Nov. 7, 1933. H. H. PORTER, JR 1,934,089

FOLDING DOOR

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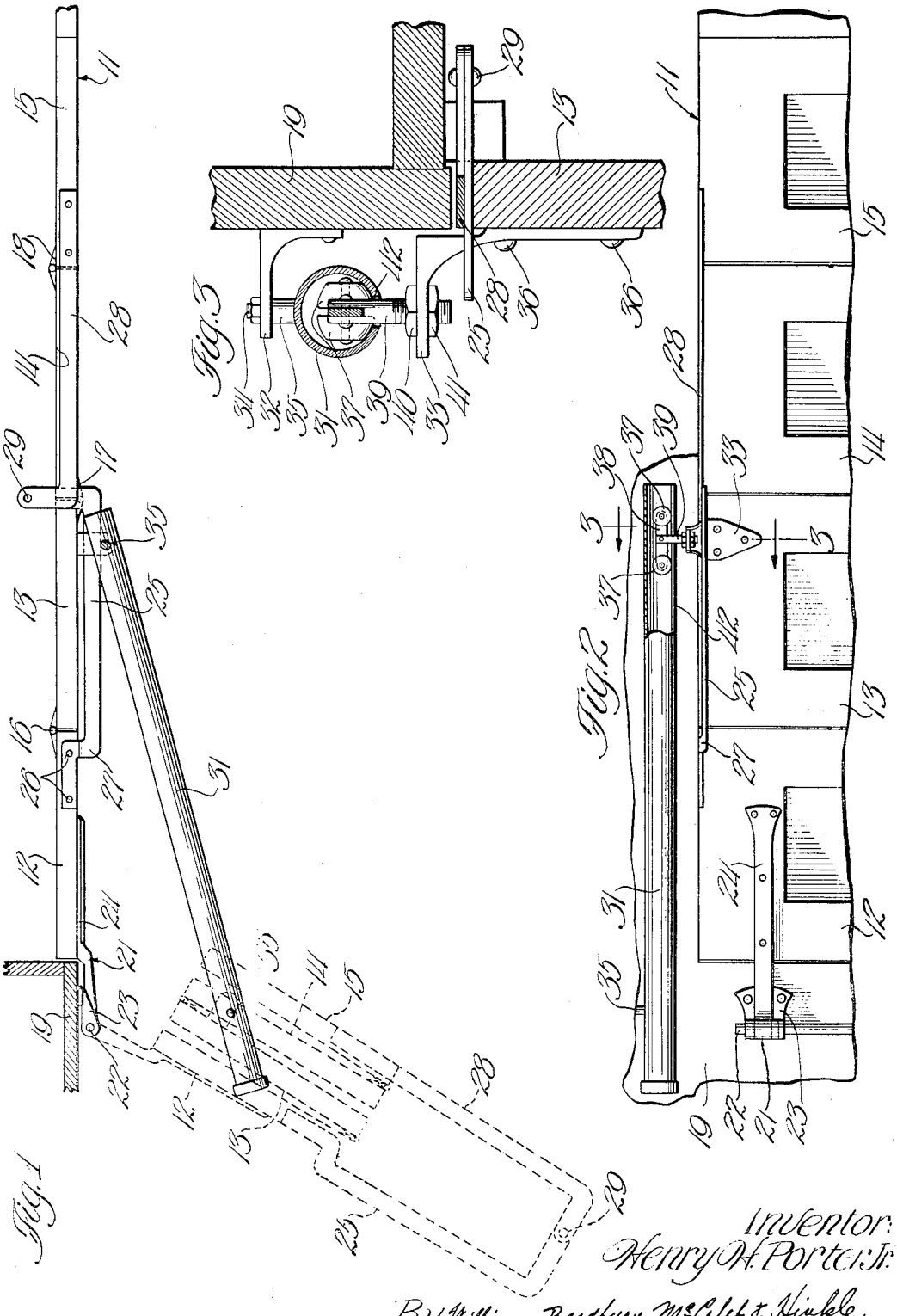


Fig. 1

Fig. 2

Fig. 3

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Fig. 4.

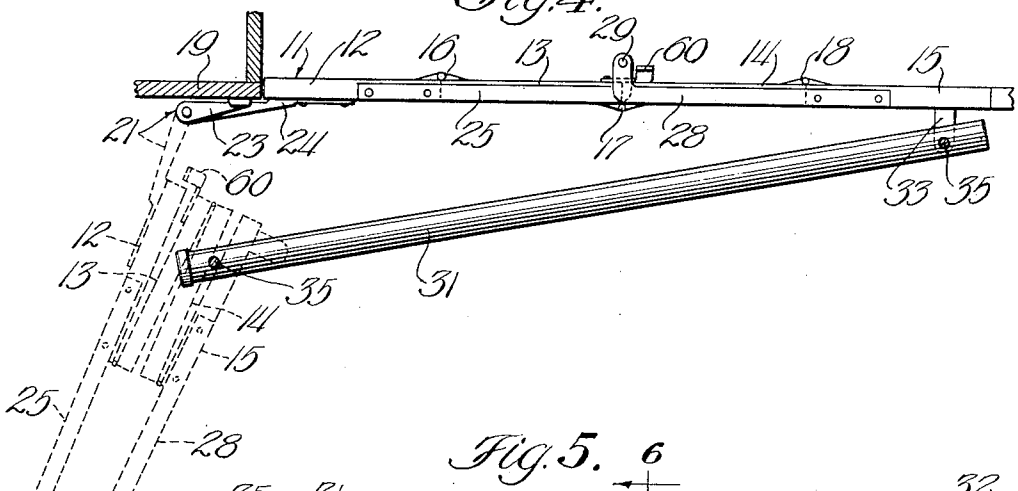


Fig. 5.

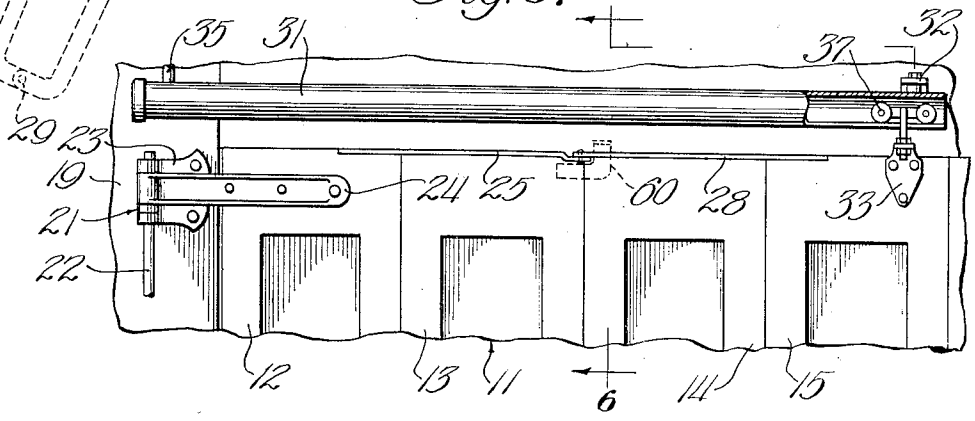


Fig. 6.

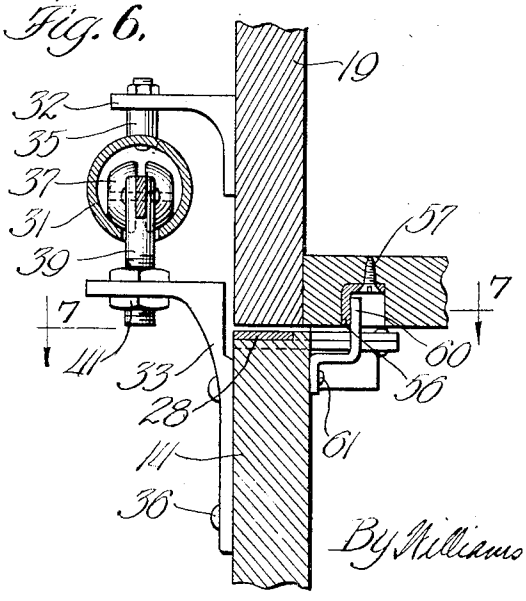
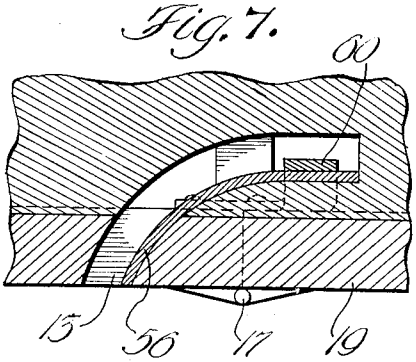


Fig. 7.



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Fig. 8.

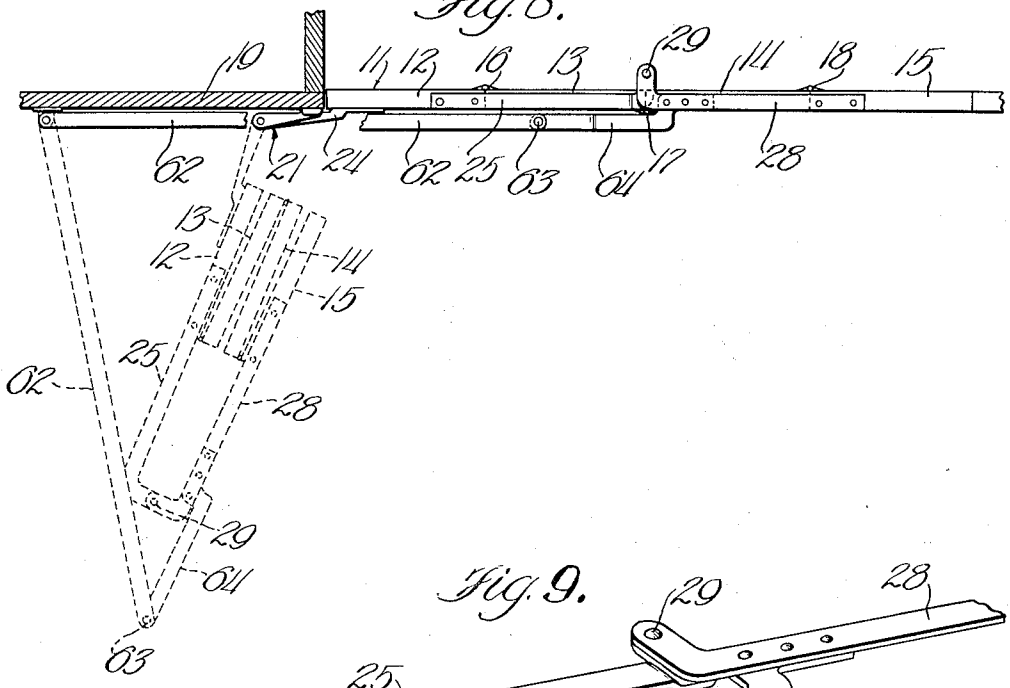


Fig. 9.

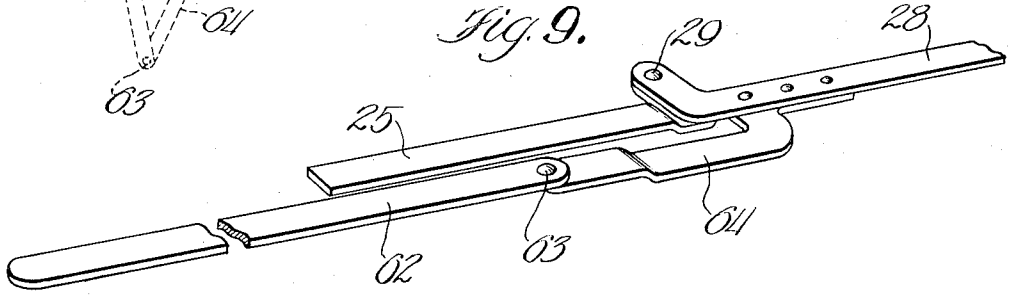
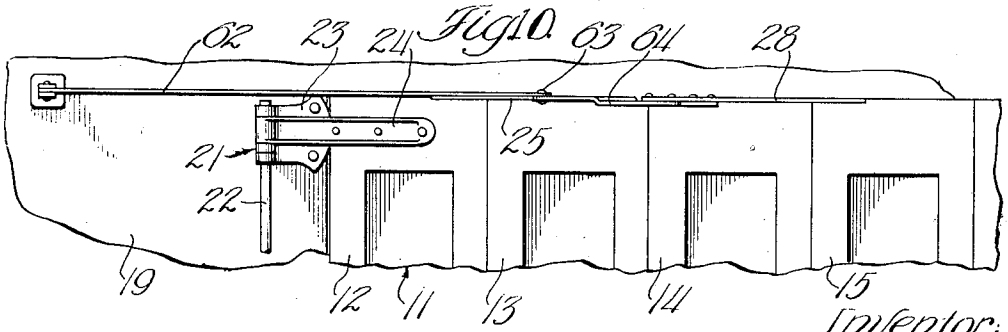


Fig. 10.



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Fig. 11

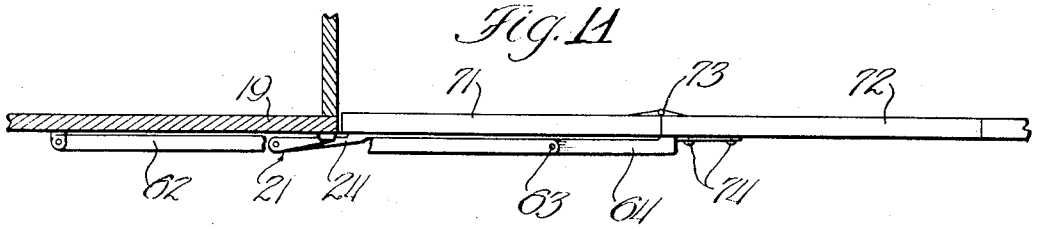


Fig. 12.

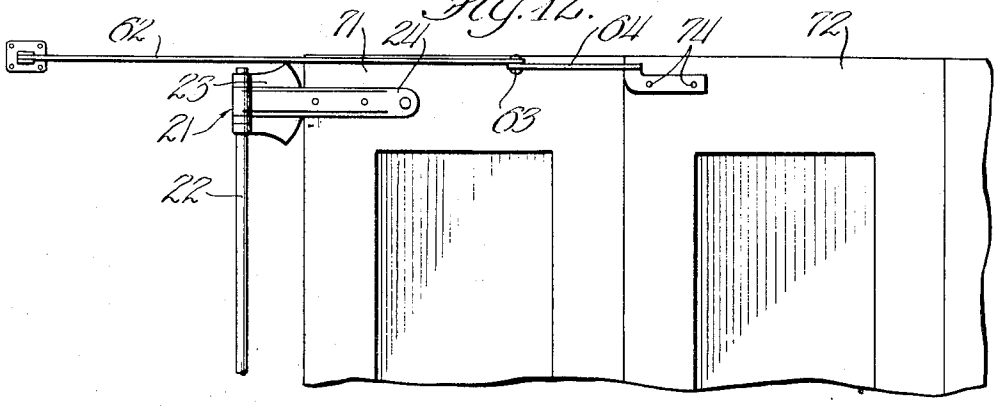
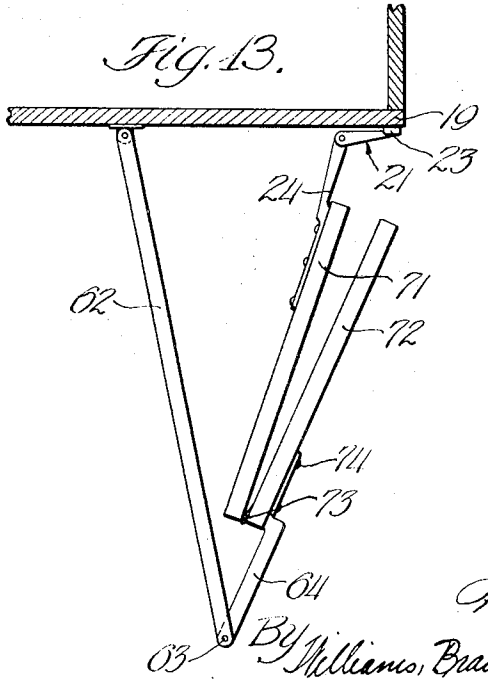


Fig. 13.



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UNITED STATES PATENT OFFICE

1,934,089

FOLDING DOOR

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Application November 29, 1929
Serial No. 410,375

20 Claims. (Cl. 20—20)

My invention relates to folding doors and more particularly to the type of doors especially suited for use on garages, barns and the like.

An object of my invention is the provision of improved mechanism whereby the doors may readily be opened and folded together out of the doorway and may be readily reclosed by simply swinging the first section on its hinges in a conventional manner.

A further object is the provision of improved actuating and supporting means for the various door sections, such that the sections will be held rigidly and locked when in fully extended or closed position.

Another object is to provide improved means for insuring the proper folding and unfolding of doors, to open and close the same, which are composed of an even number of pivotally interconnected leaves or sections.

In the accompanying drawings illustrating my invention,

Fig. 1 is a top plan view of a door made in accordance with my invention and showing a fragment of the door casing in section;

Fig. 2 is a fragmentary front elevation of that shown in Fig. 1;

Fig. 3 is a vertical section taken on the line 3—3 of Fig. 2;

Fig. 4 is a plan view similar to Fig. 1 but showing a modified construction in which the track extends substantially the entire length of the door;

Fig. 5 is a front elevation of that shown in Fig. 4;

Fig. 6 is a vertical section taken on substantially the line 6—6 of Fig. 5;

Fig. 7 is a horizontal section taken on the line 7—7 of Fig. 6;

Fig. 8 is a top plan view of a modified form of my invention showing a portion of the door casing in section;

Fig. 9 is a perspective view of the link and toggle mechanism employed in the modification shown in Fig. 8;

Fig. 10 is a fragmentary elevation of that shown in Fig. 8;

Fig. 11 is a view similar to Fig. 8 but showing a modified form of door and link mechanism and illustrating the door in closed position;

Fig. 12 is a fragmentary front elevation of that shown in Fig. 11; and

Fig. 13 is a view similar to Fig. 11 but showing the door in open position.

In the preferred form of my invention shown in Figs. 1, 2 and 3, the door designated in general by numeral 11 is composed of a plurality of sectons 12, 13, 14 and 15 which are hinged together by hinges 16, 17 and 18 such that they fold like a fan or accordion when the door is opened as illustrated in dotted outline at the left of Fig. 1.

Section 12 of the door, which hereinafter is referred to as the first section, is hinged to the door casing 19 by a plurality of offset hinges 21 providing a fixed pivot 22 about which this section is adapted to swing. The portions 23 and 24 of hinge 21 are respectively secured to the casing 19 and door section 12 by screws or the like, as may be desired.

A link member 25 is rigidly fixed to the top of section 12 by suitable screws 26 and is offset at 27 and the free end extends along and parallel with second section 13 when that section is in open or extended position. A link 28 is rigidly fixed to the top of last section 15 and extends along section 14. Links 25 and 28 have rearwardly extending end portions which are pivoted together by suitable means at 29, thereby forming a toggle mechanism which locks the sections of the door in extended position when the door is fully extended. Pivot 29 when moved forwardly, as in folding the door, passes directly over the hinge 17 connecting the adjacent edges of sections 13 and 14.

A track member 31, which is preferably of tubular form having a slot in the lower edge, is rigidly supported by means of a pair of brackets 32 having bolts 34 and spacers 35, as best illustrated in Fig. 3. A bracket 33 is rigidly fixed by bolts 36 to the door section 13. A plurality of rollers 37 are journaled in supporting bars 38, to which is fixed a depending rod 39 having nuts 40 and 41 thereon for adjustably securing the rollers in spaced relation to the upper face of bracket 33. The depending rod 39 passes through the slot 42 in the lower side of the tubular track 31 and the rollers 37 engage within the tubular track for supporting and guiding the door section 13 as it moves from extended to folded position and while in both positions. The track 31 is supported in a substantially horizontal plane and at an angle to the door as in its extended position for the purpose of accurately guiding the door from its extended position to its folded position, which is entirely out of the doorway.

Figs. 4, 5 and 6 are similar to Figs. 1, 2 and 3, except that the roller 37 is adapted to support door section 15 instead of section 13. In this

modification I have provided a curved guide bar 56 which may be of angular section as shown in Fig. 6, having screws 57 for rigidly supporting it in the position above and adjacent the adjoining edges of sections 13 and 14. On section 13 is rigidly fixed a guide lever 60 by means of bolts 61. The rearward end of lever 60 is bent rearwardly and upwardly for sliding engagement with the curved bar 56 for the purpose of holding the central portion of the door rigid when the door is locked in extended position by the toggle mechanism comprising links 25 and 28.

Figs. 8, 9 and 10 illustrate a modification comprising four sections 12, 13, 14 and 15, but the track and roller mechanism is dispensed with, instead of which I employ a link 62 which is pivoted to the door casing some distance from the hinge 21 and is pivoted at 63 to an extension arm 64, which in turn is secured to the link 28. In this arrangement the link 63 draws the links 25 and 28 forwardly into the position shown in dotted outline when the door section 12 is swung about pivot 21.

The modification shown in Figs. 11, 12 and 13 is similar in operation, except that the door is composed of two sections 71 and 72, which are hinged together at 73, and in this modification the links connecting the various sections of the door are dispensed with. The link 62, pivoted at 63 to the extension arm 64, makes connection with section 72 of the door by means of the arm 64, which is bolted rigidly in position at 74.

It will be apparent from an inspection of the drawings that no special manipulation is required for opening and folding the door in the position out of the doorway, since the mere swinging of the first section of the door in any of the modifications causes the other sections to swing on their hinges and through the medium of the link mechanism fold together as illustrated. Referring to Fig. 1, by way of example assume that a force is applied to section 12 to open it on its hinges 21. Pivot 29 on the end of link 25 moves to open position twice as fast as the pivot of hinge 16 since the link 25 is twice as long as the door is wide. Link 28 causes the hinge 18 to turn at substantially the same rate as hinge 16, and since the central portion of the door is restrained as by roller 37, the sections progressively form a fanfold and the door assumes the position shown in dotted outline. In a similar manner the door is readily closed and fully extended by simply swinging the first section of the door to closed position. When reference is made in the appended claims to the first section of the door, it will be understood to be the section adjacent the door casing and the last section is the section farthest from the door casing.

As regards the rotation of the fourth section about its hinge pintle 18, the link 28 rigidly mounted on the fourth section 15 constitutes in effect a lever of the first class with the operating force applied at the pivot 29 and the fourth section 15 itself representing the load. With the link 25 fixed on the first section and similarly constituting a lever of the first class, and the free ends of the links 25 and 28 pivotally connected, the fourth section 15 will be rotated in a direction opposite to that in which the first section 12 is rotated. In this manner the rotation of the fourth section 15 about its supporting hinge is positively controlled. The links 25 and 28 also cooperate to impart a toggle-like movement to the intervening second and third sections 13 and 14 to rotate them whereby they fold together.

It is contemplated that these doors will be used in pairs, although for the purpose of illustration I have shown only the door on the left side of the pair and in some cases illustrated a fragment of the pair at the right.

I claim as my invention:

1. A device of the class described comprising a plurality of successive door sections hinged together to form a single door, means hingedly securing the first section to swing on a fixed pivot, a link member rigidly fixed to the first section to swing therewith, a second link pivoted to the first said link and rigidly fixed to the last section to swing therewith, for folding the sections together upon swinging movement of the first section.

2. A device of the class described comprising a plurality of door sections hinged together to form a single door, hinge means on one edge of the first section providing a fixed pivot about which said section may swing, a link member rigidly fixed to the last section to swing therewith constituting a first class lever as fulcrumed at the hinge for the last section and means pivoted to the free end of said link for causing said sections to fold together when the first section swings on its hinges.

3. A device of the class described comprising a plurality of door sections hinged together to form a single door, hinge means on one edge of the first section providing a fixed pivot about which said section may swing, a link member rigidly fixed to the last section to swing therewith, and a second link pivoted to the first said link forming a toggle for folding the sections together and out of the doorway when the first section swings on its hinges.

4. A device of the class described comprising a plurality of door sections hinged together at their edges to form a single door, an offset hinge on the first section providing a fixed pivot about which said section may swing, a link member rigidly fixed to the last section to swing therewith and projecting beyond its supporting hinge and toward the first section when the door is closed and means pivoted to the free end of said link for causing said sections to fold together when the first section swings on its hinges.

5. A device of the class described comprising a plurality of door sections hinged together at their edges to form a single door, an offset hinge on the first section providing a fixed pivot about which said section may swing, a link member rigidly fixed to the last section to swing therewith, and a second link pivoted to the first said link forming a toggle for folding the sections together and out of the doorway when the first section swings on its hinges.

6. A device of the class described comprising a plurality of door sections hinged together at their edges to form a single door, an offset hinge on the first section providing a fixed pivot about which said section may swing, a link member rigidly fixed to the first section to swing therewith, and a second link pivoted to the first said link and rigidly fixed to the last section to swing therewith to fold the sections together upon swinging movement of the first section.

7. A device of the class described comprising a plurality of door sections hinged together to form a single door, hinge means on one edge of the first section providing a fixed pivot about

which said section may swing, a link member rigidly fixed to the last section to swing therewith and projecting beyond its supporting hinge and toward the first section when the door is closed, means pivoted to the free end of said link for causing said sections to fold together when the first section swings on its hinges, and means for vertically supporting the door when in extended and folded positions.

8. A device of the class described comprising a plurality of successive door sections hinged together to form a single door, means hingedly securing the first section to swing on a fixed pivot, a link member rigidly fixed to the first section to swing therewith, a second link pivoted to the first said link and rigidly fixed to the last section to swing therewith, for folding the sections together upon swinging movement of the first section, and a track and roller mechanism supporting the door against the force of gravity when extended and adapted to guide a section of the door in the folding movement.

9. A device of the class described comprising a plurality of door sections hinged together at their edges to form a single door, an offset hinge on the first section providing a fixed pivot about which said section may swing, a link member rigidly fixed to the last section to swing therewith, a second link pivoted to the first said link forming a toggle for folding the sections together and out of the doorway when the first section swings on its hinges, and a track and roller mechanism supporting the door against the force of gravity when in extended position, and adapted to guide a section of the door in the folding movement.

10. A device of the class described comprising a plurality of door sections hinged together at their edges to form a single door, an offset hinge on the first section providing a fixed pivot about which said section may swing, a link member rigidly fixed to the first section to swing therewith, and operatively connected with the last section whereby the swinging of the first section on its hinges will compactly fold the sections together and out of the doorway, and a second link member rigidly fixed to the last section to swing therewith, the adjacent ends of said links having offset portions pivoted together, thereby forming a toggle mechanism for locking said sections in extended position.

11. A device of the class described comprising a plurality of door sections hinged together at their edges to form a single door, an offset hinge on the first section providing a fixed pivot about which said section may swing, a link member rigidly fixed to the first section to swing therewith, and operatively connected with the last section whereby the swinging of the first section on its hinges will compactly fold the sections together and out of the doorway, a second link member rigidly fixed to the last section to swing therewith, the adjacent ends of said links having offset portions pivoted together, thereby forming a toggle mechanism for locking said sections in extended position, a fixed track disposed at an angle to said doorway as extended, and a roller having connection with one of said sections, and movable along said track for guiding the folding and unfolding movement of the door.

12. A device of the class described comprising a plurality of door sections hinged together at their edges to form a single door, an offset hinge on the first section providing a fixed pivot about which said section may swing, a link member rigidly fixed to the first section to swing therewith, and operatively connected with the last section whereby the swinging of the first section on its hinges will compactly fold the sections together and out of the doorway, a second link member rigidly fixed to the last section to swing therewith, the adjacent ends of said links having offset portions pivoted together, thereby forming a toggle mechanism for locking said sections in extended position, a curved guide bar fixed above the central portion of said door and a guide arm on one of said sections cooperating with said bar for guiding the central portion of the door while being extended and holding it rigid when in extended position.

13. A device of the class described comprising a plurality of door sections hinged together at their edges to form a single door, an offset hinge on the first section providing a fixed pivot about which said section may swing, a link member rigidly fixed to the first section to swing therewith, and operatively connected with the last section whereby the swinging of the first section on its hinges will compactly fold the sections together and out of the doorway, a second link member rigidly fixed to the last section to swing therewith, the adjacent ends of said links having offset portions pivoted together, thereby forming a toggle mechanism for locking said sections in extended position, a guide bar fixed above said door, a guide arm on one section adjacent the center of the door cooperating with said bar for holding the door rigid when extended, and a track and roller mechanism for supporting and guiding one of said sections during the folding movement of the door.

14. A device of the class described comprising a plurality of door sections hinged together to form a single door, hinge means at the edge of the first section remote from the second section providing a fixed pivot about which said section may swing, a link member rigidly fixed to an even numbered section beyond the second section and constituting a first class lever as fulcrumed at the hinge for the section to which the member is fixed and means pivoted to the free end of said link for causing said sections to fold together when the first section swings on its hinges.

15. A device of the class described comprising a plurality of door sections hinged together to form a single door, hinge means at the edge of the first section remote from the second section providing a fixed pivot about which said section may swing, a link member rigidly fixed to an even numbered section beyond the second section and constituting a first class lever as fulcrumed at the hinge for said even numbered section and means connected to a section other than said even numbered section and operated by the rotation of said other section and pivoted to the free end of said link for rotating said even numbered section.

16. A device of the class described comprising a plurality of door sections hinged together at their adjacent edges to form a single door, a hinge at the edge of the first section remote from the second section providing a fixed pivot about which the first section swings, a link member rigidly fixed to the fourth section to swing therewith and projecting beyond the hinge for the fourth section to constitute a first class lever as fulcrumed at the last mentioned hinge, a second link fixed to the first section and projecting therebeyond toward the fourth section, and a pivotal connection between the links, the links forming a toggle

for folding the second and third sections together and for rotating the fourth section in a direction opposite to the first section, as the first section is swung about its fixed pivot.

17. A device of the class described comprising a plurality of door sections hinged together at their adjacent edges to form a single door, a link member rigidly fixed to an even numbered section beyond the second section and constituting a first class lever as fulcrumed at the hinge for said even numbered section and means connected to an odd numbered section and operated by the rotation thereof and pivoted to the free end of said link for rotating said even numbered section.

18. A device of the class described comprising a plurality of door sections hinged together at their adjacent edges to form a single door, a hinge at the edge of the first section remote from the second section providing a fixed pivot about which the first section swings, a link member rigidly fixed to the fourth section to swing therewith and projecting beyond the hinge for the fourth section to constitute a first class lever as fulcrumed at the last mentioned hinge, a second link fixed to the first section and projecting therebeyond toward the fourth section, and a pivotal connection between the links, whereby upon the swing of the first section about its fixed pivot, the links rotate the fourth section about its hinge to the third section.

19. A device of the class described comprising a series of door sections hinged together at their adjacent edges to form a single door, the series including four consecutive sections, the first and fourth each carrying a link fixedly secured thereto and extending beyond its section toward the other section and a pivotal connection between the adjacent ends of the links whereby the rotation of one rotates the other.

20. A device of the class described comprising a series of door sections hinged together at their adjacent edges to form a single door, the series including four consecutive sections, the first and fourth each carrying a link fixedly secured thereto and extending beyond its section toward the other section and a pivotal connection between the adjacent ends of the links whereby the rotation of one rotates the other, the links also operating to draw the opposite edges of the second and third sections together togglewise to fold them together.

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