June 23, 1931. F. E. BESSLER 1,811,708

DISAPPEARING STAIRWAY

Filed Oct. 27, 1928 2 Sheets-Sheet 1

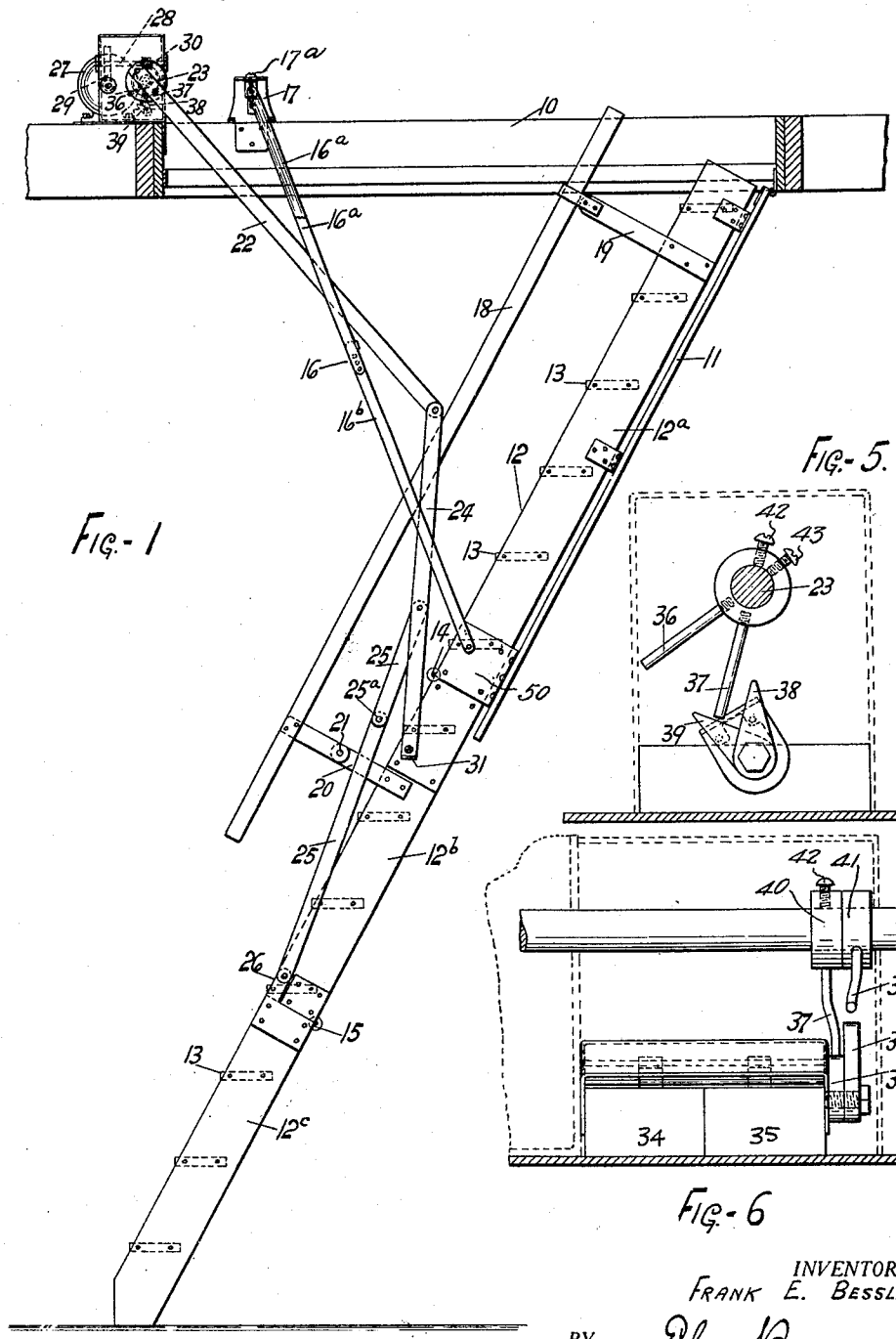


FIG. 1

FIG. 5.

FIG. 6

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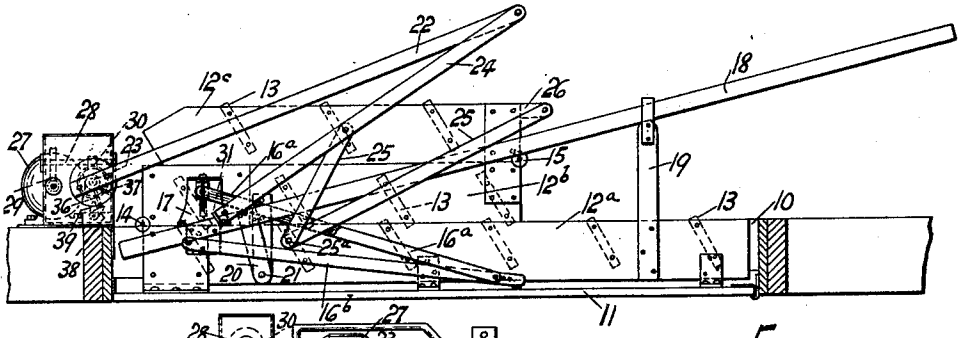


FIG. 3

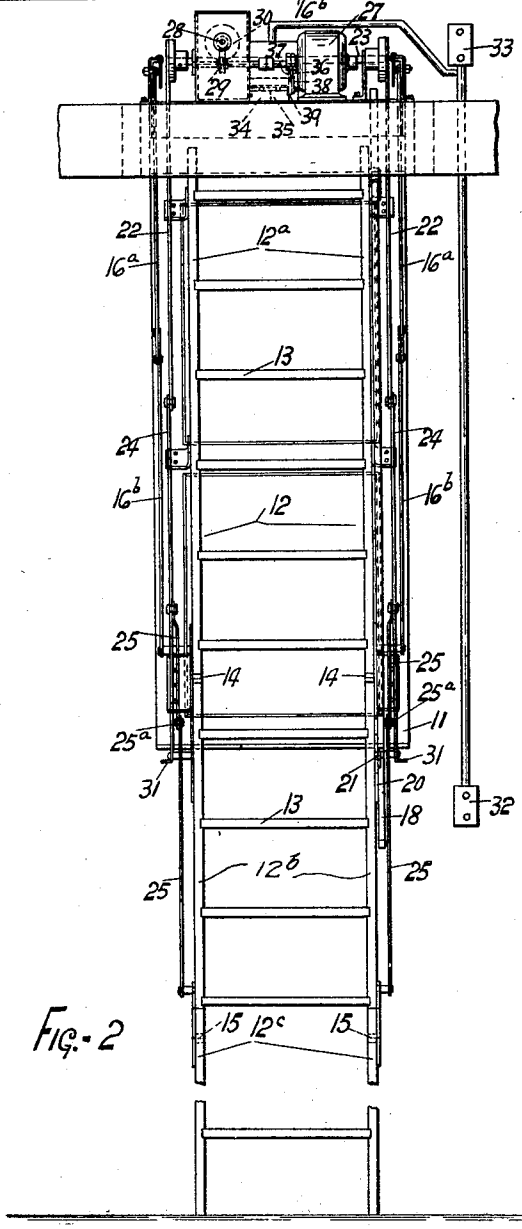


FIG. 2

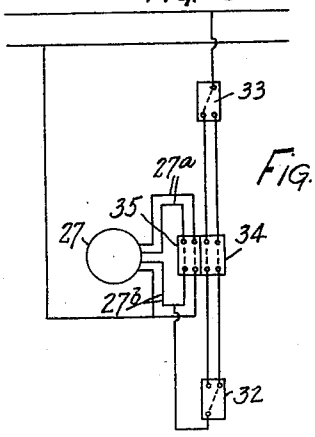


FIG. 7

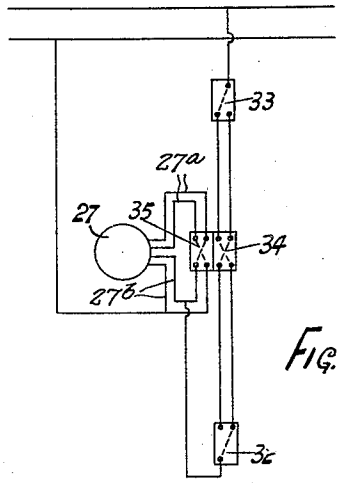


FIG. 4

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DISAPPEARING STAIRWAY

Application filed October 27, 1928. Serial No. 315,430.

This invention relates to disappearing stairways and particularly disappearing stairways of the folding type.

Folding stairways of the disappearing type which have heretofore been made have one or more sections, comprising the lower portion of the stairway, which must be manually folded and unfolded. Aside from the disadvantage of the separate manual actuation of these uncontrolled sections, they are likely to cause injury to one operating the stairway.

A particular object of the invention, therefore, is to provide means in combination with the stairway actuating mechanism for moving the folding sections to and from their extended position.

A further object of the invention is to provide a hand rail in combination with a folding stairway.

A further object of the invention is to provide in combination with a folding type of disappearing stairway power means, preferably electrical, for operating the same.

The foregoing and other objects of the invention are obtained in the disappearing stairway illustrated in the accompanying drawings and described below. It is to be understood that the invention is not limited to the particular form thereof shown and described.

Referring to the accompanying drawings,

Figure 1 is a side elevation, partly in section, of a disappearing stairway structure showing it extended for use;

Figure 2 is a front elevation thereof;

Figure 3 is a side elevation, partly in section, showing the stairway folded in its disappearing position;

Figure 4 is a wiring diagram for the stairway operating motor and control switches when the stairway is operated in one direction;

Figure 5 is a detail side elevation, partly in section, of the stopping and resetting switch control for the stairway operating motor;

Figure 6 is a detail end elevation of said switch control; and

Figure 7 is a view similar to Figure 4 showing the motor and switch circuit when the reversing switches have been thrown.

Referring to the drawings, the numeral 10 designates a rectangular opening in the ceiling of a lower room giving access to an upper room. Pivoted at one end of said opening to swing downwardly therefrom is a panel 11 on which is fixed sections 12^a, 12^a of a pair of stringers 12, 12 having a plurality of foldable sections 12^b, 12^b, 12^c, 12^c and between which are secured treads 13, 13. The sections 12^b are hinged to sections 12^a at 14, 14 and the sections 12^c are hinged to sections 12^b at 15, 15 so that section 12^b of the stair structure is foldable onto section 12^a and section 12^c is then foldable onto section 12^b, all on top of panel 11 as is shown in Figure 3.

The panel 11 is provided with supporting toggle linkages 16, 16, the upper links 16^a, 16^a of which are connected to brackets 17, 17 on each side of opening 10 by vertically adjusting means such as screws 17^a, 17^a, and the lower links 16^b, 16^b of which are pivotally connected to the outer sides of stringer sections 12^a. Reinforcing plates 50 on the stringer sections 12^a may be employed to facilitate the pivotal connection of the links 16^b thereto. The joint of toggles 16 is suitably designed to hold panel 11 against lifting until the toggles are broken.

A hand rail 18 may be provided on either or each side of the stairway, only one hand rail being herein shown on the right side thereof. This hand rail is slidably mounted adjacent one end on a rigid post 19 extending up from stringer section 12^a and it is secured on a foldable post 20 consisting of two parts pivoted together at 21, post 20 being mounted on a stringer 12^b.

The stairway actuating device includes arms 22 preferably on both sides of the stairway arranged to swing through opening 10 by being secured on a shaft 23 extending along the end of the opening 10 opposite that at which panel 11 is pivoted. Arms 22 have links 24, 24 connecting stairway section 12^b thereto to be lifted or lowered by said arms. Toggle linkages 25, 25 connect links 24 to upwardly directed extensions 26, 26 on stair-

way sections 12^c, 12^c, toggle linkages 25 being jointed at 25^a.

In order, when retracting the stairway, to break the toggles 16 as the stair structure is folded to permit elevation of the panel 11 to closed position, lugs or ears 31 are provided on the ends of links 24 which are hinged to stringers 12, the lugs being adapted to be swung into engagement with the toggles as the folding of the stair structure is being completed, whereby further movement of the arms 22 swings the panel 11 upwardly into place.

Suitable manually operable or power means may be provided for operation of the stairway. The preferred means comprises an electric motor 27 driving a shaft 28 through worm gearing 29 and worm gearing 30 for driving shaft 23 from shaft 28.

Control of the motor is effected by means of suitable manually operable three-way switches 32 and 33 suitably located on the lower and upper floors and connected as shown in Figures 4 and 7 through suitable standard reversing switches 34 and 35 to the motor. In the wiring diagrams the motor illustrated is a standard induction motor having starting leads 27^a and running leads 27^b. In Figure 4 is shown the wiring diagram just after one of the operating switches 32 or 33 has been thrown to start the motor. Both reversing switches are automatically thrown after operation of the stair structure to either of its positions by means of fingers 36 and 37 fixed to collars 40 and 41 adjustably clamped by set screws 42 and 43 on shaft 23 engaging interacting switch elements 38 and 39. Figure 7 illustrates the wiring diagram after one of the fingers 36 or 37 has thrown the reversing switches 34 and 35. It will be seen that switch 34 has broken the circuit and stopped the motor. The circuit can be completed by throwing either operating switch 32 or 33. However, when the circuit is again closed by either of the operating switches the switch 35 has reversed the starting leads 27^a so that the motor will be driven in the opposite direction, thus moving the stairway in the opposite direction. The other of the reversing fingers 36 or 37 will then come into operation to stop the stairway, as will be apparent.

When not in use, the stairway is in its disappeared position shown in Figure 3. It is lowered to the position shown in Figures 1 and 2 by operating either switch 32 or 33, the motor driving shaft 23 through the mechanism described, which swings arms 22 downwardly. Arms 22 act first to swing panel 11 downwardly until such movement is limited by toggles 16 and then by continued movement to unfold the stair structure through links 24 and toggle links 25. As section 12^b of the stairway is swung into place, the jointed post 20 which is collapsed in disappeared position, is straightened out and hand rail 18 slides downwardly on post 19 into its position of use. When the stairway is fully extended, the motor is stopped and connections are reversed as will be understood so that upon again actuating switch 32 or 33 after use of the stairway it may be retracted.

In actuating the stairway to disappeared position by operation of switches 32 or 33, upward swinging of arms 22 first folds sections 12^b and 12^c together on panel 11 and collapses post 20, sliding hand rail 18 upwardly, toggles 16 holding the panel down during this operation. Ears or lugs 31 then engage and break toggles 16, whereupon continued movement of the arms 22 swings the panel 11 up into closed position, carrying the whole folded stair structure thereon.

It will be apparent from the foregoing that a simple, effective disappearing stairway of the folding type has been provided with numerous advantageous features and in which the disadvantages and particularly the danger in the use of this type of stairway have been overcome. Obviously modifications of the invention may be resorted to without departing from the spirit thereof or the scope of the appended claims.

What is claimed is:—

1. A disappearing stairway of the folding type for use in an opening between lower and upper rooms, said stairway comprising a panel hinged at one end of said opening to close the same, toggle linkages for supporting the panel in its open position, said linkages being adapted to hold the panel against lifting until they are broken, a foldable stair structure including one section mounted on top of said panel and two folding sections hinged together and to said first section and foldable on each other and onto the first section and a hand rail slidably supported by a post on the first section and secured onto a collapsible post on the adjacent folding section so as to be slid upwardly when the stairway is folded, means for operating said stairway to and from an extended position, said means comprising arms one on each side of the stairway adapted to be swung from the other end of the opening through the opening, links connecting the arms to the upper folding section, toggle linkages connecting the said links to the other folding section, means associated with the stairway operating means and operable against the first-named toggle linkage to break the same as the folding of the stairway is completed in the disappearing operation, and means for swinging said arms comprising a shaft on which the arms are secured, an electric motor for rotating the shaft, switch means for starting the motor and means controlled by movement of the stairway for stopping the motor and for reversing the connection to the motor for a succeeding operation of the stairway as

the stairway is moved to its extended or disappeared positions.

2. A disappearing stairway of the folding type for use in an opening between lower and upper rooms, said stairway comprising a panel hinged at one end of said opening to close the same, toggle linkages for supporting the panel in its open position, said linkages being adapted to hold the panel against lifting until they are broken, and a foldable stair structure including one section mounted on top of said panel and two folding sections hinged together and to said first section and foldable on each other and onto the first section, means for operating said stairway to and from an extended position, said means comprising arms one on each side of the stairway adapted to be swung from the other end of the opening through the opening, links connecting the arms to the upper folding section, toggle linkages connecting the said links to the other folding section, means associated with the stairway operating means and operable against the first-named toggle linkage to break the same as the folding of the stairway is completed in the disappearing operation, and means for swinging said arms comprising a shaft on which the arms are secured, an electric motor for rotating the shaft, switch means for starting the motor and means controlled by movement of the stairway for stopping the motor and for reversing the connection to the motor for a succeeding operation of the stairway as the stairway is moved to its extended or disappeared positions.

3. A disappearing stairway of the folding type for use in an opening between lower and upper rooms, said stairway comprising a panel hinged at one end of said opening to close the same, toggle linkages for supporting the panel in its open position, said linkages being adapted to hold the panel against lifting until they are broken and a foldable stair structure including one section mounted on top of said panel and two folding sections hinged together and to said first section and foldable on each other and onto the first section, means for operating said stairway to and from an extended position, said means comprising arms one on each side of the stairway adapted to be swung from the other end of the opening through the opening, links connecting the arms to the upper folding section, toggle linkages connecting the said links to the other folding section, means associated with the stairway operating means and operable against the first-named toggle linkage to break the same as the folding of the stairway is completed during the disappearing operation, and means for swinging said arms as the stairway is moved to its extended or disappeared positions.

4. A disappearing stairway of the folding type for use in an opening between lower and upper rooms, said stairway comprising a panel hinged at one end of said opening to close the same, toggle linkages for supporting the panel in its open position, said linkages being adapted to hold the panel against lifting until they are broken and a foldable stair structure including one section mounted on top of said panel and two folding sections hinged together and to said first section and foldable on each other and onto the first section, means for operating said stairway to and from an extended position, said means comprising an arm adapted to be swung from the other end of the opening through the opening, a link connecting the arm to the upper folding section, toggle linkage connecting the said link to the other folding section, means associated with the stairway operating means and operable against the first-named toggle linkage to break the same as the folding of the stairway is completed during the disappearing operation, and means for swinging said arm comprising a shaft on which the arm is secured, an electric motor for rotating the shaft, switch means for starting the motor and means controlled by movement of the stairway for stopping the motor and for reversing the connection to the motor for a succeeding operation of the stairway as the stairway is moved to its extended or disappeared positions.

5. A disappearing stairway of the folding type for use in an opening between lower and upper rooms, said stairway comprising a panel hinged at one end of said opening to close the same, toggle linkages for supporting the panel in its open position, said linkages being adapted to hold the panel against lifting until they are broken and a foldable stair structure including one section mounted on top of said panel and two folding sections hinged together and to said first section and foldable on each other and onto the first section, means for operating said stairway to and from an extended position, said means comprising an arm adapted to be swung from the other end of the opening through the opening, a link connecting the arm to the upper folding section, toggle linkage connecting the said link to the other folding section, means associated with the stairway operating means and operable against the first-named toggle linkage to break the same as the folding of the stairway is completed during the disappearing operation, and means for swinging said arm as the stairway is moved to its extended or disappeared positions.

6. A disappearing stairway of the folding type for use in an opening between lower and upper rooms, said stairway comprising a panel hinged at one end of said opening to close the same, means for supporting the panel in its open position and adapted to hold the panel against lifting and a foldable

stair structure including one section mounted on top of said panel and two folding sections hinged together and to said first section and foldable on each other and onto the first section, means for operating said stairway to and from an extended position, said means comprising arms one on each side of the stairway adapted to be swung from the other end of the opening through the opening, links connecting the arms to the upper folding section, toggle linkages connecting the said links to the other folding section, means associated with the stairway operating means and operable to release the panel supporting means as the folding of the stairway is completed during the disappearing operation, and means for swinging said arms comprising a shaft on which the arms are secured, an electric motor for rotating the shaft, switch means for starting the motor and means controlled by movement of the stairway for stopping the motor and for reversing the connection to the motor for a succeeding operation of the stairway as the stairway is moved to its extended or disappeared positions.

7. A disappearing stairway of the folding type for use in an opening between lower and upper rooms, said stairway comprising a panel hinged at one end of said opening to close the same, means for supporting the panel in its open position and adapted to hold the panel against lifting and a foldable stair structure including one section mounted on top of said panel and two folding sections hinged together and to said first section and foldable on each other and onto the first section, means for operating said stairway to and from an extended position, said means comprising arms on each side of the stairway adapted to be swung from the other end of the opening through the opening, links connecting the arms to the upper folding section, toggle linkages connecting the said links to the other folding section, means associated with the stairway operating means and operable to release the panel supporting means as the folding of the stairway is completed during the disappearing operation, and means for swinging said arms as the stairway is moved to its extended or disappeared positions.

8. A disappearing stairway of the folding type for use in an opening between lower and upper rooms, said stairway comprising a panel hinged at one end of said opening to close the same, means for supporting the panel in its open position and adapted to hold the panel against lifting and a foldable stair structure including one section mounted on top of said panel and two folding sections hinged together and to said first section and foldable on each other and onto the first section, means for operating said stairway to and from an extended position, said means comprising an arm adapted to be swung from the other end of the opening through the opening, a link connecting the arm to the upper folding section, toggle linkage connecting the said link to the other folding section, means associated with the stairway operating means and operable to release the panel supporting means as the folding of the stairway is completed during the disappearing operation, and means for swinging said arm comprising a shaft on which the arm is secured, an electric motor for rotating the shaft, switch means for starting the motor and means controlled by movement of the stairway for stopping the motor and for reversing the connection to the motor for a succeeding operation of the stairway as the stairway is moved to its extended or disappeared positions.

9. A disappearing stairway of the folding type for use in an opening between lower and upper rooms, said stairway comprising a panel hinged at one end of said opening to close the same, means for supporting the panel in its open position and adapted to hold the panel against lifting and a foldable stair structure including one section mounted on top of said panel, and two folding sections hinged together and to said first section and foldable on each other and onto the first section, means for operating said stairway to and from an extended position, said means comprising an arm adapted to be swung from the other end of the opening through the opening, a link connecting the arm to the upper folding section, toggle linkage connecting the said link to the other folding section, means associated with the stairway operating means and operable to release the panel supporting means as the folding of the stairway is completed during the disappearing operation, and means for swinging said arm as the stairway is moved to its extended or disappeared positions.

10. A disappearing stairway of the folding type for use in an opening between lower and upper rooms, said stairway comprising a panel hinged at one end of said opening to close the same, toggle linkages for supporting the panel in its open position, said linkages being adapted to hold the panel against lifting until they are broken, a foldable stair structure including one section mounted on top of said panel and two folding sections hinged together and to said first section and foldable on each other and onto the first section and a hand rail slidably supported by a post on the first section and secured onto a collapsible post on the upper folding section so as to be slid upwardly when the stairway is folded, and means for operating said stairway to and from an extended position, said means comprising means for lowering and raising the panel and means associated therewith operable to unfold the foldable sections after the panel is lowered and to fold the

foldable sections before the panel is raised as the stairway is moved to its extended or disappeared positions.

11. A disappearing stairway of the folding type for use in an opening between lower and upper rooms, said stairway comprising a panel hinged at one end of said opening to close the same, toggle linkages for supporting the panel in its open position, said linkages being adapted to hold the panel against lifting until they are broken, and a foldable stair structure including one section mounted on top of said panel and two folding sections hinged together and to said first section and foldable on each other and onto the first section, and means for operating said stairway to and from an extended position, said means comprising means for lowering and raising the panel and means associated therewith operable to unfold the foldable sections after the panel is lowered and to fold the foldable sections before the panel is raised as the stairway is moved to its extended or disappeared positions.

12. A disappearing stairway of the folding type for use in an opening between lower and upper rooms, said stairway comprising a panel hinged at one end of said opening to close the same, toggle linkages for supporting the panel in its open position, said linkages being adapted to hold the panel against lifting until they are broken, and a foldable stair structure including one section mounted on top of said panel and two folding sections hinged together and to said first section and foldable on each other and onto the first section, and means for operating said stairway to and from an extended position, said means comprising means for lowering and raising the panel and means associated therewith operable to unfold the foldable sections after the panel is lowered and to fold the foldable sections before the panel is raised as the stairway is moved to its extended or disappeared positions.

13. A disappearing stairway of the folding type for use in an opening between lower and upper rooms, said stairway comprising a panel hinged at one end of said opening to close the same, means for supporting the panel in its open position and adapted to hold the panel against lifting, and a foldable stair structure including one section mounted on top of said panel and two folding sections hinged together and to said first section and foldable on each other and onto the first section, and means for operating said stairway to and from an extended position, said means comprising means for lowering and raising the panel and means associated therewith operable to unfold the foldable sections after the panel is lowered and to fold the foldable sections before the panel is raised as the stairway is moved to its extended or disappeared positions.

14. A disappearing stairway of the folding type for use in an opening between lower and upper rooms, said stairway comprising a panel hinged at one end of said opening to close the same, means for supporting the panel in its open position and adapted to hold the panel against lifting, and a foldable stair structure including one section mounted on top of said panel and two folding sections hinged together and to said first section and foldable on each other and onto the first section, and means for operating said stairway to and from an extended position, said means comprising means for lowering and raising the panel and means associated therewith operable to unfold the foldable sections after the panel is lowered and to fold the foldable sections before the panel is raised as the stairway is moved to its extended or disappeared positions.

15. In a disappearing stairway adapted for use in an opening between a lower and upper floor, a movable panel closure for the opening, a foldable stair structure carried by the panel, means for opening and closing the panel, and means actuated thereby for positively unfolding and folding the stairway.

16. In a disappearing stairway adapted for use in an opening between a lower and upper floor, a movable panel closure for the opening, a foldable stair structure carried by the panel, a collapsible hand rail structure associated with the stair structure, means for opening and closing the panel, and means associated therewith for unfolding and folding the stairway, said hand rail structure being collapsible by folding of the stairway.

17. In a disappearing stairway adapted for use in an opening between a lower and upper floor, a movable panel closure for the opening, a foldable stair structure carried by the panel, means for opening and closing the panel, means associated therewith for unfolding and folding the stairway, power means for operating the panel opening and closing means, and control means for stopping and resetting the power means for reverse operation at the completion of each operation of the stairway.

18. In a disappearing stairway adapted for use in an opening between a lower and upper floor, a movable panel closure for the opening, a foldable stair structure carried by the panel, and a collapsible hand rail structure mounted on the stair structure and adapted to be collapsed by folding thereof.

19. In a disappearing stairway of the folding type adapted for use in a ceiling opening between a lower and upper floor, a panel hinged at one edge of the opening providing a downwardly opening closure for said opening, a folding stair structure including three sections hinged together end on end on said panel, automatic means for positively unfolding and folding the three sections of the stair

structure when the panel is open, said means including connections between the three sections, and means for supporting the panel in its open position, said means being adjustable to support the lower end of the unfolded stairway substantially at the lower floor level in rooms having different ceiling heights.

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