United States Patent

[11] **3,584,904**

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[54] **LOCKING CONNECTION FOR SUPPORTING GRID SYSTEMS**
10 Claims, 7 Drawing Figs.

[52] **U.S. Cl.** **287/189.36,** 52/664, 52/667
[51] **Int. Cl.** **F16b 21/08,** E04b 1/38
[50] **Field of Search** ..... 52/664, 667, 669; 287/189.36 A

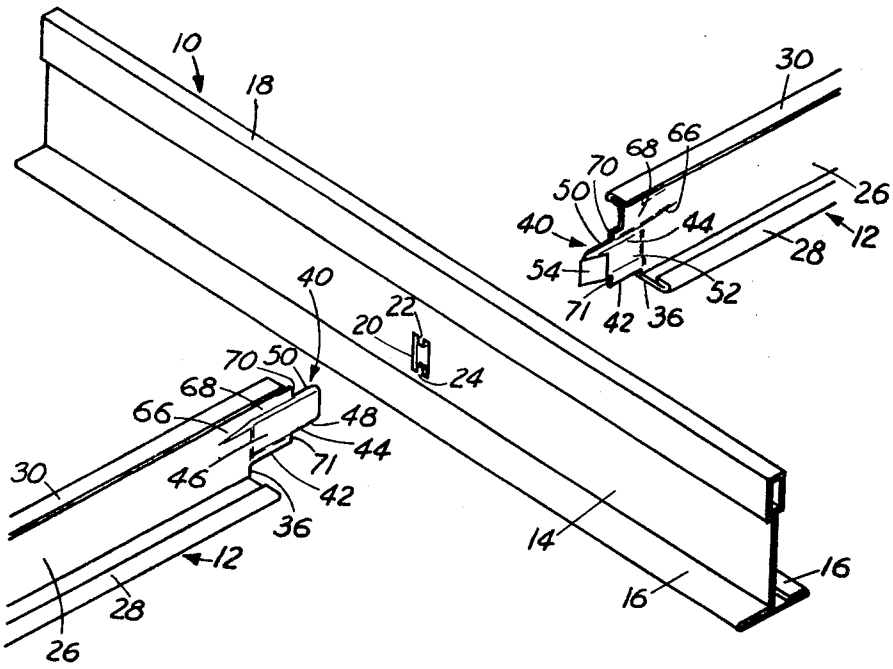
[56] **References Cited**

UNITED STATES PATENTS

3,093,221	6/1963	Purdy	287/189.36 A
3,221,466	12/1965	Downing, Jr. et al.	287/189.36 X
3,304,684	2/1967	Mock et al.	52/664 X
3,312,488	4/1967	Lickliter et al.	287/189.36 A
3,396,997	8/1968	Adams	287/189.36 A

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ABSTRACT: A first support member having a web with a slot therein and a second support member having a web and a locking connector formed integral therewith and extending therefrom for insertion in the slot. The connector has a locking tab engageable behind one side of the first support member web and reversely bent into a recess defined by a first reinforcement channel formed in the connector. A projection in the channel prevents complete collapse of the tab into the recess during insertion through the slot. A second reinforcement channel disposed above the first channel extends therebeyond into the second support member web. Stop shoulders on the locking connector engage the other side of the first support member web.



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SHEET 1 OF 2

FIG. 1

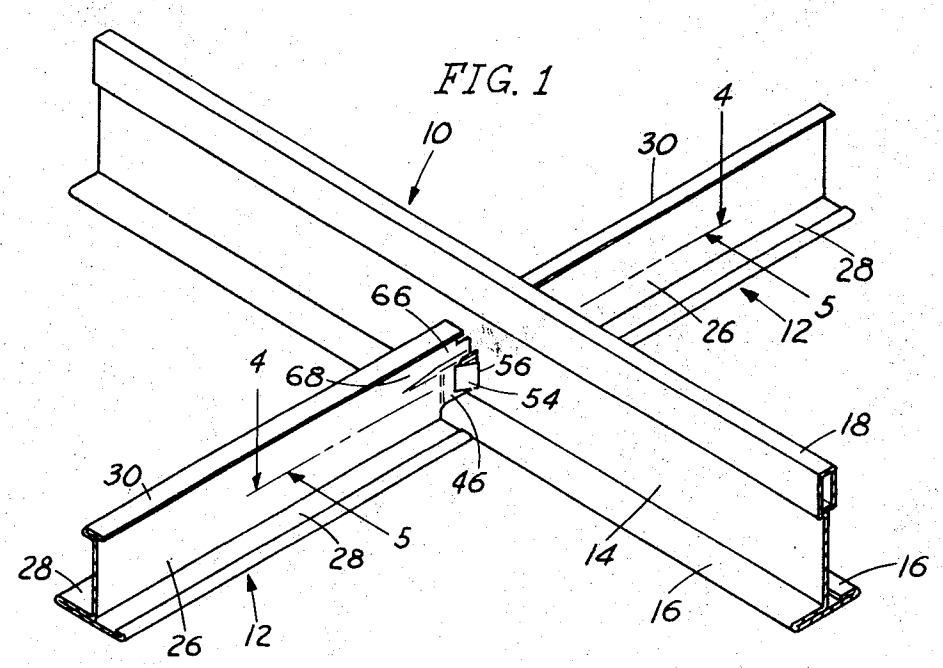
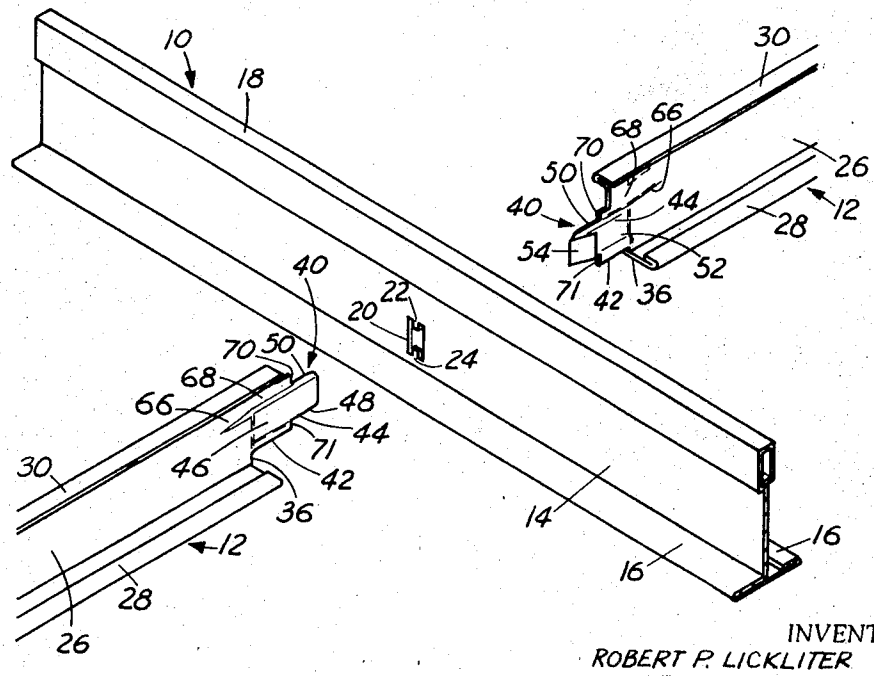


FIG. 2



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FIG. 3

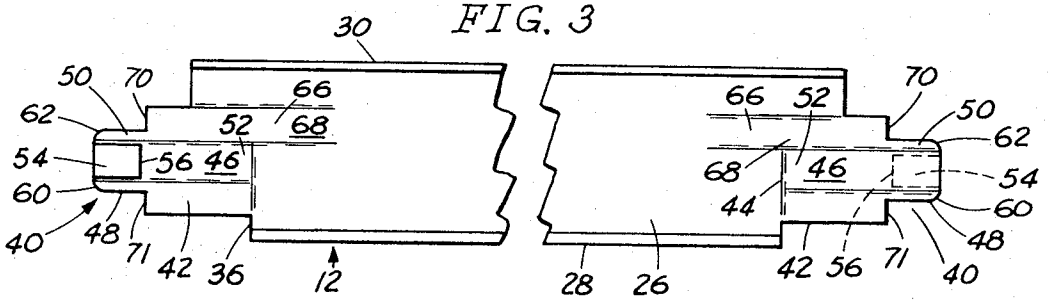


FIG. 4

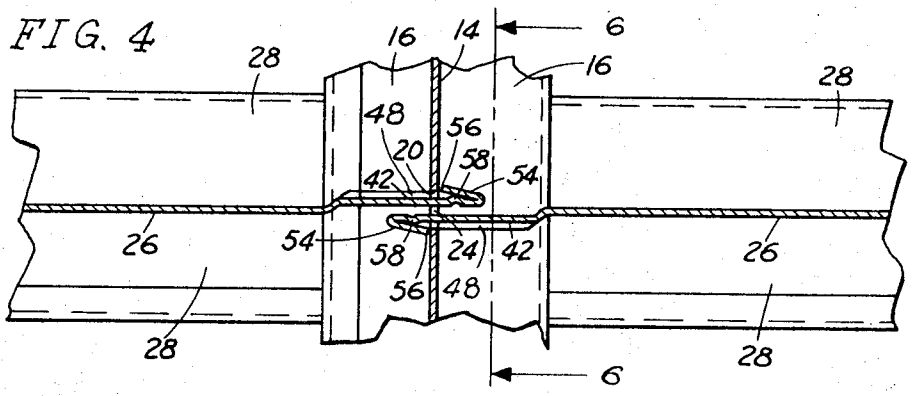
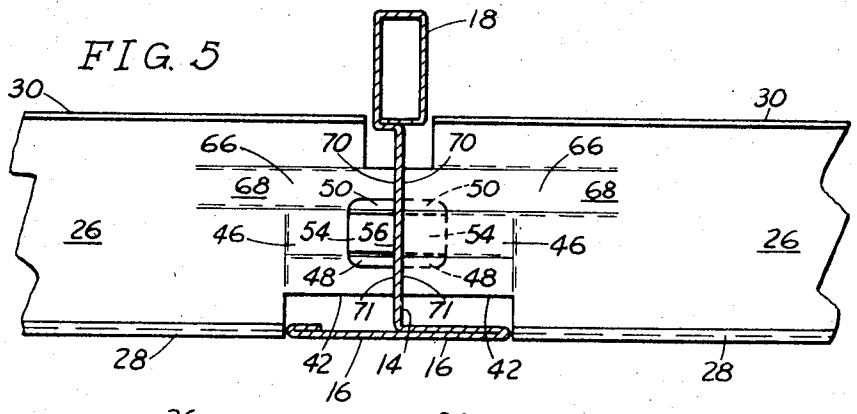


FIG. 5



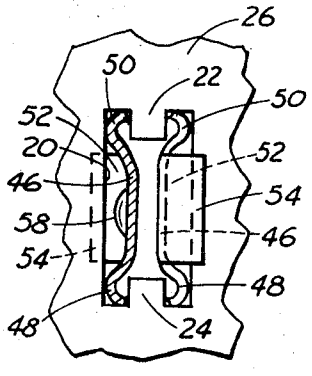


FIG. 6

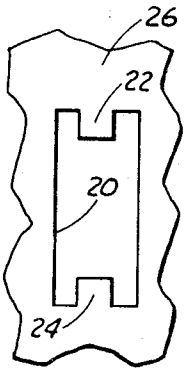


FIG. 7

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LOCKING CONNECTION FOR SUPPORTING GRID SYSTEMS

BACKGROUND OF THE INVENTION

This invention relates generally to structural connector elements and, more particularly, to locking elements used in supporting grid systems.

While not limited thereto, the present invention is particularly adapted for use in ceiling tile supporting grid systems of the type comprising a plurality of parallel spaced main grid members and cross grid members extending transversely between the main grid members and having end portions insertable through said main grid members and interlocking therewith.

One of the critical problems confronted in these supporting grid systems lies in providing satisfactory locking connections for the intersecting grid members having the requisite stability and strength to form a rigid supporting grid construction. Generally such grid members are formed of an inexpensive, soft sheet metal. It has been proposed that they be provided with connector portions having slots, notches or hooks intended to lock the grid members in position. While these types of locking means have generally served the purposes for which they were designed, they have not been entirely satisfactory because they allow some clearance or play between cooperable attaching parts and do not provide a sufficiently strong or rigid connection. Sometimes, short, resilient fingers have been struck out from the body of the connector forming an opening therein so that the finger can be cammed into the opening when inserted through a slot of a transversely extending main grid member. When the finger passes beyond the slot, its leading edge is intended to snap into locking engagement behind the web portion of the main grid member. In addition to employing much effort to insert this type of finger lock through the slot, the finger is worked to such an extent after being assembled and disconnected that the finger tends to take a permanent set toward the opening of the connector body so that its usefulness is minimized if not destroyed. Moreover, when assembled, excessive clearance is realized between the leading edge of the finger and the web portion of the main grid member. Also, the locking portions of the above known connectors are easily damaged when subjected to impact or abuse during installation and handling. In some instances, separable locking connectors fixed to the end portions of the grid members are used, thereby increasing the number of parts, complicating the assembly thereof, and increasing the cost of the system.

SUMMARY OF THE INVENTION

Accordingly, a primary object of the present invention is to provide a locking connector for supporting grid systems and the like formed integral with a grid member which slip-fits into assembled relation, easily and by hand, with a simple, linear motion and a minimum of effort.

Another object of this invention is to provide the foregoing in a connection which is economical, strong and rigid in construction, durable and reliable in use, capable of withstanding abuse during installation and handling, and which can be produced by relatively simple manufacturing techniques.

A further object of the present invention is to provide the foregoing in a locking connection which can be easily assembled with a snap fit and readily disassembled by hand and can be reused many times.

Still another object of this invention is to provide the foregoing locking connection with reinforcement means to form a strong connection and prevent lateral deflection thereof.

Generally speaking, the connection of the present invention, as hereinafter described, comprises a first support member having a slot in its web for receiving a locking connector extending from a second support member. The connector is provided with reinforcement means in the form of a rigid

channel member having a recess for receiving a portion of a resilient element adapted for movement away from the recess when effecting a connection with the first member. The resilient element has a part adapted to snap into locking engagement behind one side of the web of the first member. Means are provided for preventing the resilient element from completely entering into said recess and facilitating lateral outward movement of the element when effecting a connection. Stop shoulders are provided on the connector to engage the other side of the web of the first member in the assembled relation.

The foregoing and other objects, advantages and characterizing features of the present invention will become clearly apparent from the ensuing detailed description of an illustrative embodiment thereof, taken together with the accompanying drawings wherein like reference characters denote like parts throughout the various views.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a fragmentary, perspective view of intersecting grid members incorporating the locking connection of this invention;

FIG. **2** is a view similar to FIG. **1**, but with the members disassembled;

FIG. **3** is a side elevational view, on an enlarged scale, of a supporting grid member incorporating locking connectors of this invention, being broken away for ease of illustration;

FIG. **4** is an enlarged, fragmentary, horizontal sectional view of the assembled members taken about on line **4–4** of FIG. **1**;

FIG. **5** is a fragmentary, vertical sectional view thereof taken about on line **5–5** of FIG. **1**;

FIG. **6** is a fragmentary, vertical sectional view thereof on a further enlarged scale, taken about on line **6–6** of FIG. **4**; and

FIG. **7** is a view similar to FIG. **6** but with the locking connectors removed.

DETAILED DESCRIPTION OF THE PREFERRED FORM

Referring now in detail to the illustrative embodiment shown in the drawings, FIG. **1** shows a ceiling tile supporting grid system incorporating locking connectors of the present invention and comprising a main T-support member, generally designated **10**, detachably connected to a pair of cross T-support members, generally designated **12**. The main T-member **10** can be conveniently fabricated from a single piece of any suitable material, preferably an inexpensive, lightweight metal such as soft steel for example, and is formed to provide a generally vertical web portion **14** upstanding from laterally projecting, tile supporting flanges **16** on opposite sides thereof and surmounted by a generally box-shaped, longitudinally extending, reinforcing member **18**.

Web **14** is provided at spaced intervals with rectangular, normally vertical slots **20** for reception of the locking connectors on cross T-members **12**, only one such slot being illustrated. Slots **20** are generally H-shaped, being formed with downwardly and upwardly projecting tabs **22** and **24**, respectively, at the top and bottom of the slot (FIG. **7**) which serve as partitions or separators between the two cross T-members **12** in the assembled joint.

Cross T-members **12** can be similarly fabricated from a single piece of any suitable material, such as soft steel by way of example, and formed to provide a normally vertical web portion **26** and upstanding from laterally projecting, tile supporting flanges **28** and surmounted by a generally flat, longitudinally extending, reinforcing member **30**. It should be appreciated that reinforcing members **18** and **30** can take various shapes in transverse cross section, such as a flat horizontal strip, a reinforced flat vertical edge having a thickness approximately twice that of the web portion, or a curved or rounded bulb shape, as desired.

In accordance with this invention, cross T-members **12** are provided at their opposite ends **36** with locking connectors,

generally designated 40, extending from said opposite ends of each cross T-member 12 and formed integral therewith. It should be noted that connectors 40 at opposite ends of cross T-member 12 are offset and oriented in opposite lateral directions. As shown in FIG. 3, connectors 40 each include a tongue, generally designated 42, laterally offset from web 26 and projecting axially beyond cross T-member end 36. A significant feature of this invention is the provision of a mechanical reinforcement for each connector in the form of a channel 44 having a web body 46 and opposed longitudinally extending beads 48 and 50 defining a recess 52 therebetween. The leading edges of beads 48 and 50 are rounded, as shown at 60 and 62, to facilitate insertion of connector 40 into slot 20 of main T-member web portion 14. Beads 48 and 50 are curved in transverse cross section so that the opposite sides thereof engage the sides of slot 20 and tabs 22, 24 to form a tight connection and prevent rotation or twisting of connector 40 within slot 20, as shown in FIG. 6.

A tab 54 initially extending axially beyond channel 44 and forming a continuation of web body 46 terminates in a generally flat edge 56. Tab 54 is bent back toward web body 46 with flat edge 56 adapted to engage behind main T-member web portion 14 for locking engagement therewith in the assembled relation, as shown in FIG. 4. Tab 54 is partially disposed within recess 52 of channel 44 and is slightly inclined outwardly away from recess 52 and rearwardly toward web portion 26. Tab 54 is resiliently yieldable into recess 52, being held against complete collapse into recess 52 by means of a projection or stop 58 protruding from web body 56 toward tab 54. The material of connector 40 including tab 54 is relatively soft and ductile. However, stop 58 prevents tab 54 from being completely forced into recess 52 and taking a permanent set therein, thereby insuring an outwardly sloping disposition of tab 54 when assembled. Accordingly, tab 54 can be repeatedly installed, disconnected, and subjected to impact forces during handling and assembly without being sufficiently damaged to destroy its useful life.

Another important feature of this invention is the provision of a second channel member or elongated embossment 66 disposed above channel 44 and oriented generally parallel thereto. Embossment 66 is provided with a web body 68 recessed laterally in the opposite direction from web body 46 of the adjacent channel 44 and forms an upward continuation of a portion of bead 50. Embossment 66 has a forward edge forming a stop shoulder 70 abutting web portion 14 of main T-member 10 in the assembled relation. A second stop shoulder 71 is provided below channel 44 and has a vertical edge disposed in a common plane with shoulder 70 to preclude vertical rocking movement of support member 12 relative to member 10. Embossment 66 extends rearwardly past end 36 and tapers toward web portion 26 into which is finally merges. This embossment 66 not only provides a mechanical reinforcement for tongue 42 but also prevents lateral deflection of such tongue in the assembled connecting joint.

When assembling the grid system, connectors 40 are inserted into slots 20. In the illustrated joint, connectors 40 from the adjacent ends of aligned cross T-members 12 extend side by side through web portion 14 of main T-member 10, as shown in FIG. 4. Stop tabs 22 and 24 are vertically aligned, and divide each slot into a connected pair of slot portions, allowing connectors 40 to be inserted into each slot 20 from opposite sides of main T-member web portion 14.

As each connector 40 is linearly inserted into its side of slot 20, tab 54 bears against the main T-member web portion 14 defining that side of slot 20 and is cammed out of the way, into recess 52, permitting tab 54 to pass through slot 20. The resiliency of tab 54 permits deflection by such camming action. Recess 52 is disposed in a facing relation to tab 54 and terminates at the leading edge of connector 40 or at the juncture of tab 54 with connector 40. Recess 52 is slightly wider and appreciably longer than tab 54 in order to accommodate and receive the latter when tab 54 is cammed inwardly during insertion thereof through slot 20 in the main T-member web portion 14. The forward end portion of tongue 42 is confined between tabs 22, 24 and the side of slot 20. Further insertion of connection 40 causes tab 54 to pass beyond web portion 14, allowing the resiliently displaced tab 54, urged by stop 58, to snap laterally outwardly from recess 52 to the locking position shown in FIGS. 4 and 5. Tab 54 is thereby positioned behind web portion 14 with tab edge 56 in locking engagement thereagainst, preventing withdrawal of connector 40 from slot 20 and holding the associated cross T-member 12 connected to main T-member 10. Because of the relatively long length of tab 54 as opposed to the short, struck-out fingers known in the prior art, tab 54 is cammed inwardly only slightly during insertion whereby upon outward urging thereof only a small, tolerable clearance exists between edge 56 and web portion 14, of negligible effect in achieving a tight assembled connection. In this locked position, stop shoulders 70 and 71 engage against web portion 14 to block further insertion of connector 40. The spacing between stop shoulders 70, 71 and edge 56 is substantially the thickness of web portion 14.

It should be appreciated that in forming grid members, the web portion is not always in perfect alignment along its entire length, i.e., it is not always centered true with respect to the edges of the grid member flanges. However, since the longitudinal or lengthwise spacing between edge 56 of tab 54 and stop shoulders 70 and 71 is constant in the present invention, a tight connection between T-members 10 and 12 is insured regardless of the offcentered orientation of web portion 14 of main T-member 10. Connector 40 of the other cross T-member 12 is inserted through the other side of slot 20 in the same manner from the opposite side of main T-member 10 to form a rigid joint. Web portions 26 of both cross T-members 12 on opposite sides of main T-member lie in a generally common plane. The cross T-flanges 28 abut the main T-flanges 16, to maintain the intersecting members 10 and 12 in right angular relation.

In order to disconnect the grid member, tab 54 is resiliently displaced into recess 52 either by hand or with an appropriate tool to move edge 56 from behind main T-member web portion 14. Tabs 54 face outwardly, as shown in FIG. 4, and are accessible for this purpose. With tab 54 depressed, connector 40 is easily withdrawn from slot 20 thereby disconnecting cross T-member 12 from main T-member 10. Thus, tongue 42 along with channel 44 and embossment 66 provide a strong and rigid, snap-type connection which is easily assembled, by a simple linear insertion of the connector through the slot and which is easily disconnected. It is not necessary to thread cross T-members 12 through slot 20. Only a simple, straight-line axial motion is required.

From the foregoing, it is apparent that the objects of the present invention have been fully accomplished. As a result of this invention, an improved locking connector, formed integral with the web portion of a support member, is provided for effecting a strong, rigid joint between transversely extending support members in an efficient manner. The connectors are provided with reinforcement means to resist lateral deflection generated in the assembled joint. By the provision of a long, tapered, reversely bent locking tab, clearance between the web engaging edge of the tab and the web of a support member is minimized to ensure a tight, rigid, joint in the assembled relation. Means also are provided for preventing such locking tab from being permanently deformed into its depressed position, whereby the connector can be reused many times.

A preferred embodiment of this invention having been disclosed in detail, it is to be understood that this has been done by way of illustration only.

What we claim is:

1. A locking connection for supporting grid systems and the like comprising a first support member having a web with a slot therein; a second support member having a web with a locking connector extending therefrom and formed integral therewith; said locking connector being insertable through said slot and having a leading edge; said locking connector in-

cluding a resiliently yieldable locking means having a portion engaging one side of said web; said locking means comprising an extension of said connector and a continuation of said leading edge reversely bent to extend rearwardly from said leading edge, said locking connector being provided with a channel recess terminating adjacent said leading edge in facing relation to said reversely bent locking means and having a configuration slightly larger than said locking means whereby said locking means is adapted to be cammed into said recess upon insertion through said slot of said first support member.

2. A locking connection according to claim 1, wherein said recess is provided with means preventing complete collapse of said locking means in said recess.

3. A locking connection according to claim 1, wherein said locking connector is provided with reinforcement means extending substantially parallel to said web of said second support and extending rearwardly into said web.

4. A locking connection according to claim 1, wherein said locking connector has a stop shoulder engageable against a side of said web opposite said one side.

5. A locking connection according to claim 1, wherein said locking connector has a pair of spaced stop shoulders engageable against a side of said web opposite said one side.

6. A locking connection according to claim 5, wherein said stop shoulders are spaced from said web engaging portion of said locking means a distance substantially equal to the thickness of said first support member web.

7. A structural support member comprising a web portion and a flange portion extending laterally from opposite sides of said web portion; locking connectors extending axially from opposite ends of said support member; each locking connector comprising resiliently yieldable locking means having a leading edge and a locking portion forming a continuation of said leading edge and reversely bent to extend rearwardly therefrom, said locking connector being provided with a recess slightly larger than said reversely bent locking portion and terminating at said leading edge in facing relation to said reversely bent locking portion whereby the latter is adapted to be cammed into said recess upon lateral inward deflection of said locking portion.

8. A structural support member according to claim 7 wherein said recess is provided with means preventing complete collapse of said locking portion in said recess.

9. A structural support member according to claim 7, wherein each locking connector is provided with a pair of spaced stop shoulders located rearwardly of said locking portion.

10. A structural support member according to claim 7, wherein each locking connector is provided with a first reinforcement means having an offset channel extending parallel to said web portion and a second reinforcement means having a channel parallel to said first reinforcement means and laterally offset therefrom.