United States Patent [19]

Morros

[11] **3,902,948**

[45] **Sept. 2, 1975**

[54] **APPARATUS AND METHOD FOR FORMING CURVED STAIRWAYS**

[76] Inventor: **Jose Morros,** 2933 Toronto Cr., Calgary, Alberta, Canada

[22] Filed: **June 13, 1974**

[21] Appl. No.: **479,084**

[52] **U.S. Cl.** ..... **156/222;** 156/443; 52/187; 249/14; 264/35; 269/321 S

[51] **Int. Cl.**[2]. **B32B 31/20;** B28B 7/22; E04G 13/06

[58] **Field of Search** ..... 52/182, 183, 187, 188, 52/191; 156/222, 443; 249/14; 264/35; 269/321 S

[56] **References Cited**

UNITED STATES PATENTS

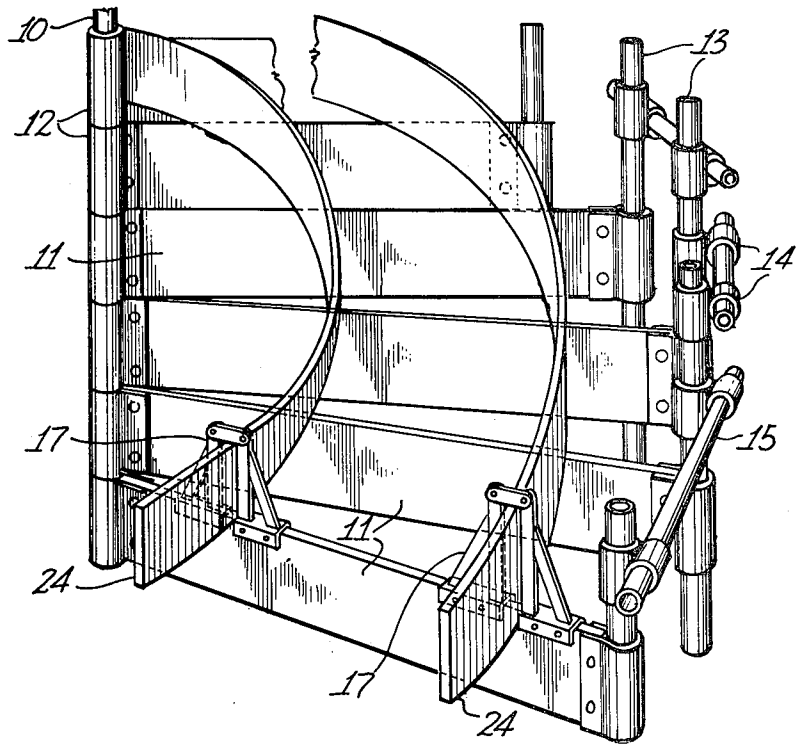
1,239,462	9/1917	Clinkunbroomer	249/14
1,774,582	9/1930	Woodbridge	52/187
2,818,945	1/1958	Holzer	52/191
3,418,770	12/1968	Allmand	52/187

Primary Examiner—Al Lawrence Smith
Assistant Examiner—James G. Smith

[57] **ABSTRACT**

The invention relates to an apparatus in the form of a jig and a method for forming a curving stairway. The jig comprises a generally circular center supporting post with a plurality of radially extending horizontal arms mounted thereon. These arms are swingably mounted on the post in a vertically stacked arrangement and are angularly displaceable from each other to form a helical path. Upwardly extending retainer members are mounted on the arms and these members with the arms therebetween form a jig defining the path of the stairway. The retainers serve to retain inner and outer concentrically curved plates forming ends of stair treads which are assembled between the plates. A complete stairway of wood, concrete or metal can be constructed on the jig, after which the jig is separated from the completed stairway to be used for the construction of another stairway.

13 Claims, 14 Drawing Figures



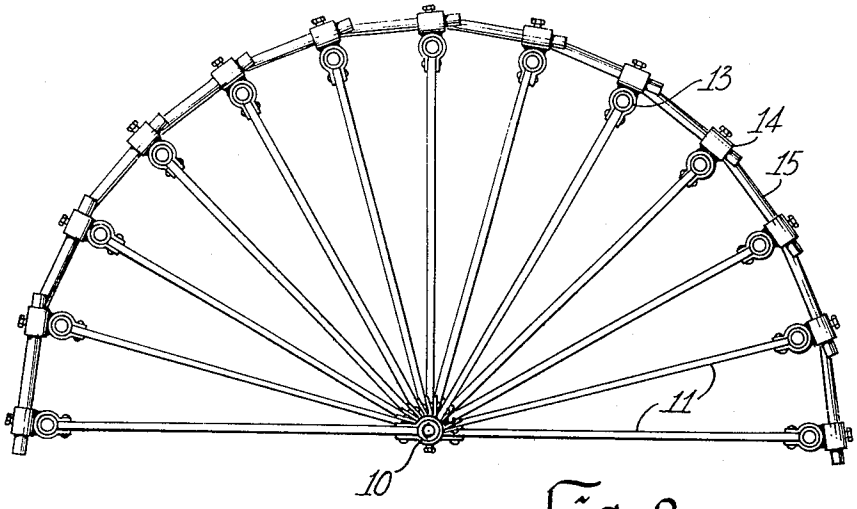


Fig. 2

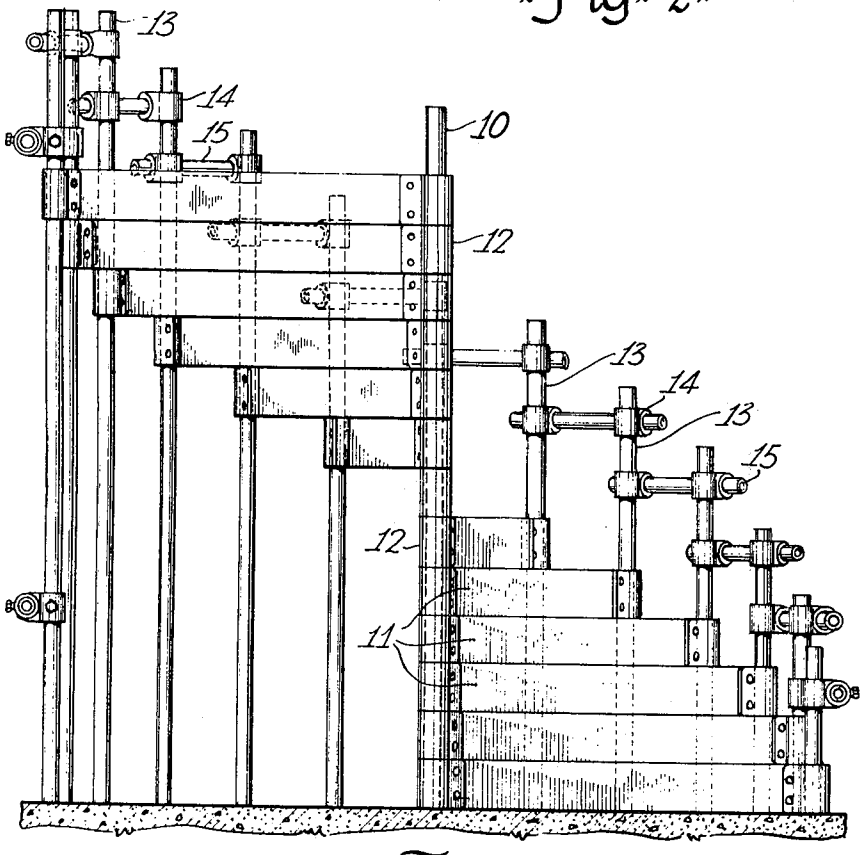


Fig. 1

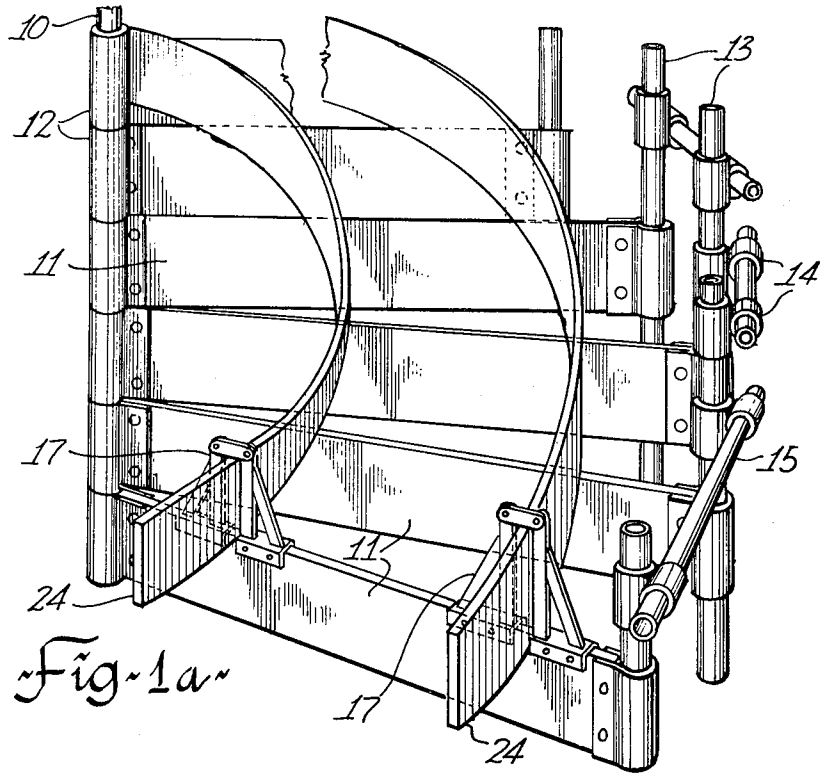


Fig-1a

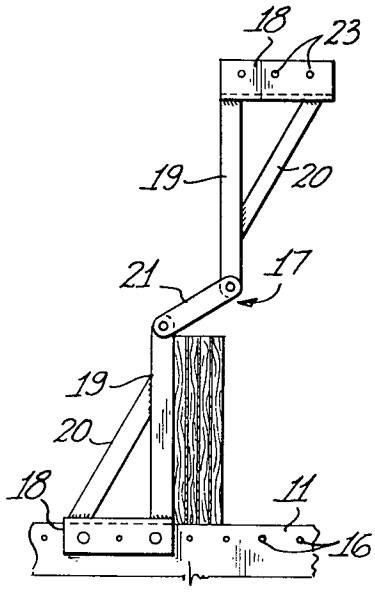


Fig-5

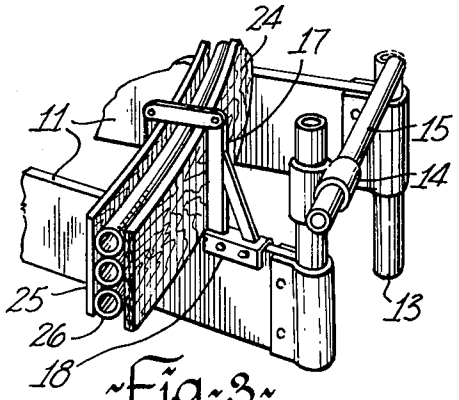


Fig-3

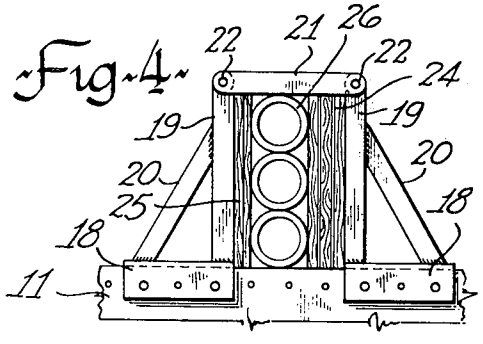


Fig-4

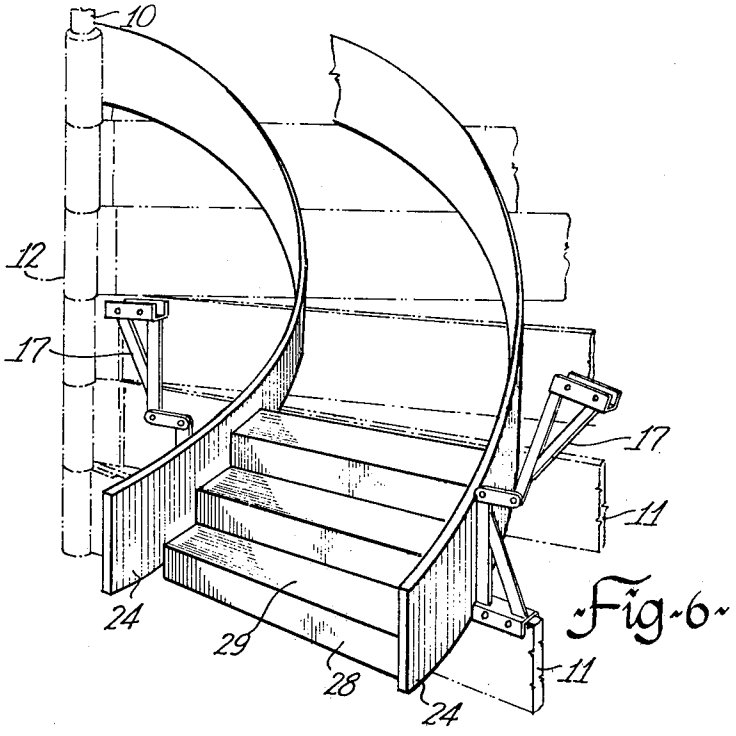


Fig-6

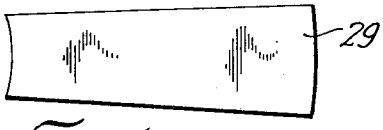


Fig-6a

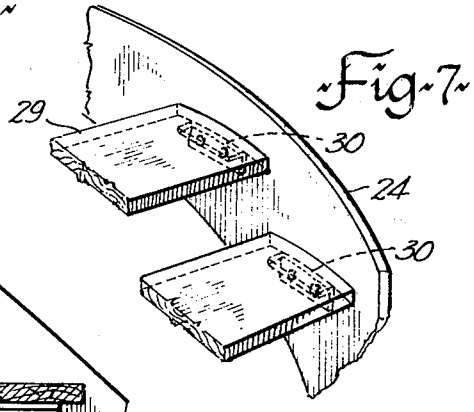


Fig-7

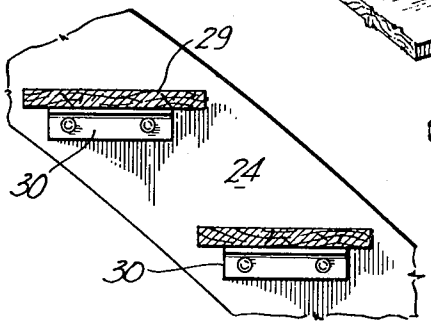


Fig-8

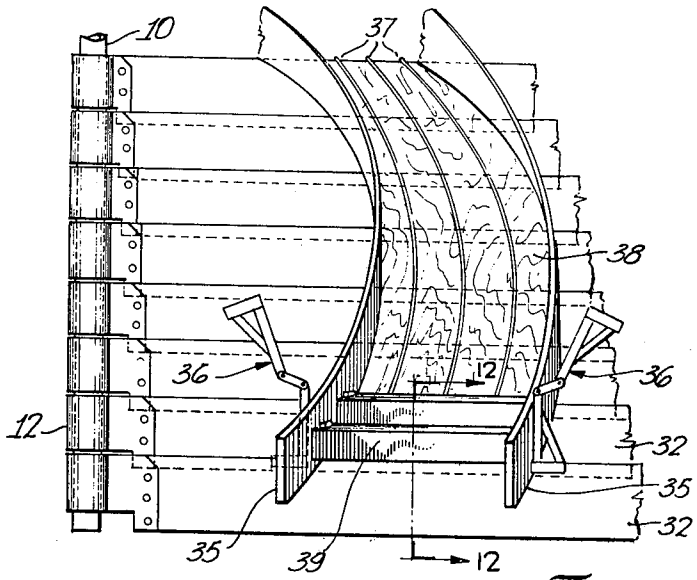


Fig. 9

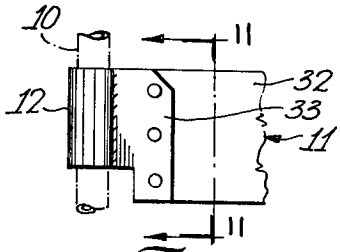


Fig. 10

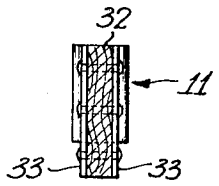


Fig. 11

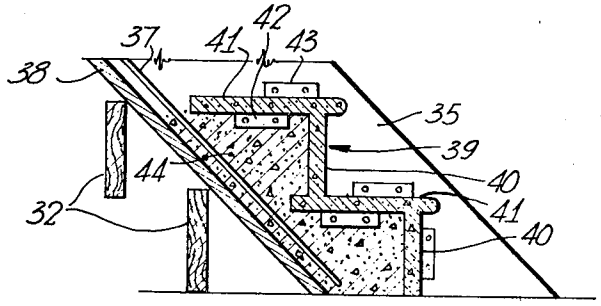


Fig. 12

APPARATUS AND METHOD FOR FORMING CURVED STAIRWAYS

BACKGROUND OF THE INVENTION

1. Field of the Invention

The invention relates to an apparatus in the form of a jig and a method for forming curved stairways. More particularly, it relates to a jig which is readily adjustable and is separted from an assembled stairway after construction is completed for re-use.

2. Summary of the Prior Art

Spiral stairways have been known since ancient times and have typically been constructed with a central support post or newel having a series of stacked segment shaped steps radiating out from this central newel in angularly displaced positions. This type of spiral stairway is satisfactory for a confined area but it is evident that the inner portion of each step in the region adjacent the newel cannot be used as a part of the stair treads. Also, this type of stairs tends to have a very short radius making them both awkward to use and unattractive in appearance. A typical spiral stairway of the classical type is described in Allmand U.S. Pat. No. 3,148,770 issued Dec. 31, 1968.

In terms of appearance and the practical utilization of all of each stair tread, the so-called "flying spiral" stairway has long been popular. They have been highly desirable in entrance halls of homes and also in public buildings where a processional stairway may be desired. A typical form of flying spiral stairway is shown in Lappin U.S. Pat. No. 3,473,275 issued Oct. 21, 1969. The great difficulty with the flying spiral stairway is that it is extremely difficult and expensive to construct. There are very few workmen who have the skill and knowledge required to construct the complex curves necessary and even for highly skilled workmen, this construction is extremely time consuming. The result is that the flying spiral stairway is rarely used in modern construction.

U.S. Pat. No. 3,473,275 represents one attempt to overcome these problems by constructing a kind of prefabricated stairway that can be assembled on location. However, it will be evident that this kind of construction is only suitable for metal stairways and has absolutely no versatility in terms of types of material, shapes, etc.

It is the object of the present invention to provide a novel apparatus and method which will permit the construction of curved stairways incorporating the flying spiral using traditional building materials and without requiring highly skilled craftsmen.

SUMMARY OF THE INVENTION

Thus, in accordance with the present invention there is provided an apparatus for forming a curved stairway comprising:

a generally circular vertical center supporting post with a plurality of radially extending horizontal arms mounted on said post, said arms being swingably mounted on said post in a vertically stacked arrangement and being angularly displaceable from each other to form a helical path. Upwardly extending retainer members are mounted on the arms and these retainer members serve to retain inner and outer concentrically curved stringers forming ends of stair treads which are assembled between the plates. The combination of radial arms and retainers is utilized as a form or jig during construction and is then separated from the completed stairway to be used again for further construction.

The jig can be set up as a permanent arrangement in a factory for the manufacture of curved stairways or it can be of a portable type which can be simply assembled on location between two floors of a building and a curving stairway can then be conveniently constructed on site. In order to retain each radial arm in a perfectly horizontal position, it is normal to use vertical supports at locations distal from the center support post and these can conveniently be in the form of the usual scaffolding material. Similar scaffolding rods and clamps can be utilized for the lateral spacing of these support rods thereby fixing the angular spacing of the radial arms withe respect to each other.

The upwardly extending retainer members on the arms are preferably movable along the length of each arm and a pair of such retainer members are normally used on each arm for defining the location of the inner and outer concentrically curved stringers forming the ends of the stair treads. These retainers can be infinitely variable in their location along each radial arm or a series of spaced holes can be provided which interlock with the retainers.

The apparatus and method of this invention can be utilized to construct curving stairways of widely differing materials and can, for instance, be used for constructing wooden stairways with either open or closed risers, concrete stairways, metal stairways, etc. For each type of stairway the basic concept is the same, namely that the radial arms and retainers are positioned to define the incline and curvature of the path to be followed by the stairway and then the stairway is simply constructed within the form or mold created by the positioned arms and retainers.

While the discussion of the above has primarily been concerned with a curving stairway of the flying spiral type, it will also be appreciated that the apparatus and method of this invention is adaptable to many different shapes including construction involving a reverse curve as well as constructions utilizing intermediate straight portions. Thus, a pair of central posts can be used so that the form will travel in one direction around one post and then reverse its direction as it travels around the second post. According to another arrangement a pair of central posts can again be used but with the same direction of curve around each post and a straight intermediate section joining the portions surrounding the post. Such straight intermediate section can be supported by standard scaffolding.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

According to one preferred embodiment of the invention, the retainer members mounted on the radial arms can each be in the form of a U-member having a pair of upstanding posts with a narrow gap therebetween. The gaps between these pairs of posts then form helical paths within which can be constructed the curved plates forming the stringers for a curving stairway. For instance, laminated wooden curved plates can be assembled between these posts and glued and clamped to form rigid curving laminated wooden stringers. With this form of construction, the retainer members are preferably articulated so that the post adjacent the stairway can be swung out of the way after the completion of the manufacture of the curved

plates. Then with the plates being held into engagement with the remaining posts, the stair treads can be mounted across between these curved plates and assembled together either by recessing of the treads into the plates or by the use of connecting brackets. If desired, risers can also be inserted at this time. After the assembly of the curving side stringers and treads has been completed, the stairway can be separated from the jig and this can then be used for the construction of another stairway.

According to another preferred embodiment of the invention, the radial arms and vertical retainer members can be set up in generally the same manner as was done for the wooden construction. However, in this case, only single uprights are necessary for each retainer and thin end plates are fixed to these upstanding retainers to form curving sides for a concrete form. A deck of sheet material is also laid on the arms between the retainers to form the bottom of the form. Once this form has been constructed, a set of concrete steps can be constructed within the form in the usual manner, after which the form is removed to leave a free standing curving concrete stairway.

Details of commercial embodiments of the invention are illustrated by the following drawings in which:

FIG. **1** is an elevation view of the apparatus according to the invention;

FIG. **1***a* is a perspective view of the apparatus;

FIG. **2** is a top plan view of the arrangement shown in FIG. **1**;

FIG. **3** is a detailed view of the forming of a laminated curved stringer;

FIG. **4** is an end elevation of the view shown in FIG. **3**;

FIG. **5** is an end elevation showing the retainer in open position;

FIG. **6** is an elevation showing the construction of a wooden stairway;

FIG. **6***a* is a plan view of a step;

FIG. **7** is a perspective view showing the connection of a stair tread to a side plate;

FIG. **8** is an end view of FIG. **7** in partial section;

FIG. **9** is an elevation showing an embodiment for constructing concrete stairways;

FIG. **10** is an elevation showing details of an alternative form of radial arm;

FIG. **11** is a cross-sectional view of the arm of FIG. **10**; and

FIG. **12** is a cross-sectional view showing preformed treads and risers which can be used in the construction of concrete stairways.

Referring now to FIG. **1**, we see a vertical circular post **10** which forms the central post for the jig assembly. Mounted on this post **10** are a series of radial arms **11** and these can be conveniently of metal construction having a sleeve **12** welded on the inner end. Each sleeve **12** fits over post **10** so that the arms can be stacked on the post in a manner shown in FIG. **1**. The ends of the arms distal from post **10** are supported by vertical scaffolding members **13** and clamp members **14**. The angular spacing of the arms **11** can be fixed by means of horizontal bracing members **15**. Each arm **11** can have extending along the length thereof a series of laterally spaced holes **16**.

Mounted on each arm **11** are a pair of spaced retainer members **17** and as best can be seen from FIGS. **3**, **4** and **5**, these retainer members can be conveniently constructed with channel members **18** which rest on the top edge of arms **11** and can be fixed in position on the arms by means of pins extending through holes **23** in the channel members **18** and the holes **16** of arms **11**. Rigidly fixed to these channel members **18** are vertical tube members **19** and extending between the vertical tubes **19** and the channel members **18** are angular reinforcing braces **20**. Extending across between the top ends of tubes **19** is a cross bar **21** which is pivotally connected at both ends by removable pivot pins **22**.

When the radial arms have been fixed into the desired position for the location of a stairway and the retainers **17** have been all positioned on the arms to define the outer edges of the stairway, construction can begin. In the construction of a wooden stairway, the first step is to make laminated stringer plates **24**, for instance using ¼ inch plywood. The laminating strips are cut and glued and placed in position in the mold formed by the retainers **17** and arms **19**. The laminate is then clamped and allowed to set and the clamping is most conveniently done by placing a stiffener board **25** against the inner vertical posts of each retainer **17** and placing pressure tubing **26** between the stiffener board and laminated stringer **24**. Air pressure is then applied to these tubes via air line **27** and this provides a uniform pressure against the laminated stringer **24** along its entire length. This pressure is maintained until the glue has set and then the pressure is released and the tubes **26** and stiffening board **27** are removed, leaving the rigid stringer **24** in position. For removing the stiffener board **25** and tubes **26**, the retainer is opened as illustrated in FIG. **5** and it is left in this open position for the continuation of the wood construction.

For the continuation of the construction, a series of treads **29** are cut to a shape shown in FIG. **6***a* and these are fixed in position between the stringers **24**. This can be done by the cutting of recesses into the stringers and nailing or bracket members **30** can be used as shown in FIGS. **7** and **8**. The bracket members are particularly convenient if the stairs are to be constructed with open risers but, alternatively, with either construction a closed riser **28** can be inserted.

When the entire wooden stairway has been completed in the above manner, the arms and retainers can be separated from the stairway and the stairway can then either remain in location if constructed on site, or be removed for transporting to a construction site.

When the method and apparatus of the invention is to be used for constructing concrete stairways, one embodiment that can be utilized is that shown in FIGS. **9** to **12**. In this embodiment a different construction of the radial arms **11** is shown and in this case they are constructed from wood since this will be lighter and easier to assemble for on site construction which is typically used for concrete stairways. Each arm **11** has a timber member **32** sandwiched at its inner end between a pair of steel plates **33** which are in turn connected to collar member **12** which fits over the post **10**. Because the timber arms tend to be deeper than the rise between adjacent arms, a notch can be provided at the inner ends as illustrated to allow for the overlap. These arms are supported at the outer ends by the posts **13** and brackets **14** with the cross bracing **15** to fix the angular position.

Also for portability and ease of assembly of the jig on site, the central post **10** can be made from a series of short tubular post members which connect end to end.

Thus, to assemble the jig, a first short post member can be positioned vertically in a support on the floor and a series of arms **11** are then stacked on the post. Then, another short post member is mounted on top of the first post and another series of arms **11** are stacked in position. This is continued until the complete jig is assembled.

For the concrete construction, the retainer members used previously can be utilized in the open position or a simpler single post type of retainer can be used as illustrated in FIG. **9**. Relatively thin plywood strips **35** can be used to construct the sides of a form and these are fixed against the retainers **36**. A plywood deck **38** is then laid between the side pieces **35** to complete the curving form. Steel reinforcing rods can then be positioned above the deck and the construction of concrete steps can then proceed in the usual manner.

It has been found to be particularly convenient to precast special tread and riser units **39** having a riser portion **40** and a tread portion **41**. These are placed in position between the curving side pieces **35** and are held in position by end blocks **42** and **43** which are connected to the end plates **35**. When each precast unit **39** is in position, the cement mix **44** is poured and compacted in the area behind the precast unit and then the next precast unit is placed in position and more cement is poured and compacted behind the next unit. This procedure then continues to the top of the stairway. After the cement is set, the form, including the radial arms and posts, is removed leaving a free standing concrete stairway.

I claim:

1. An apparatus for forming a curved stairway comprising:

a. a generally circular vertical center supporting post;

b. a plurality of radially extending horizontal arms mounted on said post, said arms being vertically stacked on said post and being horizontally swingable for angular displacement with respect to each other, thereby forming a helical path; and

c. upwardly extending retainer members mounted on said arms, said retainer members and arms forming therebetween a jig defining the path of the stairway with said retainer members serving to retain inner and outer concentrically curved plates forming ends of stair treads which are assembled between the plates to construct a stairway,

said retainers, arms and post being separable from the constructed stairway for re-use.

2. An apparatus according to claim **1** wherein load supports for said arms are provided distal from the post.

3. An apparatus according to claim **2** wherein lateral bracing members are provided for fixing the angular displacement of the arms.

4. An apparatus according to claim **1** wherein each retainer member is movable along an arm.

5. An apparatus according to claim **1** wherein each retainer member comprises a pair of upstanding posts with a small gap therebetween, said gap being adapted to receive and retain the curving plates.

6. An apparatus according to claim **5** wherein each post is rigidly fixed to a base member which is adjustably fixed to an arm.

7. An apparatus according to claim **6** wherein a cross bar is pivotally connected between the upper ends of said posts across the gap.

8. An apparatus according to claim **1** wherein each arm includes at one end thereof a tubular sleeve member which swingably mounts on said post.

9. An apparatus according to claim **8** wherein said sleeve members rest on each other in stacked relationship.

10. An apparatus according to claim **8** wherein each arm includes at the end remote from said sleeve a clamp member for receiving and holding a vertical support.

11. A method of constructing a curved stairway which comprises:

a. aligning a jig having a plurality of vertically stacked radially extending horizontal arms mounted on a vertical post such that the arms are angularly displaced with respect to each other to form a helical path;

b. positioning a pair of substantially vertical retainer members in spaced relationship on each arm whereby the retainers on the plurality of arms form a jig defining the path of a curving stairway;

c. positioning stringer members adjacent said retainers and resting on said arms;

d. constructing steps between said stringers to form a self-supporting stairway, and

e. separating the jig from the constructed stairway.

12. A method according to claim **11** wherein the stringers are constructed in the jig by laminating wood strips and step treads are permanently fixed to the stringers to form the stairway.

13. A method according to claim **11** wherein the stringers are strips of sheet material and a deck of sheet material is placed on said arms between the stringers to create a concrete mold, concrete steps are constructed within said mold to produce a self-supporting stairway and thereafter the jig and mold are removed.

* * * * *