March 6, 1962 H. E. BRANDSTETTER 3,023,865

SUSPENDED CEILING STRUCTURE

Filed April 17, 1956 5 Sheets-Sheet 1

Fig. 1

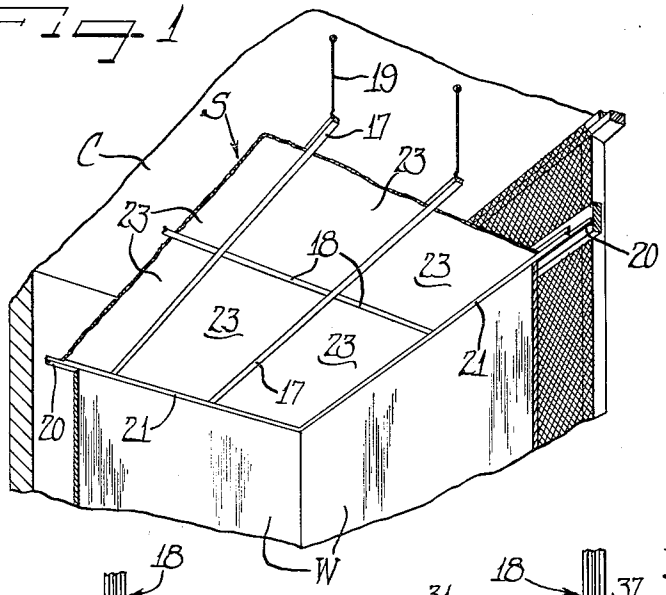


Fig. 2

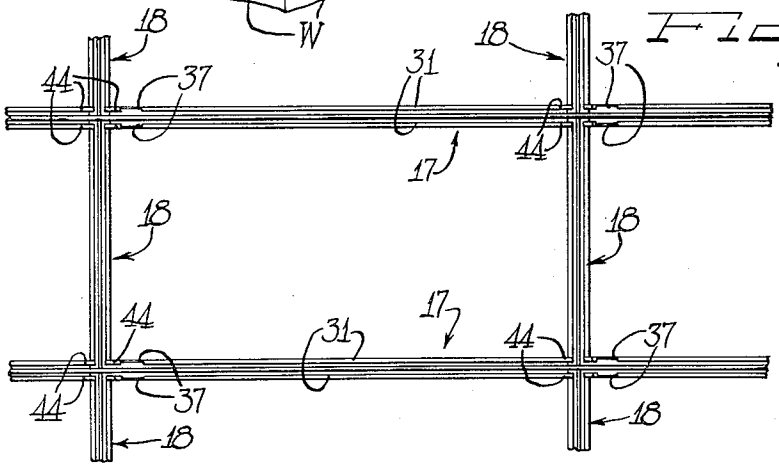
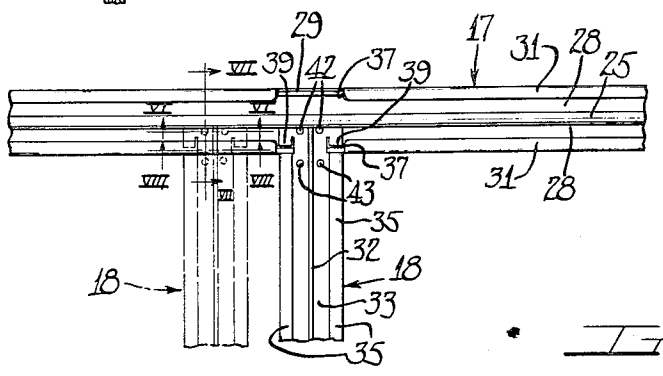


Fig. 3



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SUSPENDED CEILING STRUCTURE

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Fig. 4

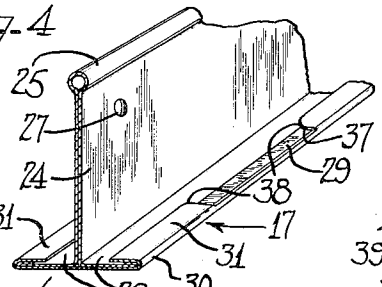


Fig. 5

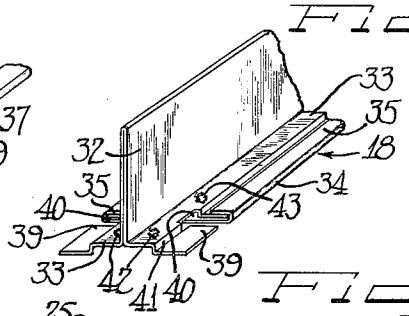


Fig. 6

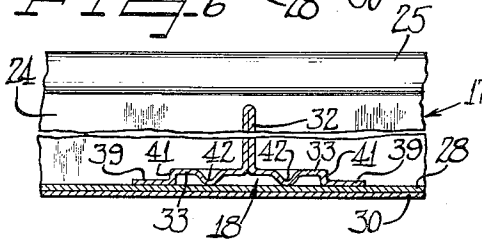


Fig. 7

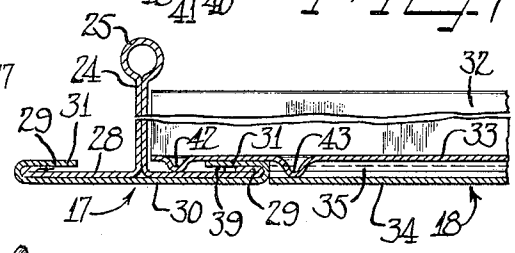
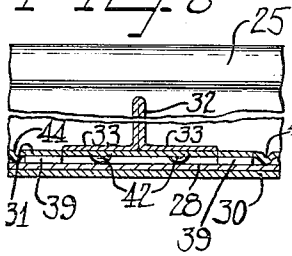


Fig. 8



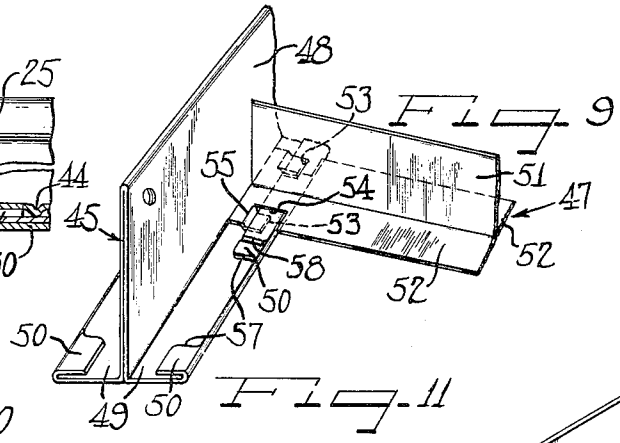


Fig. 9

Fig. 10

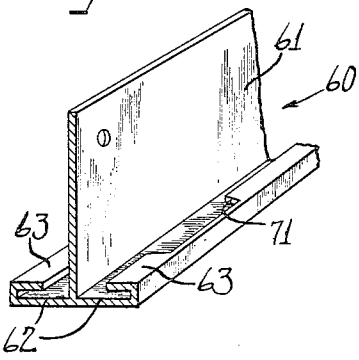
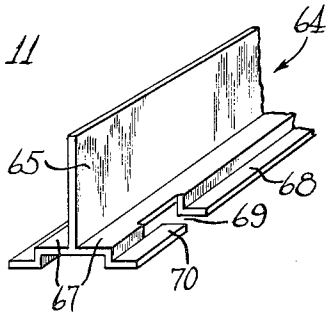


Fig. 11



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Fig. 12

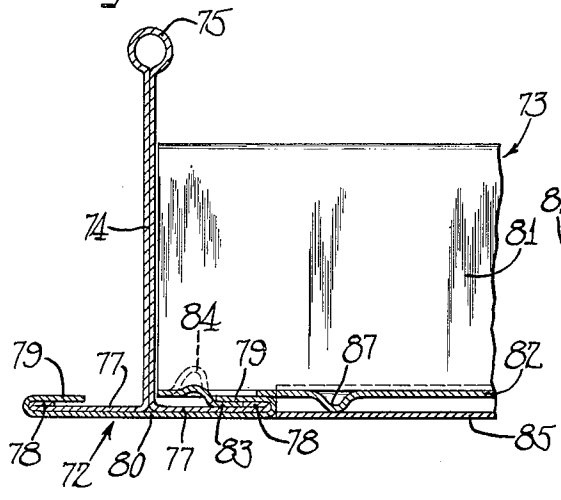


Fig. 13

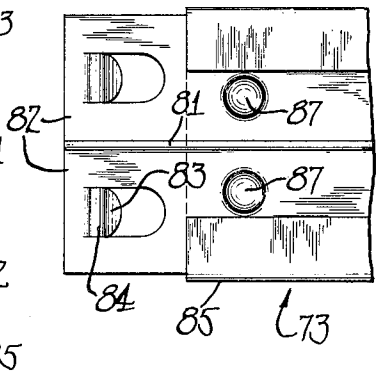


Fig. 14

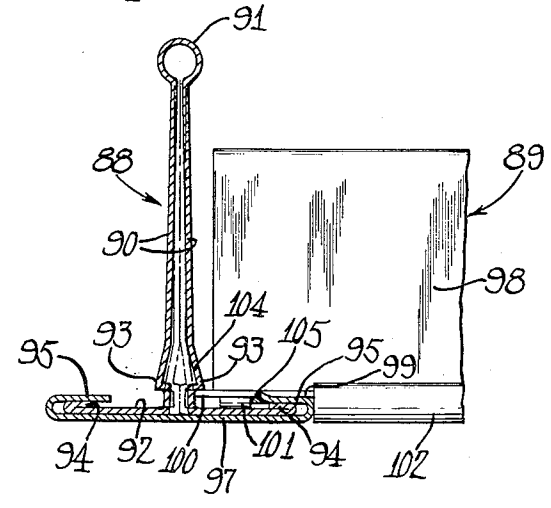
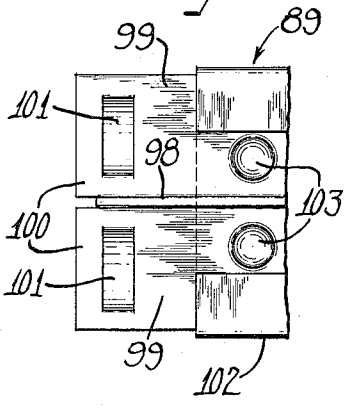


Fig. 15



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Fig. 17

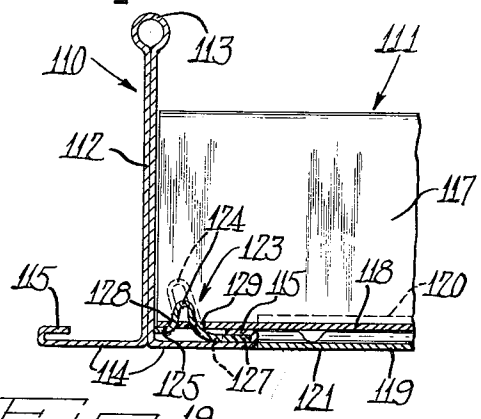


Fig. 16

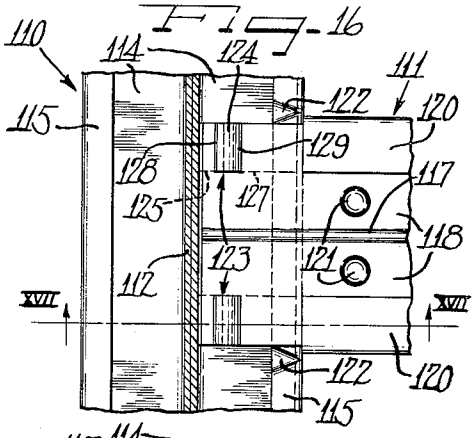


Fig. 19

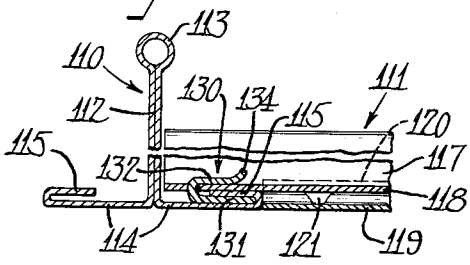


Fig. 18

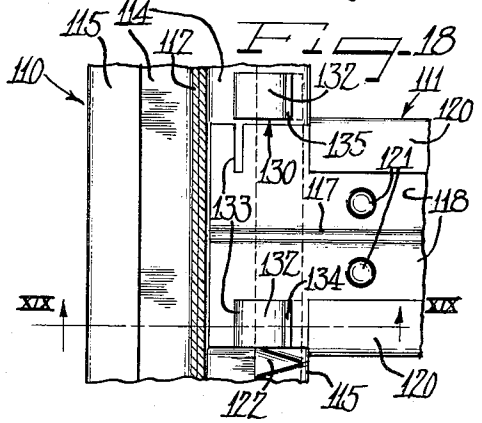


Fig. 21

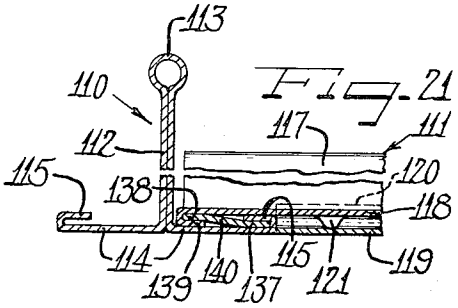


Fig. 20

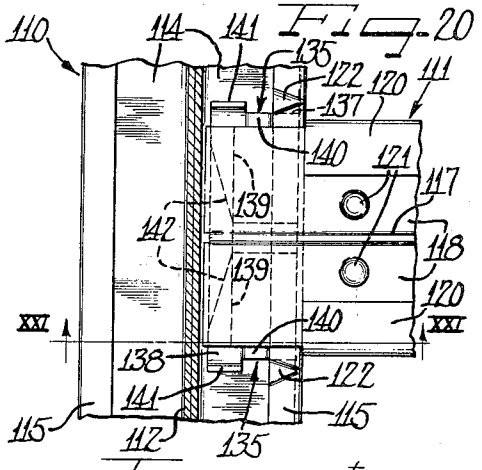
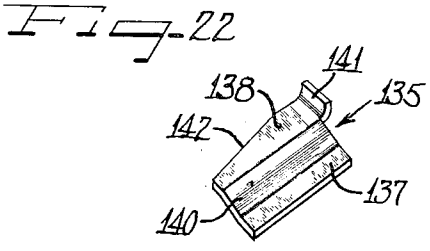


Fig. 22



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Fig. 24

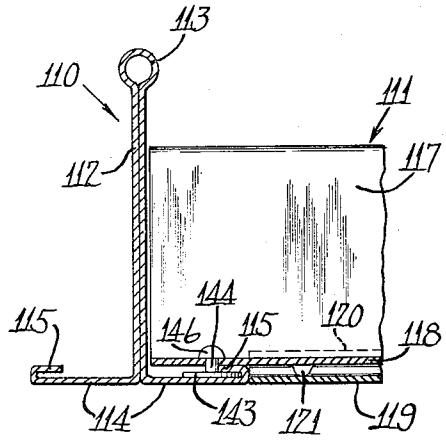


Fig. 23

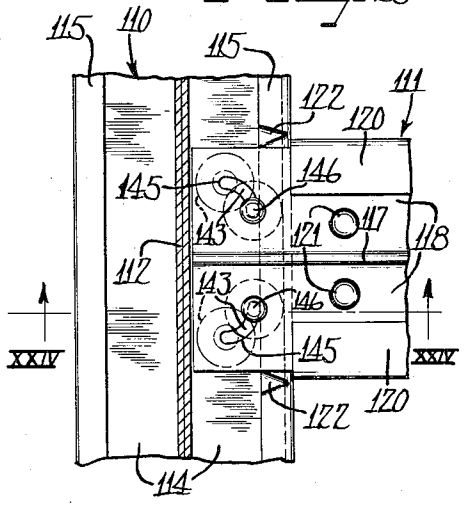


Fig. 26

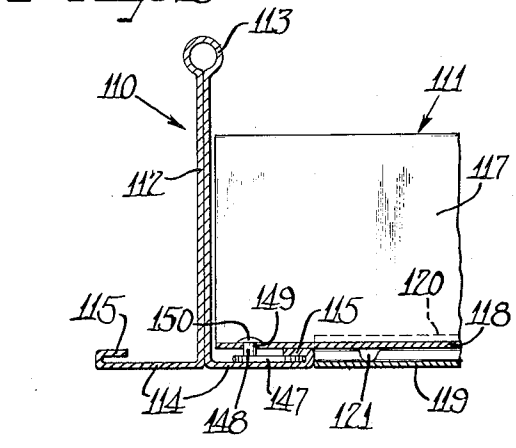
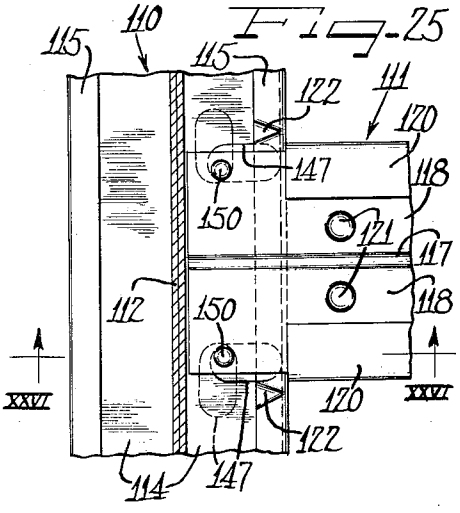


Fig. 25



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United States Patent Office 3,023,865 Patented Mar. 6, 1962

3,023,865

SUSPENDED CEILING STRUCTURE

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Filed Apr. 17, 1956, Ser. No. 578,625
10 Claims. (Cl. 189—88)

The present invention relates to suspend ceiling structures and more particularly relates to improvements in the supporting grid system for suspended ceilings.

In false or suspended ceilings utilizing a grid of connected inverted T's suspended by wires or the like and supporting wall board panels, light fixtures, sound proofing panels, and the like, a major problem has existed in the heretofore clumsy and awkward means for connecting the main and cross T's. Not only have the prior expedients been expensive to produce, but they have also been costly to assemble by reason of the time necessary for assembly purposes and thus high labor cost.

It is, accordingly, an important object of the present invention to provide a new and improved suspended ceiling framework or grid system which is not only economical to produce but also affords substantial economies in assembly time.

Another object of the invention is to provide a suspended ceiling structure in which main T's and cross T's are assembled together without the use of separately formed connecting clips or parts.

A further object of the invention is to provide novel connecting means for the main and cross T's of suspended ceiling supporting framework or grid structure.

It is also an object of the invention to provide a suspended ceiling framework or grid structure of improved strength.

Other objects, features and advantages of the present invention will be readily apparent from the following detailed description of certain preferred embodiments thereof taken in conjunction with the accompanying drawings in which:

FIGURE 1 is a fragmentary sectional perspective view of a portion of a room in a building equipped with a suspended ceiling embodying features of the present invention;

FIGURE 2 is a fragmentary top plan view of a suspended ceiling supporting framework or grid assembly of the kind shown in FIG. 1 and embodying features of the present invention;

FIGURE 3 is a fragmentary top plan assembly view of a portion of a suspended ceiling grid or supporting frame structure showing a main T and a cross T, according to the present invention, and on a somewhat larger scale than in FIG. 2;

FIGURE 4 is a fragmentary sectional perspective view of a portion of the main T shown in FIGS. 2 and 3;

FIGURE 5 is a fragmentary end perspective view of the cross T of FIGS. 2 and 3;

FIGURE 6 is an enlarged fragmentary sectional detail view taken substantially on the line VI—VI of FIG. 3;

FIGURE 7 is an enlarged fragmentary sectional detail view taken substantially on the line VII—VII of FIG. 3;

FIGURE 8 is an enlarged fragmentary sectional detail view taken substantially on the line VIII—VIII of FIG. 3;

FIGURE 9 is a fragmentary sectional elevational view of a modified main and cross T assembly;

FIGURE 10 is a fragmentary sectional perspective view of a modified main T specially adapted for production as an aluminum or similar extrusion;

FIGURE 11 is a fragmentary end perspective view of a cross T which is adapted for production as an aluminum or similar extrudable metal section;

FIGURE 12 is a fragmentary sectional elevational view of a further modified main and cross T assembly;

FIGURE 13 is a fragmentary top plan view showing one end portion of the cross T of FIGURE 12;

FIGURE 14 is a fragmentary sectional elevational view of still another modification showing a main and cross T assembly;

FIGURE 15 is a fragmentary top plan view showing one end portion of the cross T of FIGURE 14;

FIGURE 16 is a fragmentary sectional top plan view of yet another modification;

FIGURE 17 is a fragmentary vertical sectional view taken substantially on the line XVII—XVII of FIGURE 16;

FIGURE 18 is a top plan sectional view showing another modification;

FIGURE 19 is a fragmental sectional detail view taken substantially on the line XIX—XIX of FIGURE 18;

FIGURE 20 shows a further modification in top plan sectional view;

FIGURE 21 is a fragmental sectional detail view taken substantially on the line XXI—XXI of FIGURE 20;

FIGURE 22 is a perspective view of a locking wedge member as used in FIGURES 20 and 21;

FIGURE 23 is a fragmentary sectional top plan view of an additional modification;

FIGURE 24 is a fragmentary sectional detail view taken substantially on the line XXIV—XXIV of FIGURE 23;

FIGURE 25 is a fragmentary sectional plan view of another modification; and

FIGURE 26 is a fragmentary sectional detail view taken substantially on the line XXVI—XXVI of FIGURE 25.

In FIGURE 1 is shown an exemplary or typical building structure in which a suspended ceiling embodying the present invention may be installed. In this instance vertical walls W joined at a reentrant corner rise to a ceiling C spaced below which a suspended or false ceiling S is mounted. This suspended ceiling comprises a supporting grid or framework comprising supporting or main T's **17** and transverse or cross T's **18**. Suitable suspension means such as wires **19** depending from the ceiling C are connected to and support the main T's **17**. For supporting the ceiling framework or grid along the walls W suitable flange structure such as generally L-shape bars or angle irons **20** may be mounted at the proper horizontal level or elevation. Suitable half T's, that is frame strips **21** of substantially L-shape comprising generally half of the structure of the main T's **17** may be provided at the wall perimeters of the suspended ceiling framework or grid in supported relation upon the horizontal flanges of the supporting angles **20** and provide supports upon which the adjacent ends of the main and cross T's rest.

Supported by the framework or grid comprising the main and cross T's **17** and **18** is an assembly of panels **23** which rest at their respective margins upon the horizontal flanges of the cooperating main and cross T's **17** and **18**. The size of the panels **23** may vary substantially but in a popular arrangement may be about 4 ft. by 2 ft. rectangles. Since this type of ceiling structure is especially desirable for acoustical or sound deadening or proofing purposes, the panels **23** may comprise a fibrous or other sound proofing material, such as perforated wall board, perforated sheet metal with sound absorbing mats thereabove, or the like. In addition, at suitable intervals instead of the panels **23**, suitable light fixtures (not shown) may be supported by the ceiling framework. It may be noted that although in FIG. 1 the panels **23** are regularly disposed, they may be disposed in staggered relation, or in any other pattern that may be preferred since, as will be apparent, by use of the present invention a wide variety or latitude is permitted.

In a highly desirable construction, the main T's **17**

and the cross T's 18 are rolled sheet metal sections of generally inverted T form. In a preferred construction, the main T's 17 are about 1½ inches in height by about 1 inch in width, while the cross T's 18 are about 1 inch in both height and width.

A substantially rigid, highly bend or sag resistant construction of the main T's 17 (FIG. 4) in a rolled sheet metal section includes a double layer body or web 24 with the layers thereof joined at the top in a reenforcing, rigid hollow juncture bead or bulb section 25. At suitable intervals the body or web 24 is pierced in the upper portion thereof under the reenforcing bead 25 to provide anchoring holes 27 for the supporting wires 19. At their lower portions the web panels or plies of the main T are provided with oppositely directed substantially coplanar and preferably equal width supporting flanges 28. Herein the distal extremity margins of the flanges 28 are respectively turned back upon themselves on the upper sides thereof to provide reenforcing flanges 29 which are preferably as narrow as practicable. Through this construction the normal structural advantages as to strength of the T shape of the section is substantially further strengthened by the bulb bead 25 which affords high resistance to bending or buckling of the upper portion of the body web 24 of which the lower portion is, of course, strengthened against tendency to buckle or bend by the right angular relationship of the flanges 28 emanating therefrom. In addition, the flanges 28 are substantially strengthened for bending or buckling resistance by the reenforcement afforded by the outer or distal marginal flanges 29 thereof. As a result, the main T's 17 are capable of high load factors although made from fairly light gauge sheet metal strip. This enables the main T's 17 to be provided in unusually long lengths or sections that can be conveniently handled for shipment and installation without danger of bending or buckling or taking a set when subjected to fairly strong bending stresses. It also enables the main T's 17 to support high loads in service, although the main T's may be of light weight per unit length.

For economy reasons, it is desirable to make the main T's 17 of as inexpensive a material as practicable. It is therefore desirable to provide the underface of the supporting flanges 28 of the main T's with an ornamental or decorative cover. To this end, a cover strip 30 may be provided made from a rolled section of suitable sheet material which may be painted or enameled on its outer or exposed surface, but which may comprise a material that is inherently susceptible of a polished or burnished surface of suitable color, such as stainless steel, brass, aluminum or the like, or other suitable finish, and which may be workable in a light or thin gauge, preferably substantially thinner than the gauge of the principal structure of the main T 17. For assembly of the cover strip 30 with the main porion of the main T, turn back, or return bent respective longitudinal marginal flanges 31 are provided which overlap the upper sides of the main T supporting flanges 28 and are preferably somewhat wider than the reenforcing flanges 29. While the cover strip 30 may be rolled directly onto the flanges 28, it may also be formed separately and then assembled with the flanges 28 by relative longitudinal movement. Through this arrangement, moreover, the joint between the adjacent margins of the flanges 28 is covered or concealed.

Because they are used in shorter lengths, the cross T's 18 need not be of as rigid a construction as the main T. Accordingly, each of the cross T's (FIG. 5) may be constructed with a vertical body or web portion 32 of double layer or ply structure with the sheet material simply turned back upon itself into face-to-face relation and provided along the lower portions thereof with lateral, substantially coplanar supporting flanges 33. The material from which the principal portions of the cross T's 18 are made may be the same as the material from which the principal portions of the main T's 17 are made, or the material may be of somewhat lighter gauge in view of the substantially less bending or distortion hazard that may be encountered in the use of the substantially shorter cross T's. For desirable finish and ornamental effect, each of the cross T's 18 is preferably provided with a cover strip 34 which may in general respects be similar or the same as the cover strip 30, that is, a rolled section either directly rolled onto the cross T supporting flanges 33 or arranged to be slidably assembled therewith and equipped with return bent marginal upper side flanges 35 for engagement over the distal marginal portions of the supporting flanges 33.

According to the present invention novel construction and relationship of the main and cross T's 17 and 18, respectively, enables interconnecting the same in assembly by relative assembly movements without the aid of tools or the need for any special forming, punching, notching, shaping or other equipment. To this end, the return bent retaining flanges 31 of the cover 30 of each of the main T's 17 is notched out as at 37 to a width just slightly greater than the overall supporting flange width of the cross T's 18 which may be, for example, equal to the width of the supporting flange portions of the main T, namely about 1 inch, in a typical example, with the web 32 of the cross T, about the same width. Thereby, the base or supporting flanges 33 of the cross T's are engageable over the respective turned back reenforcing flanges 29 of the main T supporting flanges (FIGS. 3, 4 and 7). Each of the return bent flanges 31 is preferably provided with one or more of the notches 37, there preferably being several of the notches 37 in a substantial length of the main T 17. If preferred, such notches may be at directly opposite sides of the main T, thus facilitating cutting or punching the same in the margins of the strip from which the cover 30 is made. The corners of the flanges 31 defining the notches 37 are preferably smoothly rounded off as at 38.

For interlocking the cross T's 18 with the main T's 17, the end portions of the cross T base flanges 33 which in assembly overlie the base flanges 28 of the main T's are provided with respective suitable interlock lugs 39 which are slidably frictionally interengageable interlockingly behind the overhanging shoulder structure provided by the turned back cover flanges 31, and more particularly those portions of the cover flanges 31 which project inwardly beyond the main T base flange reenforcing flanges 29 which provide spacers whereby the inner portions of the cover flanges 31 are normally in spaced relation to the opposing portions of the main T base flanges 28. The construction and relationship is such that by simply assembling the end portions of the cross T's 18 in the notches 37, and then laterally sliding the cross T's longitudinally along the main T base flanges, the interlock lugs or flanges 39 will interengage behind the cover flanges 31 and within the longitudinal laterally opening interlock grooves defined by the cover flanges 31 and the underlying base flanges 28.

In a convenient form, the interlock lugs 39 are provided on the cross T base flanges 33 by forming the respective end portions of the flanges with respective generally L-shaped notches 40 having one leg thereof directed in from the longitudinal edge of the flange and the inner leg thereof extending toward but appropriately spaced from the adjacent terminal extremity or end of the cross T. In this manner the lugs 39 project longitudinally away from the adjacent cross T end. Then, by having the interlock lugs 39 offset downwardly from the upper normal plane of the respective base flange 33 about equal to and preferably slightly more than the thickness of the cover flange 31, as by the provision of an offsetting bend 41 longitudinally in the base flange 33 preferably coincident with the inner longitudinal leg of the notch 40, the interlock lugs 39 and the connective coplanar marginal base flange portion connecting the same to the remainder of the base flange 33 may rest slidably upon

the main T base flange 28 while the inner portion of the base flange 33 connected to the upstanding body web 32 overlies the cover flange 31 of the main T. In this relationship the return bent reenforcing flange 29 is accommodated within the laterally opening leg of the cut-out or notch 40 (FIGS. 3 and 8).

In order to improve the bearing of the cross T terminal portion upon the supporting flange 28 of the main T 17, respective nodes 42 are preferably dimpled downwardly in the body portion of the flange 33 between the offsetting bend 41 and the juncture of the base flange with the body web 32 (FIGS. 3, 5, 6 and 7).

For clearing the terminal portion of the cross T 18 for interengagement with the supporting flange 28 of the main T, the cross T cover 34 is predetermined in length to extend sufficiently short of the cross T terminal and preferably substantially coincident with the inner side of the transverse leg of the notch 40 (FIGS. 3, 5 and 7). Furthermore, in order to maintain the cover 34 substantially coplanar or flush with the main T cover 30 in the assembly, on the lower faces of the covers, appropriate spacer nodes 43 are preferably dimpled in the cross T base flanges 33. There may be as many of the spacer nodes 43 as desired, but in a two foot length of the cross T 18, one of such nodes located near each of the interlock clearance notches 40 will serve the purpose. This provides for such nodes disposed in the transversely spaced pairs adjacent each end of the cover 34.

It will thus be apparent that assembly of the cross T's 18 with the main T's 17 is easily effected by bringing the cross T's into general assembly at their terminal portions with the main T in each instance in one of the notches 37 as shown in full outline in FIG. 3, then by sliding the cross T 18 laterally in either direction from the notch 37 within which assembled engagement of the lugs 39 behind the main T cover flange 31 is effected, as indicated in dot dash outline in FIG. 3 and in full outline in FIG. 2. While in FIGS. 2 and 3 the cross T's are shown as assembled adjacent to the cut-outs or receiving notches 37, it should be understood that the cross T's can be shifted as desired into any position longitudinally of the main T. Instead of having respective receiving notches or cut-outs 37 for each of the cross T's 18, one such receiving notch or cut-out 37 may be provided to receive two or more adjacent ones of the cross T's 18. After assembly has been completed, the cross T in each instance is, of course, supported against downward displacement by resting upon the main T flange structure, while upward displacement is prevented by engagement of the interlock lugs under the downwardly facing shoulders provided within the grooves defined by the overturned flanges 31, and displacement away from the web of the main T is prevented by opposition of the lug structure to the shoulder provided by the edge of the overturned flange 31 facing toward the web.

If it is desired to secure the cross T's 18 against any possibility of being inadvertently displaced longitudinally of the main T's 17 after predetermined relative assembly has been effected, positive locking of the cross T's in position may be resorted to. In a convenient structure, locking bends or insets 44 may be crimped or forced into the cover flange 31 at opposite sides of the terminal portion of the cross T and more particularly along side the interlock lugs 39 (FIGS. 2 and 8). These locks 44 may be made by means of a suitable crimping tool.

If extreme economy in structure is required, the same principles of construction with respect to the mode of assembling the suspended ceiling framework or grid as hereinbefore described may be embodied in a modification as depicted in FIG. 9 including a rolled sheet metal section main T 45 and a rolled sheet metal section cross T structure 47. In this instance the main T has a double layer or ply vertical body or web 48 comprising longitudinal panels doubled upon themselves and provided with lateral coplanar supporting base flanges 49 each of which is provided at its outer or distal margin with a return bent longitudinal upper side reenforcing flange 50 spaced about the metal gauge thickness from the underlying main portion of the flange 49.

The cross T 47 comprises a rolled section having a vertical body web 51 comprising longitudinal panels folded into face-to-face relation upon themselves and provided at the lower margins thereof with lateral coplanar base flanges 52 respectively. For connecting the cross T's 47 to the main T's 45, interlock lugs are respectively severed from the terminal portions of the flanges 52 along generally L-shaped severance lines 54, in each instance, and the interlock lugs 53 offset downwardly along respective offset bends 55 extending transversely of the respective flange 52 at the end of the interlock lug nearest the end of the cross T. Incident to the offsetting of the interlock lug 53 the slit 54 provides a clearance notch of generally L-shape within which the associated base flange portion 50 is accommodated when the lugs 53 are slid thereunder after the terminal portion of the cross T has been inserted in initial assembly in a receiving notch or cut-out 57 in the return bent reenforcing and locking flange 50.

After the cross T 47 has been positioned longitudinally of the main T 45 in the final assembled relation, the cross T may be locked in such position by crimping respective locking insets 58 in the flange 50 at the respective outer sides of the interlock lugs 53.

The present invention is also readily adaptable for extruded metal section manufacture, as depicted in FIGS. 10 and 11. For this purpose a main T structure 60 is provided with a vertical body web or flange 61 provided at its lower edge with preferably equal lateral, coplanar supporting base flanges 62 each of which is provided with an overlying inturned marginal flange 63 spaced a predetermined distance from the underlying portion of the flange 62.

An extruded metal cross T 64 (FIG. 11) has a vertical body web 65 with lateral coplanar and equal width supporting longitudinal flanges 67 along its bottom edge, each of which is provided with a downwardly offset marginal extremity flange portion 68 formed at its end portion with a generally L-shaped notch 69 providing a respective longitudinally inwardly directed interlock lug 70 functionally similar to the interlock lug 39 of the cross T's 18.

In assembling the cross T 64 with the main T 60, the terminal portion of the cross T is assembled over the selected supporting flange 62 with the interlock lugs 70 cleared through a suitable entry slot or cut-out 71 in the inturned flange 63. Then the cross T is slid laterally thereof but longitudinally along the flange 62 into interlocked relation behind the flange 63. If desired, permanent locking of the cross T 64 may be effected by depressing a locking inset similar to the locking insets 44 and 58 hereinbefore described. It may be observed, also, that if desired the cross T 64, at least, may be provided with a cover strip to conceal the downwardly opening groove in the bottom of the base flange structure thereof if that is objectionable in the finished assembly.

In the modification of FIGURES 12 and 13, a main T structure 72 of rolled sheet metal construction is provided which may be substantially like the main T structure 17, or if preferred like the main T structure 45, while a cross T 73 embodying a slightly different interlock structure may be provided. As shown, the main T 72 includes a vertical body web 74 comprising longitudinal panels in face-to-face juxtaposition provided at their upper juncture with a reenforcing bead 75 of generally bulb shape and having at their lower margins lateral coplanar supporting flanges 77, respectively, with the distal extremities turned back on the upper sides thereof to provide reenforcing and spacer flanges 78 about which return bent somewhat wider marginal flanges 79 of a cover strip 80 are engageable.

The cross T 73 comprises a vertical longitudinal body flange or web 81 of laminar construction with sheet metal panels in face-to-face relation and provided with lower

marginal lateral coplanar supporting flanges 82 respectively. Each of the supporting flanges 82 is provided in the terminal end portion thereof with an integral struck-out interlock tab or lug 83. Initially, and before assembly with the main T, the tab 83 has the tip portion thereof offset below the lower face of the flange 82 from which it is struck a distance preferably equal to at least the material thickness of the cover flange 79, while the body portion of the tab 83 is humped up above the flange 82 into substantially a goose neck 84 and whereby the tip extremity of the interlock tab or lug is drawn toward the end of the cross T sufficiently to clear past the edge of the return bent cover flange 79 upon which the terminal portion of the cross T may be assembled with the end of the cross T close to the main T web 74. Then, by pressing down on the hump 84 with sufficient force substantially to straighten the same and thereby project the interlock tab or lug 83 under the adjacent flange 79, an interlock relationship is attained. Such bending down of the lug hump 84 can easily be effected by a suitable pressure applying tool.

A cover strip 85 may be applied to the flanges 82 of the cross T and maintained in suitable space relation thereto so as to be substantially coplanar or flush with the cover 80, by depressed or dimpled nodes 87 provided for this purpose in the supporting flange 82 in each instance.

In the modification shown in FIGS. 14 and 15, the general principles of the present invention for interconnecting a main T 88 and a cross T 89 are attained in specifically different structure. To this end, the main T 88 comprises a sheet metal rolled section including longitudinal generally vertical panels 90 disposed in generally face-to-face relation and connected along their upper margins by an integral reenforcing bulb-like bead 91, but normally spread apart to a limited extent and resiliently compressible toward one another and separable due to resilient flexible tension of the juncture bead 91. Along their lower margins and spaced in predetermined relation above lateral coplanar longitudinal marginal supporting flanges 92, the panels of the web 90 are provided with longitudinal, laterally outwardly, oppositely offset, and downwardly facing retaining shoulders 93 respectively. By preference the supporting flanges 92 are provided with return bent narrow overturned reenforcing marginal flanges 94 over which are engaged return bent retaining flanges 95 at the respectively opposite margins of a cover strip 97.

The cross strip 89 is provided with a vertical body web 98 comprising longitudinal panels in laminar face-to-face relation and provided at their lower margins with coplanar laterally projecting base or supporting flanges 99 engageable in assembly upon the cover flange 95 at the selected side of the main T 88. For interlockingly engaging with the main T, the terminal portion of each of the base flanges 99 projects a short distance beyond the end of the body web 98 and thereby provides an interlock tab or lug 100 engageable in assembly with the main T 88 under the interlock shoulder 93. Such interlock relationship is maintained by depressed or downwardly offset respective interlock lug straps or bands pressed from the terminal portions of the base flanges 99 and engageable inwardly of the edge extremities of the cover retaining flanges 95. A cover strip 102 may be provided on the cross T 89, maintained in suitable spaced relation below the supporting or base flanges 99 by means of suitable depressed dimpled nodes 103 so as to lie coplanar or flush with the cover 97 in the assembly of the cross T with the main T.

In assembling the cross T with the main T, either an endwise thrust of the interlock tab lugs 100 against the shoulder 93, or a downward camming pressure against a cam surface 104 on the upper side of the shoulder 93 causes the web panel affected thereby to flex toward the opposite panel, substantially as shown in dash outline in FIG. 14, until the interlock tabs 100 can engage under the shoulder 93 and the interlock lugs 101 can engage along the edge of the associated cover flange 95 underlying the cross T terminal portion. The flexed web panel then resiliently snaps back into position wherein the shoulder 93 lockingly overlies the interlock tabs 100.

If desired, portions forming locking shoulders 105 may be bent up from the cover flange 95 at the opposite sides of the cross T 89 to maintain the position of the cross T longitudinally of the main T 88.

In the several modifications shown in FIGURES 16 through 26, the same general mode of interlocking the main and cross T's is utilized, but a separately formed and assembled interlock lug structure is provided in association with the cross T's for locking the same in place on the main T's. In these several forms the details of the main T's and the cross T's are, as will be observed, substantially the same and the same reference numerals will be applied to the similar details throughout the several views. In each form of these modifications, however, the interlock lug structure varies in specific detail and will be individually described.

In each instance a main T 110 supports cross T's 111 only one of which is shown by way of example. The main T includes a vertical web 112 of double ply structure having an upper bulb reinforcing bead juncture 113 and lower lateral coplanar base, cross T supporting longitudinal flanges 114. Each of the base flanges 114 is provided along its distal margin with a return bent overlying reinforcing and interlock shoulder flange 115 in spaced or gap relation to the underlying marginal portion of the base flange.

Each of the cross T's 111 includes a vertical web 117 narrower than the web 112 of the main T and in the present instance comprising a double ply return bent sheet metal structure similar to the main T, with oppositely directed coplanar flat base flanges 118 which in assembly with the main T are adapted to rest upon the return bent reinforcing and supporting flange 115 of the main T base flange over which the end portion of the cross T is assembled.

While the main T 110 may be provided with a cover, in this instance it is shown without a cover, but the cross T 111 is shown as provided with a cover strip 119 having return bent marginal attachment flanges 120 overlying the respective base flanges 118 of the cross T and held in suitable spaced relation below such base flanges by means of spacer projections or dimples 121 formed in the cross T base flanges to maintain the lower face of the cover 119 flush with the lower face of the main T base. Of course, the end of the cover 119 is proportioned to lie close to the adjacent edge of the main T base while the end portion of the cross T extends therebeyond to approach closely the vertical web flange 112 of the main T.

In each instance, after assembly of the main and cross T's has been completed and interlocking effected, locking of the assembly against displacement of the cross T's longitudinally of the main T's may be effected by bending respective locking lugs 122 in the base flange turned terminal flange portions 115 alongside the respective adjacent edges of the cross T base flanges 118. Although the locking bends 122 may be bent up out of the normal plane of the flange portions 115, they may in the instant modifications be bent down toward the underlying base flanges 114 if preferred. In certain aspects the down bending of the locking lugs or bends 122 is preferred in order to retain the interlock members against separation from interlocking position in the assembly.

In the modification of FIGURES 16 and 17 respective interlock spring clips 123 are assembled with the end portions of the base flanges 118 of the cross T's which overly the respective base flange 114 of the main T. Each of the spring clips 123, which may be made from spring material, although from the mode of operation of the clips 123 they may if preferred be made from material

of low inherent resiliency and rather high malleable deflectability.

Each of the interlock lug clips **123** includes an intermediate hump or loop **124** having a short leg extension **125** at one side and a long leg extension **127** at the opposite side. Assembly of the clip **123** in each instance is effected by engagement of the opposite sides of the loop **124** into respective spaced transverse slots **128** and **129** provided in the end portions of the cross T base flanges **118** which extend inwardly beyond the edge of the turn over shoulder flange portion **115** of the main T base flange upon which the cross T is supported. Thus, the side of the loop having the short leg **125** engages in the slot **128** that is located nearest the terminus of the base flange **118** while the opposite side of the loop **124**, that is the side having the longer interlock lug leg **127** projecting therefrom extends through the slot **129** that is spaced longitudinally of the base flange **118** on the opposide of the slot **128** which is nearest the tip of the cross T base flange.

Initially the clip member **123** may be shaped or drawn up into the position indicated in dash outline in Fig. 17 wherein the long leg **127** is disposed partially within the slot **129** and with the tip thereof drawn to clear the adjacent edge of the shoulder flange portion **115**. Then, by pressing down or hammering down against the crown of the intermediate loop **124** the long interlock leg **127** will be driven or snapped longitudinally outwardly under the shoulder flange **115** and thus effect an interlocked relationship therewith whereby to hold the cross T **111** against upward displacement relative to the main T. It may be observed that in pressing of the clip **123** into the interlocking relation, the tip of the short leg **125** may engage against the adjacent web **112** of the main T whereby to assure positive interlocking extension of the long leg **127**.

In the modification of Figures 18 and 19, interlock lug clips **130** are provided. In each instance the clip **130** is of generally U-shape with an interlock lug leg **131** and a cross T engaging gripper leg **132**. Juncture of the legs **131** and **132** provides a body or web portion that is engageable in a transverse slot **133** in the end portion of the cross T base flange **118** and opening through the side edge of the base flange so that the clip in each instance may be inserted by a transverse sliding assembly movement from a free position as shown in the upper portion of FIGURE 18 into an assembled interlocking relation as shown at the lower side of FIGURE 18 and in FIGURE 19.

In assembling the interlock retaining clips **130** with the assembly of main and cross T's, the interlock lug legs **130** of the clips are inserted under the shoulder flange **115** and with the overlying leg **132** overlying such flange. Then the retaining and interlock lug clip **130** is slidably moved into assembly with the cross tee base flange **118** by moving the juncture web of the clip into the slot **133**. By preference the leg **132**, at least, of the interlock lug retaining clip **130** is resilient and initially or normally deflected toward the interlock leg **131** closer than the combined thickness of the flanges **115** and **118**. Then, when the clip **130** is moved into the final interlocking assembled relationship the clamping leg **132** is resiliently flexed onto the engaged cross T flange **118** and thus exerts a resilient clamping pressure toward the opposite interlock leg **131** and thus grips the portions of the flanges **115** and **118** therebetween with a frictional gripping action. By preference the terminus of the clamping leg **132** is turned up to provide a lug or handle **134** for manipulating the interlock clip **130**.

In Figures 20, 21 and 22, an interlock lug structure in the form of a wedging clip **135** is provided. Each of the interlock wedge clip members **135** includes a flange portion **137** that is engageable interlockingly under the shoulder flange portion **115** of the main T and an opposite marginal interlock flange portion **138** which is engageable in a socket provided by an underturned terminal flange portion **139** at the extremity of the cross T base flange **118** with which the interlock member is to be associated. By preference the interlock flanges **137** and **138** are connected by an intermediate oblique offsetting body portion **140** so as to compensate for the slight difference in elevation of the respective sockets of the T members, as seen in Figure 21.

In assembling the interlock lug wedge member **135** in interlocking relation with the T's, the interlock flange **137** is engaged under the locking flange **115** in a position clear of the base flange **118** with which the assembly is to be completed. Then, the member **135** is slidably moved into position under the base flange **118**, a handle lug **141** on the interlock flange portion **138** assisting in such manipulation. Thereby the interlock flange **138** is engaged within the socket provided by the underturned extremity flange **139**. In effecting such assembly it is desirable to provide a snug gripping relationship and in order to facilitate entry of the flange **138** into the interlock socket it is preferably marginally cut back to provide an entering cam wedge surface **142** on its longitudinal edge. Thereby entry of the wedge flange portion **138** into the socket provided by the underturned terminal flange **139** is facilitated as the wedge interlock lug member **135** is driven into the interlocking relationship either manipulatively or by means of a hammer or the like applied to the handle flange lug **141**. It may be noted that preferably the locking wedge members **135** are provided in left and right hand units as is evident in Figure 20, Figure 22 showing a right-hand unit.

In the form of Figures 23 and 24 an interlock shoulder device is shown which is movably attached to and carried by the cross T base flanges **118**. To this end, an interlock disk **143** is provided having a stem **144** which extends through an arcurate slot **145** in the base flange **118** and has a retaining and manipulating head **146** at the end opposite the disk **143**. The disk **143** is of a thickness to be received in the socket provided by the shoulder flange **115** and is disposed to depend below the carrying base flange **118** a sufficient distance to clear the flange **115**. The arcuate slot **145** is disposed in that portion of the cross T base flange **118** that projects beyond the edge of the supporting shoulder flange **115** of the main T and is angled in such a manner that the interlock disk **143** can be moved from a position clear of the shoulder flange **115** as shown in dot dash outline in Figure 23 into a locking position as shown in dash outline in Figure 23 and full line position in Figure 24 by manipulating the head **146**. Since the end of the arcuate cam slot **145** nearest the supporting and shoulder flange **115** extends generally parallel to the edge of the flange **115** and is so disposed that when the disk **143** engages the turned juncture portion of the flange **115** a gripping frictional wedging action is attained on the one hand with the edge of the disk **143** that engages the juncture portion of the flange **115** and between the stem **144** and the wedging end of the slot **145**.

In FIGURES 25 and 26 a modification of the interlock disk is shown wherein an elongated disk **147** has a pivot stem **148** projecting upwardly therefrom at one end and eccentrically disposed relative to the axis of the interlock lug disk. The stem **148** extends up through a journal aperture **149** in the end portion of the cross T base flange **118** that projects inwardly beyond the supporting and shoulder flange **115**, a head **150** on the stem maintaining a permanently assembled relationship of the interlock disk with the flange **118**. The arrangement is such that by swinging of the interlock disk **147** from dot dash position as shown in FIGURE 25 into the partially full line and otherwise dash position, the free tip of the interlock disk **147** engages frictionally against the juncture of the shoulder flange **115** with the base flange **114**. Since in the unlocked position, the locking disk **147** projects later-

ally beyond the side edge of the base flange 118, it is readily accessible manually or by means of a suitable tool to be swung in under the shoulder flange 115 and then into the wedging relation described.

In all of the forms of the invention of FIGURES 16 through 26, it will be evident that the locking bends or lugs 122 may serve also to retain the interlock clips or members against displacement.

From the foregoing it will be apparent that in all forms of the invention, assembly of the cross T's with the main T's is simply effected by easy and convenient manipulation. In the final assembly, interlock shoulder structures on the cross and main T's cooperate to hold them firmly assembled. Such shoulder structure on the main T extends longitudinally thereof and thus enables substantial range of adjustment of the cross T longitudinally of the main T. Whether or not separate clips or interlock lug elements are used in the assembly, the cross T's can be locked positively against displacement longitudinally of the main T if desired, but in certain forms of the invention where separate locking members are provided in the assembly, locking of the cross T's against longitudinal movement also locks the locking members against escape.

In addition, the invention affords a strong, durable structure that lends itself readily to mass production methods of manufacture either from sheet metal strip or as extruded metal sections.

It will be understood that modifications and variations may be effected without departing from the scope of the novel concepts of the present invention.

I claim as my invention:

1. In a suspended ceiling framework or grid structure, an elongated main metal member having an upright body web structure and a lateral longitudinal supporting flange, said supporting flange having at the distal margin thereof an overlying inwardly directed flange spaced above the supporting flange, said flange having a cut-out therein of substantial though limited width, and a metal cross supporting member having an upright body portion and a lateral longitudinal supporting flange with an end portion of the cross member overlying the inwardly directed flange of the main member supporting flange and with the terminus of the cross member opposing the upright body web structure of the main member to maintain the cross member against longitudinal displacement toward said body web structure of the main member, said supporting flange of the cross member having at said end portion a retaining lug structure offset below the cross member supporting flange and interlockingly engaged between said inwardly directed flange and said main member supporting flange and with the interlocking engagement effected by entry through said cut-out.

2. In a suspended ceiling framework or grid structure, spaced apart main T's arranged to be supported below a ceiling structure of a room, and cross T's connected at their end portions to and extending between the main T's, said main T's having respective upstanding body web portions and horizontal longitudinal side supporting flanges along the base of the body web portions, said cross T's having upstanding body web portions and horizontal longitudinal side supporting flanges along the base of the body web portions, said cross T supporting flanges respectively having individual interlock lug elements on the end portions thereof, and the main T's having longitudinal generally downwardly facing shoulders thereon overlying said main T base flanges in spaced relation and thereby defining laterally opening respective grooves, said interlock lug elements being interlockingly interengageable with said shoulders in the grooves between the shoulders and the respective underlying cross T supporting flanges, said interlock lug elements being slidable longitudinally along said main T shoulders for adjustment of the cross T's longitudinally along the main T's.

3. In a suspended ceiling framework or grid assembly, a main T having an upright web and a lateral supporting flange and including an overhanging downwardly facing interlock shoulder structure spaced a limited distance from said flange and affording a longitudinal laterally opening interlock groove, and a cross T having an upright web and a pair of lateral supporting flanges, an end of the cross T being disposed closely adjacent to the upright web of the main T and with the supporting flanges of the cross T supported by said lateral flange of the main T against downward displacement, at least one of said supporting flanges of the cross T having an interlock lug structure projecting therefrom into said groove and facing upwardly to coact with said downwardly facing shoulder and thereby maintaining the T's against vertical upward displacement relative to one another, said groove enabling infinitely incremental adjustment of the cross T and said lug structure longitudinally throughout the length of the groove.

4. In a suspended ceiling framework or grid assembly, a main T having an upright web and a lateral supporting flange with a narrow overlying flange on its distal margin projecting toward said web but substantially spaced therefrom and from said supporting flange and providing shoulder means facing toward said web and additional shoulder means facing toward said supporting flange, a cross T having an upright web and lateral supporting flanges thereon supportingly engaged upon said narrow marginal flange and with an end of the cross T located adjacent to said upright web of the main T, portions of said supporting flanges of the cross T projecting in overlying relation to the space between the edge of said narrow flange and the web of the main T, and interlock lug structure depending from said overlying portions of said supporting flanges of the cross T and coacting interlockingly with both of said shoulder means provided by said narrow flange to retain the cross T not only against upward displacement but also against displacement in a direction away from said web.

5. In a suspended ceiling framework or grid assembly as defined in claim 3, the overhanging downwardly facing interlock shoulder structure of the main T comprising a longitudinally extending lateral projection on said upright web, and the interlock lug structure on said at least one of said supporting flanges of the cross T comprising a tab projecting a short distance beyond the upright web of the cross T.

6. In a suspended ceiling framework or grid assembly as defined in claim 3, said interlock lug structure comprising a relatively movable member and means attaching said member to said at least one of said supporting flanges of the cross T.

7. In a suspended ceiling framework or grid assembly as defined in claim 6, said movable member comprising a flanged body removably interlockingly interengaging with said attaching means.

8. In a suspended ceiling framework or grid assembly as defined in claim 6, said lug structure comprising a disc element, and a pivot stem member connecting the disc element to said at least one of said supporting flanges of the cross T.

9. In a suspended ceiling framework or grid assembly as defined in claim 3, a sheet metal cover carried by said supporting flanges of the cross T, the end of said cover being spaced from the terminus of said supporting flanges sufficiently to clear said lateral flange of the main T, and downwardly projecting spacer nodes dimpled in said lateral supporting flanges of the cross T and holding said sheet metal cover in spaced relation below said cross T flanges so as to be flush with the lower face of the main T.

10. In a suspended ceiling framework or grid assembly as defined in claim 9, a cover carried by the supporting flange of the main T and providing the lower face of the main T.

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