

- [54] **VARIABLE CURVATURE AND/OR PITCH STAIRWAY HANDRAIL**
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[51] Int. Cl. **E04b 17/14**
[58] Field of Search.....256/19, 21, 22, 24, 256/59, 65-70

[56] **References Cited**

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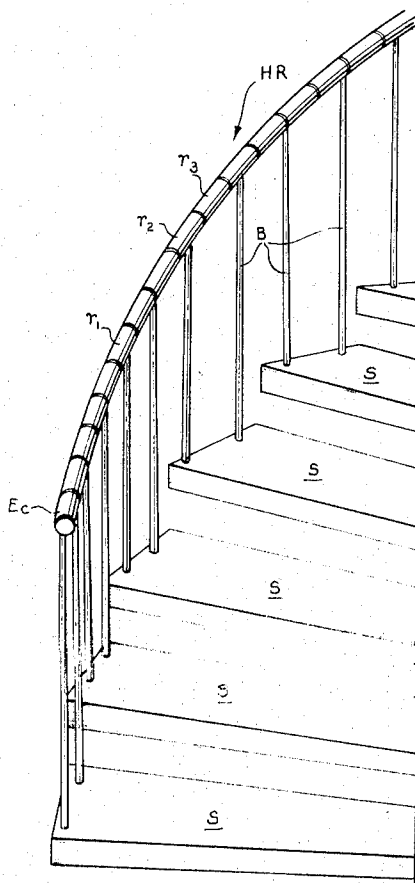
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[57] **ABSTRACT**

A variable curvature and/or pitch handrail for the balustrade (railing) of a circular, spiral and curved stairway which is capable of being assembled on the site, comprising a plurality of relatively short-length, generally cylindrical handrail sections each having an axial bore therethrough, rotatable washer-form wedges adapted to be interposed between the sections of each pair thereof, an elongate cable adapted to be threaded through the bores of end-to-end related sections and the center openings of the washer-form wedges interposed therebetween, means for tensioning the cable in manner as to secure said sections and washers together to the form of a rigid handrail, said washer-form wedges incorporating readily accessible means whereby they may be individually rotated with respect to one another and to the cylindrical handrail sections between which they are interposed thereby to "set" the curvature and/or pitch of the hand-rail to that desired.

8 Claims, 6 Drawing Figures



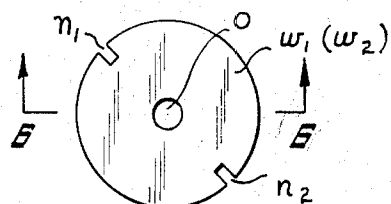
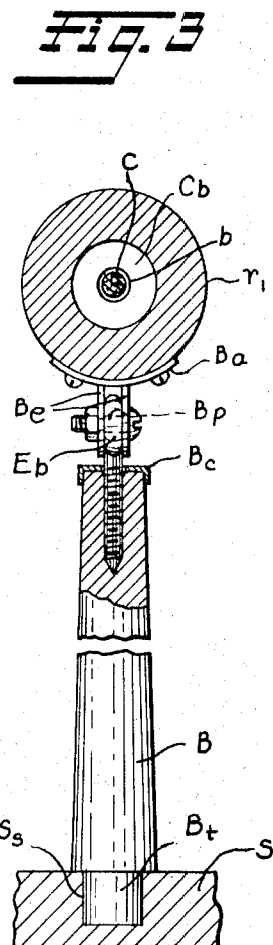
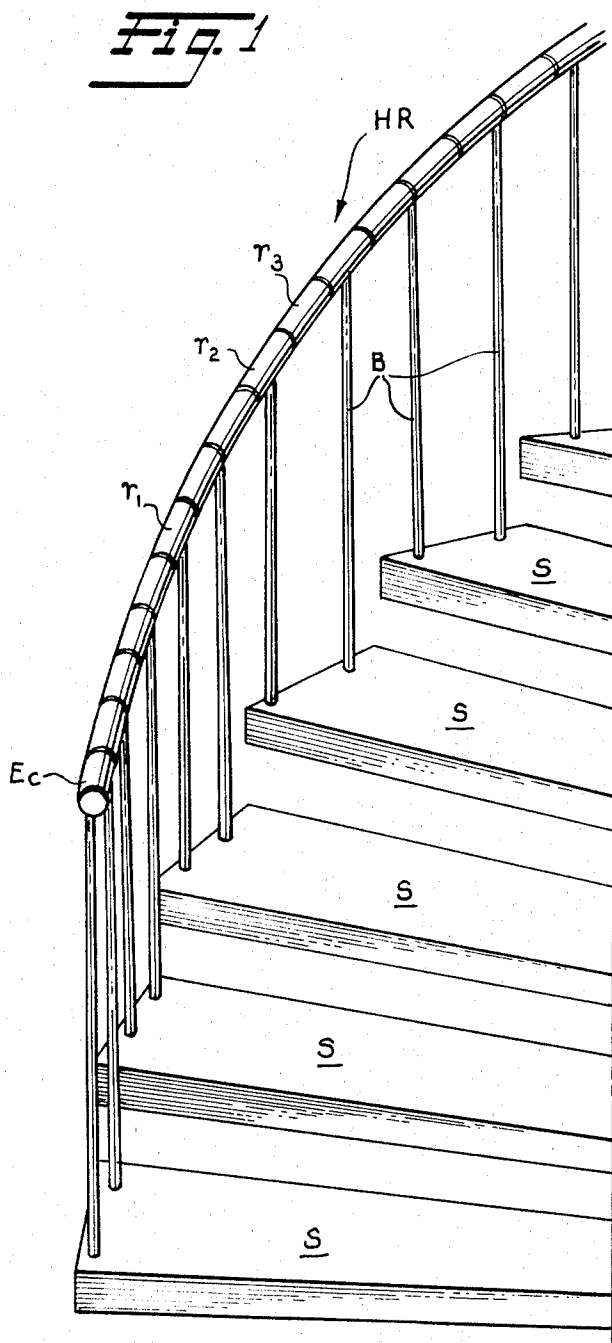


Fig. 5

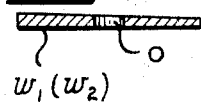
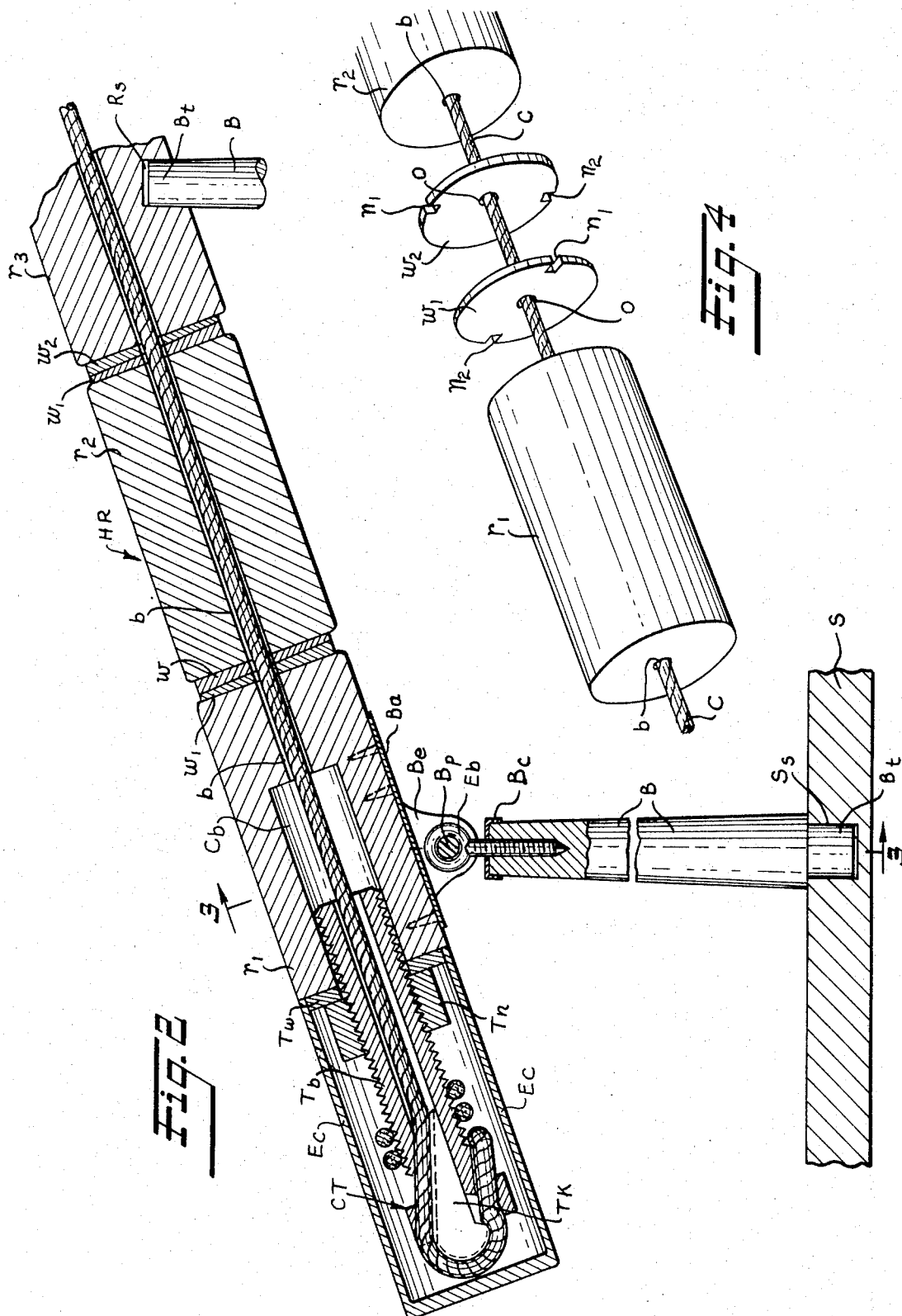


Fig. 6



VARIABLE CURVATURE AND/OR PITCH STAIRWAY HANDRAIL

INTRODUCTION

Heretofore, handrails for the balustrades or railings of circular, spiral and like stairways or staircases have been custom-fabricated complete or in section of substantial length to the curvature and/or pitch called for by the builder's specifications of each particular staircase.

Obviously, such custom-fabrication is time-consuming and expensive and it is further objectionable in that high inventory, packaging and shipment-to-site costs are involved. Thus, the practice of custom-fabricating curved stairway or staircase handrails, either complete or in long sections, has come to be recognized as economically unfeasible, and particularly so for low-cost housing and related types of building construction.

The present invention contemplates and aims to provide a handrail construction and an on-the-site fabrication procedure made possible thereby which overcomes the above stated objections to custom- or factory-fabricated curved handrails for similar use. More particularly, it is an object of the invention to provide a handrail construction and an on-the-site fabrication procedure enabling a handrail to be erected to builders' or building specifications from individual small parts capable of being inexpensively mass-produced, shipped to the site and there put together, and during the course of being put together or assembled being readily adjusted to conform to a wide variety of curvatures and/or pitch angles required by the building specifications for a particular stairway or staircase.

Still another object of the invention is the provision of a handrail of the stated character made up of parts which by virtue of their small size and to a substantial extent their identical construction are capable of being packaged, stored and/or shipped to the site at a small fraction of the cost required to package, store or inventory and ship to the site custom-fabricated handrails which were previously made up complete at the factory or in sections of substantial length.

DETAILED DESCRIPTION OF THE INVENTION

The above and other objects and advantages accruing from a handrail construction for the balustrades or railings of circular, spiral and like curved stairways or staircases as herein proposed will appear from or be self-evident from the following detailed description thereof, reference being had to the accompanying illustrative drawings, wherein:

FIG. 1 is a fragmentary elevation of a balustrade or railing having a handrail constructed in accordance with the instant invention in position on a spiral stairway;

FIG. 2 is an enlarged fragmentary section taken through substantially the vertical center plane of the balustrade (railing) according to FIG. 1, the view illustrating two forms of attaching balusters to the handrail;

FIG. 3 is a broken-away section taken generally along the line 3—3 of FIG. 2;

FIG. 4 is an exploded perspective view illustrating the preferred components and their general relationship making up a handrail of the invention;

FIG. 5 is a plan or face view and FIG. 6 is a section taken along line 6—6 of FIG. 5 intended to illustrate in

detail the constructional features of the rotatable washer-form wedges of the invention which serve to vary the angularity of the cylindrical handrail sections of the pairs thereof.

Referring to the drawings, it is explained that in the interest of simple disclosure, such illustrate generally and in detail a variable curvature and/or pitch handrail of the invention (designated HR) and its supporting balusters B applied as the protective outer railing or balustrade of a curved (spiral) stairway or staircase, preferably but not exclusively of the type disclosed and claimed in my U.S. Pat. No. 3,491,498, dated Jan. 29, 1970. Hence, if the balustrade is to perform in acceptable manner, its handrail HR must follow the curvature and pitch of such a stairway or staircase. The handrail HR of the present invention, as will now be described, not only satisfies this requirement but it does so in exceedingly simple and practical manner and through the use of relatively small, individual, generally like parts capable of inexpensive construction which may be packaged and shipped from factory to site in small compact units and which are there capable of being readily assembled on-the-site to the form of a handrail adapted for practically any curved, spiral or curved condition, without special fabrication to each such condition.

More particularly, a handrail HR according to the present invention is made up of a plurality of like, illustratively cylindrical short-length handrail sections r_1, r_2, r_3 , etc. of wood, plastic and/or light-weight metal, each provided in its fabrication with a small-diameter bore b extending axially from end-to-end thereof; a plurality of individually rotatable wedge means, i.e., washer-form wedges w_1, w_2, w_3 , etc. (sometimes also termed in the art "beveled washers") having outer diameter corresponding substantially to that of said cylindrical handrail sections and each also having a centrally disposed opening o and being further provided in fabrication with peripheral-edge notches n_1, n_2 which are preferably diametrically opposed to one another for the reception of the opposed pins or jaws of a spanner wrench (not shown), whereby each said washer-form wedge may be rotated independently of and with respect to an adjacent washer and/or to an adjacent cylindrical handrail section; an elongate high-tensile aircraft cable C on which the plurality of handrail sections and the washer-form wedges are threaded or strung; and cable-tensioning means generally designated CT (FIG. 2) associated with or built into each of the two endmost handrail sections and being operative to tension the cable by pulling or tensioning each end thereof against the other end, thereby securing the short-length cylindrical handrail sections r_1, r_2, r_3 , etc. and the interposed washer wedges w_1, w_2 together in the form of an elongate rigid handrail, whose curvature or pitch is determined and/or can be varied as desired by manual rotation of the said individually rotatable washer-wedges of the pairs thereof with respect to one another and/or to adjacent handrail sections on the site of stairway erection.

Illustratively, each of said cable-tensioning means CT also incorporates provision (as shown in FIG. 2) for holding fast an end portion of the cable C as enables it to be tensioned by the cable tensioning means effective on its opposite end. More particularly, said cable-end holding provision comprises a tear-drop or wedge-shaped key Tk over whose larger rounded end the ter-

minal portion of the cable is trained and then doubled back on itself. The smaller end of said tear-drop shaped wedge or key, together with the cable portions extending along opposite sides thereof, is fitted into a generally correspondingly shaped recess provided therefor in a turnbuckle bolt Tb having an elongated shank end which in turn extends into an enlarged counter bore bc in the endmost handrail section r_1 , into which its bore b opens. A turnbuckle nut Tn threaded on the turnbuckle bolt is so arranged that when turned in one direction on said bolt Tb it functions via a force-transmitting metal washer Tw to tension the lower-held end of the cable C against its correspondingly or equivalently held opposite (upper) end.

Illustratively, a hollow, preferably metal, end cap EC having outer diameter substantially equaling that of the handrail and which extends in continuation of the endmost handrail section r_1 to which it is suitably attached, houses the aforesaid cable-end holding and tensioning means, it being understood that a similar cap will be provided at the other end of the handrail as finally erected to house the upper-end cable holding and/or tensioning means.

From a consideration of the above, it will be appreciated that the present invention provides a handrail construction and a simple, practical, on-the-site handrail erecting procedure made possible thereby, which taken together overcome the many objections to custom- or factory-fabricated curved handrails. More particularly, the handrail HR is made up or constituted by a plurality of short-length, substantially like, preferably cylindrical handrail sections and a plurality of small washer-form wedges capable of individual rotation, all of which can be mass-produced, inventoried, packaged and shipped at a small fraction of the cost of producing custom- or factory-fabricated curved handrails.

The on-the-site fabrication procedure according to the invention proceeds from the concept of erecting a rigid elongate handrail suited or adjustable to any number of spiral, circular or curved conditions or requirements, without any special fabrication to each such requirement, from said mass-produced small parts, i.e., short-length handrail sections and washer-form wedges, simply by stringing same on a cable, illustratively in the order shown in FIG. 2, then initially tensioning the cable in manner as frictionally secures the so-strung parts or units together while permitting rotation of the washer-form wedges individually or together in their planes to angular positions with respect to one another and/or to the handrail sections between which the wedges are interposed, thereby varying the angularity of the successive handrail sections one to the other as may be necessary for a particular condition; and upon such being effected, finally tensioning the cable whereby to secure said parts (handrail sections and washer-form wedges) together and in a fixed angular relationships determined by the angle or angles through which the washer-form wedges were rotated.

Preferably, following the final tensioning of the cable C, the balusters B which support the handrail raised above the stairway steps S are attached thereto, with FIG. 2 illustrating two approved forms of baluster-to-handrail attaching means. More particularly, one such attaching means, which is that employed to attach the lowermost baluster to the lowermost handrail section r_1 , illustratively comprises a curved bracket Ba secured fast as by screws to the under curved surface of said

handrail section r_1 , the bracket having depending therefrom a pair of spaced-apart apertured ears Be, between which the eye of a metal eye-bolt Eb is accommodated. The shank end of said eye-bolt extends through a metal cap Bc into the upper end portion of said baluster, and a cross pin Bp passing through the eye of the eye bolt and the apertures in the ears Be serves to connect the upper end of the lowermost baluster to the lower or endmost handrail section r_1 .

The second of the aforementioned two means for attaching a baluster upper end of a handrail section is also illustrated in FIG. 2, wherein the upper end of the next higher baluster B₁ is formed as a tenon Bt which extends into and closely fits a correspondingly configured hole or socket Rs drilled or otherwise formed in the under side of the handrail section r_1 at a point along the length of said section as provides for the reception of the baluster-provided tenon. Said tenon and socket form of attachment is also suitable to and may be employed in securing the lower tenoned ends Bt of the balusters to the stairway steps S.

While the handrail of the invention has been illustrated as the component of a protective outer balustrade or railing of a spiral stairway, it will be understood that it is also well suited for use as the handrail component of an inner protective railing or balustrade for a stairway of the center-well type, such as that illustrated in my afore-mentioned U.S. Pat. No. 3,491,498.

Having disclosed my variable curvature and/or pitch stairway handrail, I claim therefor the following features:

I claim:

1. A variable curvature and/or pitch handrail for the balustrade or railing of curved, circular and/or spiral stairways capable of being assembled on the site, comprising: a plurality of relatively short-length, generally similarly configured handrail sections each provided with a small-diameter bore extending axially there-through, rotatable wedge means interposed between the sections of each pair thereof and having small through openings in registry with said bores, a flexible cable extending through the bores of end-to-end related sections and the through openings of said interposed wedge means, said wedge means having external configuration corresponding generally to that of the handrail sections and further incorporating readily accessible means enabling rotation thereof about the axis of the cable, thereby to vary the curvature and/or pitch of the handrail to that desired; and means for tensioning the cable in manner as to secure the plurality of handrail sections and interposed wedge means in the form of an elongate rigid handrail of a desired curvature and/or pitch.

2. A variable curvature and/or pitch handrail according to claim 1, wherein said interposed wedge means comprises at least one washer-form wedge.

3. A variable curvature and/or pitch handrail according to claim 1, wherein said interposed wedge means each comprises plural washer-form wedges.

4. A variable curvature and/or pitch handrail according to claim 1, wherein said interposed wedge means comprises two washer-form wedges disposed in face engagement, and wherein the means provided in the peripheral edges of said washer-form wedges for individually rotating the same consists of notches enabling cooperation therewith of a spanner wrench.

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5. A variable curvature and/or pitch handrail according to claim 1, wherein said cable tensioning means comprises turnbuckle means associated with both ends of the cable.

6. A variable curvature and/or pitch handrail according to claim 1, wherein said handrail is supported from stairway treads by balusters attached at their upper ends to selected ones of said handrail sections.

7. A variable curvature and/or pitch handrail according to claim 6, wherein said baluster-attaching means

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comprises metal brackets screw-threaded to the corresponding under surfaces of selected handrail sections, and eye-bolt means extending between said brackets and the upper end of each said baluster.

8. A variable curvature and/or pitch handrail according to claim 6, wherein said attaching means comprises tenon and socket connections between the upper ends of the balusters and said selected ones of the handrail sections.

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