöperate with said friction-rail, a lever through which said shaft passes for causing

its carried wheel to engage with or be disengaged from said friction-rail, and a locking device mounted upon said lever and coöperating with said friction-rail to lock the same against movement when said lever is in one of its positions; substantially as described.

17. The combination with a door, of a friction-rail carried thereby, a constantly-revolving shaft, a wheel on said shaft for coöperating with said friction-rail, a lever for moving said shaft laterally for causing the engagement or disengagement of its wheel with or from said friction-rail, and means for restoring said lever to its normal position; substantially as described.

18. The combination with a door, of a friction-rail carried thereby, a constantly-revolving shaft, a wheel on said shaft for coöperating with said friction-rail, a lever for moving said shaft laterally for causing the engagement or disengagement of its wheel with or from said friction-rail, a locking device carried by said lever for holding the friction-rail against movement when said lever is in one position, and means for holding said lever in an abnormal position, whereby said locking device is rendered inoperative; substantially as described.

19. The combination with a door, of a friction-rail carried thereby, a constantly-revolving shaft, a wheel on said shaft for coöperating with said friction-rail, a lever for moving said shaft laterally for causing the engagement or disengagement of its wheel with or from said friction-rail, and a spring for returning said lever to its normal position; substantially as described.

20. The combination with an elevator-door and its roller-hangers, of a frame consisting of parallel rails secured to said hangers, means for adjusting said frame on said hangers, a constantly-revolving shaft, a friction-wheel, carried by said shaft, and means for moving said wheel and thereby causing the engagement of said friction-wheel with one or the other of said rails; substantially as described.

21. In a mechanism for operating elevator-doors, the combination with a pair of doors, of a rotary shaft carrying a coned wheel; a friction-rail carried by one door, means for throwing the coned wheel into and out of engagement with said friction-rail, and means for operating the other door actuated by the first door, substantially as described.

In testimony whereof I hereunto affix my signature, in the presence of two witnesses, this 12th day of June, 1899.

FRANCIS K. FASSETT.

Witnesses:
F. R. CORNWALL,
A. S. GRAY.