

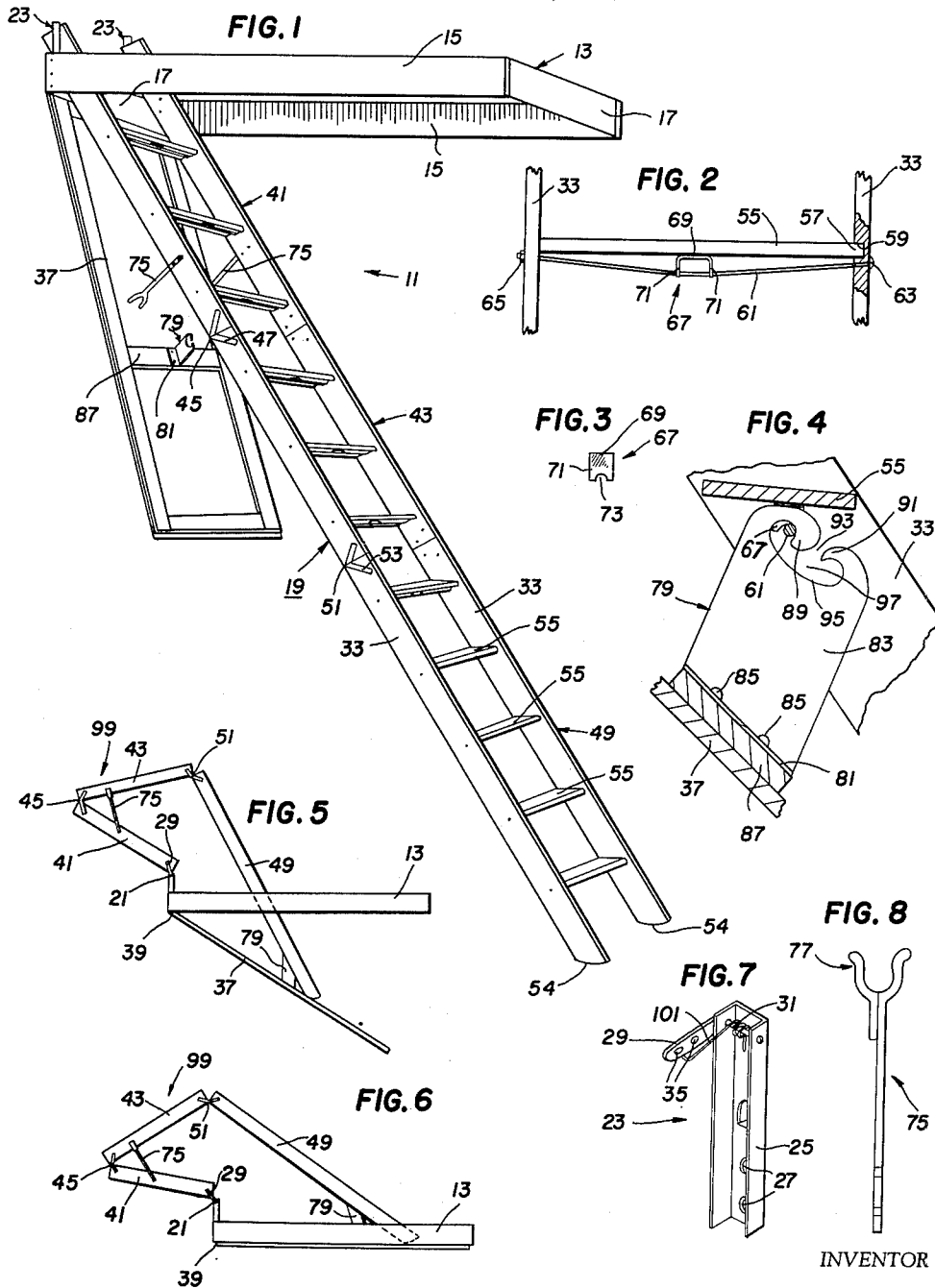
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FOLDING STAIRWAY

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1

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## FOLDING STAIRWAY

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This invention relates to improvements in folding stairways of the type in which a frame is mounted in an opening in the ceiling of a room and a foldable ladder is hingedly mounted adjacent one end to said frame, which ladder is adapted to be selectively disposed in a housed position or in an extended position in which the lower end of the ladder rests on the floor of the room.

Many previous stairs of this type have used counterbalance springs, which add to the expense of the stairway, and with the mechanisms employed therewith are subject to malfunctioning and loss of tension of the springs.

One of the principal objects of the present invention is to provide a stairway construction in which the primary lifting force of the stairway during the latter part of its movement towards the housed position is provided by a portion of the stairway itself rather than by counterbalancing springs.

A further object is to provide a stairway that is efficient in operation, simple in construction and economical to manufacture.

A further object is to provide a stairway construction having a unique principal of operation.

A further object is to provide an improved folding stairway comprising a frame defining an opening, a door for said opening pivotally connected adjacent one end to said frame; a ladder including an upper section, an intermediate section and a lower section; means for removably attaching said lower section to said door, said ladder being foldable into such a position that an effective moment arm is established which causes the ladder to rotate towards a housed position under the influence of gravity acting on a portion of said ladder to pull the remainder of the ladder upwardly and to draw the door upwardly therewith.

A further object is to improve the construction of said ladder, particularly the supporting means of the ladder steps.

A further object is, generally, to improve the design and construction of folding stairways.

The means by which the foregoing and other objects of the present invention are accomplished and the manner of their accomplishment will be understood from the following specification upon reference to the accompanying drawings, in which:

FIG. 1 is a perspective view of the folding stairway of the present invention shown in extended position.

FIG. 2 is an enlarged fragmentary elevational view of a portion of the ladder of the stairway with a part thereof being broken away for purposes of illustration.

FIG. 3 is an end-view of one of the braces for the steps.

FIG. 4 is a further enlarged fragmentary sectional view of a portion of the folding stairway taken as on a vertical plane through the center thereof and showing the connecting means of the door and the ladder in an engaged position.

FIG. 5 is a side elevational view on a reduced scale of the stairway in a partially housed position.

FIG. 6 is a view similar to FIG. 5 of the stairway in the completely housed position.

FIG. 7 is a perspective view of one of the hinge mechanisms.

FIG. 8 is an elevational view of one of the supports.

Referring now to the drawings in which the various parts are indicated by numerals, the folding stairway 11 of the present invention includes the usual substantially

2

rectangular frame 13 which is mounted in an opening in the ceiling of a room.

Frame 13 includes side members 15 joined at their opposite ends by end members 17. The upper end of an articulated ladder 19 is pivotally mounted as at pivot point 21 above one end of frame 13, preferably by a pair of hinge members 23.

Each of hinge members 23 includes a channel member 25 fixedly attached to frame 13 or to a floor joist, not shown, by suitable means, as screws, nails or the like extending through apertures 27 provided in the channel member. An arm 29 is swingably mounted from channel member 25 adjacent the upper end thereof by suitable means, as for example, a pin 31 extending through aligned apertures in the channel member and the arm so that the arm is adapted for movement about a substantially horizontal axis. The arms 29 of hinge members 23 are respectively fixedly attached to the outside faces of the side members 33 of ladder 19, as by screws, nails or the like extending through apertures 35 in arms 29. It will be understood that both of hinge members 23 are preferably identical in construction except that one is of lefthand construction and the other of righthand construction, i.e., one has arm 29 located on one side of channel member 25 and the other has the arm located on the opposite side thereof.

A door 37 is swingably mounted from frame 13 at one end thereof at 39 for swinging movement between an open position shown in FIG. 1 and a closed position shown in FIG. 6, in which the door closes the opening defined by frame 13.

Ladder 19 comprises an upper section 41, which is the portion of the ladder that is pivotally attached to frame 13 as above-described; an intermediate section 43 pivotally attached adjacent its upper end to the lower end of upper section 41 as at 45 by suitable means as hinges 47; and a lower section 49 pivotally connected adjacent its upper end to the lower end of intermediate section 43 as at 51 by suitable means as hinges 53. The lower end of lower section 49 is rounded as at 54 and is adapted to rest upon the floor when the ladder is in an extended position. It should be noted that the pivots 45 and 51 are located adjacent the lower edges of side members 33 so that when the ladder is moved towards a folded disposition, lower section 49 moves clockwise relative to intermediate section 43 and intermediate section 43 is adapted to move clockwise relative to upper section 41. This is different from the usual ladder construction in which the pivot of the intermediate section and the upper section is disposed on the forward side of the ladder so that the intermediate section is pivoted clockwise relative to the intermediate section.

Ladder 19 is provided with steps 55 spaced along the length thereof. One of the features of the present invention is the construction of steps 55 in which the opposite ends of the steps are received in sockets provided in the inner side of side members 33. This construction is identical on both ends and one is shown in FIG. 2 wherein it will be seen the end 57 is fitted into socket 59 in side member 33. In addition, under each of steps 55 is located a rod 61 mounted through bores in the opposite side members 33. Rod 61 is provided with a head 63 at one end thereof and a nut 65 threadably engaged on the other end thereof. A brace 67 is disposed between each rod 61 and each of steps 55. Each of braces 67 includes a mid-portion 69 and integrally formed therewith spaced legs 71 depending from the opposite ends of mid-portion 69. A notch 73 is provided in each of legs 71 adjacent the lower end thereof.

To install one of braces 67, nut 65 is loosened and the brace placed between step 55 and rod 61 with mid-portion 69 engaging the lower face of the step and with the

3

rod 61 engaged in notches 73. Then, nut 65 is tightened to wedge brace 67 upwardly against step 55. It will be understood that the effective height of brace 67, i.e., the vertical dimension as viewed in FIG. 3 from the upper edge of the notch to the upper surface of mid-portion 69 is greater than the spacing of the opposite ends of rods 61 below step 55 so that the above-mentioned wedging action is possible upon tightening of nut 65. From the foregoing, it will be understood that steps 55 are greatly strengthened and there is no likelihood of the steps breaking, thereby eliminating chances of accident from this cause.

A pair of supports 75 are fixedly attached to upper section 41, and depend downwardly on opposite sides thereof as best shown in FIG. 1 when the ladder 19 is in an extended position. Each of supports 75 includes a bifurcated end 77 at the distal end thereof, which bifurcated ends 77 are positioned to respectively receive the opposite side members 33 of intermediate section 43, when the ladder 19 is folded, as will be understood more fully in the description of the operation of the device to follow hereinafter.

A bracket 79, having a flange 81 and a plate 83 preferably integrally formed with flange 81 and extending perpendicularly outwardly therefrom is fixedly attached to the side of door 37 which is adjacent ladder 19 by means of bolts 85 or the like extending through apertures in flange 81 and into a cross member 87 of door 37. The distal end of plate 83 is provided with a pair of inwardly facing hooks 89, 91 which are spaced apart so that an entrance-way 93 is provided for entrance of rod 61 to the hooks, as will be more fully understood in the hereinafter described operation of the device. The portion of plate 83 between hooks 89, 91 is arcuate as at 95 and with hooks 89, 91 substantially define an elongated slot 97 having the entrance-way 93.

To house stairway 11, lower section 49 is lifted upwardly causing the lower section to pivot relative to the intermediate section 43 and the intermediate section to pivot relative to the upper section 41. This lifting motion is continued to bring the lower end of lower section 43 adjacent the top side of door 37 and then to engage one of hooks 89, 91 on the rod 61 which is beneath one of the lowermost steps 55, in the manner best shown in FIGS. 4 and 5. This place of engagement of the hook with rod 61 takes place between legs 71.

It will be understood that pivoting movement of intermediate section 43 relative to upper section 41 will be limited by supports 75 engaging intermediate section 43 as best shown in FIG. 5. It will be understood that the intermediate section 43 is supported at an angle by supports 75 to establish a rigid combination of parts designated as at 99 and which includes upper section 41, supports 75 and intermediate section 43. It will be understood that this combination of parts 99 is pivotable in a counter-clockwise direction as viewed in FIG. 5 as a whole about pivot 21 as the stairway 11 is moved towards a housed position. An intermediate position during this upward movement of the stairway 11 is shown in FIG. 5. From a consideration of FIG. 5, it will be understood that an effective moment arm is established about pivot point 21, which moment arm includes the weight of the combination of parts 99 tending to move the combination of parts counter-clockwise or downwardly as viewed in this fig., which exerts a pull at pivot 51 on lower section 49 that tends to draw the door 37 upwardly therewith. It will be understood that during the above-described movement of stairway 11 towards the housed position a point will be reached where it is no longer necessary for the person closing the stairway to exert an upward force on door 37, but instead, the weight of the combination of parts 99 will more than balance the above-described parts that it is tending to pull up so that the stairway will complete its housing under the influence of the weight of the combination of parts 99

4

without any outside force being exerted thereon. If desired, a torque spring 101 may be mounted on hinge member 23 in the manner shown in FIG. 7 to urge upper section 41 upwardly in order to aid the person housing the stairway during the first part of the movement thereof.

To extend stairway 11 for use, it will be understood that the substantial reverse of the above-described housing operation is accomplished. Thus, the door 37 is pulled downwardly until a point is reached that the stairway will move downwardly under its own weight. Then the ladder 19 is unlatched from bracket 79 and the stairway extended into the position shown in FIG. 1. It will be noted that slot 97 permits a certain amount of lost motion of ladder 19 relative to door 37 during the housing and extending of stairway 11.

From the foregoing description it will be understood that the stairway of the present invention possesses many advantages over the conventional type of foldable stairway in which the door is attached to the ladder. In the present invention, it will be seen that when unlatched, the ladder 19 and door 37 are independently mounted. Thus, stairway 11 is self-adjusting and will meet the floor properly regardless of the angle of the ladder or the ceiling height. Additionally, stairway 11 will fit any rough opening already existing for attic access, thereby possessing advantages over many other types of stairs which require much preparation and trimming out of the access hole.

Although the invention has been described and illustrated with respect to a preferred embodiment thereof, it is to be understood that it is not to be so limited since changes and modifications may be made therein which are within the full intended scope of this invention as hereinafter claimed.

I claim:

1. A stairway construction for use with a ceiling opening, said stairway construction comprising a door for said opening, means pivotally connecting said door adjacent said opening for movement between an open position relative to said opening and a closed position relative thereto, a ladder, means for pivotally connecting said ladder adjacent one end of said opening; said ladder including an upper section, an intermediate section pivotally connected to said upper section and a lower section pivotally connected to said intermediate section; a brace attached to said upper section and depending therefrom; said ladder being foldable to a folded position in which the lower end of said lower section is adjacent said door and in which said intermediate section is supported at an angle relative to said upper section by contact with said brace to establish a rigid combination of parts comprising said brace, said upper section and said intermediate section; said rigid combination of parts being pivotable as a whole about the pivotal connection of said ladder, when said ladder is folded towards said folded position said intermediate section first contacting said brace when the lower end of said lower section is below said opening when disposed in said rigid combination of parts said upper section and said intermediate section maintaining a substantially constant angle relative to one another, means for removably connecting said lower section with said door when said ladder is in said folded position, said ladder and said door being movable upwardly towards a housed position thereof to establish a moment arm including the weight of said combination of parts tending to move the combination of parts downwardly and draw substantially unassisted said lower section and said door upwardly into a housed position.

2. A stairway construction for use with a ceiling opening, said stairway construction comprising a door for said opening, means pivotally connecting said door adjacent said opening for movement between an open position relative to said opening and a closed position relative thereto, a ladder, means for pivotally connecting said

5

ladder adjacent one end of said opening; said ladder including an upper section, an intermediate section pivotally connected to said upper section and a lower section pivotally connected to said intermediate section; said ladder being foldable to a folded position in which the lower end of a said lower section is adjacent said door; interengaging means for holding said upper section and said intermediate section at an angle relative to each other when said ladder is in said folded position to establish a rigid combination of parts comprising said interengaging means, said upper section and said intermediate section; said rigid combination of parts being pivotable as a whole about the pivotal connection of said ladder, when said ladder is folded towards said folded position said interengaging means first becoming effective to hold said upper section and said intermediate section to establish said rigid combination of parts when the lower end of said lower section is below said opening, when disposed in said rigid combination of parts said upper section and said intermediate section maintaining a substantially constant angle relative to one another, means for removably connecting said lower section with said door when said ladder is in said folded position, said ladder and said door being movable upwardly towards a housed position thereof to establish a moment arm including the weight of said combination of parts tending to move the combination of parts downwardly and draw substantially unassisted said lower section and said door upwardly into a housed position.

3. A stairway construction for use with a ceiling opening, said stairway construction comprising a door for said opening, means pivotally connecting said door adjacent said opening for movement between an open position relative to said opening and a closed position relative thereto, a ladder including a plurality of steps, means for pivotally connecting said ladder adjacent one end of said opening; said ladder including an upper section, an intermediate section pivotally connected to said upper section and a lower section pivotally connected to said intermediate section; said ladder being foldable to a folded position in which the lower end of said lower section is adjacent said door; interengaging means for holding said upper section and said intermediate section at an angle relative to each other when said ladder is in said folded position to establish a rigid combination of parts comprising said interengaging means, said upper section and said intermediate section; said rigid combination of parts being pivotable as a whole about the pivotal connection of said ladder, when said ladder is folded towards said folded position said interengaging means first becoming effective to hold said upper section and said intermediate section to establish said rigid combination of parts

6

when the lower end of said lower section is below said opening when disposed in said rigid combination of parts said upper section and said intermediate section maintaining a substantially constant angle relative to one another, rod means mounted on said ladder in spaced relationship beneath one of said steps in said lower section, a bracket mounted on said door, said bracket including a pair of inwardly facing hooks adapted to engage said rod between said legs to detachably connect said lower section and said door when said ladder is in said folded position, said hooks being spaced apart to provide an entranceway for said rod to said hooks, a portion of said bracket being disposed between said hooks and defining with said hooks an elongated slot whereby when said bracket is engaged with said rod said slot is adapted to allow lost motion between said ladder and said door, said ladder and said door being movable upwardly towards a housed position thereof to establish a moment arm including the weight of said combination of parts tending to move the combination of parts downwardly and draw substantially unassisted said lower section and said door upwardly into a housed position.

4. A stairway construction for use with a ceiling opening, said stairway construction comprising a door for said opening; a ladder including an upper section, an intermediate section and a lower section; means for removably attaching said lower section to said door, interengaging means adapted to cooperate between said intermediate section and said upper section, said ladder being foldable into such a position that an effective rigid moment arm is established by said interengaging means cooperating between said upper section and said intermediate section to hold said upper section and said intermediate section at a fixed angle so that the ladder is caused to rotate substantially unassisted towards a housed position under the influence of gravity acting on said upper section and said intermediate section and said interengaging means to pull the remainder of the ladder upwardly and to draw said door upwardly therewith, when said ladder is folded towards said folded position said interengaging means first becoming effective to hold said upper section and said intermediate section at said fixed angle when the lower end of said lower section is below said opening.

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