Oct. 6, 1959 J. WAGNER 2,907,401

FOLDING STAIRS

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Fig.2

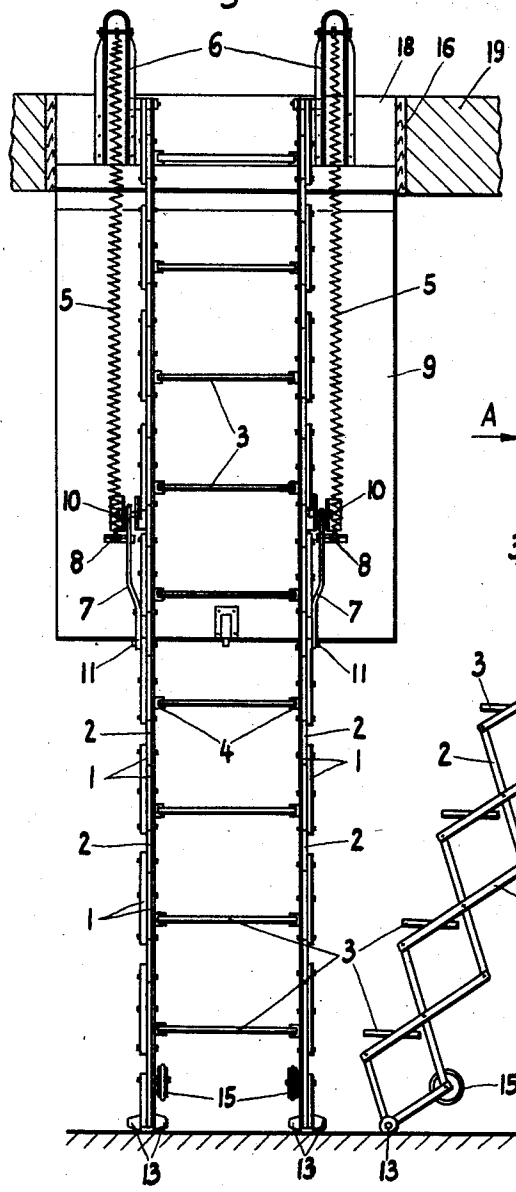
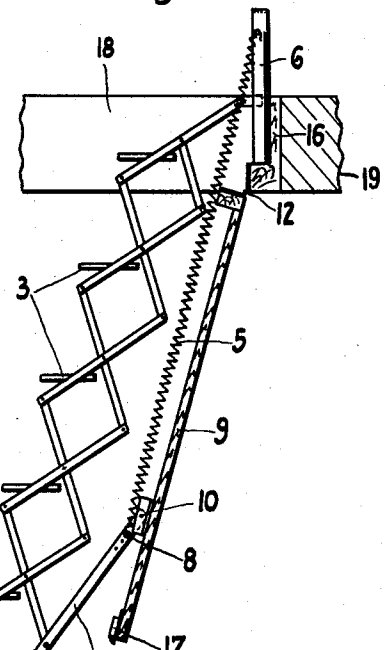


Fig.1



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Fig.3

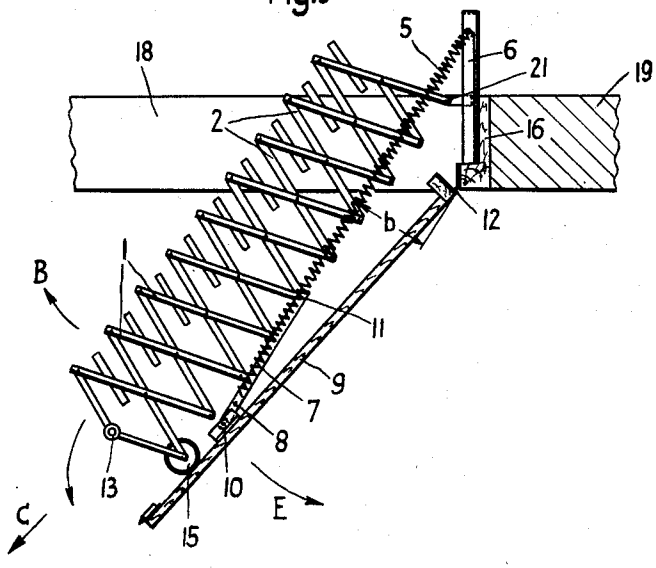
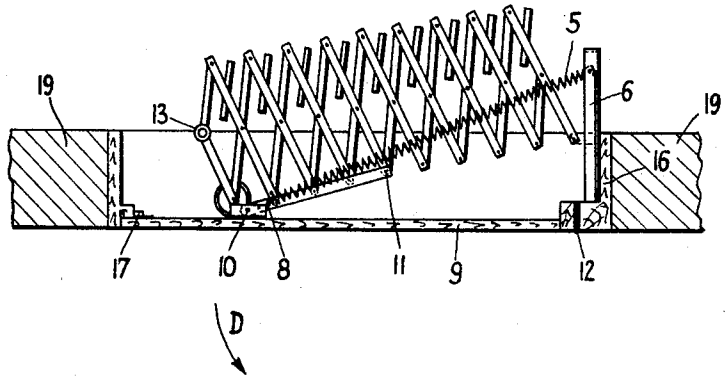


Fig.4



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FOLDING STAIRS

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Fig.7

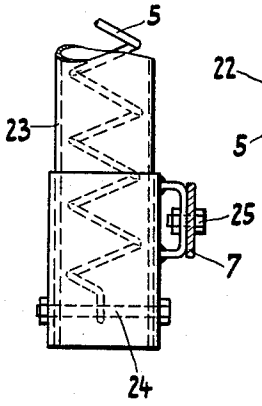


Fig.6

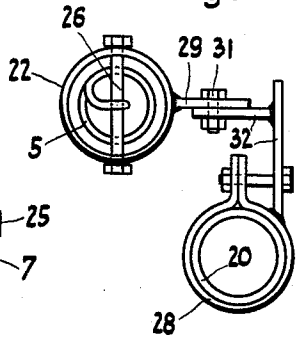


Fig.5

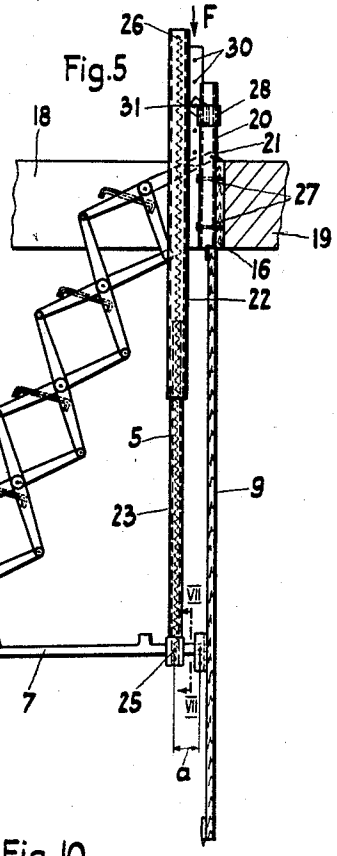


Fig.9

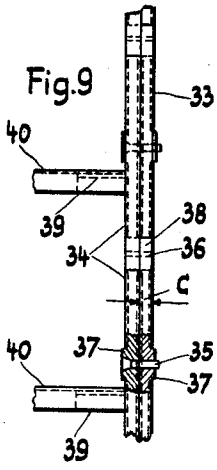
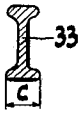
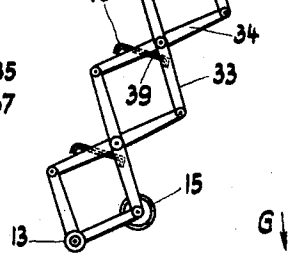


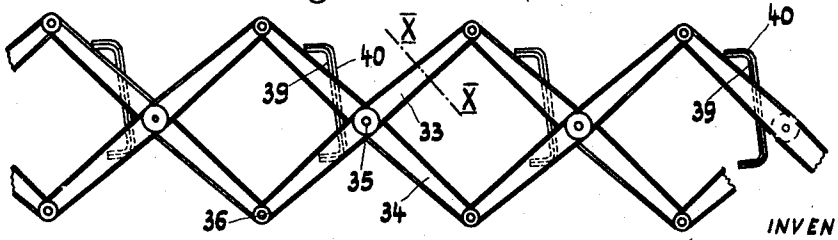
Fig.10





G

Fig.8



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FOLDING STAIRS

Johann Wagner, Augsburg, Germany

Application October 23, 1957, Serial No. 691,845

Claims priority, application Germany October 23, 1956

9 Claims. (Cl. 182—78)

The present invention relates to folding stairs to be stored on an attic trap-door, having a weight compensation consisting of tension springs and of side cheeks which consist of two folding worm-fences or lazy tong stringers.

In known stairs of this type guide rails are provided on the attic trap-door to connect the trap-door with the folding stairs. Rolls slide in these guide rails, which rolls are arranged on the articulations of the worm-fence. This construction is not only expensive, but has the disadvantage that the folding worm-fence easily gets stuck in the guide rails. In this known type of folding stairs no safety catch is provided to keep the stairs from falling down from the trap-door. Furthermore special stops are necessary to limit the maximum stretch of the stairs. Lastly, the tension springs as weight compensation are built into a hollow space of the ceiling, so that this arrangement is very expensive and often practically impossible to execute.

It is an object of the invention to construct very simple folding stairs which answer all the requirements and which in every case can be built in without any change in the ceiling construction. According to the invention each check of the stairs is so connected by a pivot arm or lever with the trap-door that said pivot arm is swivelled more than 90 degrees as compared with the trap-door when the stairs are pulled out or pushed in. On both sides of the folding worm-fences tension springs are provided which are fastened at one end to the pivot arms. These pivot arms have a multiple function: They form a simple and efficient connection between the folding stairs and the attic trap-door which acts as a second lever; they serve to limit the maximum length of the folding stairs and determine also the minimum length when the stairs are folded. Furthermore these pivot arms serve to automatically lock and unlock the folding stairs and lastly they serve as a favourable hold for the tension springs.

Other objects and advantages will be apparent from a consideration of the specification and claims.

Fig. 1 shows a side view of the new folding stairs ready for use,

Fig. 2 shows a front view in the direction A of Fig. 1,

Fig. 3 shows the closed up folded stairs with the attic trap-door swivelled downward,

Fig. 4 shows the closed folded stairs with the attic trap-door closed,

Fig. 5 shows a lateral view of a modified embodiment of folding stairs,

Fig. 6 shows a partial plan view in the direction F of Fig. 5,

Fig. 7 shows a section according to line VII—VII of Fig. 5,

Fig. 8 shows a larger scale detail of the folding stairs of Fig. 5,

Fig. 9 shows a plan view in the direction of G of Fig. 8, and

Fig. 10 shows a cross section through a jointed part according to line X—X of Fig. 8.

As can easily be seen from the drawing, the new folding stairs consist of two jointed worm-fences or lazy tong stringers which make up the side cheeks of the stairs with the worm-fence parts **1** and **2** and the step plates **3** which form the connection between the two jointed worm-fences. The ends of these step plates are rigidly connected at **4** with the members **1** of the jointed worm-fences lying parallel to each other.

In order to attain a compensation of weight in these stairs, tension springs **5** are provided on both sides of the jointed worm fences and almost in their lengthwise direction, one end of which is attached to rigid abutments or support means **6** and whose other ends are fastened to the pivot arms or levers **7**.

Preferably these tension springs are fastened to the pivot arms **7** at **8**, i.e. near the coupling points **10**. The pivot arms **7** are fastened at **10** advantageously on the lower part of the attic trap-door **9** which at **12** is fastened pivotally to a frame member **16** which limits the opening **18** in the ceiling **19**. Furthermore the pivoting arms **7** are connected pivotally to the jointed worm-fences and preferably on their middle part at **11**. As can be seen from the drawings, the pivot arms are advantageously arranged so that, when the stairs are folded up (see Figs. 3 and 4) they lie almost in the direction of the tension springs **5**. When the attic trap-door is opened, as in Fig. 3, the jointed folding stairs are supported by means of the pivot arms **7** in such a way on the attic trap-door **9** that the folding stairs are locked and cannot be pulled out in direction C; this means that the stairs cannot fall down due to their own weight. In order to bring the folding stairs into their position for use, the attic trap-door **9** must be lifted from the folding stairs in the direction E, whereby the pivot arms **7** are swivelled into the position shown in Fig. 5, whereupon the jointed folding stairs can be pulled out in the direction C to the position shown in Fig. 1. The ends of the folding stairs have preferably rubber buffers **13**, on which the stairs repose on the floor **14**.

The novel folding stairs have the advantage that comparatively strong tension springs can be provided. When the stairs are stretched out according to Fig. 1 these tension springs **5** are almost ineffective since the pivot arms **7** are almost at zero position, the tension springs acting opposite the coupling point **10** through a very small lever arm. Thus the stairs remain securely stretched out by their own weight in position for use. When the folding stairs are lifted somewhat according to Fig. 5, the pivot arms **7** turn to the shown position so that now the tension springs **5** act on the lever arm *a* and so help efficiently to close the stairs. After the folding up of the stairs in the position according to Fig. 3 the tension springs act on the static trap door **9** by means of lever arm *b*, so that, by the strong tension springs, the attic trap-door **9** is pivoted into position according to Fig. 4 and thus is closed. If desired, the trap door **9** can be provided with a bolt **17** placed on the frame **16**. In order to get a sufficiently large moment with respect to a sufficiently big lever arm *b* to close the attic trap door, the upper ends of the tension springs are fastened to the posts or support means **6** and **20** respectively, which extend beyond the attic opening **18**. As can be seen the tension springs **5** are attached on these posts above the connection point **21**, where the worm fences are coupled to said posts.

In the special embodiment shown in Figs. 5 to 7, each tension spring **5** is arranged in two telescope-shaped protecting tubes **22** and **23**, which can be moved into each other. The lower end of the spring **5** is fastened to a cross bolt **24** of the protection tube **23**, which is connected pivotally at **25** with a pivot arm **7**. The upper end of the tension spring is fixed to a transverse bolt **26** of the protection tube **22**. The posts **20**, shown as tubes, are fastened to the frame **16** with bolts **27**. These tubes **20** carry a

fastening strap 28 which serves to pivotally positioning the telescope tube 22.

On tube 22 a longitudinal rail 29 is fastened which at various points has holes 30, so that a jointed bolt can be passed through, which connects this jointed part 29 movably with a supporting bracket 32 of the fastening strap 28. The jointed folding stairs in Figs. 5 to 10 show a construction which is very sturdy and which if formed from aluminum may be very light in weight. For these purposes the jointed parts 33, 34 have an I-shaped cross-section, as seen in Fig. 10, and are provided with hubs 37 and 38 respectively in order to receive the connecting bolts 35 and 36, the width of said hubs being at least as great as the cross section width *c*.

The inner sides of the worm-fences 34 have lugs 39 which serve to place and fix the connecting step plates 40 of the jointed parts. When light metal is used, these lugs 39 as well as the step plates have advantageously U-shaped cross sections, as can be seen from the drawings.

As can be seen from the drawing, rollers 15 are placed on the lower end of the jointed folding stairs, preferably on the last worm-fence articulations facing the attic trap door 9, on which the stairs repose against the attic trap-door.

As can be seen by the drawing, the new stairs are characterized by their very simple mode of construction and by their high degree of safety in operation. The pulling out or pushing back in of the stairs does not demand any special training or knowledge, as the opening and closing of these stairs occurs automatically, therefore it is important that the unlocking and the locking of the stairs, when opening and closing, occurs absolutely automatically.

I claim:

1. A collapsible and expandable stairway comprising, in combination, support means; lazy tong means connected at one end to said support means for movement with respect thereto between a collapsed position where said lazy tong means is substantially at the elevation of said support means and an expanded position where said lazy tong means extends from said support means to a location at a different elevation therefrom; a series of spaced step members connected with said lazy tong means for movement with the latter between said collapsed and expanded positions, said step members being relatively distant from each other in said expanded position of said lazy tong means and forming steps leading between said elevations and said step members being relatively close to each other in said collapsed position of said lazy tong means; a first lever pivotally connected to said lazy tong means; a second lever pivotally connected to an end of said first lever distant from said lazy tong means, said second lever being pivotally carried by said support means and having one angular position with respect to said support means when said lazy tong means is in its collapsed position and a different angular position with respect to said support means when said lazy tong means is in its expanded position, and said first lever also having different positions with respect to said second lever when said lazy tong means is respectively in its collapsed and expanded positions; and at least one elongated spring means connected at one end to said support means and at its opposite end to said first lever and acting through the latter on said second lever and lazy tong means for yieldably maintaining said lazy tong means in its collapsed position and said second lever in said one position thereof and said spring means extending in substantially the same direction as said first lever when said lazy tong means is in its collapsed position.

2. A collapsible and expandable stairway comprising, in combination, support means; lazy tong means connected at one end to said support means for movement with respect thereto between a collapsed position where said lazy tong means is substantially at the elevation of said support means and an expanded position where said lazy tong means extends from said support means to a location at a different elevation therefrom; a series of spaced step members connected with said lazy tong means for movement with the latter between said collapsed and expanded positions, said step members being relatively distant from each other in said expanded position of said lazy tong means and forming steps leading between said elevations and said step members being relatively close to each other in said collapsed position of said lazy tong means; a first lever pivotally connected to said lazy tong means; a second lever pivotally connected to an end of said first lever distant from said lazy tong means, said second lever being pivotally carried by said support means and having one angular position with respect to said support means when said lazy long means is in its collapsed position and a different angular position with respect to said support means when said lazy tong means is in its expanded position, and said first lever also having different positions with respect to said second lever when said lazy tong means is respectively in its collapsed and expanded positions; and at least one elongated urging means connected at one end to said support means and at its opposite end to a portion of said first lever which is in close proximity to said second lever when said lazy tong means is in its expanded position so that said urging means acts through an extremely small moment arm when said lazy tong means is in its expanded position and is incapable of turning said first lever.

3. A collapsible and expandable stairway comprising, in combination, support means; lazy tong means connected at one end to said support means for movement with respect thereto between a collapsed position where said lazy tong means is substantially at the elevation of said support means and an expanded position where said lazy tong means extends from said support means to a location at a different elevation therefrom; a series of spaced step members connected with said lazy tong means for movement with the latter between said collapsed and expanded positions, said step members being relatively distant from each other in said expanded position of said lazy tong means and forming steps leading between said elevations and said step members being relatively close to each other in said collapsed position of said lazy tong means; a first lever pivotally connected to said lazy tong means; a second lever pivotally connected to an end of said first lever distant from said lazy tong means, said second lever being pivotally carried by said support means and having one angular position with respect to said support means when said lazy tong means is in its collapsed position and a different angular position with respect to said support means when said lazy tong means is in its expanded position, and said first lever also having different positions with respect to said second lever when said lazy tong means is respectively in its collapsed and expanded positions; and at least one elongated urging means connected at one end to said support means and at its opposite end to a portion of said first lever which is in close proximity to said second lever when said lazy tong means is in its expanded position so that said urging means acts through an extremely small moment arm when said lazy tong means is in its expanded position and is incapable of turning said first lever, said urging means extending in substantially the same direction as said first lever when said lazy tong means is in its collapsed position and acting through said first lever on said second lever and lazy tong means for yieldably maintaining said lazy tong means in its collapsed position.

4. A collapsible and expandable stairway comprising, in combination, support means; lazy tong means connected at one end to said support means for movement with respect thereto between a collapsed position where said lazy tong means is substantially at the elevation of said support means and an expanded position where said lazy tong means extends from said support means to a loca-

tion at a different elevation therefrom; a series of spaced step members connected with said lazy tong means for movement with the latter between said collapsed and expanded positions, said step members being relatively distant from each other in said expanded position of said lazy tong means and forming steps leading between said elevations and said step members being relatively close to each other in said collapsed position of said lazy tong means; a first lever pivotally connected to said lazy tong means intermediate the ends thereof; a second lever pivotally connected to an end of said first lever distant from said lazy tong means, said second lever being pivotally carried by said support means and having one angular position with respect to said support means when said lazy tong means is in its collapsed position and a different angular position with respect to said support means when said lazy tong means is in its expanded position, and said first lever also having different positions with respect to said second lever for restricting the contraction of said lazy tong means when the latter is in its collapsed position and for restricting the expansion of said lazy tong means when it is in its expanded position.

5. A collapsible and expandable stairway comprising, in combination, support means; lazy tong means connected at one end to said support means for movement with respect thereto between a collapsed position where said lazy tong means is substantially at the elevation of said support means and an expanded position where said lazy tong means extends from said support means to a location at a different elevation therefrom; a series of spaced step members connected with said lazy tong means for movement with the latter between said collapsed and expanded positions, said step members being relatively distant from each other in said expanded position of said lazy tong means and forming steps leading between said elevations and said step members being relatively close to each other in said collapsed position of said lazy tong means; a first lever pivotally connected to said lazy tong means; a second lever pivotally connected to an end of said first lever distant from said lazy tong means, said second lever being pivotally carried by said support means and having one angular position with respect to said support means when said lazy tong means is in its collapsed position and a different angular position with respect to said support means when said lazy tong means is in its expanded position, and said first lever also having different positions with respect to said second lever when said lazy tong means is respectively in its collapsed and expanded positions; and at least one elongated urging means connected at one end to said support means and at its opposite end to a portion of said first lever which is in close proximity to said second lever so that said urging means acts through an extremely small moment arm and is incapable of turning said first lever, said urging means extending in substantially the same direction as said first lever when said lazy tong means is in its collapsed position and acting through said first lever on said second lever and lazy tong means for yieldably maintaining said lazy tong means in its collapsed position.

6. A collapsible and expandable stairway comprising, in combination, a frame member; a pair of support means mounted on said frame member at a predetermined horizontal distance from each other; a pair of parallel lazy tong means respectively connected at one end to said pair of support means for movement with respect thereto between a collapsed position where said pair of parallel lazy tong means is substantially at the elevation of said pair of support means and an expanded position where said pair of lazy tong means extends from said pair of support means to a location at a different elevation therefrom; a series of step members mounted between said pair of lazy tong means and spacing said pair of lazy tong means at a fixed distance from and parallel to each other for movement with said pair of lazy tong

means between said collapsed and said expanded positions of the latter, said step members being relatively distant from each other in said expanded position of said pair of lazy tong means and forming steps leading between said elevations, and said step members being relatively close to each other in said collapsed position of said pair of lazy tong means; a pair of levers respectively connected at one end to said pair of lazy tong means intermediate the ends thereof, said levers each having an end distant from and beneath said lazy tong means; trap door means pivotally connected to said ends of said levers distant from said lazy tong means, said trap door means being pivotally carried by said frame member and acting as a lever cooperating with said pair of levers, said trap door means having one angular position with respect to said pair of support means when said pair of lazy tong means is in its collapsed position and a different angular position with respect to said pair of support means when said pair of lazy tong means is in its expanded position, and said pair of levers also having different positions with respect to said trap door means for respectively restricting the contraction and expansion of said pair of lazy tong means when the latter is in its collapsed and expanded positions; and at least one elongated urging means connected at one end to at least one of said pair of support means and at its opposite end to a portion of at least one of said pair of levers which is in close proximity to said trap door means when said pair of lazy tong means is in its expanded position so that said urging means acts through an extremely small moment arm when said pair of lazy tong means is in its expanded position and is incapable of turning said pair of levers, said urging means extending in substantially the same direction as said pair of levers when said pair of lazy tong means is in its collapsed position and acting through said pair of levers on said trap door means and said pair of lazy tong means for yieldably maintaining said pair of lazy tong means in its collapsed position.

7. A collapsible and expandable stairway comprising, in combination, support means; lazy tong means having a plurality of linking portions and being connected at one end to said support means for movement with respect thereto between a collapsed position where said lazy tong means is substantially at the elevation of said support means and an expanded position where said lazy tong means extends from said support means to a location at a different elevation therefrom; a series of spaced step members connected with said lazy tong means for movement with the latter between said collapsed and expanded positions, said step members being relatively distant from each other in said expanded position of said lazy tong means and forming steps leading between said elevations and said step members being relatively close to each other in said collapsed position of said lazy tong means; a first lever pivotally connected to a single one of said plurality of linking portions of said lazy tong means which is intermediate the ends thereof; a second lever pivotally connected to an end of said first lever distant from said lazy tong means, said single one of said plurality of linking portions of said lazy tong means being arranged to face said second lever, said second lever being pivotally carried by said support means and having one angular position with respect to said support means when said lazy tong means is in its collapsed position and a different angular position with respect to said support means when said lazy tong means is in its expanded position, and said first lever also having different positions with respect to said second lever when said lazy tong means is respectively in its collapsed and expanded positions; and at least one elongated spring means connected at one end to said support means and at its opposite end to said first lever and acting through the latter on said second lever and lazy tong means for yieldably maintaining said lazy tong means in its collapsed position and said second lever in said one position

thereof and said spring means extending in substantially the same direction as said first lever when said lazy tong means is in its collapsed position.

8. A collapsible and expandable stairway comprising, in combination, support means; lazy tong means connected at one end to said support means for movement with respect thereto between a collapsed position where said lazy tong means is substantially at the elevation of said support means and an expanded position where said lazy tong means extends from said support means to a location at a different elevation therefrom; a series of spaced step members connected with said lazy tong means for movement with the latter between said collapsed and expanded positions, said step members being relatively distant from each other in said expanded position of said lazy tong means and forming steps leading between said elevations and said step members being relatively close to each other in said collapsed position of said lazy tong means; a first lever pivotally connected to said lazy tong means; a second lever pivotally connected to an end of said first lever distant from said lazy tong means, said second lever being pivotally carried by said support means and having one angular position with respect to said support means when said lazy tong means is in its collapsed position and a different angular position with respect to said support means when said lazy tong means is in its expanded position, and said first lever being turnable through an arc of almost 180° with respect to said second lever and also having different positions with respect thereto when said lazy tong means is respectively in its collapsed and expanded positions; and at least one elongated urging means connected at one end to said support means and at its opposite end to a portion of said first lever which is in close proximity to said second lever when said lazy tong means is in its expanded position so that said urging means acts through an extremely small moment arm when said lazy tong means is in its expanded position and is incapable of turning said first lever.

9. A collapsible and expandable stairway comprising, in combination, support means; lazy tong means connected at one end to said support means for movement with respect thereto between a collapsed position where said lazy tong means is substantially at the elevation of said support means and an expanded position where said lazy tong means extends from said support means to a location at a different elevation therefrom; a series of spaced step members connected with said lazy tong means for movement with the latter between said collapsed and expanded positions, said step members being relatively distant from each other in said expanded position of said lazy tong means and forming steps leading between said elevations and said step members being relatively close to each other in said collapsed position of said lazy tong means; a first lever pivotally connected to said lazy tong means; a second lever pivotally connected to an end of said first lever distant from said lazy tong means, said second lever being pivotally carried by said support means turnable through an arc of more than 90° with respect to said support means and having one angular position with respect to said support means when said lazy tong means is in its collapsed position and a different angular position with respect to said support means when said lazy tong means is in its expanded position, and said first lever also having different positions with respect to said second lever when said lazy tong means is respectively in its collapsed and expanded positions; and at least one elongated urging means connected at one end to said support means and at its opposite end to a portion of said first lever which is in close proximity to said second lever when said lazy tong means is in its expanded position so that said urging means acts through an extremely small moment arm when said lazy tong means is in its expanded position and is incapable of turning said first lever.

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