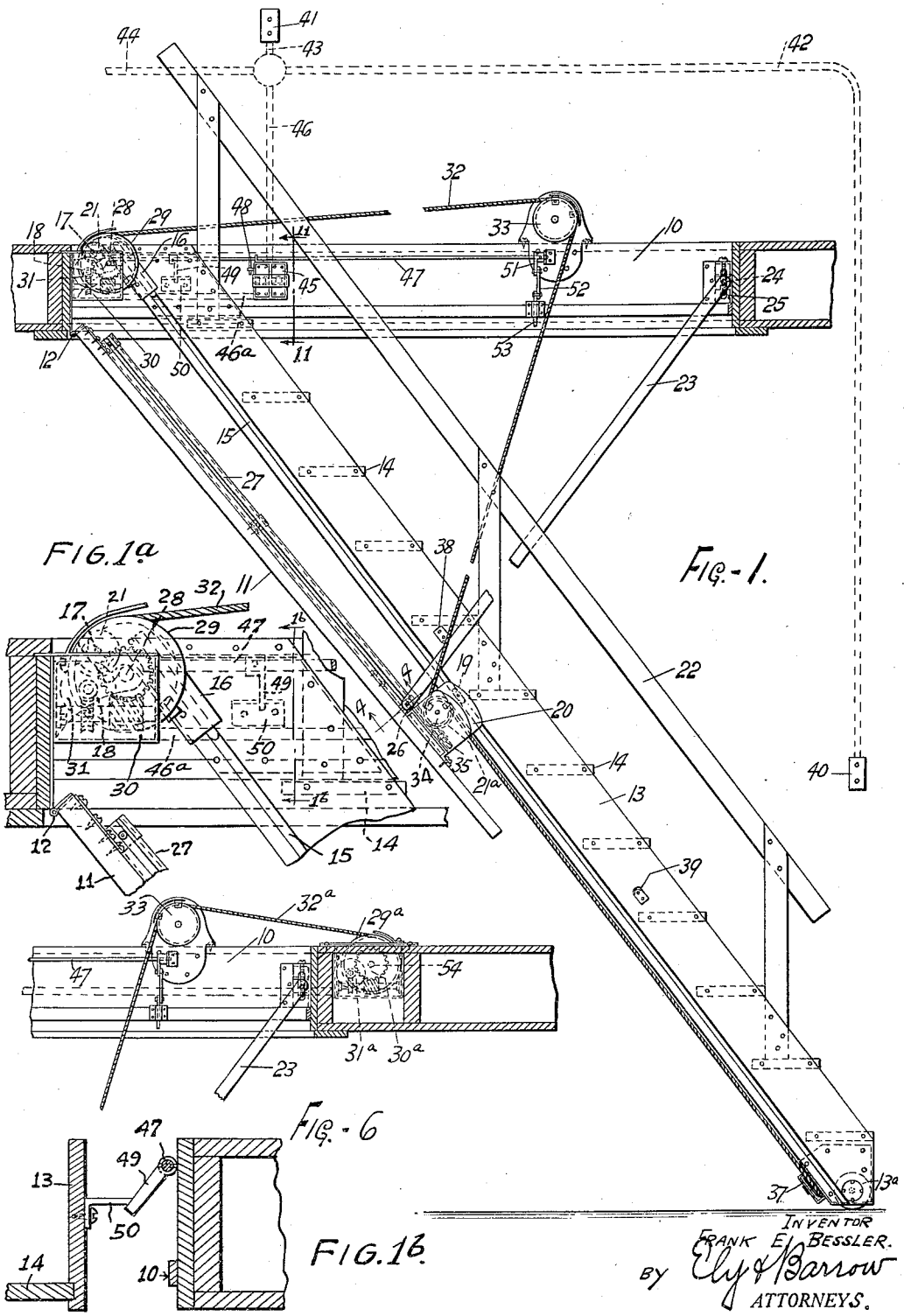
May 17, 1932. F. E. BESSLER 1,858,981

DISAPPEARING STAIRWAY

Filed Nov. 30, 1928 4 Sheets-Sheet 1



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DISAPPEARING STAIRWAY

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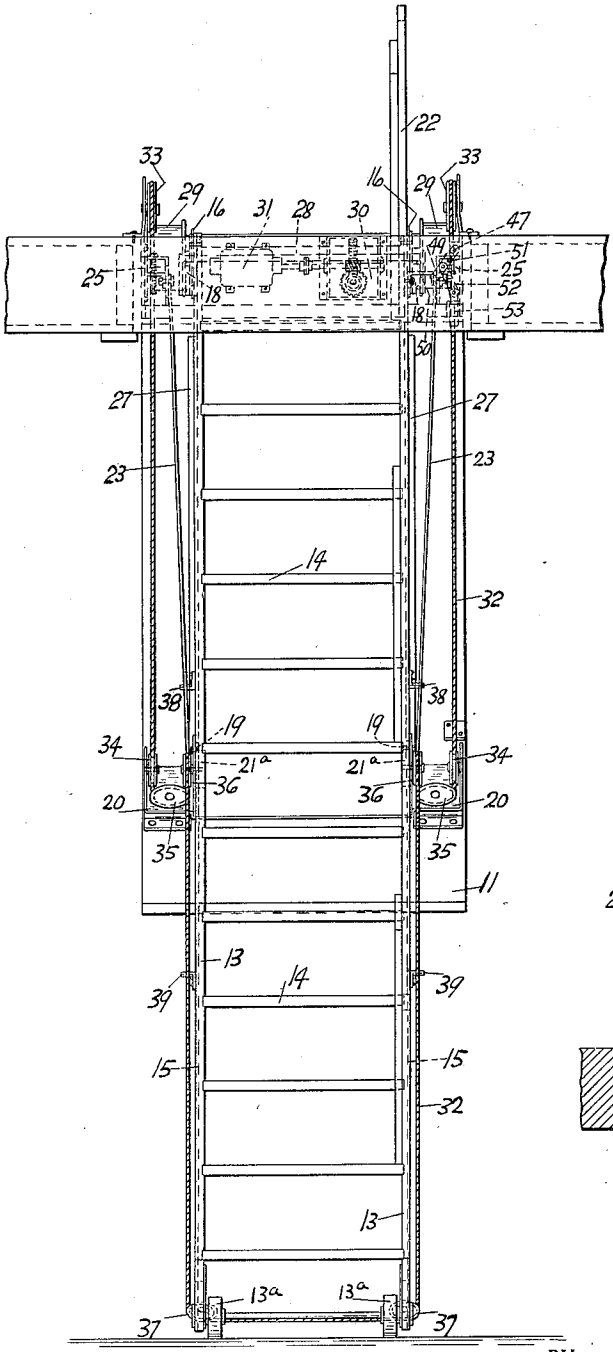


FIG. - 2

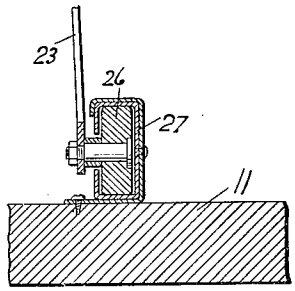


FIG. - 4.

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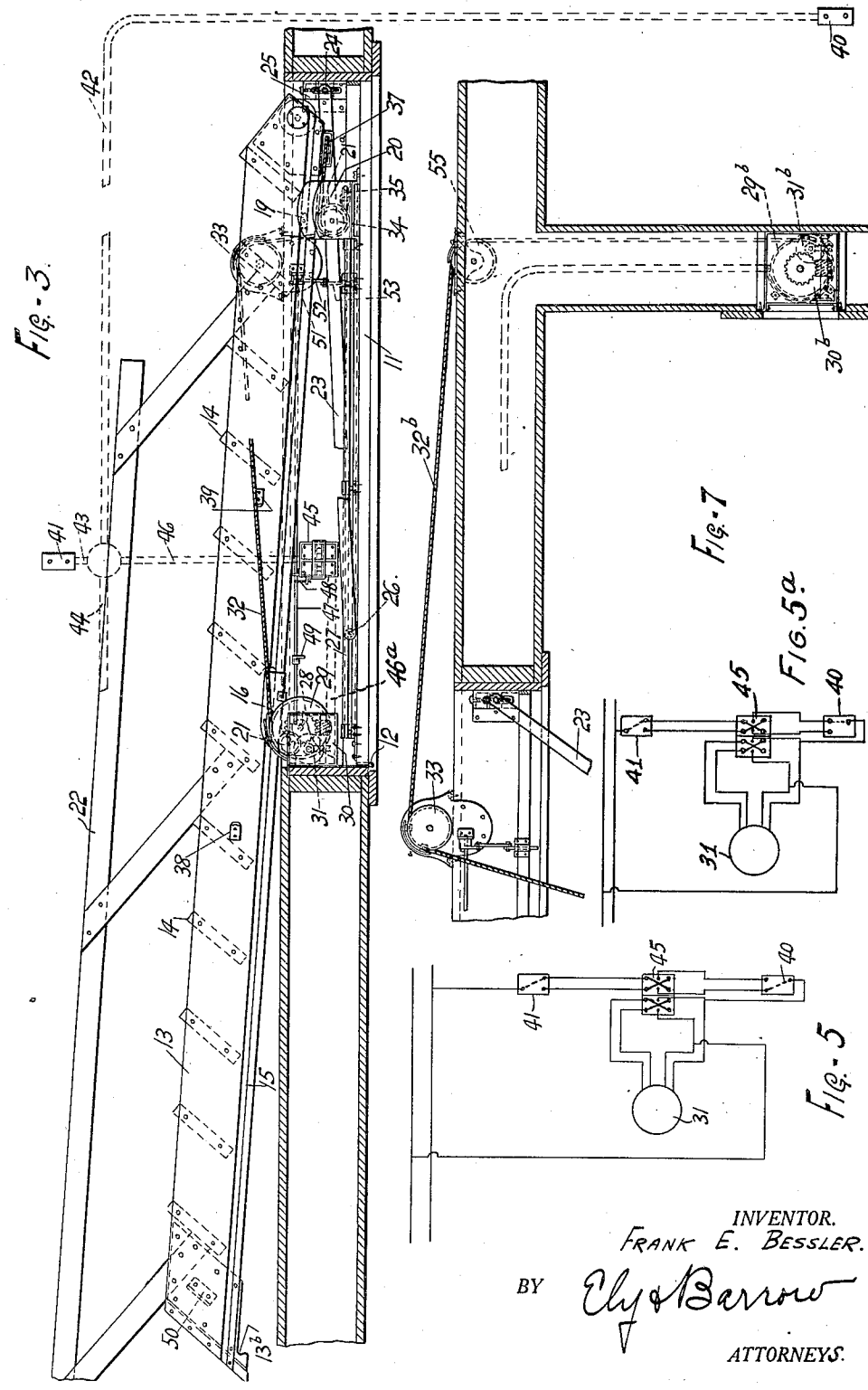


Fig. 3.

Fig. 7

Fig. 5a

Fig. 5

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DISAPPEARING STAIRWAY

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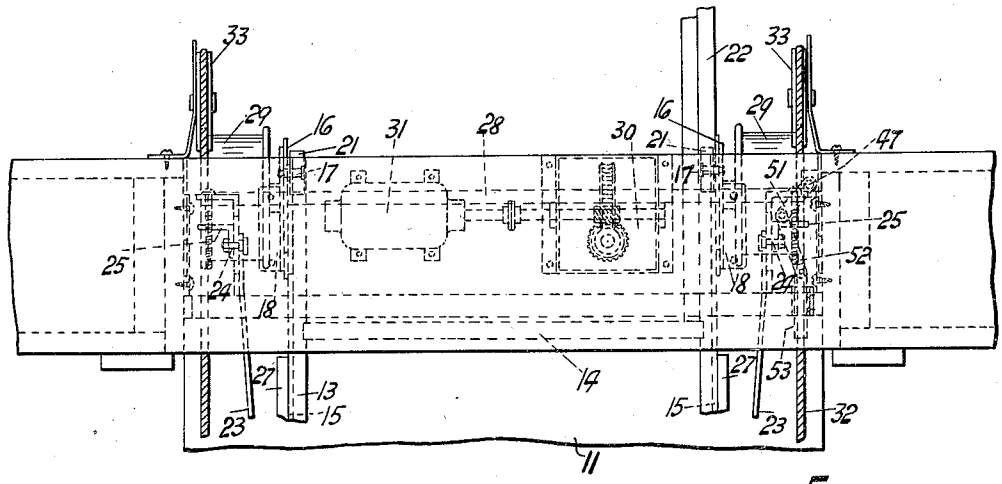


FIG. 8.

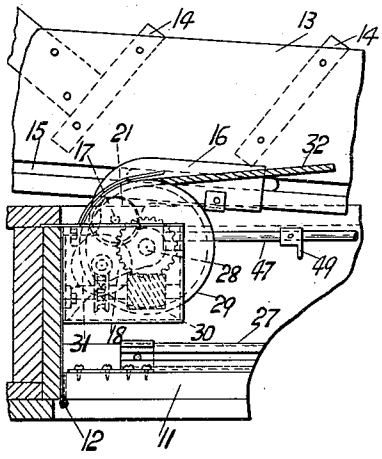


FIG. 9

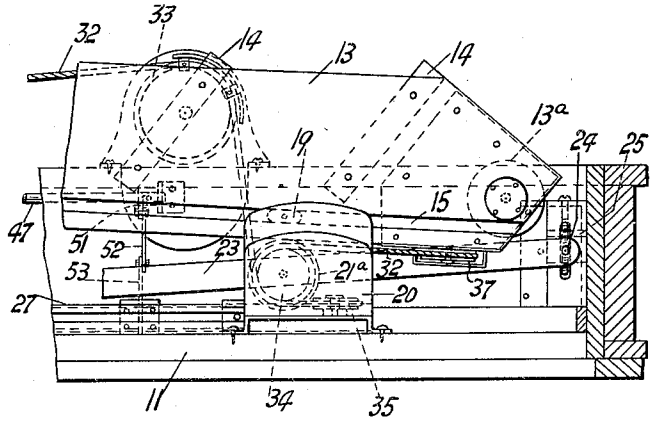


FIG. 10

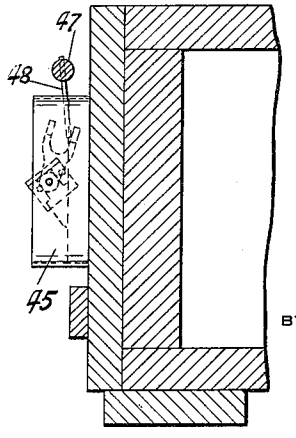


FIG. 11

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UNITED STATES PATENT OFFICE

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DISAPPEARING STAIRWAY

Application filed November 30, 1928. Serial No. 322,611.

This invention relates to disappearing stairways of that type carried by a movable ceiling panel.

The general purpose of the invention is to provide a simple stairway construction and operating mechanism for effectively operating the same between its disappeared and extended positions.

A particular object of the invention is to provide a stairway construction arranged to be motor operated so that the motor may be mounted in positions between the joists or studding in the building in which the stairway is installed.

A further object of the invention is to provide improved means adapted to be actuated by movement of the stairway to stop the motor and reverse the connections thereto as the stairway moves into its extended and disappeared positions.

A further object is to provide improved means for supporting the panel to hold it against lifting while the stair structure is moved up on the panel prior to closing of the panel, said supporting means being releasable by movement of the stair structure to permit closing of the panel.

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

Of the accompanying drawings,

Figure 1 is a side elevation, partly in section, of a stairway embodying the invention shown extended;

Figure 1[a] is an enlarged view of the upper left hand portion of Figure 1;

Figure 1[b] is a section on line 1[b]—1[b] of Figure 1[a];

Figure 2 is a front elevation of the extended stairway;

Figure 3 is a view similar to Figure 1, showing the stairway in its collapsed or disappeared position;

Figure 4 is a section on line 4—4 of Figure 1;

Figure 5 is a wiring diagram of the motor and control switch circuit, showing the connections established by the switches when the stairway is operated in one direction;

Figure 5[a] is a similar view showing the connections when the stairway is operated in the other direction;

Figure 6 is a detail side elevation showing a modified arrangement of the motor drive for the stairway;

Figure 7 is a detail side elevation of another modified arrangement of the motor drive for the stairway;

Figure 8 is an enlarged elevation of the top portion of Figure 2;

Figure 9 is an enlarged elevation of the mechanism in the left of the ceiling opening in Figure 3;

Figure 10 is an enlarged elevation of the right portion of Figure 3; and

Figure 11 is a section on line 11—11 of Figure 1.

Referring to the drawings, the numeral 10 designates an opening in the ceiling of a room between lower and upper floors. A panel 11 supporting the stairway is arranged to close said opening, it being hinged at 12 at one end of the opening.

The stairway structure includes stringers 13, 13 and treads 14, 14, the stringers being provided with grooved formations at 15, 15 on their outer edges in which are engaged tongue formations on brackets 16, 16, pivoted at 17 on brackets 18 secured to the end of the opening above the hinged end of panel 11, and in which grooves 15 are also engaged swiveled tongue members 19 mounted on brackets 20 adjacent the free end of panel 11. The stair structure is accordingly slidable on brackets 18 and 20 and is capable of swinging about the former as the panel is being swung either open or shut. Rollers are provided at 21 on pivots 17 and at 21[a] on brackets 20 to engage under the lower edges of the stringers to carry the load of the stair structure so as to permit free sliding thereof. This mode of mounting the stairway on the panel is standard and detailed description and drawings thereof, accordingly, are not necessary to understand the present invention. A suitable hand rail 22 may be mounted on one or both stringers

13 and rollers 13[a] may be provided on the bottoms of the stringers for contacting with the floor. Hook members 13[b] on the tops of the stringers are arranged to engage over a shaft 28 extending transversely across opening 10 above hinges 12 to support the upper end of the stairway when in its extended position.

For supporting the panel and preventing closure thereof until the stair structure has been slid to its retracted position thereon, a pair of links 23 are provided. These links are pivoted at one end as at 24 on vertically adjustable blocks 25 arranged on the sides of opening 10 adjacent the end of the opening remote from hinges 12 and are provided with rollers 26 at the other end engaged in tracks 27 running along the opposite side edges of panel 11. Tracks 27 are of such extent that links 23 swing from positions along the panel when the structure is retracted through the ceiling opening to positions beyond a perpendicular to the panel when the stairway is extended. By reason of the latter positioning of the links, the panel is held down while the stair structure is drawn up on the panel prior to closing of the panel.

The operating mechanism for the stairway includes cable drums 29, 29 which may be mounted on shaft 28 on the outer sides of the stairway and which are arranged to be driven through suitable reduction gearing 30 by a motor 31 supported on the end wall of opening 10 above hinges 12. A cable 32 has its ends wound on drums 29 and is trained over sheaves 33, supported on the sides of opening 10 toward the other end thereof. From sheaves 33 the cable 32 is extended downwardly about sheaves 34 arranged on brackets 20 adjacent the outer edges of and perpendicular to panel 11, then about sheaves 35 rotatably mounted on brackets 20 parallel to panel 11, then about sheaves 36 also on panel brackets 20 opposite sheaves 34 which bring the cable stretches along side of the stringers and finally the cable passes about sheaves 37 mounted adjacent the ends of the stringers, the cable extending between said sheaves under the stairway structure. By this arrangement of the cable the tensions in the various stretches on opposite sides of the stairway are equalized throughout the operation of the stairway.

To actuate the links 23 beyond their "dead center" position perpendicular to the stairway, lugs 38 on stringers 13 are arranged to engage the lower portions of the links and to shove them downwardly as the stair structure descends to its fully extended position. Lugs 39 similar to lugs 38 are provided on the stairway stringers to engage and push the links 23 back through their "dead center" position as the stair structure is pulled up on the panel to permit closing of the panel.

To control the motor 31, it is arranged in a circuit, supply lines for which may be extended to the stairway by a conduit 44, said circuit including manually operable switches 40 and 41 on the respective floor levels connected by leads in conduits 42 and 43 to the motor through leads in a conduit 46 and an automatic stopping and reverse switch box 45 and finally leads in a conduit 46[a]. A rock shaft 47 is journaled along one side of opening 10 and has an arm thereon at 48 for actuating the stopping and reversing switch 45 when said shaft is rocked in either direction. An arm 49 on said rock shaft is arranged in the path of a cam plate 50 on one stringer 13 to rock the shaft 47 in one direction as the stairway moves into its extended position. Another arm 51 is mounted on shaft 47 and is connected by a link 52 to a thrust rod 53 arranged to be moved upwardly by the panel 11 as it is closed to rock shaft 47 in the other direction.

In the modification of the invention illustrated in Figure 6, the motor 31[a], reduction gearing 30[a] and drums 29[a] are mounted near the opposite end of opening 10 between joists between the ceiling of the lower room and the floor of the upper room, the drums being mounted on a shaft 54 and the cable 32[a] extending from said drums over sheaves 33 and down to the panel and stair structure as in Figure 1.

In the modification shown in Figure 7, the motor 31[b], reduction gearing 30[b] and the drums 29[b] are mounted in a wall or partition of one of the rooms between the studding and the cable 32[b] is trained over sheaves 55 at the upper floor level and extends from said sheaves over the sheaves 33 and down to the panel and stair structure as in Figure 1.

When not in use, the stairway is in the position shown in Figure 3. To operate it to its extended position, either of switches 40 or 41 are actuated. This starts the motor 31, paying out cable from drums 29 and permitting the panel and stair structure to swing downwardly under the action of gravity. After the panel 11 is swung clear of opening 10, gravity becomes effective upon the stair structure, also causing it to slide downwardly on the panel. Links 23 during this action swing to a position perpendicular to the panel and are engaged by the lugs 38 on the descending stair structure and are forced beyond their dead center positions to lock the stair structure down. As the stringers 13 engage the floor, the hook members 13[b] engage over shaft 28 and support the upper end of the stair structure. At this time cam plate 50 engages arm 49 on rock shaft 47 and rocks the shaft which through arm 48 throws the stopping and reversing switch 45, thus stopping motor 31 and resetting its connections so that it will be driven in the opposite direction when either of switches 40 and 41 are again actuated.

When the stairway is to be retracted after use, either of switches 40 or 41 is again actuated. This causes drums 29 to wind cable 32 up, acting first to draw the stair structure up on panel 11 which is held down by links 23 due to their off-dead center positions. As the stair structure moves into its retracted position on panel 11, the lugs 39 engage links 23 and push them upwardly past their dead center positions, whereupon the pull in the cable 32 is effective on the panel to lift it into its ceiling opening, at which time it engages push rod 53 and through link 52 and arm 51 rocks shaft 47 in the opposite direction, causing arm 48 to throw switch 45 in the opposite direction to stop the motor and to reset the connections thereto for further operation of the stairway.

It will appear from the foregoing that a simple, effective stairway construction has been provided and one which, while not limited to motor operation, is readily adaptable for motor operation with the motor located at more or less remote points.

It will also appear that an operating motor and connections have been provided which permit installation of the motor at any of numerous concealed points either in the stairway opening or between joists in the partition between the ceiling of the lower room and the floor of the upper room or in a wall or partition of one of these rooms.

Modifications of the invention other than those disclosed herein 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 ceiling panel type comprising, in combination, a panel hinged at one end of the ceiling opening, a stair structure carried by the panel and extensible and retractible thereon to reach the lower floor, links pivoted at their upper ends on each side of the opening, tracks along the side edges of the panels on which the lower ends of said links run, said tracks permitting movement of the links beyond dead center positions perpendicular to the panel, means on the stair structure for engaging the links as the stair structure is extended to move the links beyond said dead center position, means on the stair structure for engaging the links to move them back of their dead center position as the stair structure is retracted, and means for lowering and raising the panel and extending and retracting the stair structure.

2. A disappearing stairway of the ceiling panel type comprising, in combination, a panel hinged at one end of the ceiling opening, a stair structure carried by the panel and extensible and retractible thereon to reach the lower floor, link means for supporting the panel, track means extending along the panel in which the link means is engaged and permitting swinging of the link means through a dead center position, means operable by extension of the stairway to swing the link means beyond its dead center position, means operable by retraction of the stairway to swing the link means back of dead center position to permit closing of the panel, and means for lowering and raising the panel and extending and retracting the stair structure.

3. A disappearing stairway for a ceiling opening comprising a panel hinged in the opening, a stair structure extensible and retractible on the panel, and means for opening and closing the panel and for extending and retracting the stairway, said means comprising cable drums located adjacent the panel hinges in the opening, a motor mounted in the opening adjacent the cable drums, reduction gearing in the opening between the motor and the drums, sheaves on each side of the opening toward the other end thereof, sets of sheaves on each side of the free end of the panel, cable stretches extending from the drums, over the first-named sheaves, then downwardly about said sets of sheaves, the latter providing means to bring the cable stretches adjacent the sides of the stairway, said cable stretches being connected to the lower end of the stairway, means manually operable to start the motor and means operable by the stairway to stop the motor and reverse the motor connections as the stairway is moved into its extended and disappeared positions.

4. A disappearing stairway for a ceiling opening comprising a panel hinged at one end of the opening, a stairway extensible and retractible on the panel, sheaves on each side of the opening toward the end thereof opposite the panel hinges, a unit including a motor, cable drums and reduction gearing between the motor and drums, said unit being adapted to be mounted at any of a plurality of positions adjacent to or remote from the ceiling opening, cable stretches from the drums over said sheaves, and means on the free end of the panel over which the cable stretches are trained from said sheaves, said cable stretches being connected to the stairway to extend and retract the stairway on the panel and to open and close the panel.

5. A disappearing stairway for a ceiling opening comprising a panel hinged at one end of the opening, a stairway extensible and retractible on the panel, means on the side of the opening over which a stairway operating cable may be trained, a unit including power means and a cable drum operable thereby, said unit being adapted to be mounted at any of a plurality of positions adjacent to or remote from said ceiling opening, and a cable extending from the drum over said means to the panel and stairway to open and close the panel and to extend and retract the stairway.

6. A disappearing stairway of the ceiling panel type, said stairway including a panel hinged at one end in a ceiling opening, a stair structure extensible and retractible on the panel, means for opening and closing the panel and extending and retracting the stairway, a motor for operating said means, a manually operable switch for starting the motor, switch means for stopping the motor and reversing the connections thereto after each operation thereof, and means operable by the stairway construction for operating the switch means as the stairway is moved into its extended and retracted positions, said switch means being mounted on one side of the ceiling opening, and said switch operating means comprising a rock shaft extended along said side of the ceiling opening, an arm on the rock shaft adjacent the end on which the panel hinges, a cam plate on the stair structure adapted to engage said arm to rock said shaft in one direction as the stairway moves into its extended position, a second arm on the rock shaft, a push rod adapted to be engaged by the panel as it closes, a link connecting the push rod and said second arm to rock said shaft in the other direction as the panel closes, and means on the rock shaft for actuating the switch means therefrom.

7. A disappearing stairway of the ceiling panel type, said stairway including a panel hinged at one end in a ceiling opening, a stair structure extensible and retractible on the panel, means for opening and closing the panel and extending and retracting the stairway, a motor for operating said means, a manually operable switch for starting the motor, switch means for stopping the motor and reversing the connections thereto after each operation thereof, and means operable by the stairway construction for operating the switch means as the stairway is moved into its extended and disappeared positions, said switch operating means comprising a rock shaft, an arm on the rock shaft, a cam plate on the stair structure adapted to engage said arm to rock said shaft in one direction as the stairway moves into its extended position, a second arm on the rock shaft, a push rod adapted to be engaged by the panel as it closes, a link connecting the push rod and said second arm to rock said shaft in the other direction as the panel closes, and means on the rock shaft for actuating the switch means therefrom.

8. In a disappearing stairway of the ceiling panel type, including a movable panel, a stair structure extensible and retractible on the panel, means for opening and closing the panel and extending and retracting the stairway, said means comprising a unit including a motor and cable drum driven thereby adapted to be placed at any of a plurality of positions more or less remote, and means adjacent the ceiling opening over which cable may be extended from the cable drum to the panel and stairway to operate the same.

9. In a disappearing stairway of the ceiling panel type, a panel movable to and from open and closed positions, a stair structure extensible and retractible on the panel, cable means including a cable drum and motor unit for opening and closing the panel and extending and retracting the stair structure, and means at the ceiling opening over which the cable means is trained whereby said cable may be extended to said cable drum and motor unit at positions adjacent to or remote from said ceiling panel.

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