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(54) **SLIP BRACKET CONNECTOR FOR RIGID MEMBERS**

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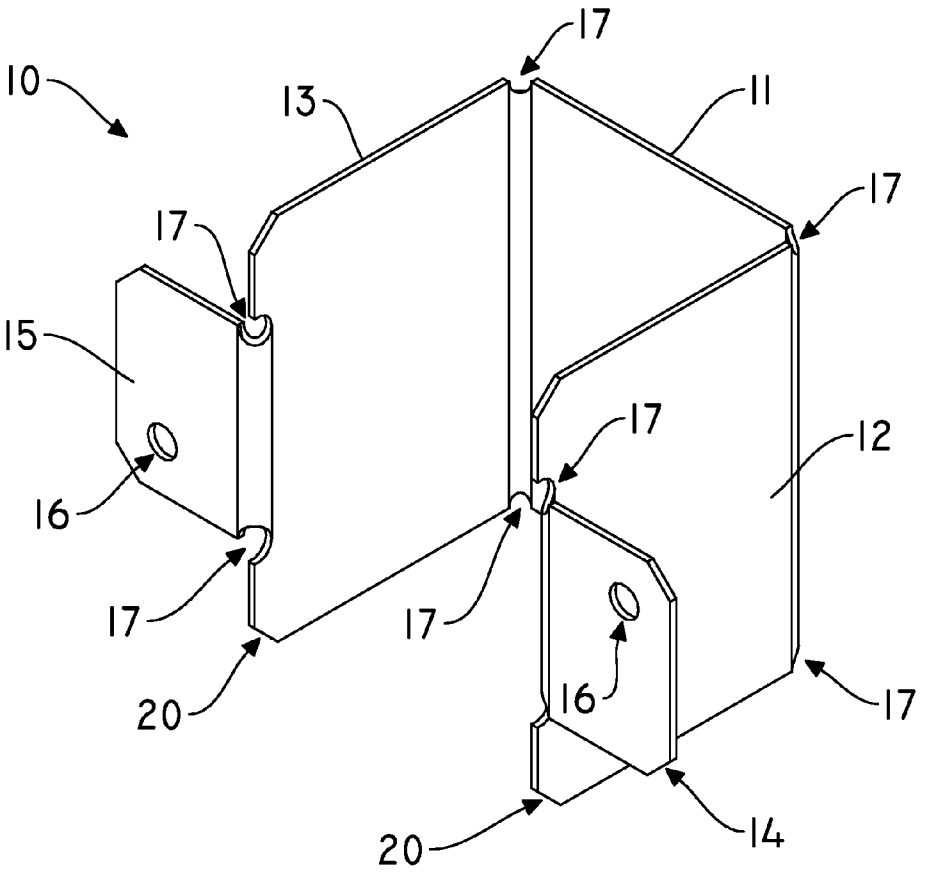
(57) **ABSTRACT**

A one-piece rigid connector allows a nominal construction wood member to slip axially while fixed at its distal end, to accommodate the naturally occurring shrinkage of lumber. The connector surrounds the wood member and attaches to a second wood member to secure the members together. The connector may be slightly larger radially than the first member to accommodate natural movement. In one embodiment, the connector is made of a light gauge sheet metal and attaches a vertical baluster to the horizontal lower deck rail of an elevated wood deck guard rail system. The connector secures the baluster horizontally, but allows the baluster to move vertically to accommodate expansion or contraction of the baluster after construction. The distal end of the baluster is secured using conventional wood screw attachment. The connector includes tabs on each side to allow fastening of the connector to the lower deck rail using conventional wood screws.



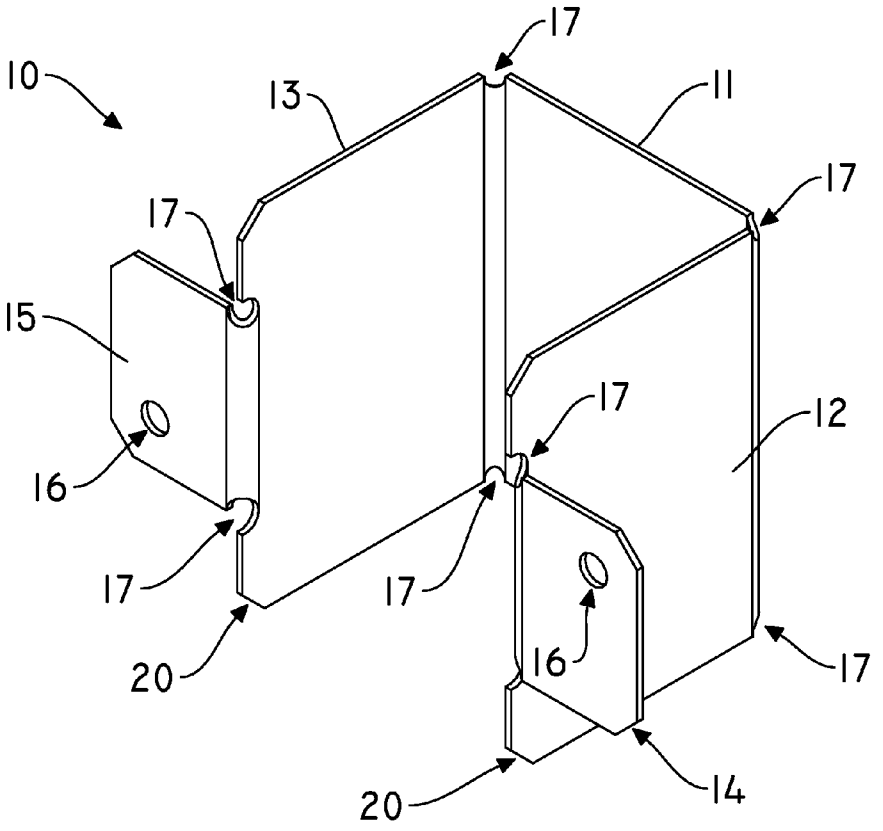


FIG. 1

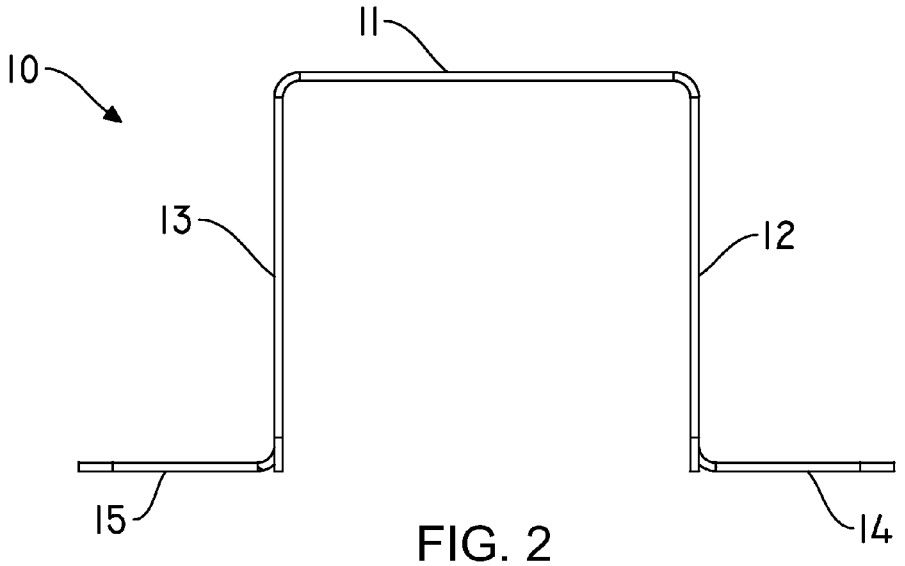


FIG. 2

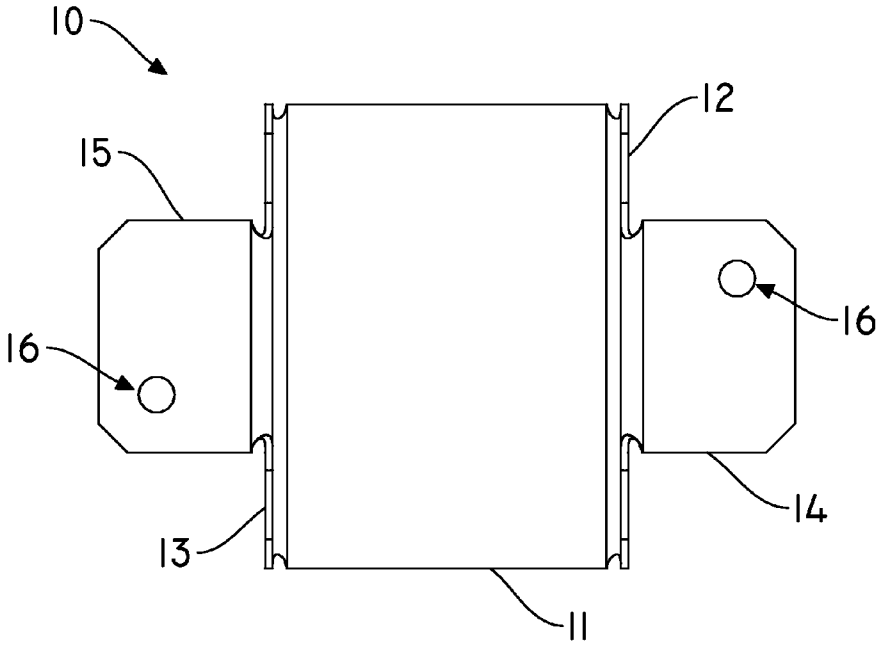


FIG. 3

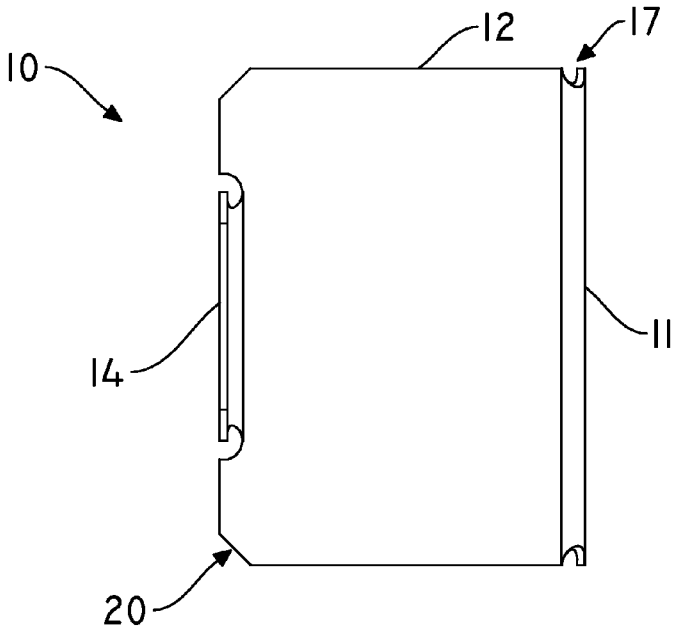


FIG. 4

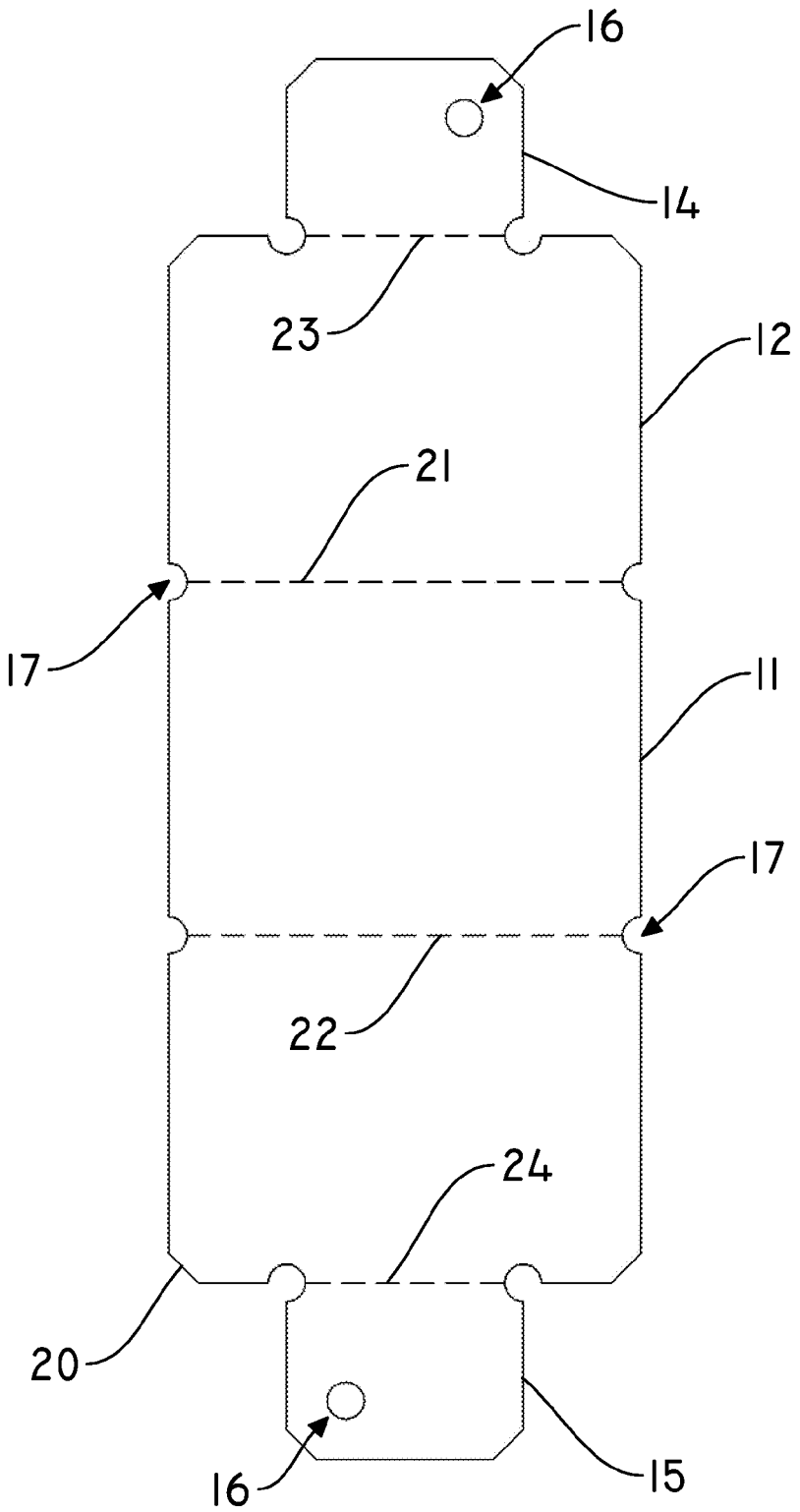


FIG. 5

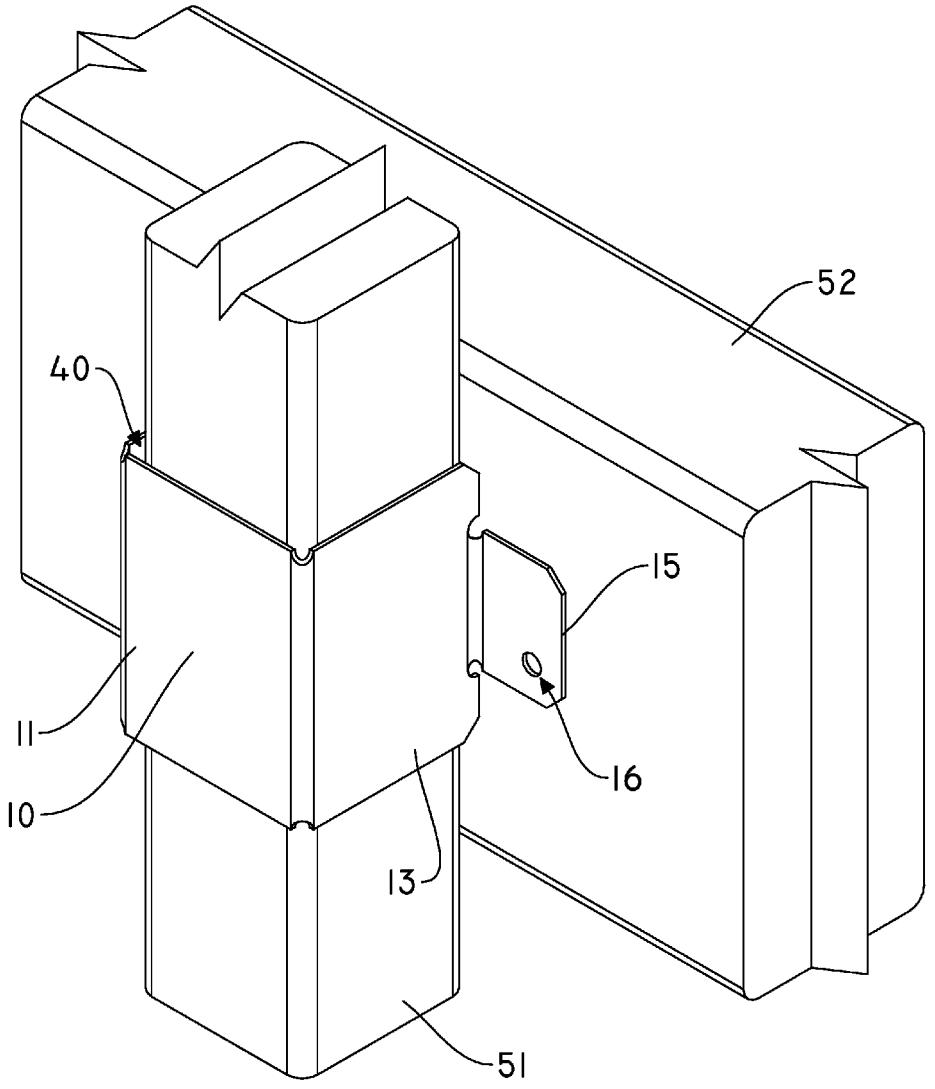


FIG. 6

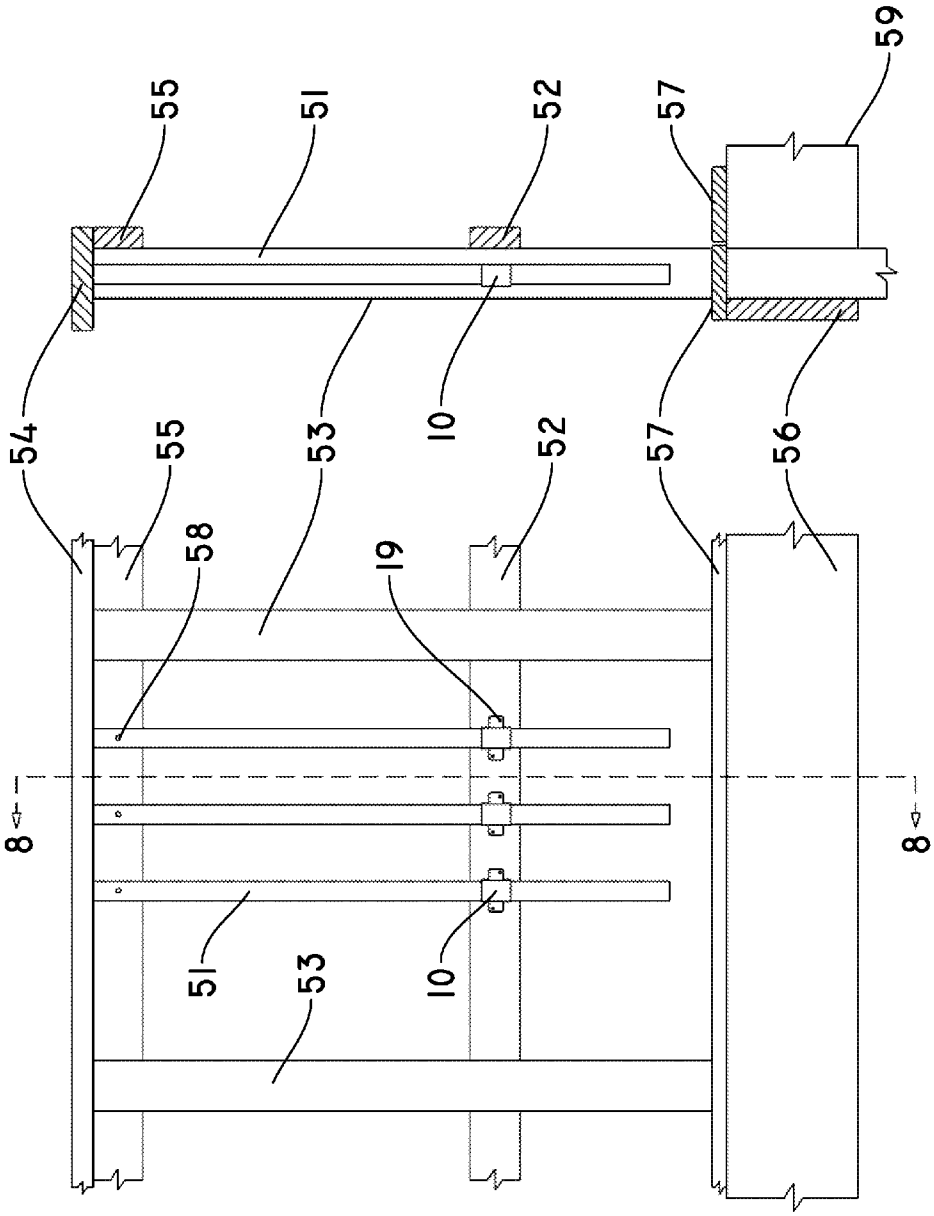


FIG. 8

FIG. 7

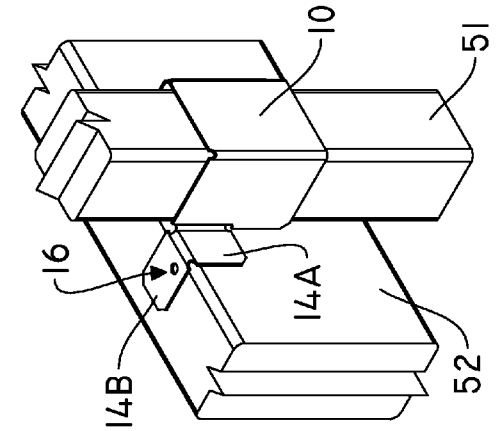


FIG. 10

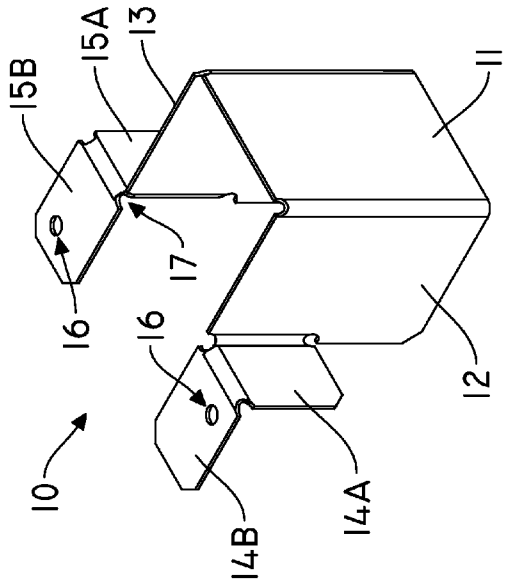


FIG. 9

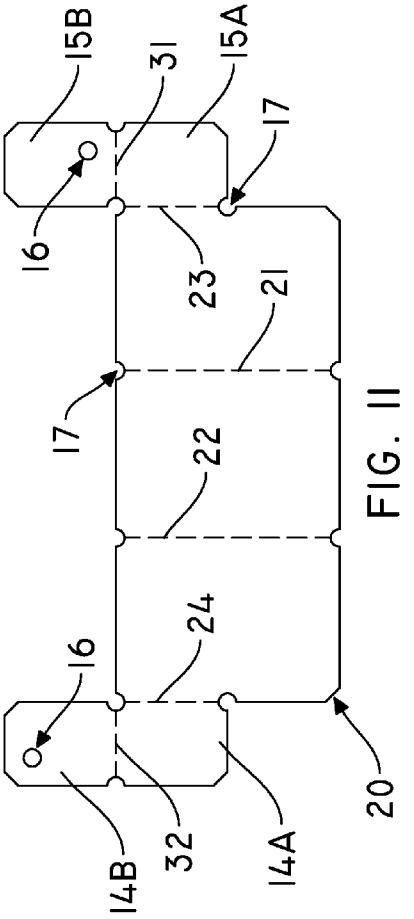


FIG. 11

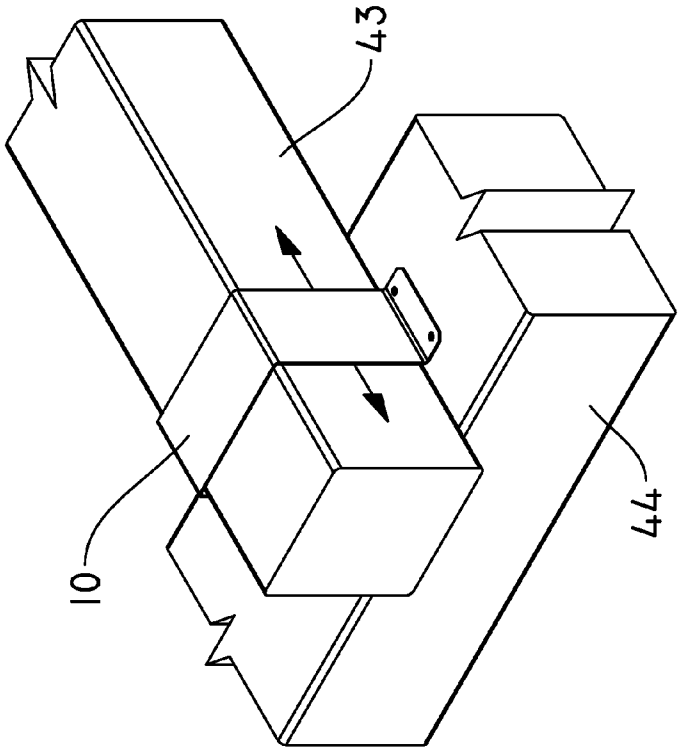


FIG. 13

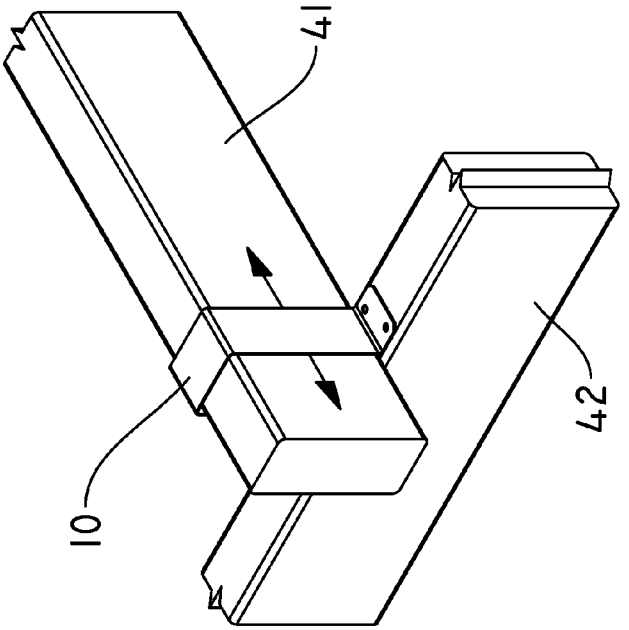


FIG. 12

SLIP BRACKET CONNECTOR FOR RIGID MEMBERS

FIELD OF INVENTION

[0001] This invention relates to rigid connectors for joining two intersecting rigid members. This invention relates particularly to a rigid one-piece connector that perpendicularly joins two rigid wood members while allowing slip movement in one of the members.

BACKGROUND

[0002] Wood beams, posts, joists, balusters, and the like, referred to collectively herein as "members," naturally shrink and expand due to the composition of the wood. A wood member can decrease and increase in length due to shrinkage and expansion in the direction of the wood grain. Frequent fluctuations of 3% are common, and fluctuations of as much as 18% may occur depending on the moisture content of the wood and the surrounding environment. Radial dimension changes also occur, although typically less drastically than length fluctuations. Despite the widespread knowledge of the natural dimensional fluctuations of wood members, conventional construction techniques largely ignore them, often to significant structural detriment.

[0003] In particular, it is often necessary to attach two wood members perpendicular to each other. Typically, the members are attached with a fastener, such as a nail or screw. Other known attachment devices include metal plate connectors that conform to the shape of the joint between the members. These metal plates are attached with fasteners to both members to create a "strong" or "rigid tie" that does not account for the dimensional fluctuations in the members. Once construction is complete, over time these fluctuations impart considerable tension forces on the members, the attachment devices, and related attached structural components. The tension forces may loosen the attachments across the joint, damage the wood, and otherwise warp the original shape and support capabilities of the constructed members.

[0004] While there are indeed requirements that some connections be rigid, in many instances the anticipated shrinkage of the wood member must be a consideration within the design and construction of wooden member connections. In particular, wood balustrades, as typically seen on balconies and decks, would benefit from a wood member connector that addresses the natural dimensional fluctuations. A balustrade is composed of several vertically-oriented balusters attached to top and bottom rails and spaced evenly apart so as to act as a guard rail or other barrier. Typically, the balusters are attached by nails or screws driven through each baluster at the upper and lower ends. The balusters then strain against the fasteners due to the dimensional fluctuations. Eventually, the fasteners begin to pull out, the wood splinters, or the contraction pulls the rails out of alignment, leading to significant safety hazards. A connector for balusters that accommodates the dimensional fluctuations is needed.

[0005] Therefore, it is an object of this invention to provide a device to attach two wood members to each other while accounting for the expected natural dimensional fluctuations of one or both members. It is a further object that the device provide a perpendicular attachment of the wood members. It is another object of the invention to provide a method of constructing structures with wood members that accounts for dimensional fluctuations in some or all of the wood members.

SUMMARY OF THE INVENTION

[0006] A bracket connector attaches a first wood member to a second wood member while allowing for a slip movement by the first member to accommodate dimensional fluctuations in the first member while it is securely fixed at one end. The connector fits around the perimeter of the first member, leaving a clearance gap that is thin enough to secure the first member laterally but wide enough to allow for natural radial and longitudinal expansion of the first member. The connector attaches to the second member with one or more nails, screws, or other fasteners. The connector does not securely attach to the first member, which allows for the slip movement along the first member's longitudinal axis. The several illustrated embodiments show the bracket connector as a u-shaped thin metal bracket sized to fit around a deck baluster, a ceiling joist, or a square support post, but applications to other wood members are contemplated.

BRIEF DESCRIPTION OF THE DRAWINGS

[0007] FIG. **1** is a top rear left isometric view of a first embodiment of the present invention.

[0008] FIG. **2** is a top view of the first embodiment of the present invention.

[0009] FIG. **3** is a front view of the first embodiment of the present invention.

[0010] FIG. **4** is a right side view of the first embodiment of the present invention.

[0011] FIG. **5** is a diagram of a stamping pattern for fabricating the first embodiment of the present invention.

[0012] FIG. **6** is a top front right isometric view of the first embodiment of the present invention placed over a baluster.

[0013] FIG. **7** is a front view of a portion of a balustrade constructed using the first embodiment of the present invention.

[0014] FIG. **8** is a cross-sectional side view of the balustrade taken along line **8-8** of FIG. **7**.

[0015] FIG. **9** is a top front left isometric view of a second embodiment of the present invention.

[0016] FIG. **10** is a top front left isometric view of the second embodiment of the present invention placed over a baluster and a lower deck rail.

[0017] FIG. **11** is a diagram of a stamping pattern for fabricating the second embodiment of the present invention.

[0018] FIG. **12** is a top front right isometric view of a third embodiment of the present invention placed over a cross beam.

[0019] FIG. **13** is a top front right isometric view of a fourth embodiment of the present invention placed over a cross beam.

DETAILED DESCRIPTION OF THE INVENTION

[0020] Referring to FIGS. **1-5**, there is illustrated a first embodiment of the present invention designated generally as **10** which is a one-piece bracket connector used to attach a first wood member to a second wood member while allowing the first wood member to fluctuate dimensionally according to the environment and the natural properties of the wood. A front portion **11** is attached to, and preferably integral with, a left portion **12** and a right portion **13** to form a three-sided brace. Preferably, the left and right portions **12**, **13** are perpendicular to the front portion **11** and parallel to each other so that the brace is u-shaped. See FIG. **2**. Alternatively, one or both of the left and right portions **12**, **13** may intersect the

front portion **11** at an acute or obtuse angle to accommodate non-square, non-rectangular first wood members, such as trapezoidal beams. The left and right portions **12**, **13** may alternatively intersect each other to form a triangular beam having an apex at the intersection of the portions **12**, **13** instead of a front portion **11**. Left and right tabs **14**, **15** are attached to, and preferably integral with, the left and right portions **12**, **13**, respectively, at the rear edge of each portion **12**, **13**. The tabs **14**, **15** project laterally from their respective portions **12**, **13** substantially parallel to the front portion **11**. Preferably, the tabs **14**, **15** are narrower than the left and right portions **12**, **13** and are centered along the rear edge of the portions **12**, **13**. The tabs **14**, **15** are preferably coplanar so that the tabs **14**, **15** together make flush contact with the planar attachment surface of the second wood member as described below. One or more apertures **16** are disposed through each tab **14**, **15**. The apertures **16** each receive a fastener, preferably a screw, for securely attaching the device **10** to the second wood member. In the preferred embodiment, the apertures **16** in each tab **14**, **15** are offset from each other, most preferably by placing one aperture **16** at the top of its tab and the other aperture at the bottom of its tab. The offset positioning minimizes the potential for the second wood member to split along its grain when the fasteners are driven into it.

[0021] The device **10** is preferably formed from a single piece of sheet metal, rendering each of the device **10** components substantially planar. The illustrated first embodiment of the device **10** may be stamped out of the sheet metal as shown in FIG. **5**. Stress relief punches **17** may be formed at each juncture of the components to facilitate bending of the sheet into the proper device **10** configuration without imparting undue stress on the components along the bend lines. Preferably, the stamped metal is folded at 90 degree angles up out of the page at first and second up-fold lines **21**, **22**, and folded at 90 degree angles down into the page at first and second down-fold lines **23**, **24**. Each bend requires a material bend allowance to maintain proper final dimensions after bending of the part is accomplished. Rear corners **20** of the left and right portions **12**, **13** may be linearly cut or rounded to prevent damage or injury from the sharp corner. Alternatively, the device **10** may be die stamped, cast, molded, or extruded, and may be a structural composite material instead of metal. The preferred metal is galvanized steel, which may be untreated or treated with one or more coatings, such as a colored powder coating.

[0022] FIGS. **6-8** illustrate the first embodiment of the present invention used to attach a baluster **51** within a typical wood deck having the following components: deck planks **57** are attached to one or more structural joists **59**; vertical support posts **53** extend upward from the deck planks **57**; a fascia **56** is attached to the ends of the joists **59** and may further be attached to the lower ends of the support posts **53** to hide the joists **59** from view; a guard rail, or balustrade, is formed with an upper rail **55** and lower rail **52** attached between support posts **53** parallel to the deck planks **57**, and a plurality of balusters **51** attached perpendicularly to the upper and lower rails **55**, **52**; a top plate **54** is attached to the support posts **53** and may further be attached at intervals to the upper rail **55**. In a typical deck construction, the balusters **51** are attached with a rigid securement, typically one or two nails or screws driven through the baluster **51**, to each rail **55**, **52** on the face of the rails **55**, **52** that faces away from the deck surface. As described above, the rigid securement prevents natural dimensional fluctuations and imparts tension forces on the baluster **51**, the fasteners, and any attached components. The resulting failures of this construction include the drawing downward and bowing of the upper rail **55** from the top plate **54** between the support posts **53**; and securement failure of the balusters **51**, potentially leading to serious consequences in the event of a foreseeable user fall event. With the balusters **51** mounted on the outside of the deck surface, the failure of the lower baluster **51** securement will often not be noticed by the home or cabin owner, particularly in instances of high elevation decks.

[0023] The device **10** mitigates the above time-dependent baluster **51** failure, as the device **10** provides for vertical tension relief of the baluster **51** during foreseeable and anticipated baluster **51** shrinkage. The vertical tension relief also allows for minor baluster **51** expansion during periods of wetness for outdoor deck railings. With the upper end of the baluster **51** conventionally secured to the upper deck rail **55** by a rigid connection, such as by one or more securement screws **58**, the device fits around the baluster **51** and is secured to the lower deck rail **52** using two wood screws **19** driven through the apertures **16** of the device **10** into the attachment surface of the lower deck rail **52**. With a rigid attachment at the upper end and no rigid attachment at the lower end, the baluster **51** is allowed any amount of slip movement resulting from dimensional fluctuations along its longitudinal axis, which in this embodiment is perpendicular to the ground. Further, the dimensions of the front, left, and right portions **11-13** are selected to leave a slight clearance gap **40** between the device **10** and the baluster **51** to allow longitudinal and radial movement of the baluster **51** while still horizontally securing the baluster **51** to prevent the baluster **51** from being kicked out by an impact force. The contained baluster **51** is thus allowed dimensional variation under conditions of contraction or expansion caused by commensurate wood moisture evaporation or absorption.

[0024] FIGS. **9-11** illustrate a second embodiment of the device **10**, which may also be used to secure balusters **51** in a balustrade. The front portion **11** is attached to or integral with the left and right portions **12**, **13** as in the first embodiment. The left and right tabs **14**, **15** of the first embodiment are modified in the second embodiment to comprise a parallel section **14**A, **15**A and a perpendicular section **14**B, **15**B. The parallel sections **14**A, **15**A are attached to or integral with their corresponding portions **12**, **13** at the rear edge of each portion **12**, **13**. The parallel sections **14**A, **15**A project laterally from their respective portions **12**, **13** substantially parallel to the front portion **11**. The parallel sections **14**A, **15**A are preferably coplanar so that the parallel sections **14**A, **15**A together contact the side of the second wood member. Preferably, the top edge of each parallel section **14**A, **15**A aligns with the top edge of its corresponding portion **12**, **13**. A perpendicular section **14**B, **15**B is attached to or integral with each corresponding parallel section **14**A, **15**A and extends to the rearward aspect of the device **10** perpendicularly from the parallel section **14**A, **15**A.

[0025] One or more apertures may be disposed through each of the parallel sections **14**A, **15**A and perpendicular sections **14**B, **15**B. Preferably, one aperture **16** is disposed through each of the perpendicular sections **14**B, **15**B, allowing fasteners to be driven into the top of the second wood member. In this configuration, forces imparted on the screws by the baluster **51** will be shearing forces rather than tension forces. Typically, screws and nails are configured to withstand much greater forces in shear than in tension. Preferably, the

position of each aperture **16** is offset with respect to the positions of the other apertures **16** to reduce or prevent splitting of the second wood member as described above.

[0026] The illustrated second embodiment of the device **10** may be stamped out of sheet metal as shown in FIG. **11**. Stress relief punches **17** may be formed at each juncture of the components to facilitate bending of the sheet into the proper device **10** configuration without imparting undue stress on the components. Preferably, the stamped metal is folded at 90 degree angles up out of the page at first and second up-fold lines **21**, **22** and third and fourth up-fold lines **31**, **32**, and folded at 90 degree angles down into the page at first and second down-fold lines **23**, **24**. Each bend requires a material bend allowance to maintain proper final dimensions after bending of the part is accomplished. Rear corners **20** of the right and left portions **12**, **13** may be linearly cut or rounded to prevent damage or injury from the sharp corner.

[0027] The inventive device **10** may be applied in any scenario where restricting the dimensional fluctuations of the first wood member is best avoided. FIG. **12** illustrates a third embodiment of the device **10** used to attach a rectangular first wood member, such as a wall stud or ceiling joist **41**, to a second wood member, such as a floor plate or joist **42**. In this embodiment, the axis of the first wood member, and therefore the axis of the device **10**, is horizontal rather than vertical. Further, the dimension of the device **10** from front to rear aspect is longer to accommodate the additional width of the first wood member. In a fourth embodiment, illustrated in FIG. **13**, the device **10** secures a larger square support beam **43** to a wide support beam **44**.

[0028] While there has been illustrated and described what is at present considered to be the preferred embodiment of the present invention, it will be understood by those skilled in the art that various changes and modifications may be made and equivalents may be substituted for elements thereof without departing from the true scope of the invention. Therefore, it is intended that this invention not be limited to the particular embodiment disclosed, but that the invention will include all embodiments falling within the scope of the appended claims.

1. A device for attaching a first wood member to a second wood member, the device comprising:

a) a brace configured to fit around the first wood member and to allow for natural dimensional fluctuations in the first wood member; and

b) one or more tabs attached to the brace such that the tabs make flush contact with the second member, each tab having at least one aperture disposed through the tab for receiving a fastener.

2. The device of claim **1** wherein the brace extends around three sides of the first wood member,

3. The device of claim **2** wherein the brace is u-shaped.

4. The device of claim **3** stamped out of a single piece of sheet metal and bent into form.

5. The device of claim **3** wherein the brace is sized to leave a clearance gap between the brace and the first wood member when the device is secured to the second wood member.

6. The device of claim **1** wherein the fasteners are driven through the apertures into the second wood member to secure the device to the second wood member.

7. The device of claim **6** wherein the brace is sized to leave a clearance gap between the brace and the first wood member when the device is secured to the second wood member.

8. The device of claim **1** comprising two coplanar tabs.

9. The device of claim **8** wherein each tab comprises a parallel section attached to the brace, and a perpendicular section attached to the parallel section and extending perpendicular to the parallel section.

10. The device of claim **9** wherein at least one of the apertures in each tab is positioned on the perpendicular section.

11. The device of claim **10** stamped out of a single piece of sheet metal.

12. The device of claim **1** wherein the first wood member is a baluster.

13. The device of claim **12** wherein the baluster is rigidly attached at one end to a third wood member.

14. A device for attaching a first wood member to a second wood member, the device comprising:

a) a u-shaped brace configured to fit around the first wood member and to allow for natural dimensional fluctuations in the first wood member, the brace comprising a planar front portion and planar left and right portions integral with the front portion;

b) a planar right tab integral with the right portion and extending parallel to the front portion away from the right portion such that the right tab makes flush contact with the second member, the right to comprising a first aperture for receiving a fastener;

c) a planar left tab integral with the left portion and extending parallel to the front portion away from the left portion such that the left tab makes flush contact with the second member, the left tab comprising a second aperture for receiving a fastener, the second aperture being offset from the first aperture;

d) a plurality of stress relief punches, one punch being disposed at each intersection of:

i. the front portion with each of the left and right portions;

ii. the left portion with the left tab; and

iii. the right portion with the right tab;

the device being stamped out of a single piece of sheet metal and bent into form.

15. The device of claim **14** wherein the first and second apertures are positioned so that fasteners inserted therein are placed under tension forces by the device.

16. The device of claim **14** wherein:

a) the right and left tabs each comprise a parallel section that is parallel to the front portion, and a perpendicular section integral with the parallel section and extending perpendicular to the parallel section;

b) each of the first and second apertures is disposed in the perpendicular section of the corresponding tab; and

c) stress relief punches are disposed at each intersection of the perpendicular section with the parallel section of each tab.

17. A method of attaching a first wood member to a second wood member so that natural dimensional fluctuations of the first wood member are not restricted, the method comprising:

a) placing a connector around the first wood member, the connector comprising:

i. a brace configured to fit around the first wood member and to allow for natural dimensional fluctuations in the first wood member; and

ii. one or more tabs attached to the brace such that the tabs make flush contact with the second member, each tab having at least one aperture disposed through the tab; and

b) driving a fastener through each aperture into the second wood member.

18. The method of claim **17** wherein the first wood member is a baluster having a first end rigidly connected to a third wood member.

19. The device of claim **1** wherein the natural dimensional fluctuations include a longitudinal expansion of the first wood member,

20. The device of claim **1** wherein the natural dimensional fluctuations include a slip movement in a longitudinal direction along the first wood member.

* * * * *