United States Patent

Lickliter et al.

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[54] LOCKING CONNECTION FOR SUPPORTING GRID SYSTEMS

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[21] Appl. No.: **18,071**

Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 806,977, March 13, 1969, Pat. No. 3,584,904.

[52] **U.S. Cl.** .....**287/189.36 A,** 52/664, 52/667

[51] **Int. Cl.** **E16b 21/08,** E04b 1/38

[58] **Field of Search**.....52/665, 667, 484, 475, 664; 287/189.36 A

[56] **References Cited**

UNITED STATES PATENTS

3,367,695	2/1968	Haertel et al.	287/189.36 A
3,023,865	3/1962	Brandsteffer	52/484 X
3,501,185	3/1970	Brown et al.	287/189.36 A
1,714,188	5/1929	Plym	287/189.36 A X

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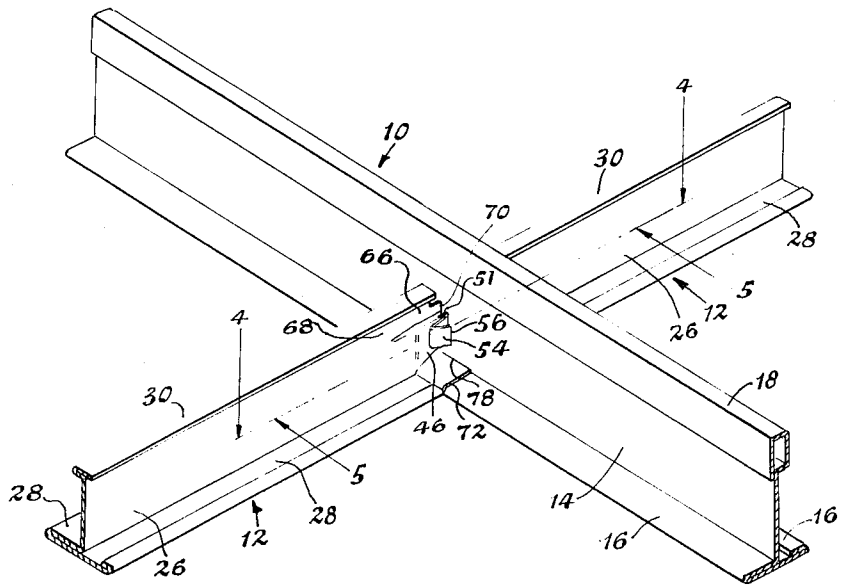
[57] **ABSTRACT**

A first support member having a web with a slot therein and a second support member having a web upstanding from a pair of laterally extending support flanges and a locking connector formed integral with the web and extending axially therefrom for insertion in the slot. The connector has a locking tab engageable behind one side of the first support member web. The second support member has an offset end portion forming a continuation of the support flanges and adapted to overlie the first support member support flanges. The offset portion is provided with a transverse edge engageable with the other side of the first support member web to provide a rigid connection between the first and second support members. The offset portion has a thickness less than one-half the thickness of the support flanges with which it is integrally formed.

9 Claims, 8 Drawing Figures



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SHEET 1 OF 2

Fig. 1.

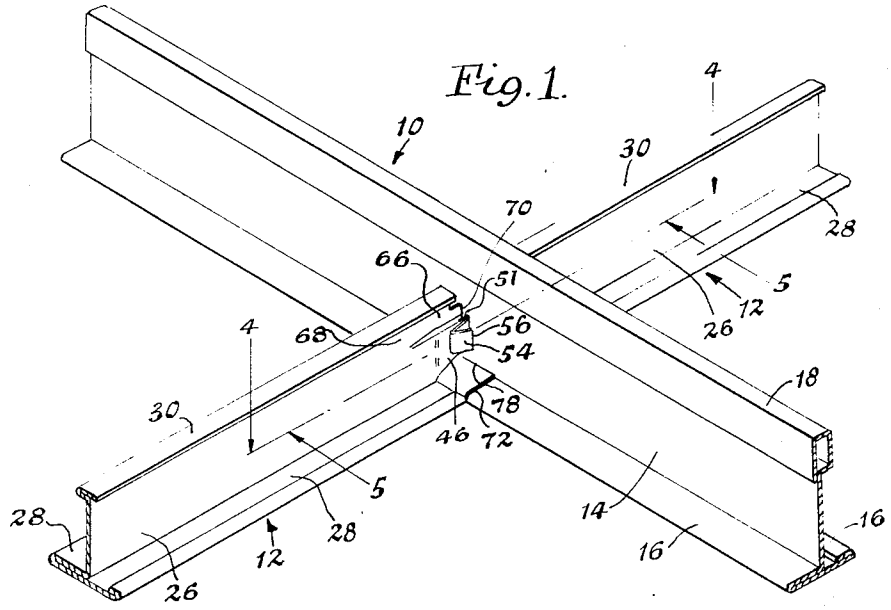

Fig. 2.

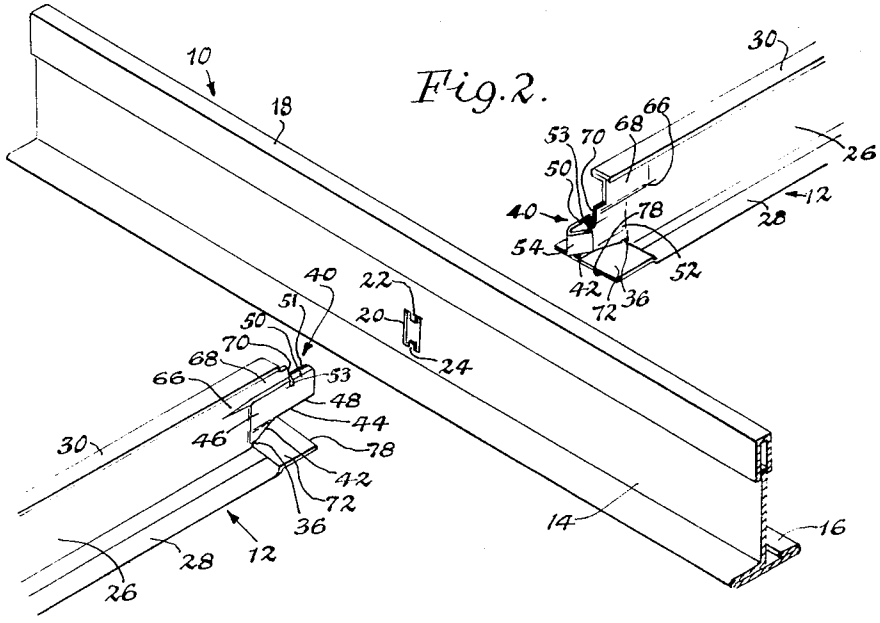

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Fig.3.

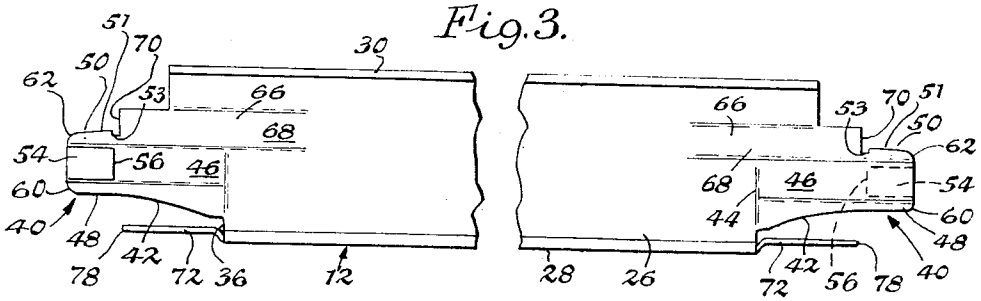


Fig.4.

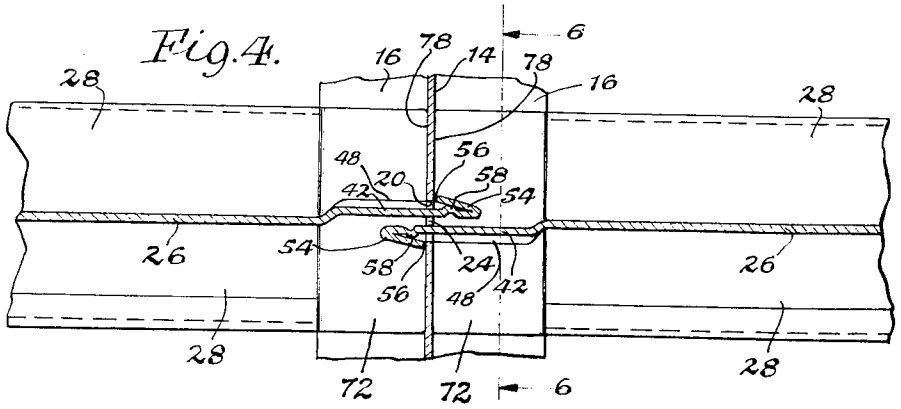
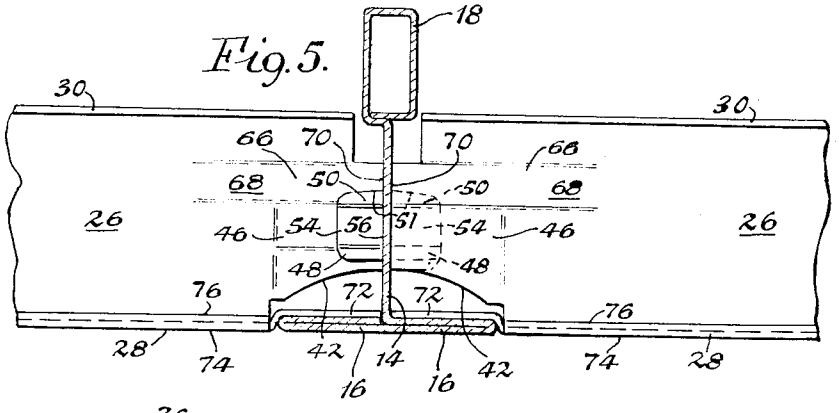


Fig.5.



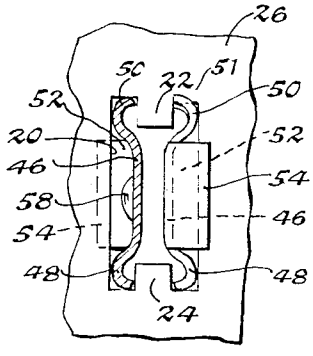


Fig.6.

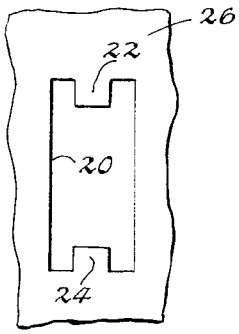


Fig.7.

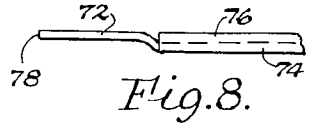


Fig.8.

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LOCKING CONNECTION FOR SUPPORTING GRID SYSTEMS

CROSS-REFERENCE TO A RELATED APPLICATION

This application is a continuation-in-part of Application Ser. No. 806,977, filed Mar. 13, 1969 on a Locking Connection for Supporting Grid Systems now U.S. Pat. No. 3,584,904.

BACKGROUND OF THE INVENTION

This invention relates generally to structural connector elements and, more particularly, to rigid locking connections between support members 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.

Prior to the invention claimed and disclosed in application Ser. No. 806,977, these intersecting grid members often were provided with locking connectors having slots, notches or hooks intended to lock the grid members in place. Others employed short, resilient fingers stuck out from the body of the connector forming an opening so that the fingers could be cammed into the opening when inserted through a slot of a transversely extending main grid member and snapped into locking engagement behind the web portion of the main grid member when passed through the slot. Still others utilized separable locking connectors fixed to the end portions of the grid members. These locking connectors possessed certain disadvantages in that they often were relatively complicated or expensive, or excessive clearance was realized between the interlocking parts thereby effecting a loose and unsatisfactory connection between the grid members.

The invention claimed and disclosed in Application Ser. No. 806,977 obviated these disadvantages encountered in prior known locking connectors by forming locking connectors of a unitary, one-piece construction having a tab extending axially outwardly of the connector and reversely bent into a reinforced recess in the connector body to form a resilient locking member adapted to snap into firm locking engagement behind one side of the main grid support web to form a tight and rigid connection. However, to maintain the intersecting grid members in right angular relation, the tile supporting flanges of the cross grid terminated sufficiently inwardly of the locking connector member in an axial direction to accommodate the coplanar tile supporting flanges of the main grid member and abut the same with a tight fit. It can be appreciated that in such a connection, the width of the main grid member tile supporting flanges must be maintained within close tolerances to provide a tight, flush fit with the recessed ends of the cross grid member tile supporting flanges. Since these flanges are roll formed, the problem of maintaining accurate close tolerances is compounded and meticulous and diligent quality control must be exercised to maintain such flanges within these close tolerances. It is desirable, therefore, to eliminate the problem of maintaining the width of the tile supporting flanges within such close tolerances.

It has been proposed to offset the cross member of tile supporting flanges so as to rest upon the main grid member tile supporting flanges in the assembled relation. However, this poses a problem because the thickness of the reversely bent flanges causes the tiles to be tilted and inclined on the supporting flanges. This not only presents an uneven and irregular ceiling surface having sound and heat conducting openings therein, but detracts considerably from the decor of the ceiling surface.

SUMMARY OF THE INVENTION

The primary object of the present invention is to provide a locking connection between intersecting grid members retaining the advantages found in the locking connector of Ser. No. 806,977 without requiring the maintaining of close tolerances in roll forming the main grid flanges.

The improved connection of the present invention is characterized by the provision of an offset portion located at opposite ends of a cross grid member having a flat edge engageable with the web portion of the intersecting main grid member. The offset portion has a thickness of less than one-half the thickness of the tile supporting flanges to minimize the tilting disposition of the tiles on the supporting flanges of the intersecting support flanges. The flat terminal edge of the offset portion is spaced from the cross grid member locking connector substantially the thickness of the main grid member web portion secured therebetween.

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 rigid 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 the offset tile supporting flanges 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;

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

FIG. 8 is a fragmentary side elevational view of the offset supporting flange.

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, detachable 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 of 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 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.

Cross T members **12** are provided at their opposite ends 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 the end of cross T member **12**. A mechanical reinforcement is provided 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**. To further facilitate continued insertion of connector **40** into slot **20**, bead **50** is slightly tapered at its upper edge **51** longitudinally toward the leading edge thereof as shown in FIG. **3**. 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 of twisting of connector **40** within slot **20**, as shown in FIG. **6**. A small slot **53** is formed at the rear end of bead **50** for engaging the upper edge defining the slot portion between tab **22** and the side of slot **20** as will hereinafter become apparent.

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 an assembly without being sufficiently damaged to destroy its useful life.

A second channel member or elongated embossment **66** is 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. Embossment **66** extends inwardly of web portion **26** and tapers toward web portion **26** into which it 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.

A significant feature of this invention is the provision of an offset portion **72** on the distal end of tile supporting flanges **28** adapted to overlie and rest on the tile supporting flanges **16** of main T support member **10**. Offset portion **72** is less than one-half the thickness of flanges **28** and is offset upwardly to lie in a common plane with the upper folded portion of flanges **28** so as to present a substantially continuous coplanar surface as shown in FIG. **8**. Cross T member **12** is fabricated from a suitable flat, one-piece blank with flanges **28** consisting of reversely bent portions **74** and **76** contiguously disposed and shaped by roll forming. Thus the thickness of flanges **28** is at least twice the thickness of the original blank or the summation of the thicknesses of portions **74**, **76** and the inherent spaces or voids therebetween. Since offset portion **72** is a continuation of the underlying portion **74**, its thickness is the same as said portion **74** or less than one-half the composite thickness of flanges **28**. Offset portion **72** is formed by prenotching and then removing sections of material from opposite sides of the blank at the opposite ends thereof prior to the flange forming operation. After the flange forming operation, portion **72** is offset from the plane of portion **74** to the plane of portion **76** in a suitable press forming operation.

Offset portion **72** terminates in a flat terminal edge **78** which can have rounded corners and is adapted to abut and fully engage thereacross with web portion **14** of main T member **10**. The spacing between edge **78** of offset portion **72** and the edge **56** of locking tab **54** is substantially the thickness of web portion **14** thereby insuring a rigid connection between main T member **10** and cross member **12** in the interlocking relation without any lateral rocking movement therebetween.

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. The forward end portion of tongue **42** is confined between tabs **22**, **24** and the side of slot **20**. During such tab insertion, offset portion **72** rides on the upper surfaces of flange **16** of main T member **10**. 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, terminal edge **78** of offset portion **72** engages against web portion **14** along with shoulder **70**, to block further insertion of connector **40**. The spacing between edge **78** of offset portion **72** and edge **56** of tab **54**, is substantially the thickness of web portion **14** to insure a rigid connection between the intersecting T members **10** and **12** and maintain them in right angular relation.

As offset portion **72** of cross T member **12** rides on the upper surfaces of flange **16** of main T member **10** during the linear insertion of each connector **40** into its side of slot **20**, connector **40** is urged upwardly against the upper edge of slot **20**. The tapered edge **51** of bead **50** compensates for this and permits easier insertion of connector **40** into slot **20**. Further insertion of connector **40** causes bead **50** to pass beyond slot **20** and slot **53** is advanced into registry with slot **20**. The upward force exerted by offset portion **72** urges the bottom of slot **53** into engagement with the top edge of slot **20** to provide a second locking engagement between main T member web portion **14** and the rear end of bead **50** insuring that the associated cross T member **12** is positively held connected to main T member **10**.

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 longitu-

dinal or lengthwise spacing between edge **56** of tab **54** and edge **78** of offset portion **72** is constant in the present invention, a tight connection between T members **10** and **12** is insured regardless of the off-centered 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 engagement of edges **78** with web **14** maintains the intersecting members **10** and **12** in right angular relation, and together with shoulder **70** prevents vertical rocking of the cross T members.

In order to disconnect the grid member, bead **50** is depressed and 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 bead **50** and tab **54** depressed, connector **40** is easily withdrawn from slot **20** thereby disconnecting cross T member **12** from main T member **10**.

From the foregoing, it is apparent that the objects of the present invention have been fully accomplished. By providing the cross support member with an integral offset portion having a transverse terminal edge adapted to engage the main support member web portion and spaced from the abutting edge of the locking connector substantially the thickness of each web portion, a strong, rigid joint is effected between the transversely extending support members. Moreover, the spacing between such transverse edge and the locking connector edge can be relatively easily maintained within close tolerances, as can the spacing between shoulder **70** and edge **56** thereby eliminating the much more difficult problem of maintaining close tolerances on the tile supporting flange width. Since the thickness of such offset portion is less than one-half the thickness of the tile supporting flanges, the difference in elevation is negligible in achieving a substantially continuous ceiling surface. Also, the urging of the bottom edge of slot **53** against the top edge of slot **20** by offset portion **72** provides a second locking engagement between the rear end of bead **50** and the main support member web portion **14** to further prevent withdrawal of connector **40** form slot **20**.

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 is claimed is:

1. A locking connection for supporting grid systems and the like comprising a first support member having flanges and a web upstanding therefrom provided with a slot; a second support member having flanges and a web upstanding therefrom provided with a locking connector extending axially therefrom and insertable through said slot; said locking connector having a portion engaging one side of said first support member web; said second support member having an end portion forming a continuation of said support flanges thereof and having a terminal edge below said locking connector portion engaging the other side of said first support member web; said locking connector having a stop shoulder above said locking connector portion engaging said other side of said first support member web above said end portion terminal edge and substantially vertically aligned therewith.

2. A locking connection according to claim **1** wherein said end portion has a thickness substantially less than the thickness of said flanges of said second support member.

3. A locking connection according to claim **1** wherein said end portion has a thickness less than one-half the thickness of said flanges of said second support member.

4. A locking connection according to claim **1** wherein said end portion has a thickness no greater than one-half the thickness of said flanges of said second support member.

5. A locking connection according to claim **1** wherein said end portion is offset and overlies a flange of the first support member.

6. A locking connection according to claim **1** wherein the spacing between said end portion terminal edge and said locking connector portion is substantially the thickness of said first support member web.

7. A locking connection according to claim **1** wherein said locking connector is provided with a bead along one longitudinal edge thereof, said bead having a tapered edge inclined toward the free end of said bead.

8. A locking connection according to claim **7** wherein said bead is provided with a slot at the end remote from said free end.

9. A locking connection according to claim **1** wherein the spacing between said end portion terminal edge and said locking connector portion is substantially the thickness of said first support member web; said end portion being offset and adapted to overlie a flange of the first support member; said end portion having a thickness substantially less than the thickness of said flanges of said second support member; a tapered bead along the outer longitudinal edge of said locking connector inclined toward the free end of said locking connector; the other end of said bead terminating in a slot.

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