Aug. 11, 1936. C. TRAUT 2,050,593

COLLAPSIBLE STAIRWAY

Filed July 13, 1933 3 Sheets-Sheet 1

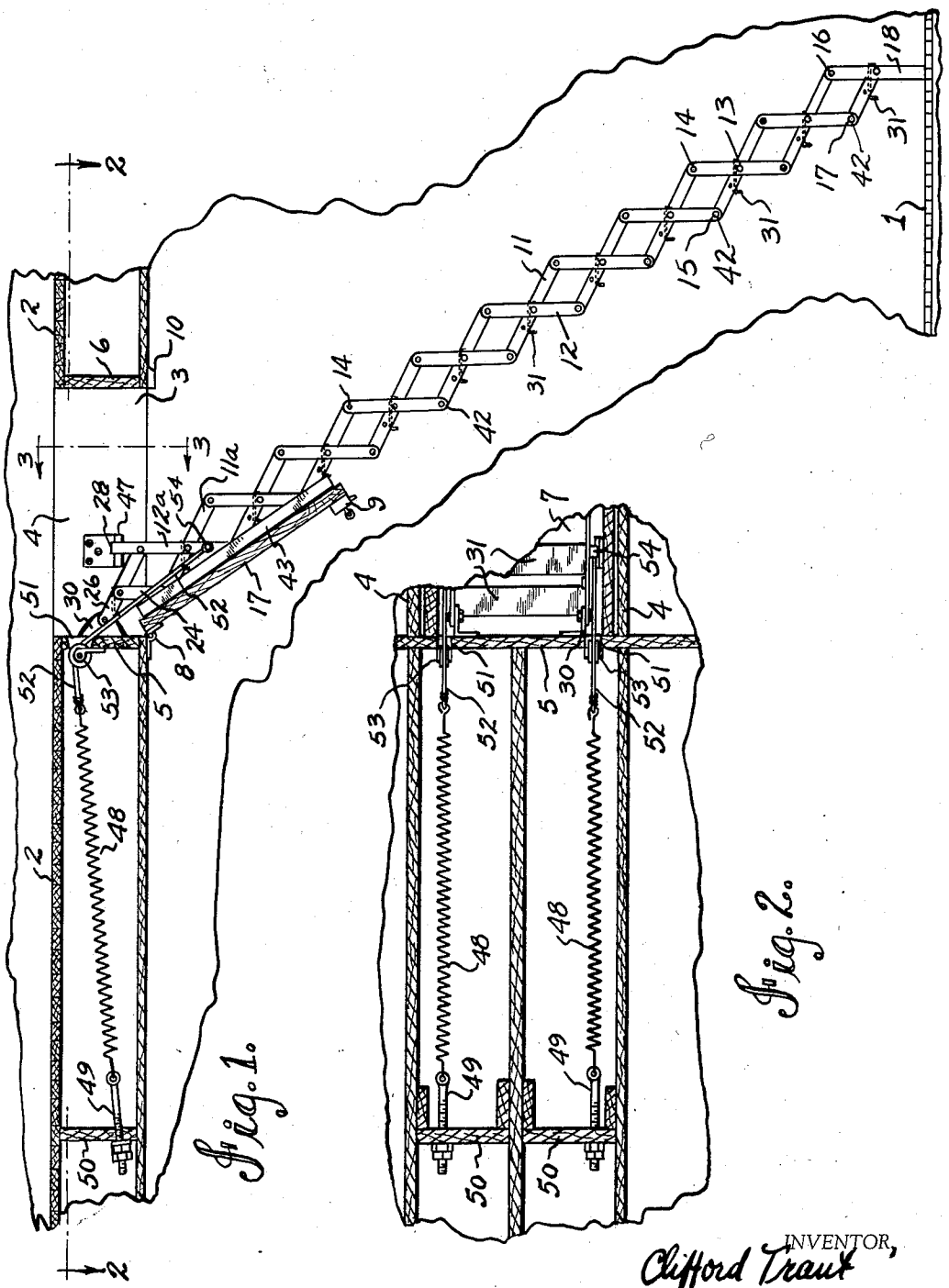


Fig. 1.



Fig. 2.

INVENTOR,
Clifford Traut
BY Allen & Allen
ATTORNEYS

Aug. 11, 1936. C. TRAUT 2,050,593

COLLAPSIBLE STAIRWAY

Filed July 13, 1933 3 Sheets-Sheet 2

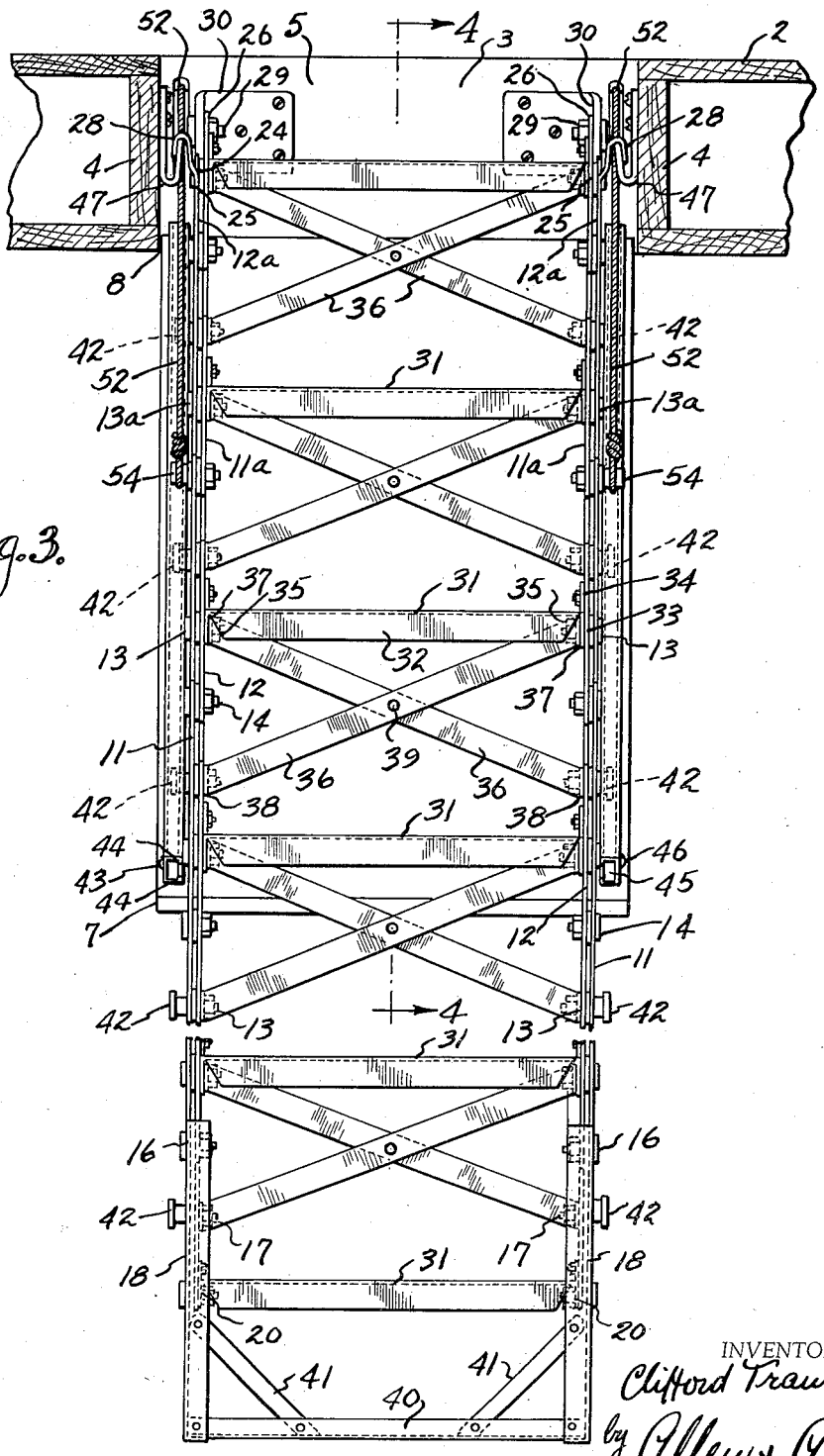



Fig. 3.

INVENTOR.
Clifford Traut
by Allen & Allen
ATTORNEY.

Aug. 11, 1936. C. TRAUT 2,050,593

COLLAPSIBLE STAIRWAY

Filed July 13, 1933 3 Sheets-Sheet 3

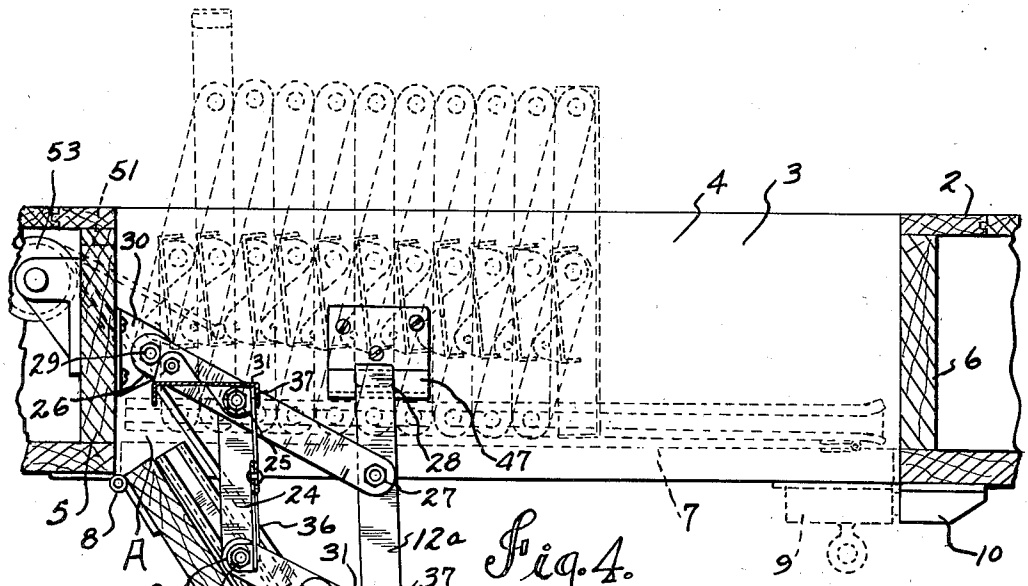



Fig. 4.

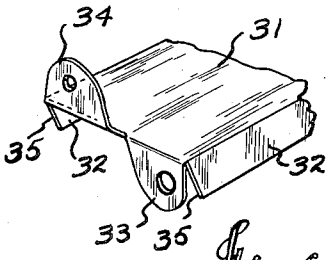



Fig. 6.

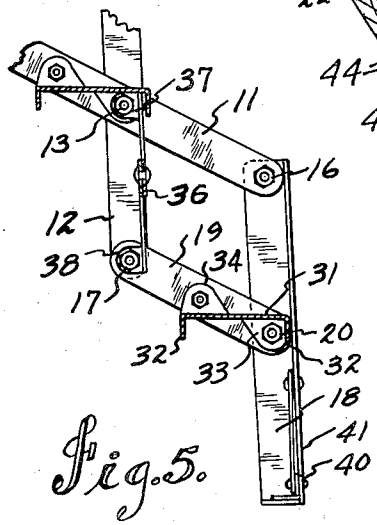
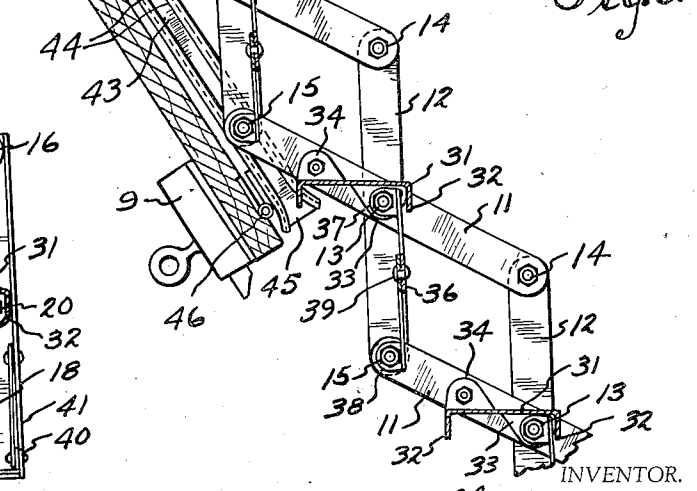



Fig. 5.




INVENTOR.
Clifford Traut
BY
Allen & Allen
ATTORNEYS.

Patented Aug. 11, 1936 2,050,593

# UNITED STATES PATENT OFFICE

2,050,593

## COLLAPSIBLE STAIRWAY

Clifford Traut, Newport, Ky., assignor to The Higgin Manufacturing Company, Newport, Ky., a corporation of West Virginia

Application July 13, 1933, Serial No. 680,261

12 Claims. (Cl. 228—50)

My invention relates to stairways, and more especially to stairways in which a step-supporting structure is collapsible into a floor opening or hatchway or extensible down therefrom toward the lower floor.

An object of my invention is to provide a device of this character which is of simple and light, yet rugged construction, safe, and easy to operate into and out of extended condition. An especial object is to provide such a device to operate in conjunction with a downwardly opening trap door or shutter for the floor opening or hatchway, for disposal of the stairway in its collapsed condition above the door, in the hatchway, or its extension downwardly as the door is opened. A further especial object is to provide a simple, compact and safe means for counterbalancing the stairway for ease of operation into and out of its extended condition. Other objects will appear in the course of the following description, illustrated by the accompanying drawings, in which—

Figure 1 is a side elevation of a stairway embodying my invention, parts of the floors and the hatchway door being in vertical section.

Figure 2 is a partial sectional plan view of the same, the section being on the line 2—2 of Figure 1 through the upper floor structure above the stairway structure.

Figure 3 is an enlarged front elevation of the stairway structure with part of the upper floor structure in cross section on the line 3—3 of Figure 1, and intermediate parts of the stairway structure broken away and omitted for lack of space.

Figure 4 is a vertical front to rear section on the same scale, of the upper part of same, on the line 4—4 of Figure 3, the closed position of the door and position of the collapsed stairway being indicated by dotted lines.

Figure 5 is a similar section of the lower end part of the stairway in its extended condition.

Figure 6 is a detailed view of a portion of a step.

Broadly stated, my invention comprises a pair of transversely spaced lazy-tong stringers, links of which have respective stair steps mounted on them, with crossing diagonal struts bracing the stringers laterally in conjunction with the steps; track means mounted on the hatchway door in which the lower joints of the lazy-tong stringers ride upon rollers; a connection of the last upper links of the lazy-tong stringers to the hatchway rear wall above the door hinge; and a counterbalancing device, preferably a pair of tension springs, mounted within the upper floor structure and connected through the hatchway rear wall with certain links of the lazy-tong stringers by cables.

To limit the extension of the stairway structure, certain of its links are made to engage stops on the hatchway side walls; and to render the coaction of the door and stairway structure easy, and to avoid the necessity of very accurate design of the parts, the track on the door is made movable thereon so that while it guides the collapsing and extending stringers, it adjusts itself to them in their collapsed condition. When extended, the lower end of the structure rests on the lower floor, and the limiting stop mentioned above prevents the sliding of the lower end on the floor to a more extended position. The counterbalance is sufficient to render the device easy of operation without entirely overcoming its weight, so that when extended the device rests firmly on the lower floor. The door is latched or otherwise suitably held in its raised, closed position, and supports the collapsed stairway.

In my preferred construction, as shown in the drawings, my device is provided in conjunction with the lower floor 1 and upper floor 2 of a building; the upper floor having an opening or hatchway 3 formed between two joists of the floor, which form the side walls 4 with short cross joists forming the rear and front walls 5 and 6, respectively, of the hatchway. The hatchway door 7 is hinged at 8 to the lower edge of the rear wall 5, and at its front edge has a suitable latch 9 coacting with a stirrup 10 on the lower edge of the front wall 6. This is a usual construction and is explained merely to facilitate the disclosure of the relation of my invention thereto.

Each lazy-tong stringer comprises a series of pairs of step links 11 and riser links 12 which cross each other and are connected at their crossings by pivots 13. Pivots 14 and 15 connect the ends of the successive pairs of links 11 and 12. Considering either stringer in its downwardly inclined position, the lowest pair of links 11 and 12 have their lower ends connected by pivots 16 and 17 to the upper ends of a foot link 18 and a short step link 19, which latter has its lower end connected to an intermediate part of foot link 18 by a pivot 20. The foot link 18 is an angle bar, and its lower end rests on the lower floor 1.

The upper ends of the uppermost pair of links 11 and 12 are connected by pivots 21 and 22 to

an additional pair of step and riser links 11*a* and 12*a*, respectively. These links are connected, where they cross each other, by a pivot 13*a*. The upper end of step link 11*a* is connected by pivot 23 to a short link 24, the upper end of which is connected by pivot 25 to the terminal step link 26, in an intermediate part thereof. One end of this step link 26 is connected by a pivot 27 to the upper part of riser link 12*a*, which extends above the pivot 27 and has its upper end offset outward and bent downward, forming a hook 28. The other end of the terminal step link 26 is connected by pivot 29 to an anchor bracket 30 fixed on the rear wall 5 of the hatchway 3.

The step links 19, 11, 11*a*, and 26 of the two stringers lie at the inner sides of the riser links, and the steps 31 are mounted on respective pairs of these step links at such an angle in front to rear extent that each step lies approximately horizontal when the stringers are in their inclined extended position. Each step preferably consists of a plate bent to channel shape with its flanges 32 depending along its longitudinal edges, and having at its ends ears 33 and 34 bent down near the front and up near the rear, respectively. The front bent down ear 33 is held by the crossing pivot 20, 13, 13*a* or 25, as the case may be, and the rear bent up ear is riveted to the respective step link. Each step 31 thus is in effect unitary with a pair of step links. The corners of the step flanges 32 are cut away at 35.

To stiffen the stair structure transversely, in addition to the stiffening afforded by the steps 31, diagonal braces 36 have ears 37 and 38 at their ends, and a crossing pair of these is provided at each step. Each brace has one end ear 37 connected to the pivot 13, 13*a* or 25 at the front ear of the step, and its opposite end ear 38 connected to the respective bottom pivot 17, 15, 22 or 23, as the case may be. The braces 36 of each pair preferably are secured together where they cross, by a rivet 39. It will be seen that each pair of braces 36 makes up, with the respective pair of riser links 12, 12*a* or 24 connected thereto by the pivots through the step links, a rigid transverse truss, and each step and respective pair of step links make another such truss, the two trusses being pivoted to swing relatively for the lazy-tongs action, with the steps swinging downwardly and forwardly in back of the respective pairs of braces 36 when the lazy-tongs structure folds up as shown by the dotted lines in Figure 4. The foot links 18, in their extensions below the pivots 20, are connected and rigidly braced by a transverse strut 40 with its ends riveted to the lower end parts of the inturned members of these links, and diagonal braces 41 riveted to the upper parts of these inturned members and to the strut 40.

The bottom pivots 17, 15, 22 and 23 of the lazy-tong stringers have laterally outward extensions carrying rollers 42, spaced out from the riser links. On the upper side of the hatchway door 7, close to and parallel with the respective lateral edges thereof, track members 43 are mounted, each in the form of a channel opening inwardly, with its flanges turned in toward each other at their inner edges, forming retaining beads 44. These channel flanges and their beads 44 flare outwardly at the lower ends 45 of the members 43 for ready entrance of the rollers 42 to the channels. These track members 43 are not fixed to the door 7, but merely are connected thereto by hinges 46 at their ends near the front edge of the door. When the stairway structure is extended the three upper ones of the rollers 42, in the example as shown, remain in the track member 43 at each side. When the stairway structure is collapsed, the other lower rollers 42 enter these track members. The beads 44 hook inside the rollers 42 which are in the track members, so that the track members and lazy-tongs structure are retained in operative relation with respect to lateral displacement.

Hook brackets 47 are fixed on the side walls 4 of the hatchway, opening upwardly, at such location as to receive the hooks 28 of the upper ends of the extended riser links 12*a*, before described, when the lazy-tongs stairway structure is extended into its lowered position. The engagement of these hooks 28 with the hook brackets 47 limits the extension of the structure, and in conjunction with the engagement of the bottoms of the foot links 18 with the lower floor 1, prevents forward slippage of the stairway structure under the load on the steps. With their extension thus limited, the lazy-tong stringers constitute trusses effective in vertical planes, and the assembly of cross braces 36 and riser links, and steps 31 and step links, constitute trusses effective in transverse planes. The extended structure therefore is very rigid against deflection either in a vertical or a transverse direction.

As the entire extensible structure is rather heavy, and the friction in its numerous pivot joints also offers considerable resistance to collapsing, I provide a suitable counterbalancing device. As herein shown, this device includes a pair of tension springs 48, seen in Figures 1 and 2, within the upper floor structure to the rear of the hatchway 3. The rear ends of these springs 48 connect to eye bolts 49 extending through blocks 50 built into the floor structure as shown. The joist piece forming the rear wall 5 of the hatchway has suitable apertures 51, and cables 52 connected to the front ends of the respective springs 48 pass over grooved rollers 53 mounted on the back of the joist piece, and pass out forwardly through the respective apertures 51 and have their forward ends connected to studs 54 fixed in and extending out from the outer sides of the respective riser links 12*a* up from the lower ends thereof far enough to clear the tops of the track members 43. The springs 48 are so made and adjusted that they counter balance most but not all of the weight of the extensible structure in addition to overcoming the friction of its pivot joints. The structure thus will extend downwardly by gravity, but may be pushed up into collapsed condition with ease.

It will be understood that the operator may raise the structure first by directly engaging it with the hand, and then in the higher stages, engage it with a suitable pusher rod, pole or the like, which also may be used to operate the door 7 and latch 9. The cables 52 might be connected at any point to the risers 12*a*, or to any point of any other riser, or to any of the step links, and the springs would be effective on the structure. I prefer to make the lower connection because, as will be seen by the dotted lines in Figure 4, the cables 52 have a material upward slant over the rollers 53 when the device is collapsed and the door 7 closed. This is effective to cause a not too sudden drop of the door 7

under the weight of the device, when the latch 9 is released. By connecting the cables to one of the upper pairs of links, the necessary travel of the cables is minimized, calling for strong springs but with relatively little required extension, which is most favorable to the use of springs.

It will be noted that the device collapses to a length much less than that of the door 7, so that it amply clears the front 6 of the hatchway 3 in opening and closing. As the lazy-tongs sleepers are connected to the door by their rollers 42 and the track members 43, and are connected to the hatchway rear wall 5 by terminal step link 26 and bracket 30, the motion of the door is imparted in some degree to the extensible structure, so that extension and collapse of the latter is accompanied by the door opening and closing, respectively. The result is a more continuous and rapid action of the structure and door collectively, either in opening or in closing. This connection of door, stairway structure and upper floor structure also relieves the door hinge 8 of most of the strain of supporting the stairway structure, either in collapsed or extended condition.

By using springs instead of weights, for instance, I am able to make the entire device very compact, without any excessive extensions from the floor or hatchway, avoiding obstruction to free passage and storage in the vicinity of the device. The connection of the counterbalancing device to an upper part of the collapsible structure also avoids the tendency to distort the structure that is present with connection to the lower part thereof, in addition to reducing the necessary range of action of the counterbalancing device as before mentioned.

Owing to the advantageous disposition of the parts, in respect of bracing in the vertical and transverse planes as before mentioned, and to the easy action of the counterbalance on the structure, the parts may be relatively light and of simple formation. This, of course, results in economy of manufacture as well as ease of operation. The track members 43 being hinged to the door 7, can adjust to any slight discrepancy of relative position of the lazy-tongs structure and door in closed, collapsed condition, as seen at A in Figure 4. This avoids necessity of very accurate design and installation of the apparatus. It is preferable that the track members 43 should bear firmly on the door when the device is opened and extended, as indicated in Figure 4 at B.

This is easily accomplished, and the proper coaction of hook members 28 and 47 is assured by installing members 30 and 47 on the hatchway walls while the stairway structure is extended and resting on the lower floor 1, after first connecting the track members 43 by their hinges 46, to the door, swinging these members 43 onto the door, and inserting the upper rollers 42 into the track members. The counterbalancing apparatus, of course, requires removal of the boards of upper floor 2, for installing it; and this is conveniently done when the device is in closed, collapsed condition, adjusting the springs to the required initial tension by the eye bolts 49.

It will be understood that various modifications may occur, and that I am not limited to the precise disclosure herein; but having thus fully described a preferred example of my invention, what I claim and desire to secure by Letters Patent, is:

1. In a collapsible stairway, longitudinally collapsible stringers, steps carried by said stringers, means pivotally anchoring said stringers at one end of the stairway, and means movable relatively to the anchorage means, forming a guide for the stringers as they collapse, and supporting the stairway in its collapsed condition.

2. In a collapsible stairway, longitudinally collapsible stringers, steps carried by said stringers, means pivotally anchoring said stringers at one end of the stairway, and means supporting the stairway in its collapsed condition comprising a guide, and means moving with the stringers and guided in said guide.

3. In a collapsible stairway, longitudinally collapsible stringers, steps carried by said stringers, means pivotally anchoring said stringers at one end of the stairway, and means supporting the stairway in its collapsed condition comprising a guide, and means moving with the stringers and guided in said guide, said guide being movably connected to said supporting means to adjust to the stairway when the latter is collapsed.

4. In a collapsible stairway, longitudinally collapsible stringers, steps carried by said stringers, means pivotally anchoring said stringers at one end of the stairway, and means supporting the stairway in its collapsed condition comprising a guide, and means moving with the stringers and guided in said guide, said guide being movably connected to said supporting means to adjust to the stairway when the latter is collapsed, and said guide and said guided means having mutual engagement to limit relative lateral displacement of the guide and the stringer elements.

5. In a collapsible stairway, collapsible stringers comprising pivotally connected step and riser links, steps forming trusses with the step links and braces forming trusses with the riser links, and means anchoring one end of said stairway, the opposite end of said stairway adapted to rest against a suitable support.

6. In a collapsible stairway, lazy tongs stringers comprising step and riser links, steps connected to the step links at the crossing pivots of the links and at locations spaced from said pivots, and diagonal crossing braces connected to said pivots and to outer pivots of the lazy-tongs assembly.

7. In a collapsible stairway, lazy tongs stringers, steps connected to the stringers, guides, and extensions from outer pivots of the lazy-tongs assembly, traveling in the respective guides.

8. In a collapsible stairway, lazy tongs stringers, steps connected to the stringers, guides, and extensions from outer pivots of the lazy-tongs assembly, traveling in the respective guides, a door, and a support on which the door moves, said guides being carried on said door and adjacent end links of the lazy-tongs structure being pivoted to said support.

9. In a collapsible stairway, lazy tongs stringers, steps connected to the stringers, guides, and extensions from outer pivots of the lazy-tongs assembly, traveling in the respective guides, a door, and a support on which the door moves, said guides being carried on said door and adjacent end links of the lazy-tongs structure being pivoted to said support, certain links of said lazy-tongs stringers having projections at their ends opposite the ends having the guided pivot extensions, provided with engaging means, and engaging means on the support with which the link projecting engaging means engage to limit extension of the stringers.

10. In combination with a floor having an opening or hatchway, and a trap door hinged to one side of said hatchway to open downwardly, a collapsible stairway comprising pivotally connected elements, one of which is pivoted to said side of the hatchway, and others of which have certain pivotal connections movably connected to said door.

11. In a collapsible stairway structure, a lazy-tongs assembly of step and riser links, and steps, each step having at each end a downturned ear connected to a respective crossing pivot of said links, and an upturned ear connected to the respective step link.

12. In a collapsible stairway structure, a lazy-tongs assembly of step and riser links, steps, each step having at each end a downturned ear connected to a respective crossing pivot of said links, an upturned ear connected to the respective step link, and crossing diagonal braces, each having an ear at each end, one ear connected to a respective one of said crossing pivots, and the other ear connected to a respective outer pivot that connects the riser link to a step link of an adjacent pair of links of the lazy-tongs assembly.

CLIFFORD TRAUT.