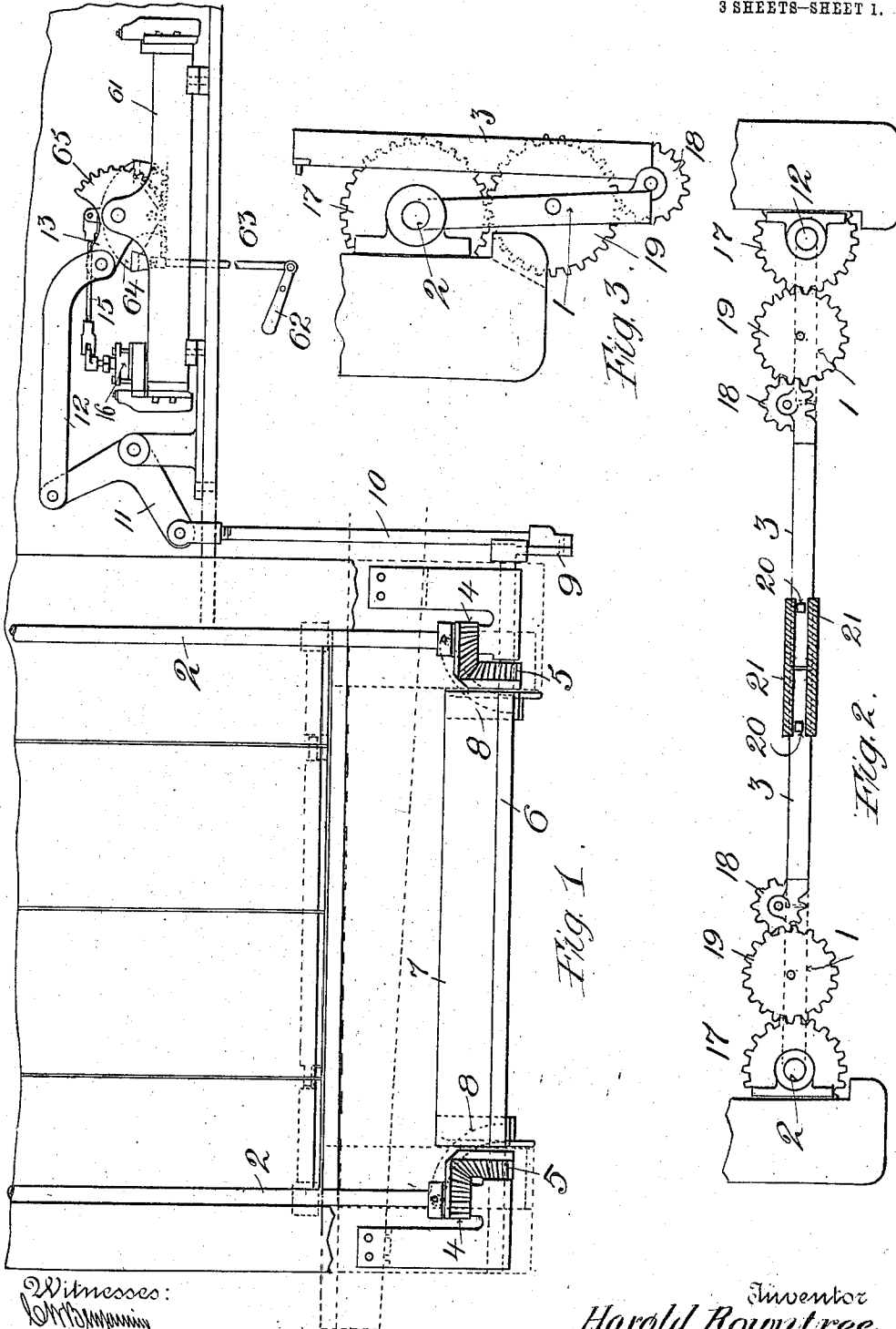


H. ROWNTREE.
DOOR AND STEP OPERATING MECHANISM.
APPLICATION FILED FEB. 4, 1909.

1,014,907.

Patented Jan. 16, 1912.

3 SHEETS-SHEET 1.



Witnesses:
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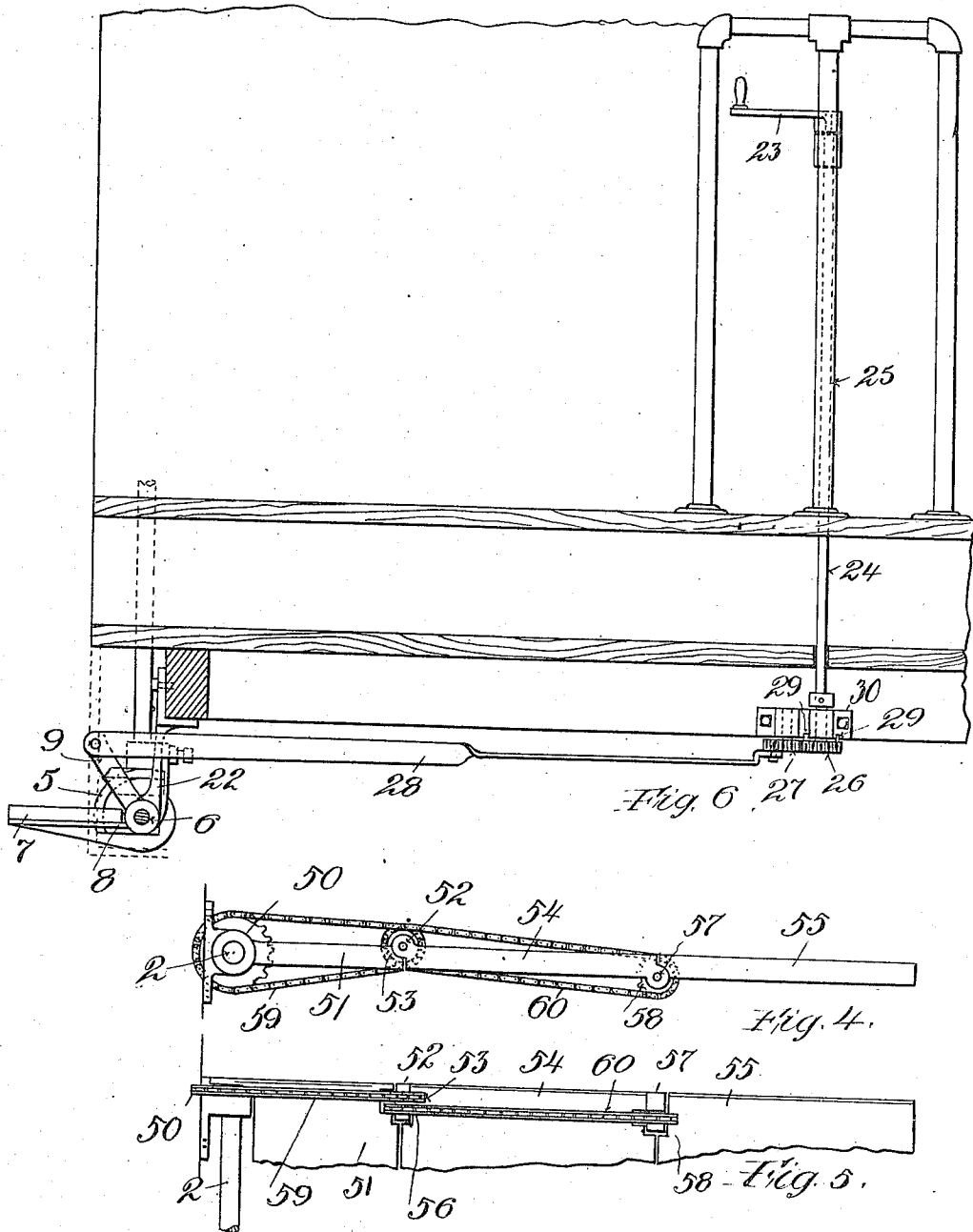
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3 SHEETS-SHEET 2.



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3 SHEETS—SHEET 3.

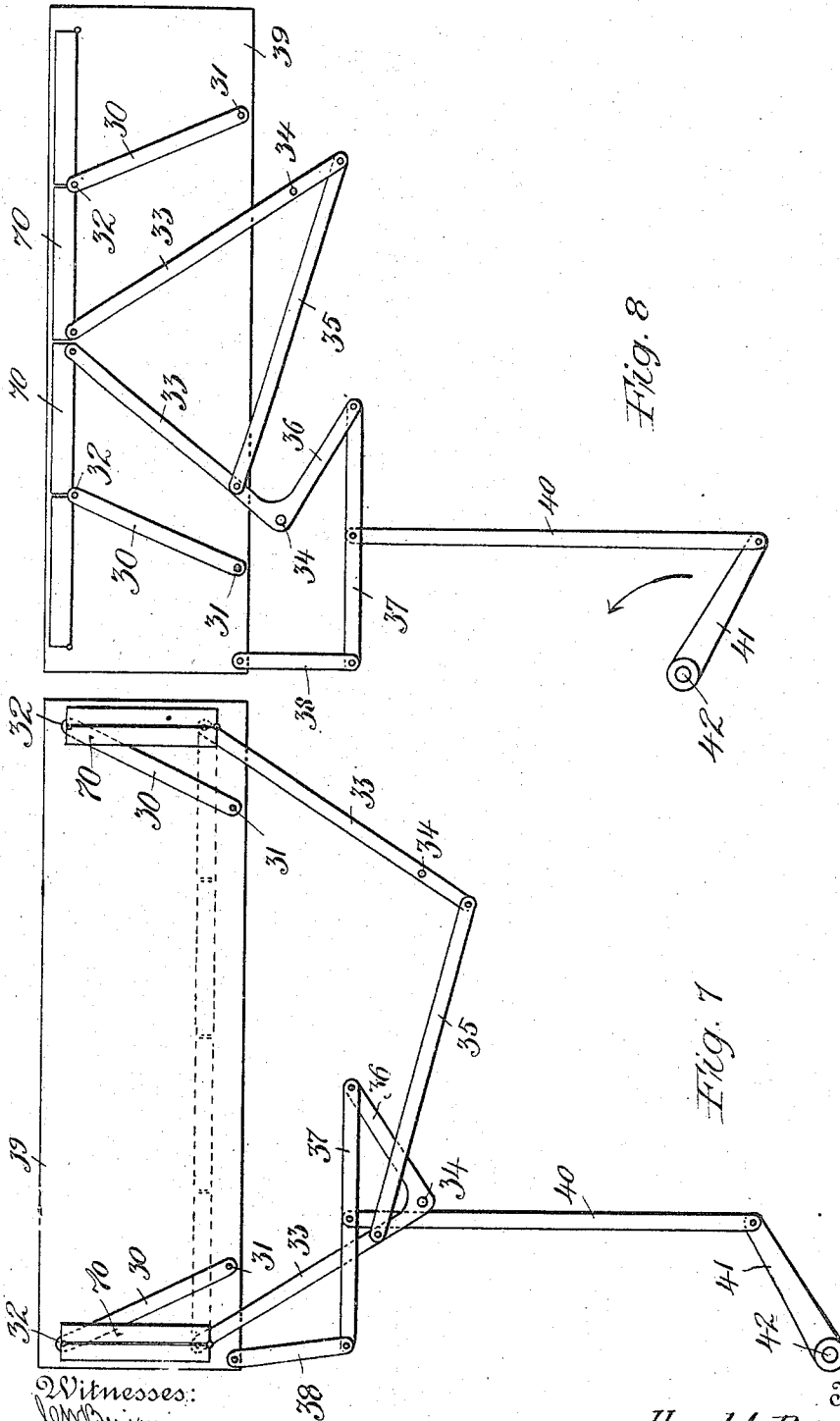


Fig. 8

Fig. 7

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UNITED STATES PATENT OFFICE.

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NATIONAL PNEUMATIC COMPANY, A CORPORATION OF WEST VIRGINIA.

DOOR AND STEP OPERATING MECHANISM.

1,014,907.

Specification of Letters Patent.

Patented Jan. 16, 1912.

Application filed February 4, 1909. Serial No. 476,031.

To all whom it may concern:

Be it known that I, HAROLD ROWNTREE, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have made a certain new and useful
Invention in Door and Step Operating Mechanism, of which the following is a specification.

This invention relates to door and step operating mechanism, and particularly to folding doors or doors composed of foldable panels and mechanism for operating the same either alone or in association with a movable step.

The object of the invention is to provide a construction of foldable door and means for operating the same in association with a movable step, and which is simple and efficient in operation.

A further object is to provide a construction of door and operating means therefor wherein the door is made in hinged or pivoted panels which are foldable together in opening, and distended into line with each other in closing, in association with a cooperating movable step.

A further object of the invention is to provide a foldable door, in association with a movable step, and means controllable from any convenient point for operating the same.

A further object of the invention is to provide a car with doors composed of foldable sections, and having associated therewith a movable step, with means controllable from a convenient point within the car for operating the door and step.

Other objects of the invention will appear more fully hereinafter.

The invention consists substantially in the construction, combination, location and relative arrangement of parts, all as will be more fully hereinafter set forth, as shown in the accompanying drawings, and finally pointed out in the appended claims.

In the accompanying drawings,—Figure 1 is a view in side elevation, of a foldable door and a cooperating step and showing a form of operating mechanism therefor, and embodying the principles of my invention, the upper part of the door sections being broken off. Fig. 2 is a top plan showing the door panels occupying closed position and one form of connecting mechanism therefor for folding the panels upon each other in opening. Fig. 3 is a view similar to Fig. 2,

showing the panels of one door in folded position to open the doorway. Fig. 4 is a view similar to Figs. 2 and 3, showing another form of connecting mechanism for the door panels, and embraced within the scope of my invention. Fig. 5 is a view in side elevation of the construction shown in Fig. 4. Fig. 6 is a view in section, taken transversely of a street or other car, showing a form and arrangement of manual operating means adapted for use in connection with my invention. Fig. 7 is a view in diagram showing another form of door and step operating mechanism embraced within the scope of my invention, the door panels being shown in folded relation, and the doorway open. Fig. 8 is a view similar to Fig. 7, showing the door panels in distended relation, with the doorway closed.

The same part is designated by the same reference sign wherever it occurs throughout the several views.

In carrying out my invention I employ a door composed of panels or sections suitably hinged or otherwise connected together for relative swinging or other movement, whereby, in opening the door panels fold upon each other and in closing they are distended into alined relation, and I provide suitable connecting mechanism intermediate the door panels or sections, whereby the enforced movement of one section which may be called the primary or master section for description purposes, will cause the proper movements of the other sections or panels into their opened or closed position as the case may be. The enforced movement of the primary or master section or panel of the door may be accomplished manually or by power mechanism as may be desired, and may be controlled from any suitable or desired point within the contemplation of my invention. I also propose to employ, when desired; a step as, for instance, when the apparatus is employed on a street or other car, I provide suitable connections to secure co-incident and coöperative operation of the step with the door.

In the practical application of my invention, and particularly where the apparatus is employed on a street railway, elevator, or other car, I prefer to so arrange the door panels or sections, and their connecting and operating mechanism that, in opening, the central panel or panels, that is, the ones oc-

cupping the central portion of the doorway when closed, will move outwardly thereby permitting occupants of the car to stand or remain in close proximity to the door without interfering with the proper operation thereof.

In the accompanying drawings I have shown various constructions, forms and arrangements embodying the principles of my invention, which I will now proceed to describe more in detail.

Referring to Figs. 1, 2 and 3, I have shown my invention as embodied in a double folding door, each composed of suitably hinged or relatively movable panels or sections as above indicated, one foldable door being arranged on one side of the doorway and the other on the other side of the doorway, the two cooperating together to open and close the doorway when properly operated. My invention, however, as defined in the claims, is not to be limited or restricted to a double folding door construction. In these views of the drawings reference signs 1, 1, designate what, for descriptive purposes, I shall refer to as the primary or master sections or panels of the two halves respectively of the double door. These panels or sections are respectively secured rigidly or otherwise at one edge, to the shafts 2, 2, vertically journaled adjacent the door jambs, whereby, by rotating said shafts these primary or master door sections or panels will be rocked or moved about the axes of said shafts. The panels or sections 3, 3, of the door are respectively hinged or otherwise suitably connected for relative movement to the other edges of the primary sections 1, 1. The shafts 2, 2, are geared to a rock shaft 6, suitably and conveniently journaled, whereby, by rocking shaft 6, a coincident rocking movement of shafts 2 in unison with each other is secured. A single bevel gear arrangement 4, 5, is shown for connecting the shafts 2 and 6.

I will now describe one form of means for connecting the panels or sections of the door so as to secure a coincident operation thereof in unison when the primary or master panels are moved. Mounted concentrically with the shafts 2, but secured rigidly against rotative movement therewith, is a gear wheel 17, see Figs. 2 and 3. A gear wheel 18, preferably of one half the diameter of gear wheel 17, is secured rigidly to the hinged edge of door panel 3, being arranged in axial line with the hinge of said panel, and preferably secured to the hinge axis or pin thereof. An intermediate gear 19 intermeshes with the gears 17, 18. From this arrangement of gearing connections it will be readily seen that when either of the shafts 2 is given an axial rotative movement through an arc of ninety degrees, that is,

is given a one quarter revolution, the primary door panel 1, associated therewith is brought into the position shown in Fig. 3, while, at the same time, the door panel 3, is, through the connecting gearing above described, folded upon the section or panel 1, as shown in Fig. 3, the hinged edge thereof moving in one direction through an arc of ninety degrees and the outer or free edge of such panel moving in the opposite direction through a similar arc, thereby securing an opening of the door way by reason of the door sections or panels folding upon each other and against the sides of the doorway. Where a double door is employed it is evident that each half will be similarly operated and in unison, the sections of one half folding upon each other and upon one side or jamb of the doorway and the sections of the outer half folding upon each other and upon the other side or jamb of the door.

It is obvious that many other forms of connections between the door panels may be employed, and each door may be composed of more than two panels, without departure from the spirit and scope of my invention.

In Figs. 4 and 5, I have shown a door composed of three panels or sections, though in this respect I do not desire to be limited or restricted, and instead of intermeshing gears I employ sprocket chains operating around gear wheels. Thus one gear wheel 50, is stationary and has the same arrangement and relation with respect to the shaft 2 and the primary door panel or section 51, as the gear wheel 17, above described. The pivot pin 52, of the panel 54, carries two gears 53, 56, the former being secured to panel 54, while the latter is secured to panel 51. The pivot pin 57, of panel 55, carries one gear 58 which is secured to panel 55. A sprocket chain 59, operates over the gears 50 and 53, while a sprocket chain 60, operates over gears 56 and 58. In this manner it will be obvious that as many door panels or sections as desired may be employed, and that when the shaft 2 is rocked, as above explained, the several sections or panels of the door will fold upon each other and upon the side of the doorway, in opening, or will be distended into alinement with each other in closing.

The constructions of folding doors as heretofore employed have been open to the objections that when moved to complete open position, that is, when the panels are in parallel position, it requires a complicated arrangement of lever mechanism to operate them and the door is caused to open inwardly. This is objectionable in the case of street or other cars for the reason that with the door opening in this manner passengers or occupants of the car, if

standing close to the door are liable to interfere with the operation of the door or else to be injured thereby. In an arrangement embodying my invention, however, I am enabled not only to avoid the necessity for the use of complicated lever connections, but also to cause the central door panels to move outwardly in opening, thereby enabling occupants or passengers of the car to stand in close proximity to the doorway without interfering with the proper operation of the door.

It is desirable to employ a foldable or movable step and to associate the same with the door operating mechanism so that when the door panels are folded upon each other or moved into open position the step will move automatically and coincidently into position for use, and when the door sections or panels are distended into closed position the step will be automatically and coincidently moved into retracted position. This coincident and coöperative movement of the door and step may be accomplished in a wide variety of ways. In Figs. 1 and 6, I have shown a simple and efficient arrangement for accomplishing the desired object where I connect a step 7, through brackets 8, or otherwise, rigidly to shaft 6, whereby when said shaft is rocked to operate the door sections or panels, the step is coincidently operated. A limit stop 22 connected to the bracket which carries the step and arranged to bring up against the shaft 2, or other convenient part may serve to give a rigid support for the step when in position for use.

As above indicated the doors, or the door and step, where a step is employed, may be operated in any convenient manner, manually, or by power mechanism, or otherwise, as may be desired, and from any suitable or convenient point. In Fig. 1, I have shown one form of power mechanism for this purpose, and comprising a power cylinder 61, controlled by a valve mechanism arranged in casing 16, and operated in any suitable manner, as for instance by a control lever 62, and intermediate connections 63, 64 and 15. A rocking gear 65, operated by the motor 61, has an arm 13, connected by a link 12, to one arm of a bell crank lever 11, the other arm of said bell crank lever being connected by rod 10, with a crank arm 9 on the rock shaft 6. The power mechanism above described may be of any desired construction and arrangement and capable of securing a cushioning effect, as more fully shown, described and claimed in my Patent No. 870,051, granted Nov. 5, 1907, and pending application Serial No. 393,911, filed Sept. 21, 1907, and in the pending application of Paris R. Formán, Serial No. 393,908, filed Sept. 21, 1907.

In Fig. 6 I have shown a construction of

manually operated mechanism which is well adapted for use in connection with my invention, wherein a hand lever 23, is placed in convenient position, preferably at a point within the car, and intermediate the transverse width thereof, and, if desired, at near or adjacent a convenient point to be within easy reach of the conductor, either when occupying a position where he collects the fares of the passengers or at any desired or convenient location. This hand lever is connected to a rock shaft 24, which, if desired, may extend up through the floor of the car and through a post 25, or otherwise, as may be convenient or desired. Upon the lower end of shaft 24, is mounted a gear wheel 26, meshing with and actuating another gear wheel 27, having eccentrically connected thereto one end of a rod 28, the other end of said rod being connected to the crank arm 9 on shaft 6. The shaft 24, may be prevented from rotating too far in any suitable or convenient manner, as, for instance, by means of stops 29, carried by gear 26, and adapted to strike against the bracket 30, in which shaft 24, is journaled, or other suitable or convenient point.

It may be desirable to prevent the doors or door panels from being forcibly moved out of their completely closed position by pressure applied thereto, as, for instance by passengers in a car pressing thereagainst. This may be accomplished in many specifically different ways. I have shown a simple and efficient construction for the purpose, wherein I provide the door panels 3, at a convenient point on their outer or free edges with lugs or shoes 20, adapted, when the door panels or sections are in their completely closed position to engage or enter between the guide plates 21. It is obvious that many other specific structures might well subserve the same purpose. By the provision of such means it will be readily seen that the gear connections between the various panels are relieved of strain in case the door panels are pressed against. It may also be desirable to provide means for automatically locking the door panels in their completely closed position. This may be accomplished in many specifically different ways. For instance, in the case of the use of power mechanism for operating the apparatus the lever connections intermediate the motor and the shaft 6, may be arranged at some convenient point to pass a dead center as the door panels attain completely closed position. In the form shown the link or rod 12 may be employed and arranged in this manner to accomplish the desired result. Similarly the doors may be locked in their completely opened position. In the case of the manually operated devices shown in Fig. 6, the same results may be attained by so proportioning the gears 26.

27, that the latter will rotate slightly beyond a half revolution while the door moves from one limit of its movement thereby causing the rod 28 to assume dead center positions and hence locking the doors opened or closed as the case may be while the handle 23 and gear 26 can be given any desired relative degree of movement.

In Figs. 7 and 8, I have shown arrangement for operating folding doors into fully opened or fully closed position and from any suitable or convenient point of control, and embraced within the spirit and scope of my invention. In this form of my invention I have also shown a movable step associated with the doors and coöperatively operated coincidentally therewith, but in this case a sliding step is employed instead of a folding step, but the principle is the same. In this form the movable step 39 has the arms 30, attached at one end thereto at the points 31, near one edge thereof, the other ends of said arms being attached as at 32, to the hinges which connect the panels of the doors together. Arms 33, are attached to the free edges of the outer panels 70, said arms 33, being pivoted at 34, and connected together to move in unison as, for instance, by the cross arm 35. A lever 37, is connected at one end to any arm 36, of the arms 33, and at the other end to a link 38, which is connected to the edge of the step 39. An operating shaft 42 which may be rocked by a control handle, or otherwise and from any suitable or convenient point, is provided with an arm 41, connected by a link 40, to the central point of lever 37.

From this construction and arrangement it will be seen that when the crank arm 41 is rocked in the direction indicated by the arrow in Fig. 8, it tends to move both ends of the lever 37, through the intermediate connection 40. But since the doors are in completely closed position and are in dead center relation, the end of lever 37, which is connected to arm 36, cannot move, but the end of said lever which is connected by link 38, to the step 39 can move thereby causing the step to move outwardly into position for use taking with it the hinges 32 of the door panels by reason of the arms 30, thereby breaking the dead center alinement of the door panels and hence enabling the whole mechanism to move in unison until the door is in its fully opened position and the step is in its completely operative position. So too, in commencing to close from the position indicated in Fig. 7, the reverse of the above operation takes place, since the end of lever 37, which is connected to the step cannot move the step on account of the latter being locked, for the moment, by the arm 30, which is connected to the hinge 32. The other end of lever 37, which is connected to the arm 36, is free to move and the

door panels are therefore moved toward closed position. When this movement commences the locking relation of arm 30 is released and thereafter the whole mechanism moves in unison to the closed positions.

I do not claim herein the combination which includes the door and the door operating mechanism *per se*, as the subject-matter thereof is claimed in my application Serial No. 569,843, filed July 1st, 1910.

The principles of my invention may be embodied in many other different constructions and arrangements and still fall within the scope of my invention. While, therefore, I have shown and described various specific constructions and embodiments in the broadest scope of my invention as defined in the claims I do not desire to be limited or restricted to such specific constructions.

It is obvious that my invention is well adapted for use in any relation or situation where hinged or foldable doors, or hinged or foldable doors and steps associated together are employed, as in street or other railway cars, elevators, houses or other buildings, or the like. I do not desire therefore, to be limited in respect of the location or place of use of the apparatus. And while a construction embodying the principles of my invention is adapted for use generally, it is particularly desirable in connection with the doors of street or other cars, and especially for the doors in the sides of the cars since I avoid the necessity for providing pockets in the sides of the car to receive the doors when open and since the doors are not required to slide in a right line they may be applied to the rounding or slightly tapering contour of the car platforms at the ends of the cars, and hence may be applied to cars already built, and not requiring a special construction of car body. But

Having now set forth the object and nature of my invention, and various constructions embodying the principles thereof, and having explained such constructions, their purposes, functions and modes of operation, what I claim as new and useful, and of my own invention and desire to secure by Letters Patent is:—

1. A door including swinging panels, gearing intermediate said panels for folding the same the one upon the other, a movable step, and means also operating to move said step whereby all of said parts move in unison.

2. A door composed of panels hinged together, gearing intermediate adjacent panels and operating, when one panel is moved to swing the next adjacent panel relative thereto, a movable step and means for moving one of said panels, said means also operating to move said step.

3. A door composed of foldable panels, an

operating shaft therefor, a driving shaft for the operating shaft, a step having operating connection with said driving shaft, and means for operating said driving shaft whereby said door panels and step are operated in unison.

4. A door composed of foldable panels in combination with a movable step, and a motor for operating the panels and step in unison.

5. A door composed of swinging sections in combination with a step, and a motor for operating the swinging door sections and step in unison.

6. In a car, a door composed of swinging sections, a pivoted step, means controllable from a point within the car for simultaneously operating the door and step, and means for locking the swinging door sections in closed position.

In testimony whereof I have hereunto set my hand in the presence of the subscribing witnesses, on this 18 day of February A. D., 1909.

HAROLD ROWNTREE.

Witnesses:

C. C. HUNICKE,
S. E. DARBY.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."