Nov. 28, 1961 M. L. LYDARD 3,010,550

GRID STRUCTURES FOR SUSPENDED CEILINGS

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FIG.1.

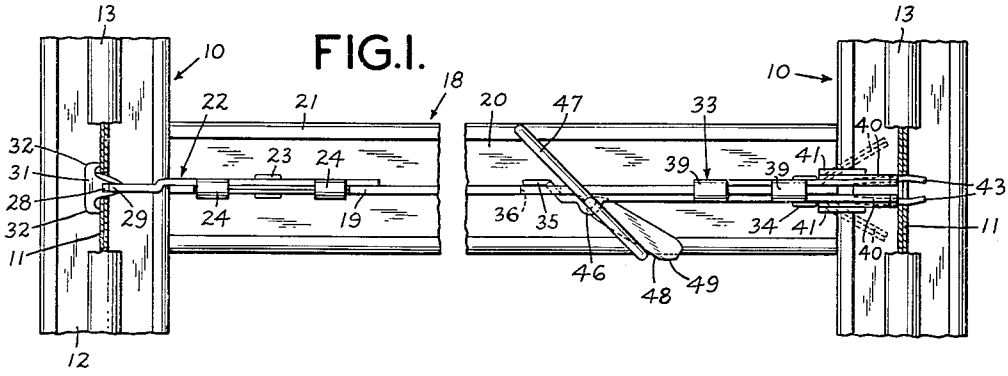
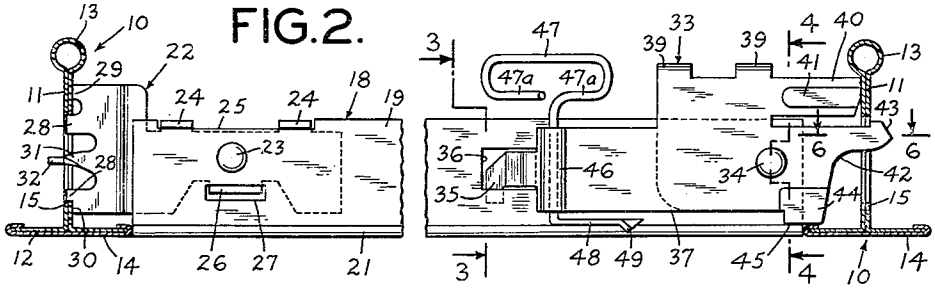


FIG.2.



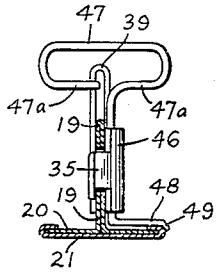


FIG.3.

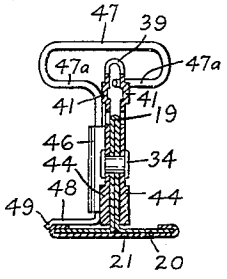


FIG.4.

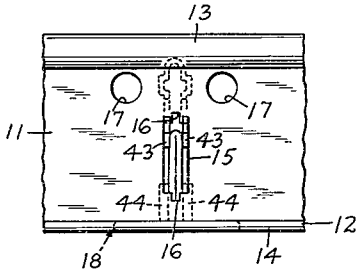


FIG.5.

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FIG.7.

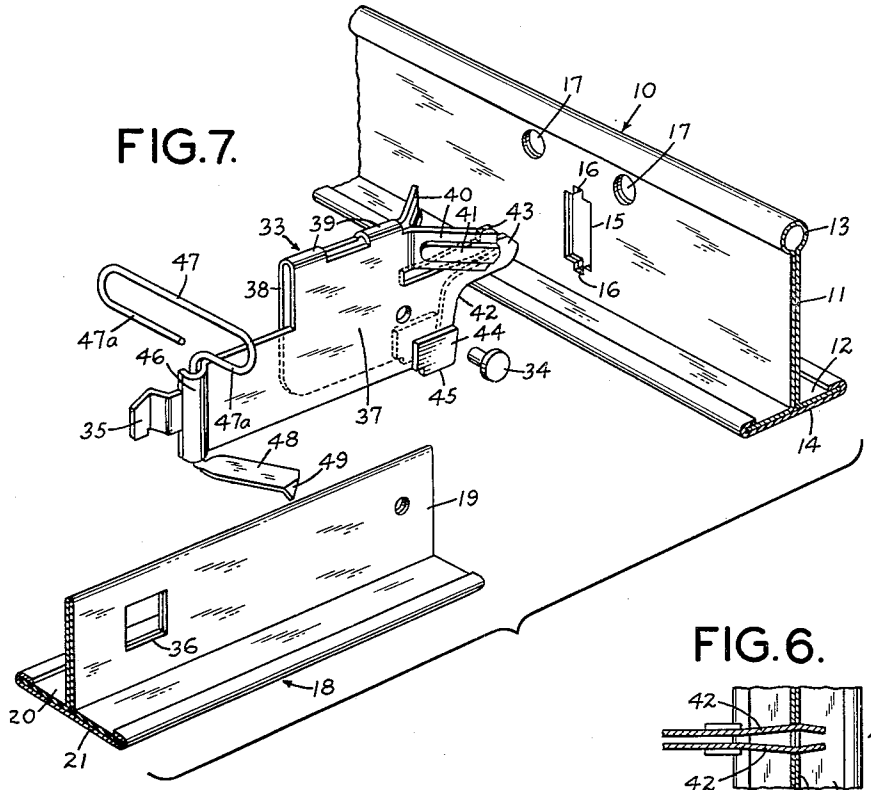
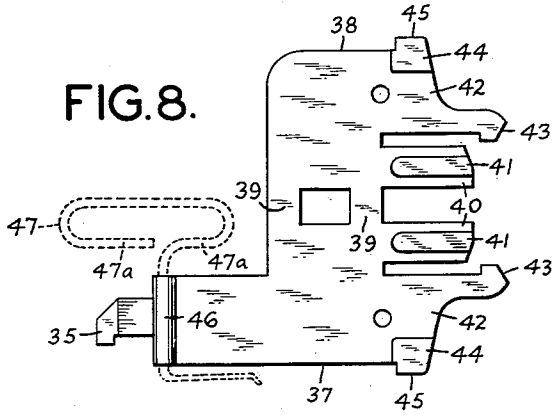


FIG.6.

FIG.8.



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FIG. 9

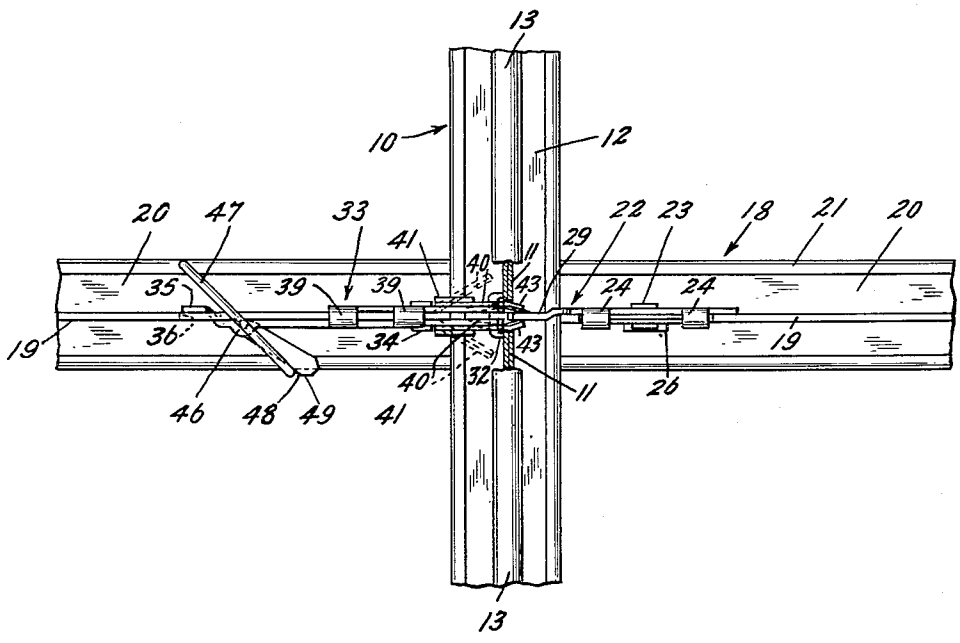
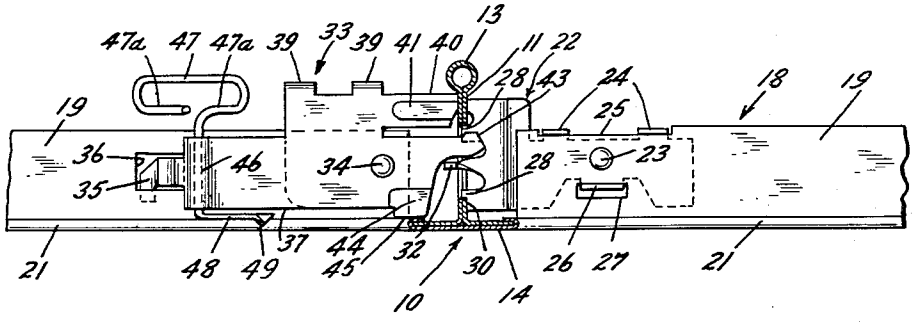


FIG. 10



United States Patent Office 3,010,550 Patented Nov. 28, 1961

3,010,550
GRID STRUCTURES FOR SUSPENDED CEILINGS

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Filed Nov. 5, 1958, Ser. No. 771,983
4 Claims. (Cl. 189—82)

This invention relates to new and useful improvements in ceiling construction and more particularly to an improved grid structure for suspended ceilings.

In the construction or modernization of buildings it has become an accepted practice to utilize suspended ceilings. Such ceilings are particularly adapted for recessed lighting fixtures or luminous lighting panels in conjunction with sound absorbent ceiling materials, the latter being commonly supplied in the form of panels in various standard dimensions.

The suspended ceiling structure may comprise a grid formed from intersecting steel or aluminum inverted T beams. The grid usually has square or rectangular opening defined by the intersecting T's and is suspended by wires or cables from the roof trusses or other structural parts of the building. A channel or angle molding which may be affixed to the building wall, if desired, is generally attached at the edges of the grid structure. In this construction the flanges of the inverted T's provide a support which is well adapted to carry recessed lighting fixtures or luminous lighting panels as well as panels of ceiling material.

A basic problem involved in the construction of suspended ceilings utilizing a grid structure relates to joining the T beams at right angles. The grid structure frequently comprises a first group of parallel evenly spaced inverted T beams extending lengthwise of the structure and a second group of T beams, known as cross T's, perpendicular to the first group and extending across the structure. The cross T's are of such length as to fit between the parallel T beams. Since the bottom or flange surfaces of the T beams and cross T's are commonly exposed, it is desirable that the joint therebetween present a tight and neat appearance. It is also desirable that the grid structure be strong and rigid. However for the purpose of economy a minimum number of types of parts which may be quickly and easily assembled without the use of special equipment should be employed.

It is therefore a primary object of the present invention to provide a grid structure which is suitable for use in suspended ceiling construction and structurally strong and rigid but which may be quickly and easily assembled.

A further object of the invention is to provide a grid structure which is structurally strong and rigid and comprises a minimum number of different types of parts.

A still further object of the invention is to provide a grid structure in which the flanges of the T beams are accurately perpendicularly aligned and maintained in close juxtaposition.

Another object of the invention is to provide a novel and improved cross T for use in a ceiling grid structure.

A feature of the invention has been the provision of a novel and improved fastener for cross T's.

Further objects and advantages of the invention will be apparent from the following description.

In accordance with the present invention there is provided a series of evenly spaced parallel inverted T beams adapted to be supported from roof trusses or other structural members by wires or cables. A series of evenly spaced parallel inverted cross T members is located perpendicularly to the inverted T beams so that the flange portions of the T beams and the cross T's lie substantially in a plane. Each T beam is provided with a series of spaced openings located in the web portion thereof and adapted to receive fasteners which are permanently mounted on the ends of the web portion of each cross T member. The cross T members are provided with a first type fastener mounted on one end thereof and a second type fastener employing a novel construction on the opposite end thereof. The construction of the second type fastener mounted on each cross T member is such that it may be attached to a T member directly opposite to the first type fastener of a second cross T member. Thus the grid structure of the present invention is constructed essentially from only two types of parts, i.e. long inverted T beam members having spaced openings in the web portion thereof and short cross T members having permanently mounted on respective ends thereof a first type fastener and a second type fastener.

The invention will now be described in greater detail in connection with the accompanying drawings in which:

FIG. 1 is a fragmentary plan view, partly broken away, of a grid structure in accordance with the present invention;

FIG. 2 is a fragmentary side elevation, partly in section, of the grid structure shown in FIG. 1;

FIG. 3 is a cross sectional view taken along line 3—3 of FIG. 2;

FIG. 4 is a cross sectional view taken along line 4—4 of FIG. 2;

FIG. 5 is a fragmentary end elevation of the grid structure shown in FIG. 1;

FIG. 6 is a fragmentary plan view taken along line 6—6 of FIG. 2;

FIG. 7 is a fragmentary exploded perspective view of a grid structure in accordance with the present invention;

FIG. 8 is a view showing the blank from which a T fastener in accordance with the present invention may be formed;

FIG. 9 is a fragmentary plan view, partly broken away, illustrating cooperative engagement of the two types of cross T end fasteners with a T beam, in accordance with the invention; and

FIG. 10 is a fragmentary side elevation, partly in sectionfi of the grid structure shown in FIG. 9.

Referring now to the drawings and particularly FIGS. 1 and 2, long T beam members are generally designated at **10**. The T beam members **10** comprise a web portion **11** and a flange portion **12**, said web and flange portions of the T beam member **10** being generally disposed in the form of an inverted T. As best shown in FIG. 7, the T beam members **10** may be formed from a single piece of malleable material such as steel, aluminum or the like. The upper edge of the web portion **11** of the T beam member **10** preferably is formed into a strengthening rib **13**. As the bottom surface of the flange **12** may be exposed in the finished ceiling construction, it may be desirable to crimp a light steel or aluminum strip **14** over the flange **12**, which strip **14** may have any desired finish applied thereto.

Spaced openings **15** are located in the web portion **11** of the T beam member **10**. The openings **15** conveniently may be located approximately 12 inches apart although this spacing may be varied as desired to accommodate particular sizes of electrical fixtures or ceiling panels. Openings **15** are generally rectangular in configuration and disposed in the web portion **11** of the T beam **10** so that the shorter sides of the openings **15** are substantially parallel to the flange portion **12** of the T beam **10**. A notch **16** is centrally located along each of the shorter sides of the opening **15**. Holes **17** preferably are symmetrically located above and on each side of the opening **15** in the web **11** of the T beam member **10**. The holes

17 are adapted to accommodate T beam support wires (not shown).

Cross T members indicated generally at 18 are disposed in perpendicular relation to the T beam members 10. The cross T members 18 comprise a web portion 19 and a flange portion 20, the web and flange portions of the cross T member 18 being generally disposed in the form of an inverted T. As best shown in FIG. 7, the cross T member 18 may be formed from a single piece of malleable material such as steel, aluminum or the like. The cross T member 18 is not required to carry a heavy load and generally will not exceed a length of about 4 feet. Thus it is normally unnecessary to provide a rib comparable to rib 13 of the T beam and the web 19 may be of a smaller dimension than the corresponding web 11 of the T beam member 10. Since the bottom surface of the flange 20 may be exposed in the finished ceiling construction it may be desirable to crimp a light steel or aluminum strip 21 over the flange 20, which strip 21 may have any desired finish applied thereto.

One end of each cross T member 18 is adapted to carry a first type fastener, indicated generally at 22. The fastener 22 is permanently mounted on the cross T member 18 by rivet means 23. Rotation of the fastener 22 with respect to the cross T member 18 conveniently may be prevented by means of lugs 24 which engage groove 25 of the cross T member 18 and lug 26 which seats in hole 27 of the cross T member 18. The fastener 22 may also be rigidly mounted on the cross T member 18 by the use of two or more rivets, bolts or the like, if desired.

One end of the fastener 22 extends beyond the end of the cross T member 18 and terminates in a pair of lugs 28 adapted to seat in the notches 16 formed in the web 11 of the T beam member 10 and lug 29 adapted to abut against the inner side of the web 11 of the T beam member 10, while the end of the strip 21, or the flange 20 if no strip 21 is employed, abuts against the adjacent edge of the strip 14, or the flange 12 if no strip 14 is employed. Shoulder 30 is adapted to lie close to but not touch the inner side of the web 11. Intermediate the lugs 28 is located a tongue 31 bearing flanges 32. Tongue 31 and flanges 32 are adapted to pass through the opening 15 in the web 11 of the T beam member 10 so that when the tongue 31 is twisted approximately 90° the flanges 32 bear against the opposite side of the web 11 from the lug 29 thereby rigidly affixing the fastener 22 of the cross T member 18 to the T member 10. Rotation of the cross T member 18 about an axis normal to the web 11 of the T beam member 10 is prevented by the lugs 28 which seat in the notches 16. Rotation of the cross T member 18 about an axis normal to the flange 12 of the T beam member 10 is prevented by the closely abutting relation of flange 20 of cross T member 18 with flange 12 of cross T member 10, or by the closely abutting relation of strip 21 of cross T member 18 with strip 14 of T beam member 10 if such strips be used.

The opposite end of each cross T member 18 is adapted to carry a second type fastener of novel construction, indicated generally at 33. Fastener 33 is permanently mounted on the cross T member 18 by rivet means 34. Rotation of the fastener 33 with respect to an axis perpendicular to the web portion 19 of the cross T member 18 is prevented by means of key lock 35 which seats in hole 36 of the cross T member 18. It will be understood that the novel fastener 33 may also be rigidly mounted on the cross T member 18 by the use of two or more rivets, bolts or the like. However, for purposes of economy it is preferable to affix the fastener 33 to the cross T member 18 in the manner described above.

As best shown in FIGS. 7 and 8, fastener 33 may be formed from a single piece of malleable material such as steel. Fastener 33 comprises a first body portion 37 and a second body portion 38 joined by struts 39. As shown in FIG. 7 the body portions 37, 38 are disposed in parallel spaced relation so as to fit snugly over the web portion 19 of the cross T member 18. Arms 40 which may include reinforcing ribs 41 extend outwardly from the body portions 37, 38 of the fastener 33 adjacent to one of the struts 39. Arms 40 are initially formed so as to lie substantially parallel to the flange 20, but at an acute angle to the web 19, of the cross T member 18 and are adapted to be bent subsequently so as to be substantially parallel to each other and to the web portion 19 of the cross T member 18. Immediately below arms 40 on the body portions 37, 38 of the fastener 33 are located flanges 42, upon which are formed, at the outer extremities thereof, hook elements 43. The lower portions of the flanges 42 terminate in footings 44 which have a flat base 45 located adjacent and parallel to the upper surface of the flange 20 but extending somewhat beyond the end of flange 20. The hook elements 43, of the flanges 42 are adapted to pass through an opening 15 in the web 11 of a T beam member 10 and engage portions of the surface of the said web adjacent to each side of the notch 16 which is nearest to the rib 13 of the T beam member 10. The relationship between the arms 40, hook elements 43 and footings 44 is such that when the hook elements 43 are in engagement with the web 11 of a T beam member 10, a portion of the flat base 45 of the footings 44 engages the upper surface of the flange 12 (or the crimped-over surface of strip 14 if such strip be used) of the T beam member 10. When the arms 40 are bent so as to be substantially parallel, the ends of the said arms engage a portion of the surface of web 11 which is approximately opposite the surface engaged by the hook elements 43, thereby providing a rigid connection between the cross T member 18 and the T beam member 10 by means of the fastener 33.

In order to facilitate the attachment of the fastener 33 to the T beam member 10 it may be found desirable to bow the flanges 42 slightly, as is best shown in FIG. 66 and to chamfer the lower corners of the arms 40 as shown in FIGS. 2 and 7.

Rotation of the cross T member 18 about an axis normal to the flange 12 of the T beam member 10 is prevented by the closely abutting relation between the flange 20 of the cross T 18 and the strip 14 or flange 12 of the T beam member 10. Rotation of the cross T member 18 about an axis normal to the web 11 of the T beam member 10 is prevented by the spaced apart relation of the foot elements 44 which also determine the alignment of the flanges 20, 12. The fastener 33 thus provides a simple yet strong and rigid connection between cross T 18 and T beam 10 and assures that the flanges 20, 12 or strips 21, 14 will be in close juxtaposition and substantially co-planar.

Fabrication of a grid structure in accordance with the present invention may be accomplished as follows:

T beam members 10 are first hung at the desired level by passing wires or cables through some of the holes 17 and attaching such wires to suitable structural parts of a building. A series of cross T members 18 of the desired length having a first type fastener 22 mounted on one end and a second type fastener 33 mounted on the other end is then installed between the first two parallel T beam members 10. This installation is accomplished by first inserting the hook elements 43 through the openings 15 so as to engage the web 11, then locating the footings 44 against the upper surface of the flange 12 and finally bending the arms 40 to a substantially parallel position whereby the fastener 33 and cross T member 18 are rigidly attached to the T beam member 10. After the ends of the cross T members 18 bearing the fasteners 33 are all installed the tongues 31 of the fasteners 22 may be inserted through openings 15 in the adjacent T beam member 10 and twisted into locking relationship therewith as hereinbefore described.

A second group of cross T members 18 may then be assembled between the second and third parallel T beam members 10 by inserting the hook elements 43 of the

fasteners 33 into the openings 15 which already contain the tongues 31 and flanges 32 of the first type fasteners 22, and then bending the arms 40, as previously described, to attach the fasteners 33 in locking engagement with the second T beam member 10. The fasteners 22 on the opposite end of the second group of cross T members 18 then may be affixed to the third parallel T beam member 10 as previously described and the assembly procedure continued until the grid structure is complete.

In assembling a grid structure in accordance with the present invention, it is necessary, when it is desired to attach cross T members 18 directly opposite to each other on a T beam member 10, to first affix the first type fastener 22 to the web 11 of the T beam member 10 and then affix the second type fastener 33 on the opposite side of the web 11 of the T beam member 10.

As described above, the rigid grid structure of the present invention provides rectangular flanged openings which are adapted to carry lighting fixtures, ceiling panels or the like. Since ceiling panels are relatively light, it may be found desirable to provide locking means whereby the ceiling panels may be locked against the flanges 20 of the cross T members 18. In accordance with this feature, the fastener body portion 37 is provided with a vertical bearing groove 46 in which is mounted a hold down lock 47. The hold down lock 47 includes an upper horizontally disposed locking element 47*a* and a flat horizontally disposed lock arm 48 which terminates in a downwardly bent lock tab 49. The hold down lock 47 is mounted in the bearing groove 46 so that the lock arm 48 is located adjacent to the flange 20 of the cross T member 18 and is movable in a horizontal plane. Locking element 47*a* and lock arm 48 are spaced apart so that the distance therebetween is approximately equal to the thickness of the ceiling panel adapted to be supported by the grid structure. Hold down lock 47 is rotatably mounted in bearing groove 46 so that the locking element 47*a* may be rotated from a position parallel to the web 19 of cross T member 18 to a position transverse to the web 19 of cross T member 18. When the locking element 47*a* is parallel to the web 19, ceiling panels may be inserted in or removed from the grid structure but when the locking element 47*a* is transverse to the web 19, the ceiling panels are effectively locked in the grid structure. The relationship between the locking element 47*a* and the lock arm 48 is such that when the hold down lock 47 is in the locked position, the lock tab 49 is adjacent to the flange 20 (or strip 21) of the cross T 18 thus substantially hiding the lock arm 48 from view. The hold down lock 47 may be locked or unlocked from beneath the grid structure by actuating the lock tab 49. A similar locking structure may be provided for the fastener 22.

While the invention has been described in connection with a specific embodiment thereof and in a specific use, various modifications thereof will occur to those skilled in the art without departing from the spirit and scope of the invention as set forth in the appended claims.

What is claimed is:

1. A grid structure adapted to support ceiling panels, lighting fixtures and the like, comprising a plurality of spaced parallel inverted T beams having flange and web portions, said T beams having formed in the webs thereof a plurality of spaced apertures, a plurality of spaced parallel inverted cross T's having flange and web portions and being located between and in perpendicular relation to said parallel T beams, said cross T's each having a hole formed in and adjacent to one end of its web portion, a plurality of first type fasteners one permanently mounted on the other end of each cross T and extending beyond said other end, said first type fasteners each comprising first lug elements arranged to register with a portion of one of said apertures in an adjacent T beam, a second lug element adjacent to one of said first lug elements and arranged to abut against a first side of the web of said adjacent T beam and a tongue element extending through said aperture and forming an abutment against a second side of the web of said adjacent T beam, and a plurality of second type fasteners mounted on said one end of each cross T, said second type fasteners each comprising a body portion pivotally connected to said one end of each cross T, a key lock extending from one end of said body portion through said hole in the web of the associated cross T and locking said second type fastener to the associated cross T, hook elements formed on said body portion of said second type fastener extending beyond the other end thereof and substantially parallel to the associated cross T, said hook elements on the second type fastener on one cross T extending through one of said apertures in juxtaposition with the tongue on the first type fastener on another cross T and bearing against a first side of the web of the corresponding T beam adjacent said one aperture a pair of bendable arm elements extending from said second type fastener body portion adjacent to said hook elements and beyond the associated cross T, said bendable arm elements extending substantially parallel with the web of said cross T and in abutting relation to a second side of the web of said T beam at respective laterally spaced points thereon, and foot elements affixed to said body portion of said second type fastener adjacent to said hook elements, said foot elements being in abutting relation to the upper surface of the flange portion of said T beam.

2. In a grid structure comprising inverted intersecting T beams and cross T's and adapted to support ceiling panels, lighting fixtures and the like, a cross T member having flange and web portions, a first type fastener permanently mounted on one end of the web of said cross T and having first lug elements, a second lug element and a twistable tongue element disposed on one end of said first type fastener and forming a rigid connection with said T beam when the said first and second lug elements are in abutting relation to said T beam and the said tongue element has been inserted through a hole in said T beam and twisted into locking connection therewith, and a second type fastener permanently mounted on the opposite end of the web of said cross T, said second type fastener having a body portion attached to the web of said cross T, hook elements extending from one end of said body portion substantially parallel to and beyond the web of said cross T, a pair of bendable arm elements extending from the body portion of said fastener adjacent to said hook elements and beyond and at respective opposite angles to the web of said cross T whereby said arms extend on opposite side of said hook elements, and foot elements affixed to the body portion of said fastener adjacent to the flange of said cross T and extending beyond the end of said cross T, said hook elements, arm elements and foot elements forming a rigid connection with a T beam when said hook elements are inserted through a hole in a second T beam and said foot elements are in abutting relation to said second T beam and said arm elements are bent into abutting relation with said T beam so that said arm elements are substantially parallel to the web of said cross T.

3. A fastener for rigidly connecting together first and second perpendicularly disposed, abutting, inverted T members, said fastener being formed from a single sheet of metal and comprising a first web portion, a second web portion disposed substantially parallel to and closely adjacent said first web portion, said fastener being adapted to fit over and be affixed to the web of said first T member adjacent one end of the latter and with said web portions each in close surface contact with a respective side of said web of said first T member, a pair of hook elements each projecting from a respective one of said web portions at one end thereof and extending substantially parallel to said web portions, said hook elements being adapted to pass through an aperture in said second T member and each having a shoulder adapted to contact

the web of said second T member adjacent said aperture, a pair of arm elements each projecting from a respective one of said web portions at said other end thereof and being disposed at respective opposite angles to said web portions, said arm elements being bendable so as to become substantially parallel to said web portions and when so bent being adapted to abut the adjacent web of said second T member at spaced apart points when said fastener is affixed to said first T member and said T members are in said abutting relationship, and a pair of foot elements each formed at said other end of a respective one of said web portions and being adapted to abut the adjacent flange of said second T member at spaced apart points when said fastener is affixed to said first T member and said T members are in said abutting relationship.

4. A fastener for rigidly connecting together first and second perpendicularly disposed, abutting, inverted T members, said fastener being formed from a single sheet of metal and comprising a first web portion, a second web portion disposed substantially parallel to and closely adjacent said first web portion, said fastener being adapted to fit over and be affixed to the web of said first T member adjacent one end of the latter and with said web portions each in close surface contact with a respective side of said web of said first T member, a key lock extending from one of said web portions adjacent the end thereof which is remote from said one end of said first T member when said fastener is affixed to the latter, said key lock being adapted to pass through a corresponding hole in said web of said first T member for locking said fastener to said first T member, a pair of hook elements each projecting from a respective one of said web portions at the other end thereof and extending substantially parallel to said web portions, said hook elements being adapted to pass through an aperture in said second T member and each having a shoulder adapted to contact the web of said second T member adjacent said aperture, a pair of arm elements each projecting from a respective one of said web portions at said other end thereof and being disposed at respective opposite angles to said web portions, said arm elements being bendable so as to become substantially parallel to said web portions and when so bent being adapted to abut the adjacent web of said second T member at spaced apart points when said fastener is affixed to said first T member and said T members are in said abutting relationship, and a pair of foot elements each formed at said other end of a respective one of said web portions and being adapted to abut the adjacent flange of said second T member at spaced apart points when said fastener is affixed to said first T member and said T members are in said abutting relationship.

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