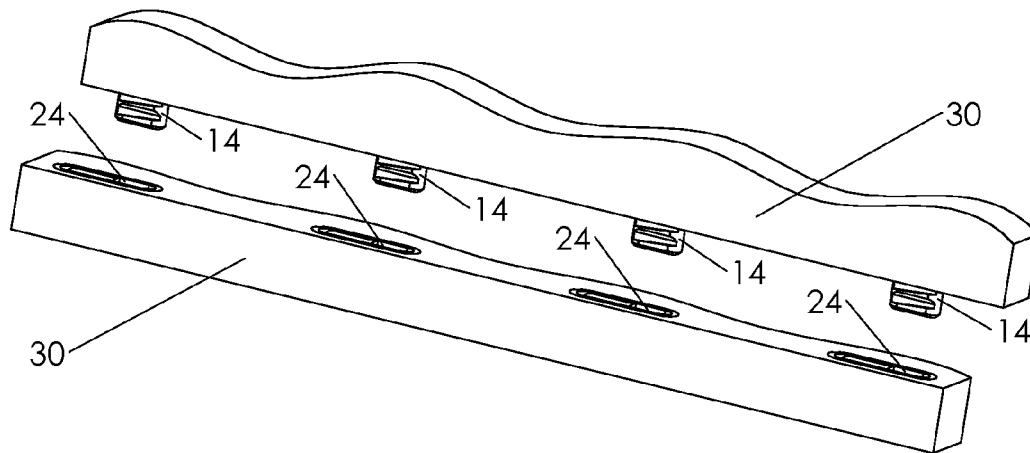




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(19) **United States**(12) **Patent Application Publication**
Wang(10) **Pub. No.: US 2013/0239509 A1**(43) **Pub. Date: Sep. 19, 2013**(54) **INVISIBLE BUTT JOINT FASTENER**(75) Inventor: **Jian Wang**, Sunnyvale, CA (US)(73) Assignee: **Jian Wang**, Sunnyvale, CA (US)(21) Appl. No.: **13/418,632**(22) Filed: **Mar. 13, 2012****Publication Classification**(51) **Int. Cl.**
E04B 1/38 (2006.01)(52) **U.S. Cl.**
USPC **52/704**(57) **ABSTRACT**

A fastener for connecting two structural pieces over abutting surfaces with no or minimum exposure of the fastener itself. Each fastener comprises a male and a female member to be fixed into abutting surfaces of the structural pieces to be connected. The tongue of the male member can be inserted into and slide inside the socket of the female member when the two structural pieces slide against each other along the abutting surface. The socket surface is partially covered with raised ribs, that can catch the ribs on the male tongue when the tongue is at the locking position but not at the releasing position. All the ribs are slopped relative to the sliding direction to convert part of the sliding action into a pulling action, so as to create a preload between the structural pieces when connected.



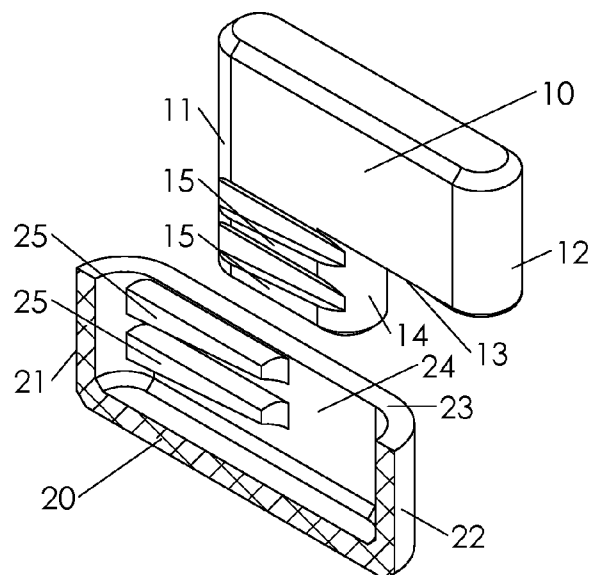


FIG. 1

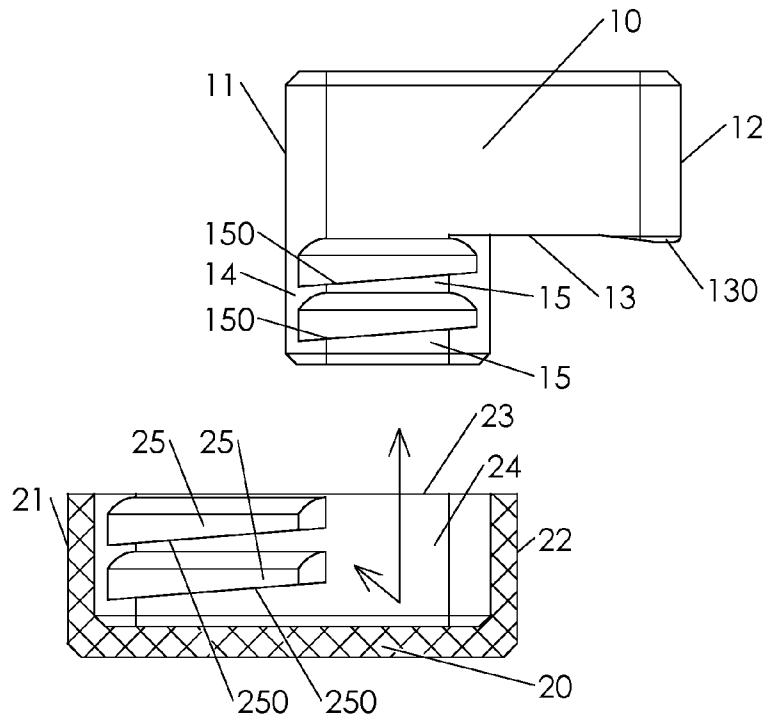


FIG. 2

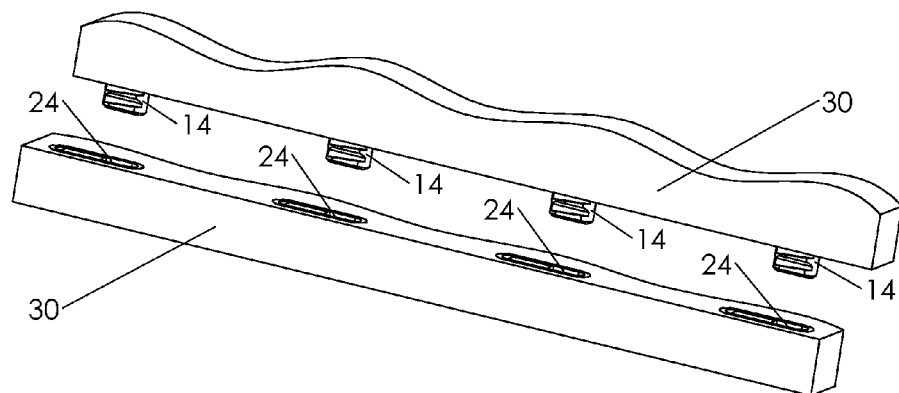


FIG 3

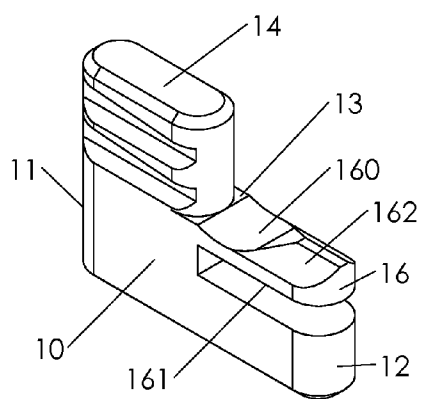


FIG 4

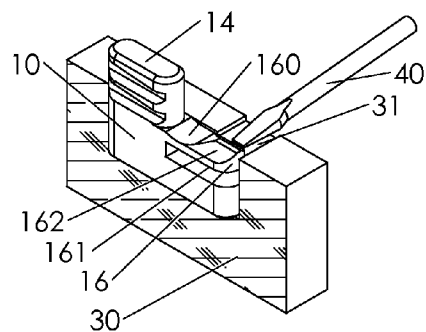


FIG 5

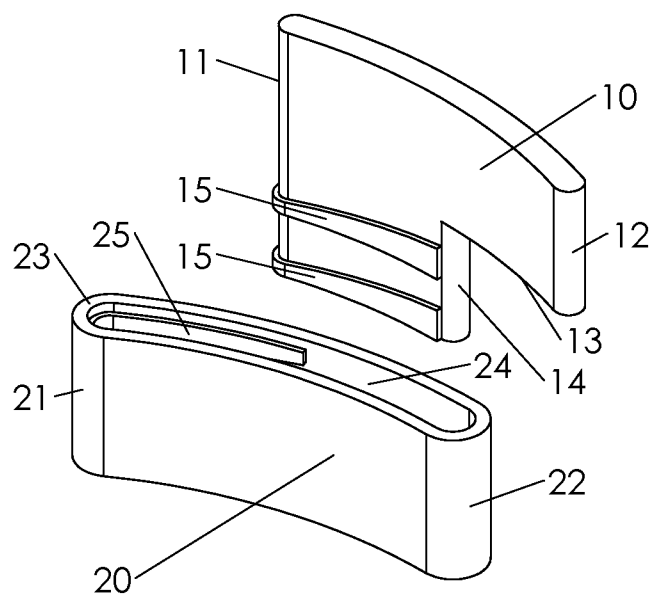


FIG 6

INVISIBLE BUTT JOINT FASTENER

BACKGROUND

[0001] Butt joint is one of the simplest wood joints both in terms of construction and appearance. Many modern furniture used mechanical fasteners, such as the cam-dowel described in German Auslegeschrift 2625182 and U.S. Pat. No. 4,131,376, to recreate the simple look; however, each fastener has to expose certain tightening/releasing interface, and hiding the interface inside a furniture may not always be feasible. These fasteners also typically require two interconnected holes, which are harder than single hole to drill.

[0002] The present invention is a butt joint fastener, designed with the objectives to eliminate or minimize its visibility, and simplify the making and assembling of furniture. The new fastener is primarily designed to be used in groups to connect structural pieces so that they can all be locked in one sliding action between the two pieces along the abutting surfaces, rather than being tightened individually like traditional fasteners, thus no exposure to the fastener is needed as the tightening and releasing forces are directly applied to the structural pieces instead of the fasteners. The fastener requires only one groove on the abutting surface of the structural piece, and can be routed out relatively easily.

SUMMARY

[0003] A fastener for connecting two structural pieces over abutting surfaces is presented. Each fastener comprises a male and a female member. A series of such fasteners are typically fixed into the abutting surfaces of the structural pieces to be connected, with the two members on opposite structural pieces and leaving only the tongues of the male members sticking out of the abutting surfaces. The male tongue can slide inside the female socket when the two structural pieces slide against each other along the abutting surface, and the socket surface is partially covered with raised ribs, that can catch the ribs on the male tongue when the tongue is at the locking position but not at the releasing position. All the ribs are sloped relative to the sliding direction to convert part of the sliding action into a pulling action, so as to create a preload between the structural pieces when connected. The lead angle between the ribs and the abutting surface is small, so friction can keep the fastener from sliding open even when a pulling force perpendicular to the abutting surface is applied, but an optional elastic retaining clip may further prevent the joint from accidental sliding open.

BRIEF DESCRIPTION OF THE DRAWINGS

[0004] FIG. 1 is a perspective partial section view of the preferred embodiment of the fastener.

[0005] FIG. 2 is a parallel side view of the preferred embodiment of the fastener.

[0006] FIG. 3 is a typical application of the fastener, where a series of the fastener are used to butt join two structural pieces.

[0007] FIG. 4 is a lockable embodiment of the fastener.

[0008] FIG. 5 is the typical application of the lockable embodiment.

[0009] FIG. 6 is a perspective view of a curved embodiment of the current invention.

DETAILED DESCRIPTION OF THE DRAWINGS

The Preferred Embodiment—FIGS. 1 Through 3

[0010] FIG. 1 is a perspective view of the preferred embodiment of the current invention, with the female member drawn in section. The male member has a generally elongated body 10 with a head end 11, a tail end 12, a fore-face 13, a tongue 14 extending from the fore-face 13, and a series of raised ribs 15 on the surface of the tongue 14. The female member has an elongated body 20 with a head end 21, a tail end 22, a fore-face 23, a socket 24 indenting into the fore-face 23, and a series of raised ribs 25 on part of the inner surface of the socket 24 near the head end 21.

[0011] FIG. 2 shows the same preferred embodiment in parallel projection from a side. The male tongue 14 can be inserted into the rib-free region of the socket 24 near the tail end 22, and slide towards the head end 21 to get locked inside. The unlocking process is just opposite the locking process, and both processes are shown with the arrow-ended line in the FIG. 2. The male ribs 15 runs with a small lead angle between the rail edge 150 and the fore-face 13, inclining towards the fore-face 13 near the tail end 12. The rail edge 250 of the female rib 25 also runs with a lead angle matching that of the rail edge 150. The two rail edges 150 and 250 can glide against each other to pull the two members closer together in the locking action. The male member fore-face 13 has a small hump near the tail end 12 to form a retaining clip 130 that may clip to the inside wall of the female socket 24. Due to the natural elasticity of the material, the retaining clip 130 does totally prevent the tongue 14 from sliding out of the socket 24, but does make accidental releasing much harder.

[0012] The FIG. 3 shows the typical application of the fastener in connecting two structural pieces 30. The bodies 10 and 20 are pre-glued into grooves, leaving only the male tongues 14 extending out of the abutting surface. All fasteners are lined up in a row so all male tongues 14 can be inserted into female sockets 24 simultaneously, and be locked with one sliding action between the two structural pieces 30.

Alternatives—FIGS. 4 Through 6

[0013] The lead angle between the ribs 15/25, or more specifically the rails 150/250, and their respective fore-faces 13/23 is small, so friction can keep the fastener from sliding open even when a pulling force perpendicular to the abutting surface is applied to the locked fastener; therefore, the retaining clip 130 can be eliminated in applications where no side-way forces are expected on a joint.

[0014] On the other hands, when side-way motion is frequent or severe, a more secure lock such as the latch 16 in FIG. 4 may be needed. The latch 16 is designed to be higher than the retaining clip 130 above the fore-face 13, so the latch 16 cannot be opened by side-way forces alone when locked inside the female socket 24. The only way to unlock the latch is to push it directly down towards the body 10. A gap 161 between the bottom of the latch 16 and the male body 10 allows the latch to bend down, and a narrow waist 160 makes the bending easier. The sides of the latch are beveled 162 to allow easier tool access to the top of the latch 160. As shown in the FIG. 5, a screw driver 40 is inserted from the side of the latch, through a channel 31 in the structural piece 30, to push the latch 16 down when unlocking is needed. Although the fastener is not totally invisible in this case, the exposure is still minimal comparing to traditional fasteners.

[0015] Butt joints are used not only for connecting straight edges of structural pieces. FIG. 6 showed a curved embodiment of the current invention that can be used to connect curved edges, which are often seen in trade-show display construction. A moderate degree of flexibility can also be achieved with certain plastic materials without making the fastener overly stretchy.

[0016] The FIG. 6 also showcased several minor variations to the preferred embodiment. The ribs 15 on both sides of the male tongue 14 are connected at the head end 11. In fact, they can be connected at the tail end 12 too, or broken somewhere as long as gliding on female rib 25 is not interfered, or even leaving one entire side of the tongue flat. The same is true for female ribs 25 as well. Many of the detailed features of the ribs 15/25 shown in the FIG. 1 through FIG. 5, such as the rounded endings and the chamfered non-rail edges, are more for a smooth looking than for any function, can be eliminated as shown in the FIG. 6.

[0017] The male body 10 and female body 20 may be glued into structural pieces 30 as shown in the FIG. 3; however, other means of fastening are equally valid with straightforward modifications to them. For example, the female body 20 may include holes at the bottom to be screwed into grooves, or the male body 10 may be made thinner with screw holes on it.

The claims are:

1. A fastener for joining structural pieces over abutting surfaces, comprising

- a) a male member, which further comprising a tongue for extending from a mating surface of a first structural piece to be connected, and a plurality of outward-facing ribs on surface of said tongue running generally alongside said mating surface of said first structural pieces, and,

- b) a female member, which further comprising a generally slotted socket for receding from a mating surface of a second structural piece to be connected, and said socket further comprising a ribbed section covered with a plurality of inward-facing ribs running generally alongside said mating surface of said second structural piece for engaging said outward-facing ribs on said tongue, and a flat section for allowing said tongue to be inserted into or extracted from freely,

therefore, said tongue may be locked inside said socket in a locking action, which is sliding from said flat section to said ribbed section of said socket, and unlocked in a releasing action, which is sliding from said ribbed section to said flat section of said socket.

2. The fastener of claim 1, wherein,

- a) said outward-facing ribs of said tongue comprising a rail edge, which faces and inclines towards said mating surface of said first structural piece at a small lead angle along said opening action direction, and
- b) said inward-facing ribs of said socket comprising a rail edge, which faces against and inclines towards said mating surface of said second structural piece at said small lead angle along said opening action direction,

therefore, said rail edge of outward-facing ribs of said tongue can glide against said rail edge of inward-facing ribs of said socket to pull said male member and said female member closer in said locking action.

3. The fastener of claim 1, wherein said male member comprising an elastic retaining clip, normally extending from but can be depressed into said mating surface of said first structural piece, and is located relative to said tongue so that when said tongue is fully locked into said ribbed section of said socket, said retaining clip springs right into said flat section of said socket to restrict said opening action.

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