June 6, 1967 R. H. MURDOCK 3,323,781

RAIL SYSTEM

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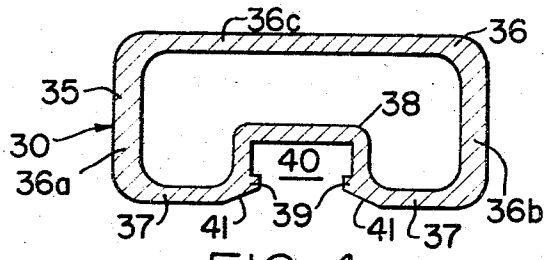


FIG. 4

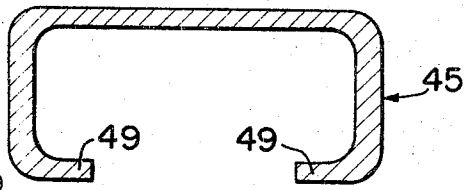


FIG. 5

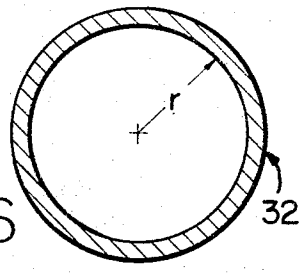


FIG. 6

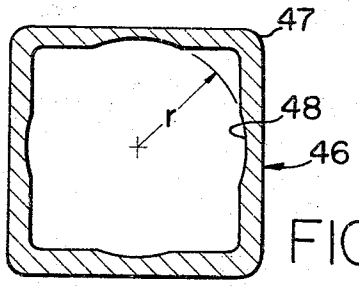


FIG. 7

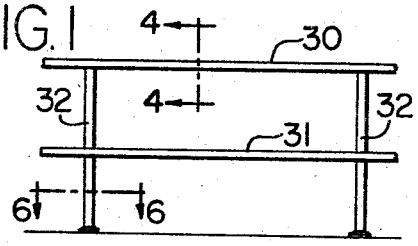


FIG. 1

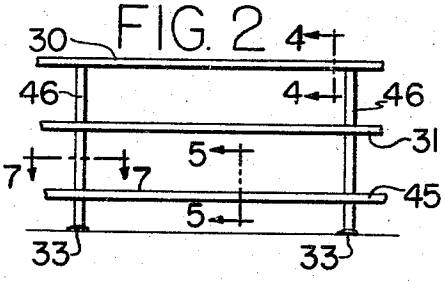


FIG. 2

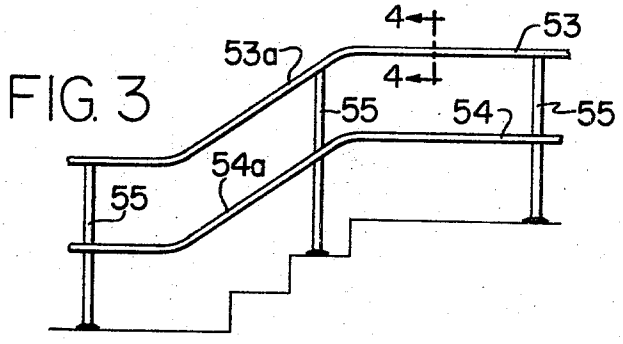


FIG. 3

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RAIL SYSTEM

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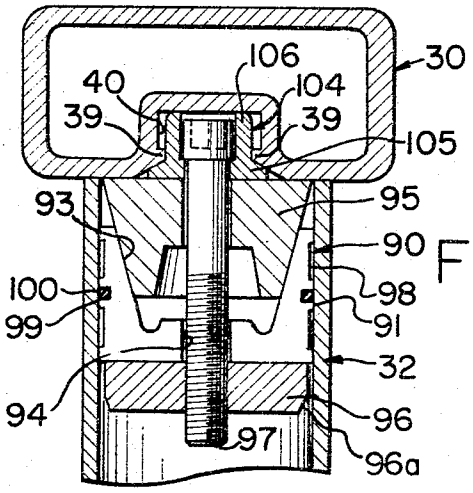


FIG. 8

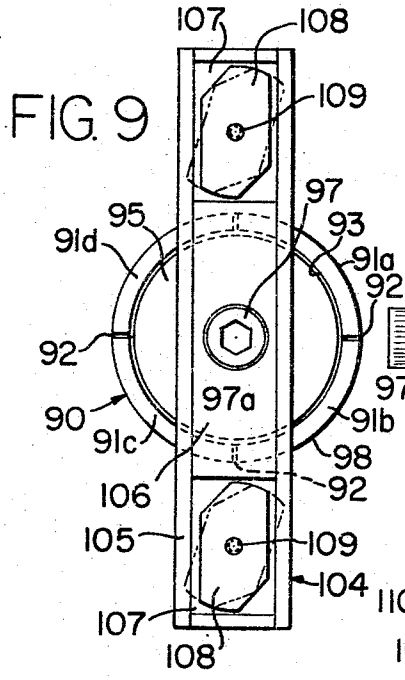


FIG. 9

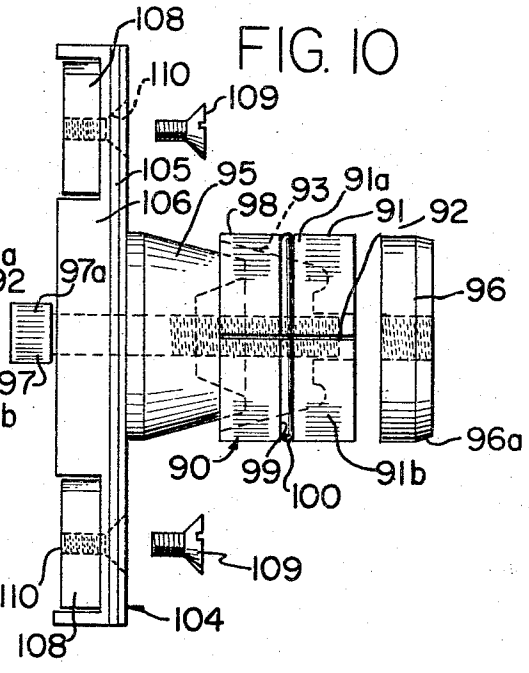


FIG. 10

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RAIL SYSTEM

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Filed June 9, 1964, Ser. No. 373,683
9 Claims. (Cl. 256—67)

This invention relates generally to a rail system, and more specifically to a hand railing system formed of interconnected railings and posts with necessary connectors for use as protective and hand railing along balconies, stairs, and the like, and which may be readily assembled from standardized extruded metallic components.

Recent technological advances in the metallurgical sciences have resulted in the increased use of strong, lightweight, and corrosion-resistant metals, such as aluminum, with or without anodizing, in the construction industries for many applications, such as railings, panels, and the like. The use of such metals in hand railings has become increasingly popular, because the railings are not only extremely strong and durable, but are adaptable to be constructed in various eye-pleasing designs and may be further provided with various attractive, colorful and maintenance-free finishes, such as anodizing and porcelain enamel.

However, the past structure and assembly of such metal railings was a time-consuming and consequently expensive process due to the various operations such as cutting, welding, fitting, polishing, and the like, which were required at the point of installation to provide the desired quality of railing. A dangerous disadvantage inherent in prior railings was due to the manner of assembly thereof in which fasteners, such as boltheads, screwheads, or the like, were exposed to cause injury to fingers and hands of a person, especially small children, traversing the railing. Furthermore, such exposed fasteners render the railing susceptible to tampering, vandalism, and public sabotage. One improved railing component which overcomes many of these disadvantages is disclosed in my co-pending application, Ser. No. 263,160, filed Mar. 6, 1963, and assigned to the same assignee as the present invention.

Accordingly, it is an object of the present invention to provide a new and improved railing system.

A further object of the present invention is to provide a new hand railing system having a smooth, integral appearance which is quickly and easily assembled without excessive operations of drilling, tapping, cutting, polishing, or welding at the point of installation.

A further object of the present invention is to provide a railing system which is quickly assembled with no exposed fasteners to provide a smooth and uninterrupted railing surface.

Another object of the present invention is to provide a new and improved railing.

A further object of the present invention is to provide a new and improved railing which is readily assembleable into a railing system with no exposed fasteners.

Another object of the present invention is to provide a new and improved means for locking a rail of a railing system to a supporting post.

Yet a further object of the present invention is to provide a new and improved top connector for interconnecting a top railing with a supporting post, and wherein there are no exposed fasteners.

Further objects and advantages of the present invention will become apparent as the following description proceeds and the features of novelty which characterize the invention will be pointed out with particularity in the claims annexed to and forming a part of this specification.

In accordance with these and many other objects of the present invention, there is provided a railing system according to the present invention, including a plurality of interconnected rails and hollow vertical posts, which rails and posts may be formed of extruded aluminum or other suitable metal. A preferred rail includes an integral, elongated member having a generally rectangular hollow section formed of a first external U-shaped part, the legs of which form spaced vertical side walls of the rail, and the bight portion of which forms an upper wall of the rail. The rail is provided with spaced lower wall portions extending toward each other from the lower end of the legs. An internal U-shaped part is disposed within the rail section between the spaced lower wall portions and interconnecting the lower wall portions to provide a longitudinally extending T-shaped slot in the bottom of the rail. The slot is defined by the internal U-shaped portion and by additional longitudinally extending confronting ribs on the inside of the internal U-shaped part. Advantageously, the lower corner of the confronting edges of the spaced lower wall portions forming the neck of the T-shaped slot may be chamfered. The railing system may additionally include one or more open rails of generally inverted U-shape.

According to another feature of the present invention, there is provided an advantageous, top connector interconnecting the uppermost railing with the top of a post. In accordance with this aspect of the invention, the top connector includes an elongated slide member of somewhat inverted T-shaped cross section including a head and a shank. The shank is readily insertible between the ribs forming the T-slot in the bottom of the rail. Latch members are carried by the slide member and are also insertible through the neck of the T-slot and are pivotable within the head of the T-slot so as to lock within the T-slot. Screws are provided to tighten the latch members and clamp the ribs forming the neck of the T-slot between the slide member and the latch members. Additionally, wedge means are provided for securing the top connector to the top of a post. The wedge means includes an expandable leaf member formed of a cylindrical element provided with a plurality of axial cuts so as to permit the leaves of the member to expand relative to each other. The leaves are provided with a tapered wedge on their inner surface forming a camming surface. A tapered mandrel forming a cam is adapted to the wedge axially against the camming surfaces of the leaf member. The mandrel may be wedged axially by means of a set screw extending through the slide and clamped prior to assembly of the slides with the rail.

Advantageously, the generally T-shaped slot in the bottom of the rail at its center line provides many combinations of uses to achieve the improved rail system according to the present invention. More specifically, the bottom slot allows for the positive locking of decorative panels to the underside of the top rail by means of a suitable filler piece slid into the slot and extending from one post to the next post. All fastenings to the filler piece are completely concealed within the filler and, therefore, within the slot, thus providing wholly-tamper-proof, swift connections. Additionally, the bottom T-slot allows for the use of the advantageous top clamp connecting the top rail to a post. Each of these fastening devices provides rapid means of positively fastening the rail with no part of the fastening device extending beyond the peripheral dimensions of the rail shape. Additionally, the top connector provides for connecting a rail to a post without recourse to welding or exposed bracketing.

For a better understanding of the present invention, reference may be had to the accompanying drawing wherein:

FIGURE 1 is a fragmentary elevational view of a railing system according to the present invention;

FIGURE 2 is a fragmentary elevational view of a railing system according to another embodiment of the present invention;

FIGURE 3 is a fragmentary elevational view of a railing system according to the present invention illustrating the railing system at the edges of stairs;

FIGURE 4 is a cross sectional view, drawn to a larger scale, of a rail according to the present invention, and taken along plane 4—4 of FIGURE 1, 2, or 3;

FIGURE 5 is a cross-sectional view of another rail according to another embodiment of the present invention, and taken along plane 5—5 of FIGURE 2;

FIGURE 6 is a cross-sectional view of a typical round post according to the present invention, and taken along line 6—6 of FIGURE 1;

FIGURE 7 is a cross-sectional view of a typical square post according to another version of the present invention, and taken along line 7—7 of FIGURE 2.

FIGURE 8 is a fragmentary sectional view of a top railing to post connection, illustrating a top connector according to the present invention;

FIGURE 9 is a top plan view of the top connector of FIGURE 8; and

FIGURE 10 is a partially exploded side elevational view of a top connector of FIGURE 8.

Referring now to the drawings, and particularly to the embodiment of FIGURES 1, 4, and 6, there is illustrated a typical railing system according to the present invention. As therein illustrated, there is provided a plurality of interconnected rails **30**, **31** and posts **32**. The upper rail **30** is connected to the top of the post **32** by a top connector (not shown in FIG. 1), according to the present invention, while the intermediate rail **31** is connected to the post **32** by a suitable post clamp (not shown). The rails **30** and **31** and post **32** may be suitably formed of aluminum extrusion. In the embodiment of FIGURE 1, the posts **32** are hollow, round posts, as more clearly illustrated in FIGURE 6, having an internal radius *r*. The rails **30** and **31** are identical in cross-section, the cross-sectional shape of which is best illustrated in FIGURE 4.

Referring now to the cross-section of the rail, as illustrated in FIGURE 4, a typical rail section according to the present invention comprises an integral elongated extruded metal element, extruded of a suitable material, and provided with a generally rectangular hollow section **35** formed of an external inverted U-shaped part **36**, the legs **36***a*, **36***b* of which form spaced vertical side walls of the rail, and the bight **36***c* of which forms an upper wall of rail. Spaced lower wall portions **37** extend from the lower end of the legs toward each other and an internal inverted U-shaped part **38** is disposed within the external U-shaped part extending between the wall portions **37** and interconnecting the wall portions **37**. Opposed longitudinally extending ribs **39** are provided on the inside of the internal U-shaped part **38** to define a T-slot **40** within the internal U-shaped part. In a preferred embodiment of the rail cross-section, as illustrated in FIGURE 4, the lower corner of the confronting edges of the spaced lower wall portions **37** are chamfered as illustrated at **41**.

Referring now to the embodiment of a railing system as illustrated in FIGURES 2, 5, and 7, the railing system therein illustrated includes interconnected upper and intermediate rails **30** and **31**, identical to the rails **30** and **31** heretofore described in the embodiment of FIGURES 1, 4, and 6, and a lower rail **45**, interconnected with vertically-positioned square posts **46**. The post **46** may be secured to the floor of a building by suitable floor mounts **33**. In a preferred embodiment of the invention, the post **46**, of square, external, cross-section may be formed of extruded aluminum or other suitable material and provided with rounded corners **47**. Additionally the inner center of the walls of the square post **46** may be provided with an arcuate recess **48** of a radius *r*, equal to the inner radius *r* of the round post **32**, thereby to facilitate the use of the same top connector for both round and square posts. In the illustrated embodiment the lower rail **45** is an open bottom railing of generally inverted U-shaped cross-section, as best illustrated in FIGURE 5, and provided with confronting flanges **49** extending from the lower edges of the vertical sidewalls of the U-shaped portion.

FIGURE 3 illustrates a typical railing system at the edge of stairs, and provides upper and intermediate rails **53**, **54**, interconnected with vertical posts **55**. The upper rail **53** is provided with a cross-section identical to rails **30** and **31** in the embodiment of FIGURES 1 and 2, and illustrated in FIGURE 4. The intermediate rail **45** may be provided with a suitable cross-section either as illustrated in FIGURE 4 or 5. Moreover, the posts **55** may be square or circular as desired for the authentic appearance of the railing system. The rails **53** and **54** have an intermediate portion **53***a*, **54***a* inclined to the horizontal to provide for the slope of the stairs.

For interconnecting an upper rail **30** to a square or round post, illustrated as a round post **32** in FIGURE 8, there is provided a top connector **90**, best illustrated in FIGURES 8, 9 and 10. Therein illustrated, the top connector **90** includes an expandable leaf member **91** formed of a cylindrical element provided with a plurality of grooves or axial cuts **92**, FIGURE 10, to separate the leaf member **91** into a plurality of leafs **91***a*, **91***b*, **91***c*, and **91***d*, which are expandable relative to each other. The outer diameter of the contracted leaf member **91** is slightly less than the radius *r* of the round or square posts. The leaf member **91** is provided with a tapered wedge **93** on its inner surface forming a camming surface. An axial aperture **94** is provided through the bottom surface of the leaf member **91**. A tapered mandrel **95** forms a cam and is adapted to wedge axially against the tapered wedge camming surface **93** of the leaf member to expand the individual leafs **91***a*, **91***b*, **91***c*, and **91***d*. A lower disc nut **96** and an Allen screw **97** are effective to wedge the mandrel **95** axially relative to the leaf member **91**. A chamfer **96***a* on the lower edge of the nut **96** aids in leading the top connector **96** easily into the aperture of the post. The outer cylindrical sidewall of the leaf member **91** may be knurled, as at **98**, to provide for biting of the leafs **91***a*, **91***b*, **91***c*, and **91***d* into the inner surface of the post **32**. The leafs **91***a*, **91***b*, **91***c*, and **91***d* may be retained together to form a one-piece unitary member **91**. In the illustrated embodiment the leaf member **91** is provided with a circumferential groove **99** retaining an elastic band **100** which serves to maintain the leafs **91***a*, **91***b*, **91***c*, and **91***d* in proper position. It is understood that the unity of leaf members **91** may also be retained to provide a one-piece member **91** by cutting three of the grooves **92** so that they do not slice all the way to the bottom of the cylinder, while the fourth one of the grooves **92** does slice through the member **91**. In this manner the expandability of the leaf member can be achieved while maintaining a one-piece member.

To provide for connection with the T-slot **40** of the rail **30**, there is provided an elongated slide member **104**. The slide member **104** is of somewhat inverted T-shaped cross-section, including a head portion **105** and a shank portion **106**. The shank portion is insertible between the ribs **39**, forming the T-slot **40** in the lower surface of the rail **30**. Portions of the shank portion **106** are recessed, as at **107**, to accommodate a pair of latch members **108**. The latch members **108** are carried by the slide member **104** and are also insertible through the neck of the T-slot **40** between the ribs **39** thereof. The latch members **108** are pivotal within the head of the T-slot, as indicated in phantom in FIGURE 9, to lock therewithin. Screws **109** extend from the lower surface of the slide member **104** into threaded openings **110** (FIGURE 10) in the latch members **108**. The threaded openings **110** in the latch members **108** are deformed sufficiently, for example by peening, to provide a tight threaded fit between the screws **109**

with the threaded openings **110**. This is effective to initially pivot the latch members **108** to their locked position upon turning the screws **109** in a tightening direction. The Allen screw **97** extends through the slide member **104**, with its head **97***a* countersunk into the shank portion **106** of the slide member, thereby to secure the slide member **104** with the leaf member **91**.

From the above detailed description of the top connector **90**, the operation of the top connector is believed clear. However, briefly, it will be understood that in operation the top connector **90** is first inserted with the leaf member **91** into the top opening of a post, such as the illustrated round post **32**. It is understood that the top connector is equally applicable with the square post **46**, FIGURE 7. Thereafter the Allen screw **97** is tightened, driving the wedge mandrel **95** downward relative to the tapered wedge surface **93** of the leaf member **91** and expanding the leafs **91***a*, **91***b*, **91***c*, and **91***d* relative to each other to cause the leafs to grip the inner surface of the post. Thereafter, with the latch members **108** in the unlatched position, as illustrated in solid in FIGURE 9, the top rail **30** is inserted over the top connector, the shank portion **106** of the slide member **104** passing into the head of the T-slot **40**. The screws **109** are then tightened, initial turning of the screws **109** being effective to rotate the latch members **108** into a latch position, as indicated in phantom in FIGURE 9.

Although the present invention has been described by reference to various embodiments and modifications, it will be apparent that numerous other modifications and embodiments may be devised by those skilled in the art which will fall within the true spirit and scope of the present invention.

What is claimed as new, and desired to be secured by Letters Patent of the United States, is:

1. A rail system including a vertical post; a rail having a T-slot formed in its lower surface; and a top connector connecting said rails to the top of said post and including a plurality of leaves expandable relative to each other and provided with wedge means on their inner surface forming a camming surface and inserted within the top of said posts, a mandrel wedge forming a cam wedged against said camming surface and expanding said leaves against the inner surface of said post, means camming said mandrel wedge into engagement with said camming surface of said leaves, an elongated slide member of generally-inverted T-shaped cross-section, including a head and a shank, said shank being insertible through the neck of said T-slot, latch members carried by said slide member insertible through the neck of said T-slot and pivotal within the head of said T-slot to lock within said T-slot, and screw means extending through said slide member threadingly engaged in threaded apertures in said latch members and tightened to clamp said neck of said T-slot between the head of said T-shaped slide member and said latch members.

2. A rail system as set forth in claim **1** above wherein the threaded connection between said screws and said latch members are deformed sufficiently to provide a tight threaded fit to provide for initial pivoting of said latch members within said head of said T-slot.

3. A rail system including a vertical post; a rail having a T-slot formed in its lower surface defined by inwardly extending ribs; and a top connector connecting said rail to the top of said post and including an expandable leaf member formed of a cylindrical element provided with a plurality of axial cuts to separate said leaf member into a plurality of leaves expandable relative to each other, said leaf member being provided with a tapered wedge means on its inner surface forming a camming surface; a tapered mandrel forming a cam adapted to the wedge axially against the camming surface; an elongated slide member of somewhat inverted T-shaped cross-section, including a head and a shank, said shank being insertible through the neck of said T-slot, latch members carried by said slide member insertible through the neck of said T-slot pivotal within the head of said T-slot to lock within said T-slot, and screw means extending through said slide member threadingly engaged in threaded apertures in said latch members and tightened to clamp said ribs between the head of said T-shaped slide member and said latch members.

4. A top connector for interconnecting an upper rail to the top of a post and comprising an expandable leaf member formed of a cylindrical element provided with a plurality of axial cuts to separate said leaf member into a plurality of leaves expandable relative to each other, said leaf member being provided with a tapered wedge means on its inner surface forming a camming surface; a tapered mandrel forming a cam and adapted to be wedged axially against said camming surface; an elongated slide member joined to one of the above mentioned members and having a somewhat inverted T-shaped cross-section including a head and a shank, said shank being insertible through the neck of a T-slot, latch members carried by said slide member insertible through the neck of a T-slot and pivotal therewithin to lock said slide member to a T-slot, and screw means extending through said slide member threadingly engaged in threaded apertures in said latch members.

5. A top connector as set forth in claim **4** above and additionally including screw means for drawing said leaf member and said mandrel together to expand said leaves relative to each other.

6. A rail system including a vertical post; a rail having a generally-rectangular cross-section comprising an externally-U-shaped part, the legs of which form spaced vertical walls of said rail and the bight of which forms an upper wall of said member, spaced lower wall portions extending from the lower ends of said legs toward each other, an internal U-shaped part disposed within said section between said portions interconnecting said portions, and longitudinally-extending confronting ribs on the inside of said internal U-shaped part to define a T-slot within said internal U-shaped part; and a top connector connecting said rail to the top of said posts and including a plurality of leaves extendable relative to each other and provided with wedge means on their inner surface forming a camming surface and inserted within the top of said post, a mandrel wedge forming a cam and wedged against said camming surface expanding said leaves against the inner surface of said post, means camming said mandrel wedge into engagement with said camming surface of said leaves, and means secured within the T-slot of said rail whereby said rail is secured to said post and including an elongated slide member of somewhat inverted T-shaped cross-section, including a head and a shank, said shank being insertible between the ribs forming said T-slot, latch members carried by said slide member insertible through the neck of said T-slot and pivotal within the head of said T-slot to lock within said T-slot, and screw means extending through said slide member threadingly engaged in threaded apertures in said latch members and tightened to clamp said ribs between the head of said T-shaped slide member and said latch members.

7. A rail system as set forth in claim **6** above wherein the threaded connection between said screws and said latch members are deformed sufficiently to provide a tight threaded fit to provide for initial pivoting of said latch members within said head of said T-slot.

8. A top connector for connecting an upper rail to the top of a post and comprising a plurality of leaves expandable relative to each other and provided with wedge means on their inner surface forming a camming surface adapted to be inserted within the top of a post, a mandrel wedge forming a cam and wedged against said camming surface expanding said leaves against the inner surface of said post, means camming said mandrel wedge into engagement with said camming surfaces of said leaves, and means for securing said top connector within

a T-slot of a rail and including an elongated slide member of somewhat inverted T-shaped cross-section including a head and a shank, latch members carried by said slide member for insertion through the neck of a T-slot and pivotal therewithin to lock within a T-slot, and screw means extending through said slide member threadingly engaged in threaded apertures in said latch members.

9. A top connector as set forth in claim **8** above wherein the threaded connection between said screws and said latch members are deformed sufficiently to provide a tight threaded fit to provide for initial pivoting of said latch member upon initial rotation of said screw.

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