



US 20090064607A1

(19) **United States**  
(12) **Patent Application Publication**  
**Katz**

(10) **Pub. No.: US 2009/0064607 A1**  
(43) **Pub. Date: Mar. 12, 2009**

(54) **ADJUSTABLE STAIR RAIL**

**Publication Classification**

(76) Inventor: **Howard Katz**, Riegelsville, PA  
(US)

(51) **Int. Cl.**  
**E04F 11/18** (2006.01)  
(52) **U.S. Cl.** ..... **52/184**

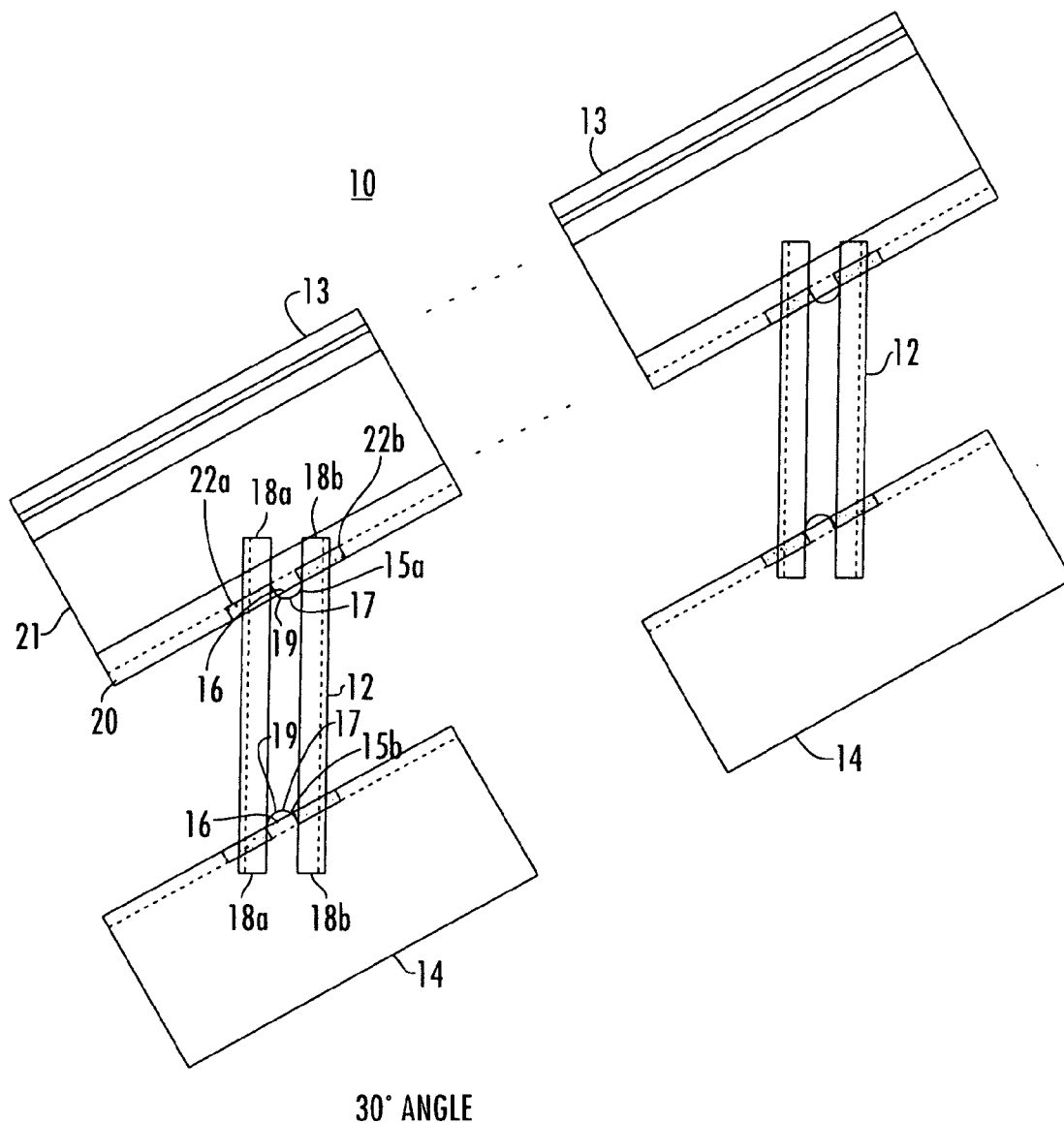
Correspondence Address:  
**MATHEWS, SHEPHERD, MCKAY, & BRU-**  
**NEAU, P.A.**  
**29 THANET ROAD, SUITE 201**  
**PRINCETON, NJ 08540 (US)**

(57) **ABSTRACT**

The present invention relates to an angle adjustable stair rail assembly comprising a top and bottom rail and a plurality of parallel balusters joined to the top rail and the bottom rail by deforming a cut-out opening in the baluster around a punched web openings in a wall of the top and bottom rails so that the rails and balusters can be moved to any angular disposition keeping the balusters parallel to each other and the top rail and bottom rail parallel to each other. The cut-out opening in the baluster can form a pair of legs. The retention of the baluster is accomplished by a simple clamping action after the legs of the baluster are received in the openings in the wall of the top or bottom rail.

(21) Appl. No.: **11/899,903**

(22) Filed: **Sep. 6, 2007**



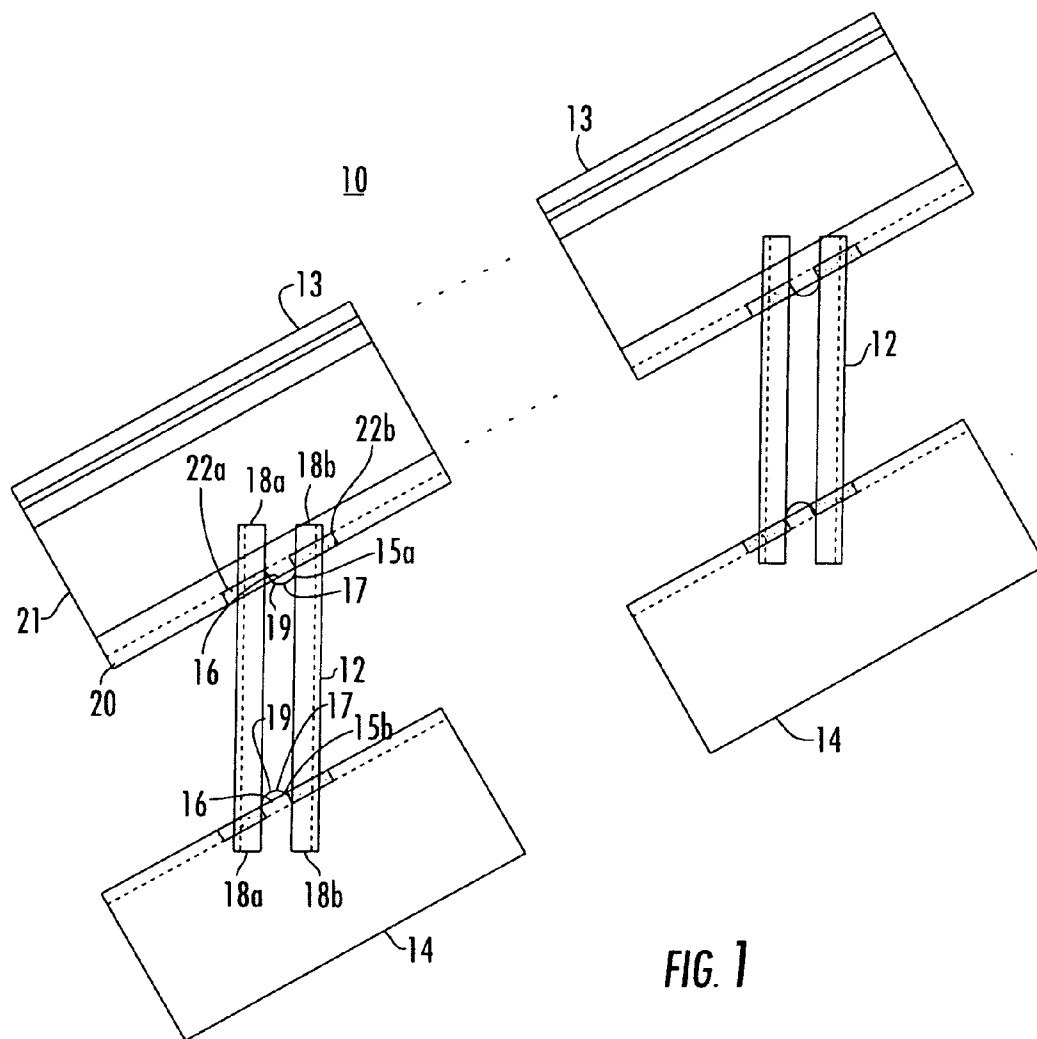


FIG. 1

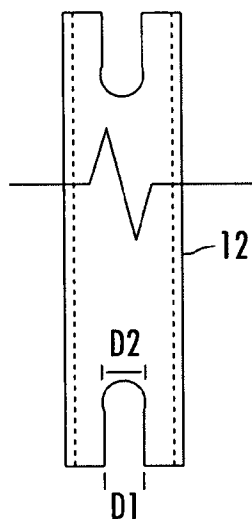


FIG. 2

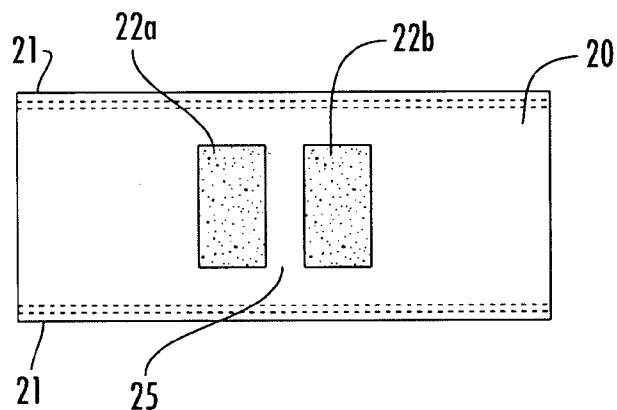


FIG. 3

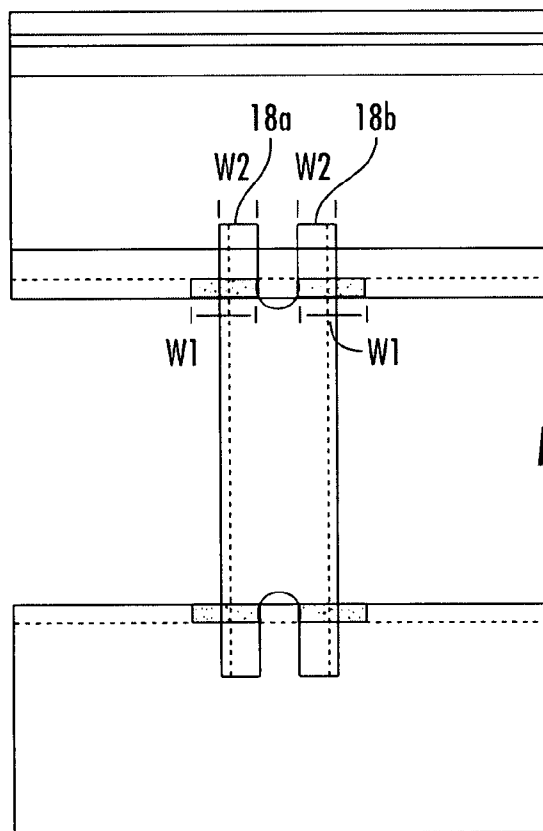


FIG. 4

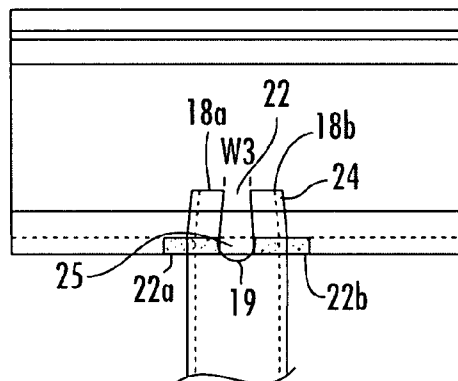


FIG. 5

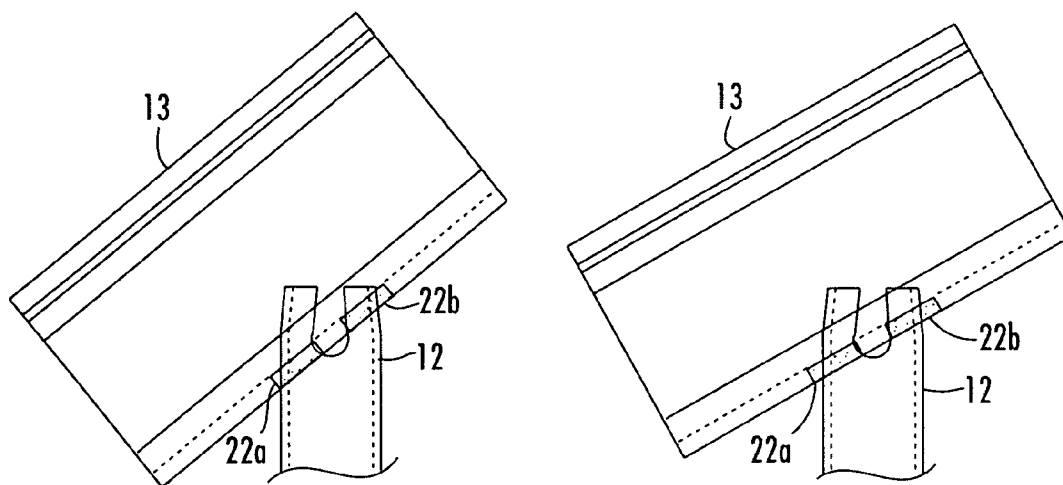


FIG. 6

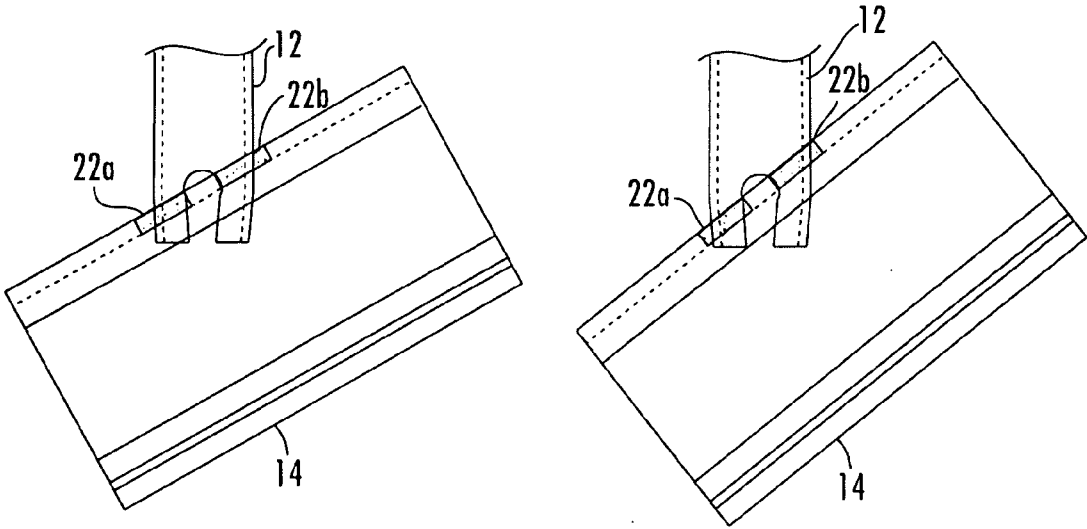


FIG. 7

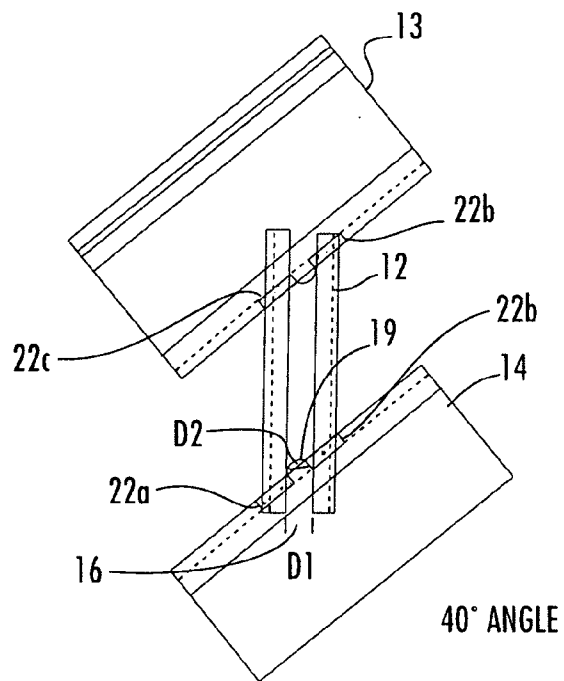


FIG. 8

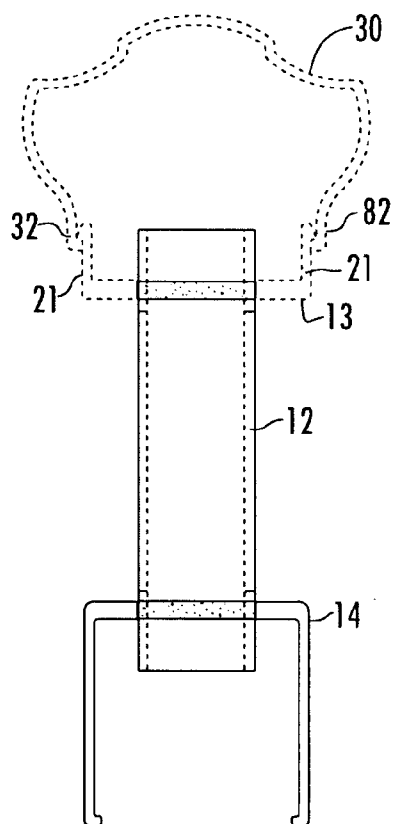


FIG. 9

## ADJUSTABLE STAIR RAIL

### BACKGROUND OF THE INVENTION

#### [0001] 1. Field of the Invention

[0002] The present invention relates to an adjustable stair rail in which a plurality of parallel balusters are coupled to a top rail and a bottom rail by forming an opening in the top and bottom rail as a punched web; receiving a portion ends of the balusters in the opening and deforming the balusters to retain the balusters in the opening so that the rails and balusters can be angularly adjusted while keeping the top and bottom rails parallel to each other and the balusters parallel to each other.

#### [0003] 2. Description of Related Art

[0004] Rail connectors for attaching balusters, columns or posts to rails have been described. U.S. Pat. No. 1,777,159 describes a swivel connection. The swivel connection includes a cylindrical block with a threaded hole by which the block can be fastened to the top and bottom rail with a screw. The cylindrical block has recesses on opposite sides in an axis perpendicular to the threaded hole by which the baluster can be pivotally connected to the block and thereby to the rail.

[0005] U.S. Pat. No. 4,352,485 describes a variable rake system rail assembly including a joining element extending into an end of the baluster and engaging one of the rails. The joining element comprises a flexible dowel. Accordingly, the above described patents provide a pin or dowel for connection.

[0006] U.S. Pat. No. 4,408,749 describes a variable pitch railing system in which a rail has an elongated recess and an interior socket laterally intersecting the recess. The socket has a curved wall that pivotally receives a pivot at one end of a baluster. A molding attached to the rail laterally confines the pivot in the socket between the molding and an interior wall of the socket. This patent needs the combination of a socket and wall member to provide adjustability.

[0007] It is desirable to provide an adjustable stair rail without the use of an additional axle/pin or socket and pivot having minimal parts and fabricating steps, thereby providing low costs for manufacturing.

### SUMMARY OF THE INVENTION

[0008] The present invention relates to an angle adjustable stair rail assembly comprising a top and bottom rail and a plurality of parallel balusters joined to the top rail and the bottom rail by deforming a cut-out opening in the baluster around punched web openings in a wall of the top and bottom rails so that the rails and balusters can be moved to any angular disposition keeping the balusters parallel to each other and the top rail and bottom rail parallel to each other. The cut-out opening in the baluster can form a pair of legs. The retention of the baluster is accomplished by a simple clamping action after the legs of the baluster are received in the openings in the wall of the top or bottom rail. The adjustable stair rail assembly is simple to fabricate and assemble while minimizing the need for additional parts, thereby provide low manufacturing costs. The punched webs provide angular adjustability from 0 to 40 degrees, which is universal in use to any rake of ramp of stair. A decorative cap can be coupled to the top rail. The adjustable rail provides rapid installation and eliminates the need to measure and make a rigid rail for a particular application.

[0009] The invention will be more fully described by reference to the following drawings.

### BRIEF DESCRIPTION OF THE DRAWINGS

[0010] FIG. 1 is a schematic front elevational adjustable stair rail assembly in accordance with the teachings of the present invention.

[0011] FIG. 2 is a schematic front view of a baluster used in the adjustable stair rail assembly.

[0012] FIG. 3 is a plan view of a top rail used in the adjustable stair rail assembly.

[0013] FIG. 4 is a schematic front elevational view of a baluster and rail.

[0014] FIG. 5 is a schematic diagram of the baluster and rail after crimping of the baluster.

[0015] FIG. 6 is a schematic diagram of the baluster and top rail after rotation of an angle of the baluster.

[0016] FIG. 7 is a schematic diagram of the baluster and bottom top rail after rotation of an angle of the baluster.

[0017] FIG. 8 is a schematic diagram of the baluster and top rail after rotation of an angle of the baluster.

[0018] FIG. 9 is a schematic diagram of a decorative cap attached to the adjustable stair rail assembly.

### DETAILED DESCRIPTION

[0019] Reference will now be made in greater detail to a preferred embodiment of the invention, an example of which is illustrated in the accompanying drawings. Wherever possible, the same reference numerals will be used throughout the drawings and the description to refer to the same or like parts.

[0020] FIG. 1 is a schematic diagram of adjustable handrail system 10 in accordance with the teachings of the present invention. One or more balusters 12 extend between top rail 13 and bottom rail 14. In one embodiment, a plurality of balusters 12 are positioned at a predetermined spacing along top rail 13 and bottom rail 14.

[0021] Each end 15a and 15b of baluster 12 includes cut-out opening 16. Opening 16 can have curved shape 19 at end 17. Opening 16 forms legs 18a and 18b. In one embodiment, curved shape 19 can have a slightly larger diameter D<sub>1</sub> than diameter D<sub>2</sub> of opening 16, as shown in FIG. 2.

[0022] Top rail 13 and bottom rail 14 include base wall 20. Side walls 21 extend from base wall 20. Side walls 21 can have a decorative appearance. Base wall 20 can be formed as a punched web for forming a pair of openings 22a and 22b in base wall 20 around web portion 25, as shown in FIG. 3. Openings 22a and 22b have a shape corresponding to a shape of legs 18a and 18b which are received in openings 22a and 22b of base wall 20, as shown in FIG. 4. Each of openings 22a and 22b has a width W<sub>1</sub> which is larger than the width W<sub>2</sub> of respective leg 18a or 18b.

[0023] After receipt of legs 18a and 18b in respective openings 22a and 22b, end 24 of baluster 12 can be crimped for reducing width W<sub>3</sub> of opening 22 at end 24. After crimping, legs 18a and 18b are retained within openings 22a and 22b and web portion 25 is retained in curved shape 19. Legs 18a and 18b cannot be removed from openings 22a and 22b without bending of end 24 to increase width W<sub>3</sub> of openings 22a and 22b at end 24, as shown in FIG. 5. Web portion 25 is a rotation point for top rail 13 and bottom rail 14 and can rotate at various angles to baluster 12, as shown in FIG. 6. Bottom rail 14 can rotate at similar various angles, as shown

in FIG. 7. Accordingly, baluster 12 can be moved to any angular disposition within the range of about 0 degrees to about 40 degrees to keep balusters 12 parallel to each other as well as top rail 13 and bottom rail 14 parallel to each other. For example, top rail 13 and bottom rail 14 can be rotated to have a 30 degree angle, as shown in FIG. 1. Alternatively, top rail 13 and bottom rail can be rotated to have a 40 degree angle, as shown in FIG. 8. Decorative cap 30 can be attached with coupling 32 to side walls 21 of top rail 13, as shown in FIG. 9. [0024] It is to be understood that the above-described embodiments are illustrative of only a few of the many possible specific embodiments, which can represent applications of the principles of the invention. Numerous and varied other arrangements can be readily devised in accordance with these principles by those skilled in the art without departing from the spirit and scope of the invention.

What is claimed is:

1. An angle adjustable stair rail assembly comprising: a top rail and a bottom rail, said top rail and said bottom rail including a pair of openings in a base wall of said top rail and said bottom rail, and one or more balusters extending between said top rail and said bottom rail, said balusters including a pair of legs at each end thereof; each of said pair of legs being received and retained in respective said openings in said base wall of said top rail and said bottom rail, wherein said balusters can be moved angularly within said openings of said top rail and said bottom rail.
2. The stair rail assembly of claim 1 wherein said openings are formed of a punched web in said base wall and a portion of said web extends between said pair of legs.
3. The stair rail assembly of claim 2 wherein said pair of legs are retained in said openings through crimping each of said legs toward one another and around said portion of said web.
4. The stair rail assembly of claim 1 comprising of a plurality balusters, wherein said balusters can be moved angularly within said openings in said top rail and said bottom rail while keeping each of said balusters parallel to each other and said top rail and said bottom rail parallel to each.
5. The stair rail assembly of claim 4 wherein said balusters can be moved at any angle of between about zero and about 40 degrees.

6. The stair rail assembly of claim 1 wherein a cut-out opening in each of said ends of said balusters forms said pair of legs.

7. The stair rail assembly of claim 6 wherein said cut out opening has a curved end and said web portion is retained in said curved end.

8. The stair rail assembly of claim 6 wherein a diameter of said curved end is larger than a diameter of said opening in said baluster.

9. A method for forming an adjustable stair rail assembly comprising:

forming a pair of openings in a base wall of a top rail and a bottom rail;

inserting an end of a baluster into said pair of openings, said end of said baluster including a cut-out opening forming a pair of legs which are received in said pair of openings; and

retaining said pair of legs in said pair of openings of said top rail and said bottom rail,

wherein said balusters can be moved angularly within said openings of said top rail and said bottom rail.

10. The method of claim 9 wherein said openings are formed of a punched web in said base wall and a portion of said web extends between said pair of legs.

11. The method of claim 9 wherein said step of retaining said pair of legs in said openings is performed by crimping each of said legs toward one another and around said portion of said web.

12. The method of claim 9 comprising of a plurality balusters, wherein said balusters can be moved angularly within said openings in said top rail and said bottom rail while keeping each of said balusters parallel to each other and said top rail and said bottom rail parallel to each.

13. The method of claim 9 wherein said balusters can be moved at any angle of between about zero and about 40 degrees.

14. The method of claim 9 wherein a cut-out opening in each of said ends of said balusters forms said pair of legs.

15. The method of claim 9 wherein said cut out opening has a curved end and said web portion is retained in said curved end.

16. The method of claim 9 wherein a diameter of said curved end is larger than a diameter of said opening in said baluster.

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