Jan. 23, 1934. O. A. BAILEY 1,944,159

STAIR CONSTRUCTION

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Fig. 1.

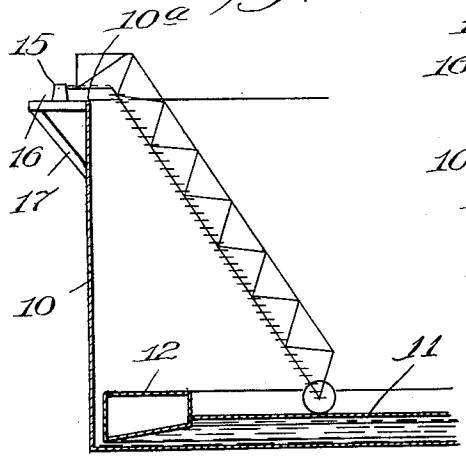


Fig. 2.

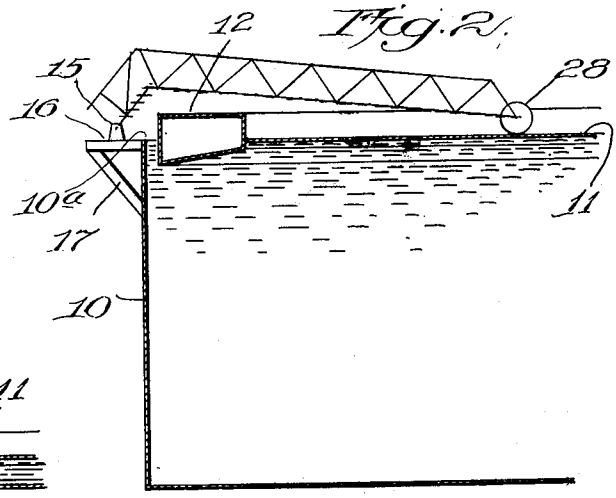
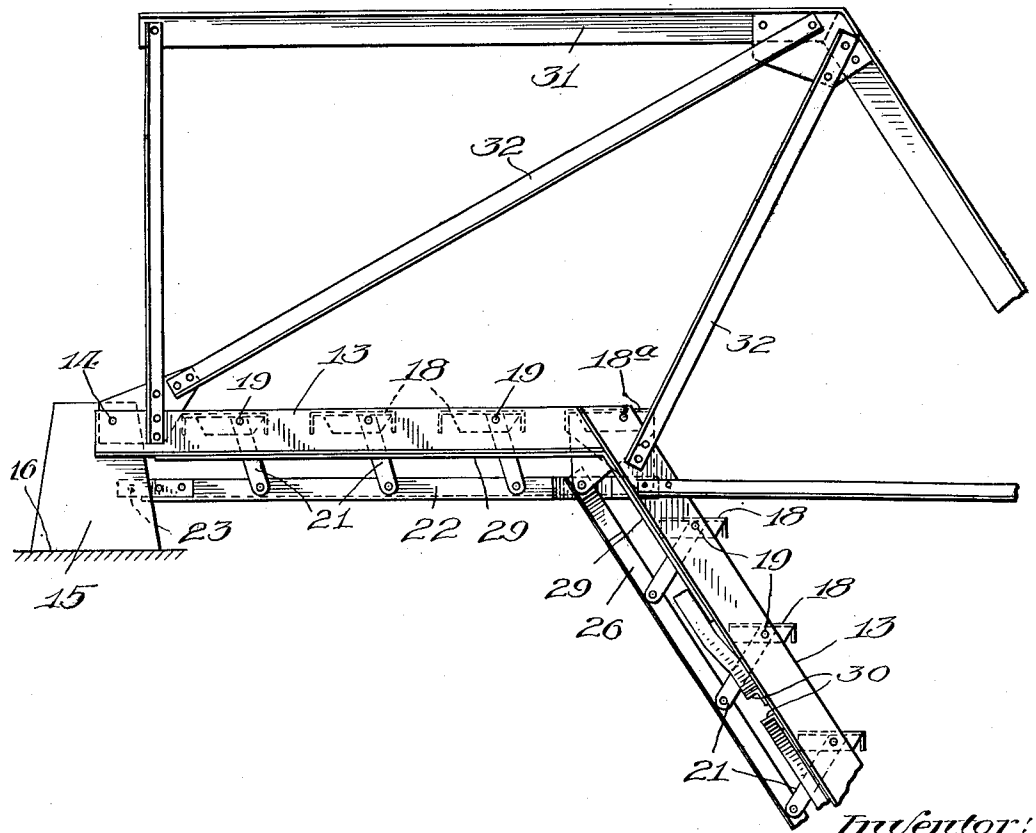


Fig. 3.



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STAIR CONSTRUCTION

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Fig. 4.

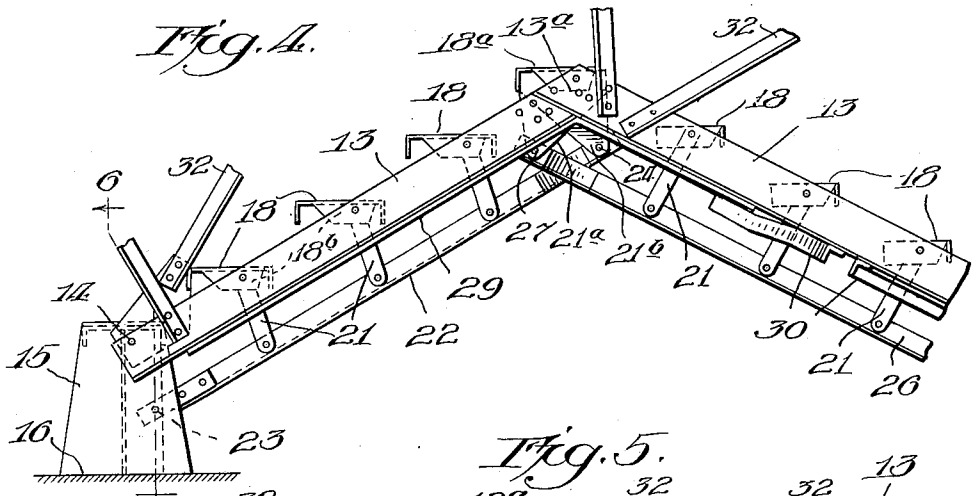


Fig. 5.

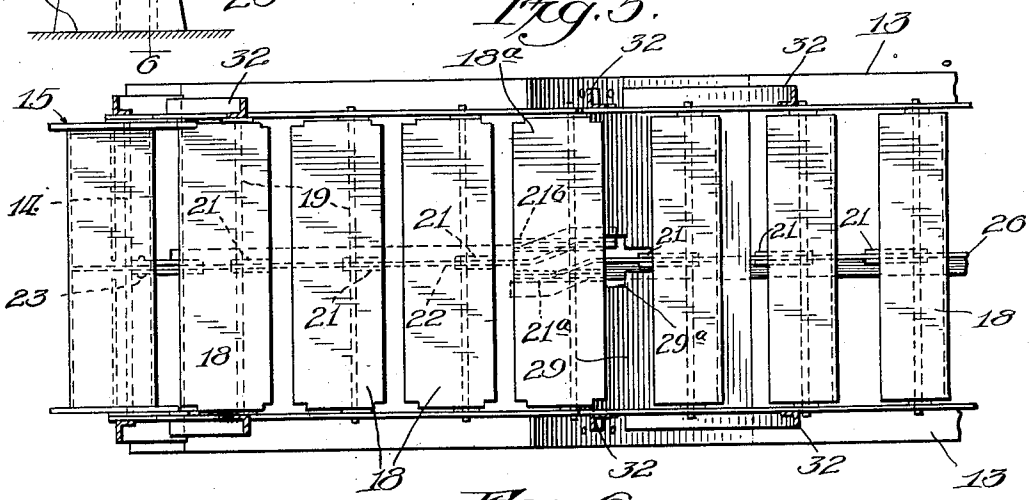
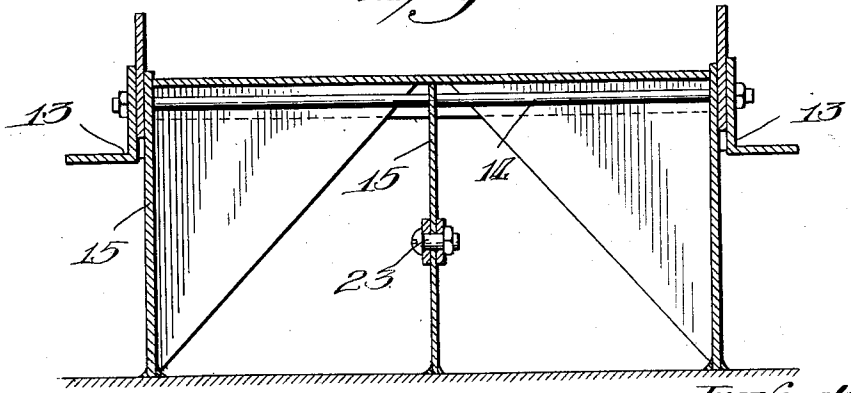


Fig. 6.



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STAIR CONSTRUCTION

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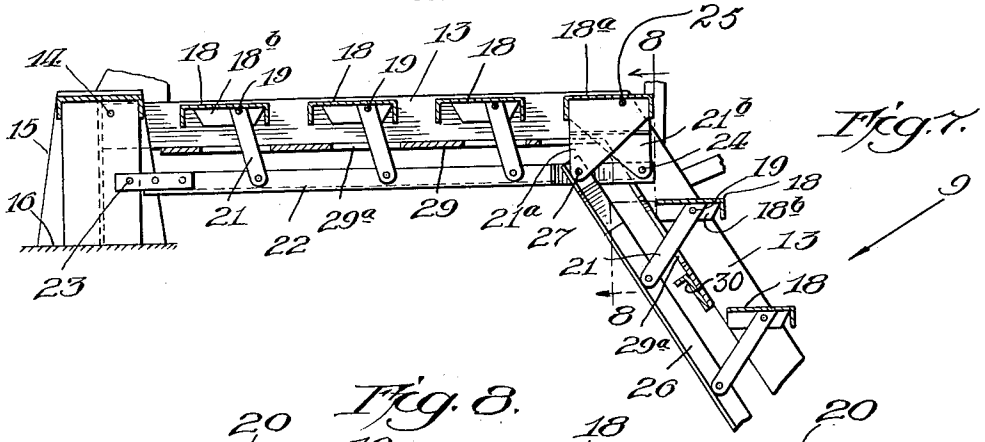


Fig. 7.

Fig. 8.

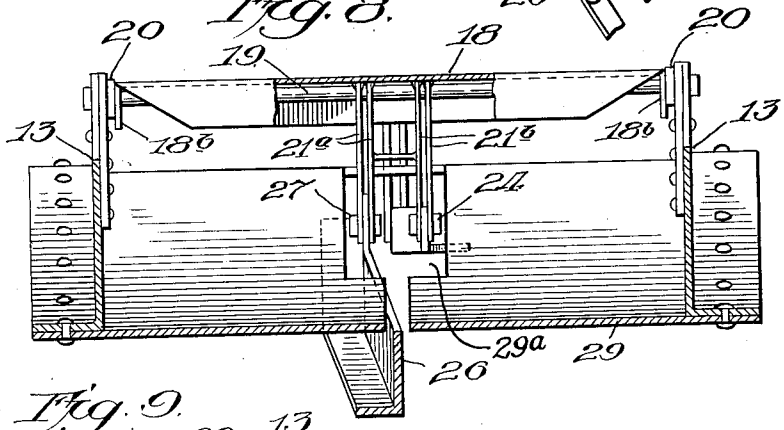
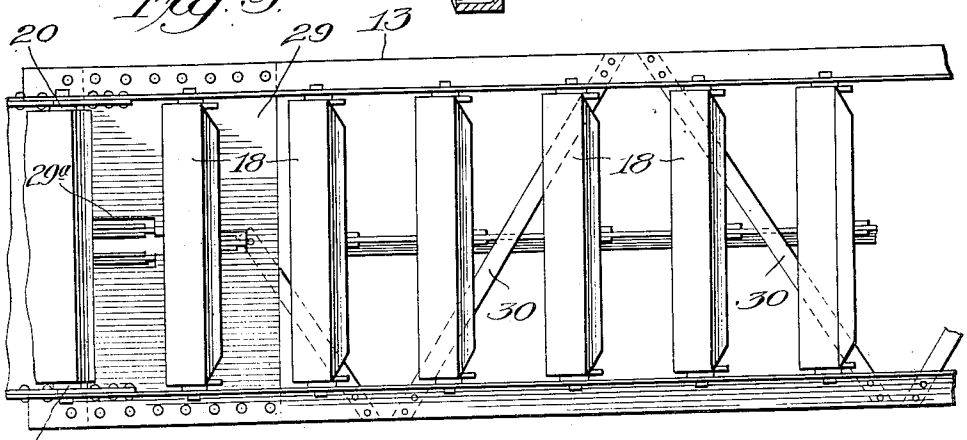


Fig. 9.



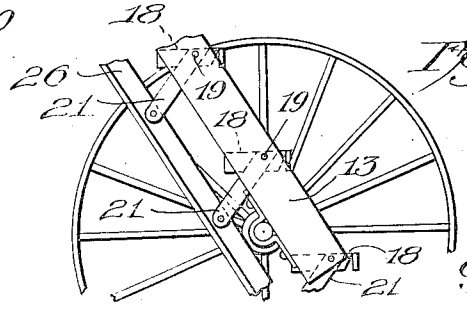


Fig. 10.

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Patented Jan. 23, 1934 1,944,159

UNITED STATES PATENT OFFICE

1,944,159

STAIR CONSTRUCTION

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Application November 2, 1931. Serial No. 572,673

4 Claims. (Cl. 228—54)

This invention relates to improvements in stair construction and, more especially, an adjustable or swinging stair or ladder with means for keeping the treads horizontal in all positions of the stair.

The invention is applicable for use, for example, in connection with a floating roof or deck on an oil storage tank where it is desired to provide a stair from the upper edge of the tank to the deck. In such cases, the stair must be made adjustable or swingable to compensate for up and down movement of the roof or floating deck.

One of the principal features of my invention is the provision of such a stair with angular or bent stringers. Such stair construction is frequently necessary or desirable in connection with storage tanks having floating roofs. Such roofs frequently have portions adjacent the rim that project above the side wall of the tank when the roof is in its uppermost position. It is therefore desirable to provide a stairway with angular or bent stringers to clear such projections when the roof is at its top. I have provided this kind of stair with means for maintaining all the treads thereof in horizontal position.

Other features and advantages of my invention will appear more fully as I proceed with my specification.

In those forms of devices embodying the features of my invention shown in the accompanying drawings—

Figures 1 and 2 are diagrammatic views showing the stair in its lower and uppermost positions, respectively; Fig. 3 is a fragmentary view in side elevation showing the stair in its lowermost position; Fig. 4 is a view similar to Fig. 3 showing the stair in its uppermost position; Fig. 5 is a fragmentary top plan view of the stair in the position shown in Fig. 4; Fig. 6 is a view taken as indicated by the line 6 of Fig. 4; Fig. 7 is a vertical sectional view similar to Fig. 3; Fig. 8 is a view partly broken away taken as indicated by the line 8 of Fig. 7; Fig. 9 is a view taken as indicated by the line 9 of Fig. 7; and Fig. 10 is a fragmentary view in side elevation of the lower end of the stair.

As shown in the drawings, the stair is illustrated in connection with a storage tank having a floating roof, in order to show one example of the use of the invention. In such drawings, for example, 10 may indicate the cylindrical wall of a liquid storage tank and 11, a floating roof or deck adapted to float on the liquid in the tank. As here shown, this deck is supported by the annular pontoon 12 which projects somewhat above the deck 11 at the periphery thereof. The stair forming the subject-matter of this invention is adapted to extend from the upper edge of the wall 10 of the tank to the deck 11. It will be seen that when the deck is in its uppermost position, as shown in Fig. 2, the annular pontoon 12 projects some distance above the upper edge 10^a of the wall 10. Consequently, it is necessary or desirable to make the stair angular or bent. That is, the stringers are not straight, but have an angle in them so that when the deck is in its uppermost position, as shown in Fig. 2, the stair will extend from the upper edge of the side wall of the tank up over the pontoon 12 and thence to the deck 11.

The stair includes a pair of parallel angular stringers 13, 13 with their upper ends pivotally attached at 14 to a support or pedestal 15 attached to the upper edge of the wall 10 of the tank. Such attachment may be accomplished by mounting the support or pedestal 15 on a platform 16 extending from the upper edge 10^a of the wall 10 of the tank and additionally supported by the diagonal braces 17. Each of the stringers or side bars 13 may be made of angle iron, as shown. In speaking of these stringers as being angular, however, I refer to the angle or bend in the same, as indicated by 13^a. In other words, each stringer has an upper and lower portion angularly connected. In the construction here shown, the stringers 13 are not actually bent at 13^a but the angle there formed is accomplished by riveting together two pieces of stringer 13 in angular relationship.

Numerals 18, 18 indicate a plurality of horizontal treads pivotally mounted between the stringers 13, 13. The tread adjacent the angle 13^a in the stringers 13 I have indicated by 18^a. The pivotal mounting of the treads 18 and 18^a is accomplished by providing the ends thereof with depending flanges 18^b through which extend the pivot bolts 19, the ends of which extend through the stringers 13. The treads are pivotally mounted on these bolts or the bolts themselves may be swiveled in the stringers 13. Spacing washers 20 are provided between the ends of the treads and the stringers 13.

Each of the treads is provided with a single centrally arranged pair of depending arms or levers 21 with the exception of the tread 18^a at the angle which is provided with two such pairs 21^a and 21^b. Numeral 22 indicates a link bar having one end pivotally anchored or attached at 23 to the support or pedestal 15, the pivot

points 14 and 23 defining a line parallel to the arms 21 on the treads 18 lying between the pedestal and the tread 18^a. The outer end of the link bar 22 is pivotally connected to the arms 21^b on the tread 18^a at 24. 25 indicates the pivot of the tread 18^a. The pivot points 25 and 24 define a line parallel to the pivot points 14 and 23. This furnishes the well-known parallelogram arrangement by which the treads 18 and 18^a are maintained in horizontal position regardless of the swinging movement of the stair.

Numeral 26 indicates a second link bar with its upper end pivotally connected at 27 to the arms 21^a on the tread 18^a. The pivot points 25 and 27 define a line parallel to the arms 21 attached to the treads 18 which lie below the tread 18^a. This furnishes the well-known parallelogram construction serving to maintain the treads 18 in the lower part of the ladder in horizontal position regardless of the swinging of the stair.

The lower free swinging ends of the stringers 13 may be supported on the deck 11 by the wheels 28.

Numeral 29 indicates a stiffening plate fastened to the stringers 13 at the angle 13^a in order to strengthen the structure. This plate 29 is provided with suitable slots 29^a to accommodate the arms 21 fastened to the stair treads.

The stringers 13 are further supported and strengthened by diagonal cross braces 30, said braces being so spaced and separated that they extend between the arms 21 and will not be engaged by said arms during the movements of the stair. The link bar 26 lies below these cross braces 30.

A suitable trussed hand rail 31 may be provided, the same being supported by a post 32 from the stringers 13.

While I have shown and described certain embodiments of my invention, it is to be understood that it is capable of many modifications. Changes, therefore, in the construction and arrangement may be made without departing from the spirit and scope of the invention as disclosed in the appended claims, in which it is my intention to claim all novelty inherent in my invention as broadly as permissible, in view of the prior art.

What I regard as new, and desire to secure by Letters Patent, is:

1. Stair construction of the character referred to, including; a pair of parallel angular stringers with their upper ends pivotally attached to a support and their lower ends free to swing; a plurality of horizontal treads pivotally mounted on said stringers, one of said treads being located adjacent the angle in said stringers; two arms carried by the tread located adjacent the angle of the stringers, and one arm carried by each of the other treads; a link bar having one end pivotally attached to the support and the other end pivotally attached to one of the arms on the tread adjacent the angle in the stringers, the arms on the intermediate treads being pivotally attached to said link bar; and a second link bar having its upper end pivotally attached to the other arm on the tread adjacent the angle in the stringers and its lower end pivotally attached to the arm on the lowermost tread of the stair, the arms on intermediate treads being pivotally attached to said second link bar.

2. Stair construction as claimed in claim 1, in which the arms on the treads depend from the same, and in which cross braces connect the stringers, said cross braces lying between said depending arms and above the link bar.

3. Stair construction of the character referred to, including; a pair of parallel stringers, each having an upper and lower portion angularly connected, the upper ends of said stringers being pivotally attached to a support and their lower ends free to swing; a plurality of horizontal treads pivotally mounted between the upper portions of said stringers; a plurality of horizontal treads pivotally mounted between the lower portions of said stringers; and a link bar pivotally connected to the treads substantially between the upper portions of the stringers and a second link bar pivotally connected to the treads substantially between the lower portions of the stringers, the adjacent ends of said link bars being both pivotally connected to the same tread, and one of said link bars being anchored whereby the treads will be maintained in horizontal position during the swinging movement of the stair.

4. Stair construction as claimed in claim 3, in which the link bar connecting the treads between the upper portions of the stringers is anchored to the support to which the upper ends of the stringers are pivotally attached.

OTTERBEIN A. BAILEY.