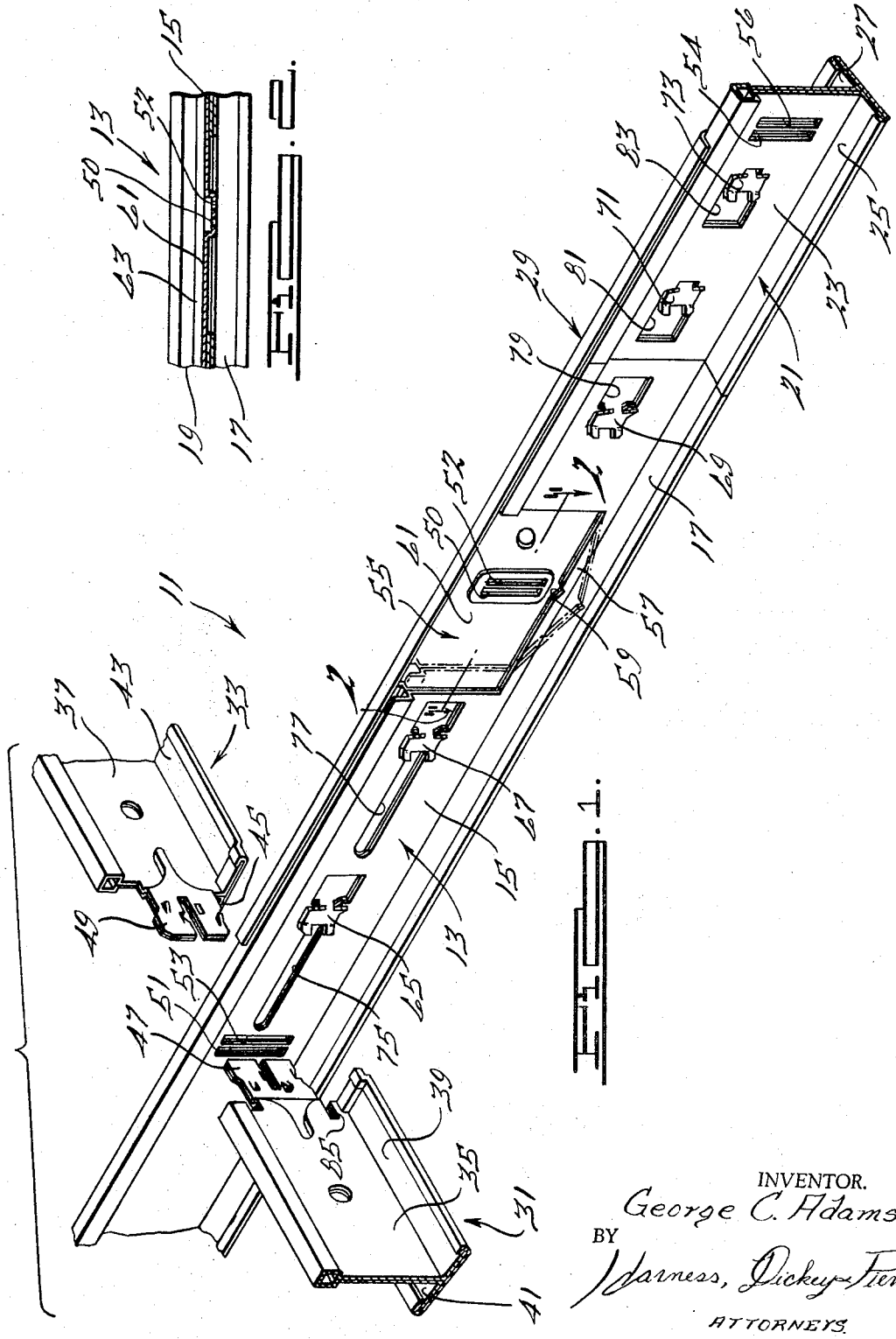
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EXPANSION CONNECTION FOR FIRE RATED CEILING GRID SYSTEM

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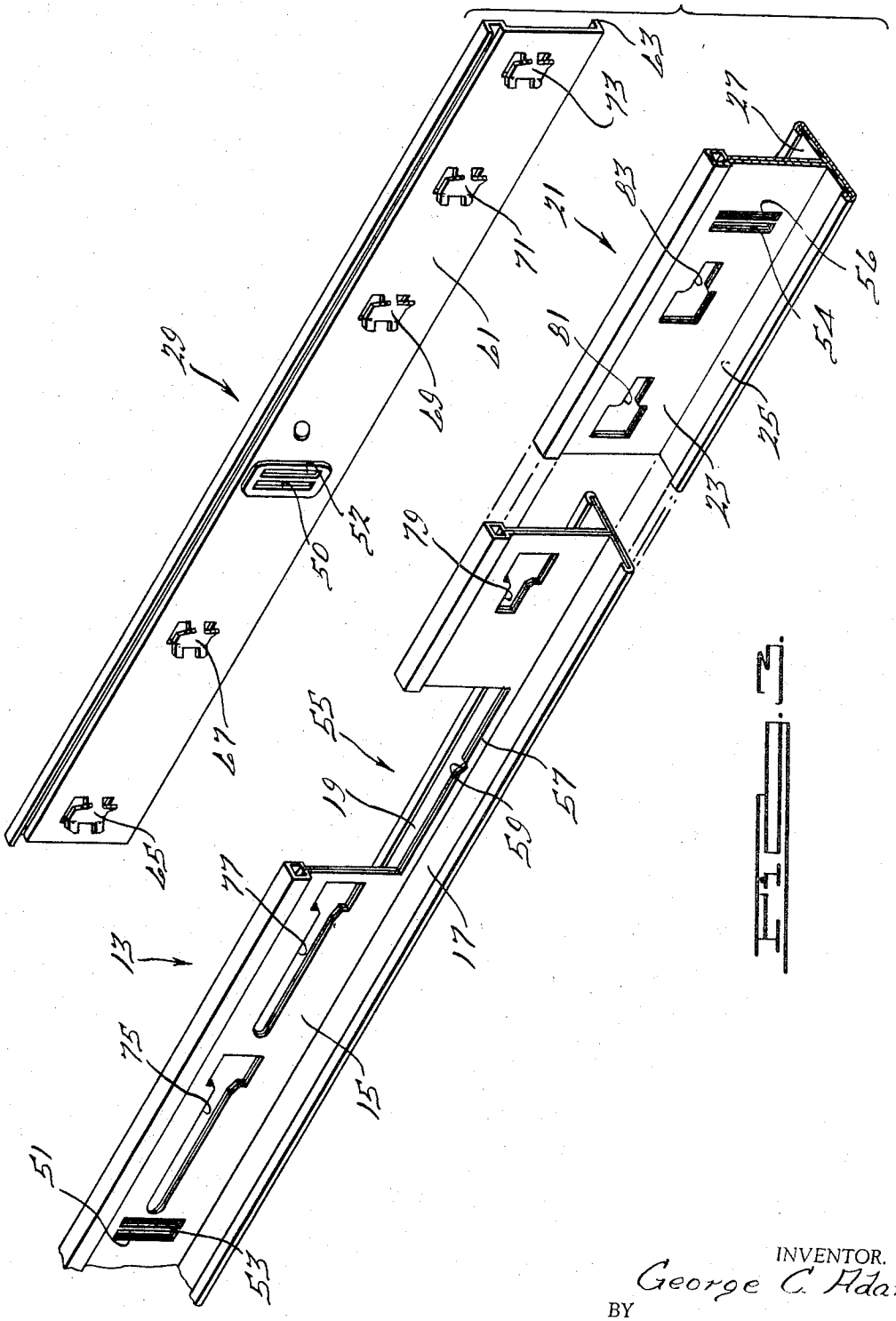


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# EXPANSION CONNECTION FOR FIRE RATED CEILING GRID SYSTEM

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## ABSTRACT OF THE DISCLOSURE

The instant invention comprises a pair of main T-bars or T-members butted end-to-end in a grid system and held in this position by a splicer which is attached thereto by suitable clip and slot means in a manner permitting controlled expansion of the T-members when exposed to fire or similar conditions and without disrupting the ceiling assembly. To this end, at least one of the main T-members is provided with a cut-out area in the vertical flange thereof adjacent its butted end and within the portion lapped by the splicer. In order to make the T-member adequately strong under normal conditions and at the same time permit it to collapse smoothly and uniformly without disrupting the ceiling, the cut-out area extends downwardly from the upper edge of the vertical flange to a point adjacent to but spaced above the horizontal bottom flanges. This arrangement leaves a narrow portion of the vertical flange between the cut-out area and the horizontal flanges which serves a stiffening and strengthening function under normal service conditions. A single generally V-shaped notch provided in the narrow vertical flange portion intermediate the opposite sides of the cut-out area causes the portion of the T-member below the cut-out area to fold downwardly under thermal expansion conditions with the apex of the fold at the notch. Movement of the T-member into the cut-out area and relative to the splicer under expansion conditions is permitted by special clip and elongate slot means interconnecting the splicer and the vertical flange of the T-bar. The integrity of the grid assembly in normal service is enhanced by providing the splicer in the area of the cut-out area with means for attachment of a cross T-member; and, in order to permit elongation of the main T-member under thermal expansion conditions without opening up the ceiling and without interference from the cross T-member, the attaching means is located generally in line with the V-notch and disposed at a substantial distance from the side of the cut-out area remote from the butted end and the remote side of the cut-out area is caused to extend transversely of the T-member in substantially a straight line from the bottom of the cut-out area.

This invention relates generally to ceiling structures, and particularly to an improved expansion connection for a suspended ceiling component.

In general, suspended ceilings, of the type to which the present invention relates, include a plurality of normally disposed interconnected grid members suspended from a conventional ceiling or overhead structure of an enclosure. These grid members conventionally include parallel spaced main grid members which extend one full dimension of the enclosure and which may be of integral construction but which preferably are of end-to-end spliced construction and cross grid members which extend normally to and interconnect the main grid members. The main and cross grid members each are of generally inverted T-shape in vertical cross section and together form a lattice defining a plurality of rectangular openings. A rectangular acoustical tile is positioned in each opening



in the lattice and is supported on the bottom flanges of the grid members and provides a generally aesthetically pleasing and acoustically superior ceiling for the enclosure.

One of the problems arising in these ceiling structures relates to maintaining the integrity thereof under high ambient temperature conditions. Thus, when a fire occurs in the enclosure, the metallic grid members expand and buckle so that the acoustical tiles in the grid openings are disturbed and tilted sometimes to such an extent that they fall through the openings. When this occurs, the effectiveness of the suspended ceiling is destroyed and the overhead ceiling and related structure is exposed to the fire so that the latter can spread more easily and quickly through the entire structure.

From the foregoing, it is readily apparent that suspended ceiling structures desirable should maintain their integrity and hold the individual tiles in place as long as possible under any elevated temperature or fire condition. In this manner, fire within the enclosure is delayed and perhaps prevented from spreading to the overhead structure and therefore to other parts of the building.

The main object of the present invention therefore is to provide an improved grid member assembly for a suspended ceiling structure which is adapted to isolate and control thermal expansion thereof to a particular area and thereby maintain the integrity of the suspended ceiling under elevated ambient temperature conditions.

Further objects include a grid member assembly of the above character which is relatively inexpensive to manufacture, sturdy in construction and reliable in use.

Other objects and advantages of the present invention will become more apparent from a consideration of the following detailed description taken in conjunction with the drawings in which:

FIGURE 1 is a perspective view illustrating a main grid constructed according to the present invention and shown with a pair of cross grid members before assembly thereof;

FIG. 2 is a sectional view of FIG. 1 taken along the line 2—2 thereof; and

FIG. 3 is an exploded perspective view of the grid member of FIG. 1.

Broadly described, the present invention comprises a grid assembly including an elongated grid member of generally inverted T-shape vertical cross section defining a vertical flange and a pair of horizontal flanges, said vertical flange having a rectangular slot therein intermediate its ends and extending to an area adjacent said horizontal flanges, a generally V-shaped notch in the bottom of said slot intermediate the ends thereof whereby thermal expansion of said grid member causes said slot to collapse and said horizontal flanges to bend downwardly in the area below said slot forming an apex opposite said notch.

Referring now more specifically to the drawings, a main grid member assembly embodying the present invention is illustrated generally at **11** in FIG. 1 and is seen to include a grid member **13** commonly referred to in the trade as a T-member because of its generally inverted T-shaped vertical cross section. As shown, the T-member **13** has a vertical flange **15** and a pair of horizontal bottom flanges **17, 19** at opposite sides of the flange **15**. The grid member **13** is shown in aligned and abutting end-to-end relation with another grid member **21** having a vertical flange **23** and horizontal flanges **25, 27** identical to the flanges **15** and **17, 19**, respectively, of the grid member **13**. The main grid members **13, 21** are releasably held together by a splicer **29** and permit using a standard length main grid member, e.g., 12 feet, in various multiples or parts thereof to accommodate different enclosure sizes.

The main grid members are installed in parallel rows spaced apart a distance substantially equal to or slightly greater than one width dimension of the ceiling panels (not shown) to be used whereby these panels rest upon the horizontal flanges **17, 19** and **25, 27**. The rows of main grid members are interconnected by cross grid members **31, 33** which also are generally inverted T-shaped in vertical cross section defined by a vertical flange **35, 37** and horizontal flanges **39, 41** and **43, 45**, respectively. The extremities of the cross grids **31, 33** are formed with tabs **47, 49** receivable in a set of apertures **51, 53** formed in the vertical flange **15** of the main grid **13**. Additional sets of apertures are formed in the main grid vertical flange **15** (not shown), the splicer **29** as at **50, 52** and the main grid vertical flange **23** as at **54, 56** to receive projecting tabs on other cross grids (not shown) and these sets of apertures are spaced apart a distance substantially equal to or slightly greater than the other width dimension of the ceiling panels (not shown) which are supported thereon so that the grid system formed by the main grids and the cross grids defines substantially a rectangular lattice and together with the panels supported thereon present an aesthetically pleasing and acoustically superior ceiling for the enclosure. The details of the interlocking relation between the main grids and the cross grids do not form a part of the present invention and are not described further here. Reference, however, may be made to my copending application Ser. No. 537,055, filed Mar. 24, 1966, for a detailed explanation thereof as well as for an illustration and explanation of the grid system formed thereby.

As described briefly above, a fire within the enclosure in which the ceiling is suspended heats the grid members and causes them to expand. If these grid members are rigidly confined, this expansion causes at least some of the grid members to buckle whereupon the ceiling panels supported thereby are either raised, tilted or fall out of the grid system and the fire is permitted to spread quickly to the overhead structure. In an effort to maintain the integrity of the grid system, means may be provided whereby the cross grid members **31, 33** are permitted to expand without buckling or causing the main grid members to buckle. One such means is that illustrated in FIG. 1 and illustrated and described in detail in my copending application, Ser. No. 537,055, filed Mar. 24, 1966. In addition to the cross grid members, the main grid members **13, 21** and therefore the grid assembly **11** also expand under this heat. Because of the relatively great length of the grid assembly **11**, expansion thereof, if left uncontrolled, causes the main grid assembly to buckle and dislodge the ceiling tile and thereby speeds the spread of the fire.

It has been discovered that if a particular area or areas of the main grid member assembly **11** be weakened in a novel manner, expansion thereof can be confined to this area or areas and integrity of the system can be maintained. To this end, the main grid member **13** is seen to have a generally rectangular cut-out area or slot **55** formed in the vertical flange **15**. The cut-out area **55** opens through the upper edge of the flange **15** and extends downwardly therefrom to a point adjacent to but spaced above the horizontal flanges **17, 19** leaving a relatively narrow portion **57** of the vertical flange **15** which serves a strengthening and stiffening function in the normal use of the T-member **13**. A generally V-shaped notch **59** is formed in the narrow flange portion **57** at substantially the midpoint thereof. The purpose of the notch **59** is to weaken the flange portion **57** sufficiently so that the lower portion of the T-member **13** will fold at this point under forces of compression due to expansion of the member in the event of fire or the like. To this end, the notch **59** need not extend all the way to the horizontal flanges **17** and **19** although it may do so if the loss of strength and stiffness resulting therefrom is not critical.

When the main grid member **13** is heated and caused to expand, it collapses first at the area of the slot **55** since this portion of the grid member **13** is substantially weaker than the rest of the grid member. In addition, because of the notch **59**, the flange portion **57** and the flanges **17, 19** bend in a fashion forming an apex at the notch **59**, substantially as shown in dot-dash lines in FIG. 1. The bending of the flange portion **57** and the flanges **17, 19** is prevented from occurring in a lateral direction both by the relatively great strength of the flanges **17, 19** in this direction and because of the presence of the ceiling panels (not shown) which rest thereon. Further, this bending is prevented from occurring upwardly by the presence of the splicer **29**, in a manner to be described, and is caused to occur in a vertical downward direction substantially as shown in the figure. In this way, the adjacent panel or panels seated thereon are not lifted therefrom and tend to remain in place so that the integrity of the ceiling is maintained.

It has been discovered that by utilizing a generally elongate slot **55** and by providing only one notch **59** which is disposed centrally of the bottom flange portion **57**, the overall force required to bend the horizontal flanges **17, 19** and the flange portion **57** and therefore collapse of the T-member **13** at the slot **55** is substantially less than if a plurality of notches **59** are provided. Tests have demonstrated particularly that significantly less force is required to start the bending and collapsing action which occurs at the slot **55** when the member **13** is under compression of a magnitude developed in case of a fire for example. Apparently, under these conditions, the forces of compression are concentrated at the single notch **59** in such a way that collapsing begins to occur sooner than if a plurality of notches are used according to conventional practice even though some tearing of the metal at the corners of the notch must occur in order for the bending action to progress. The single notch **59**, when located as shown and described, concentrates the forces of compression in the T-member **13** in such a way that bending always occurs first at the notch. The portion of the member **13** below the notch **55** begins to fold downwardly into a V-form as shown by broken lines in FIG. 1, and it continues to collapse in this manner as long as the forces of compression continue to build up in the member. Thus, the single notch **59** provides a construction that is desirably normally stronger and more rigid than a similar construction having more than one notch but unexpectedly yields more readily to initial bending. This assures a more effective control of the collapsing action under fire conditions and maintains the integrity of the ceiling for a longer time than otherwise would be the case.

As shown in FIGS. 1 and 3, the splicer **29** is substantially S-shaped in vertical cross section and includes a vertical web **61** adapted to overlie the vertical flange **15** of the main grid **13** and a lower horizontal flange **63** which seats against the horizontal flange **19**. The splicer **29** is secured to the main grid members **13, 21** by butterfly type clips **65, 67, 69, 71, 73** which are receivable in key-shaped openings **75, 77, 79** in the vertical flange **15** and key-shaped openings **81, 83** in the vertical flange **23**. Conveniently, the butterfly clips **65, 67, 69, 71, 73** are struck out from the splicer web **61** and are formed by a punching operation during formation of the splicer **29**.

The key slots **75, 77, 79** in the vertical web **15** are oriented oppositely with respect to the key slots **81, 83** in the vertical web **23** to permit easy assembly of the parts. Thus, after the splicer **29** is mounted on the main grid **13** with the clips **65, 67, 69** in place in the key slots **75, 77, 79**, the main grid **21** is brought to position the clips **71, 73** in the slots **81, 83**. The clips **65, 67, 69, 71, 73** and the slots **75, 77, 79, 81, 83** are of course positioned so that when the main grids **13, 21** are in end-to-end abutting relation, the clips and slots obtain as shown in FIG. 1.

In accordance with the present invention, the slot **55** is positioned between two of the key slots **75, 77, 79** and

adjacent one end of the main grid **13**. In addition, the key slots **75, 77** on one side of the slot **55** are considerably longer than the key slot **79** on the other side of the slot **55**. The key slots **81, 83** in the main grid vertical flange **23** are substantially the same size as the key slots **79** so that when the parts are assembled as shown in FIG. 1, the clips **69, 71, 73** are precluded from further longitudinal movement in their key slots **79, 81, 83** while the clips **65, 67** and their slots **75, 77** can move longitudinally relative to each other. Thus, when the main grid **13** thermally expands, the abutting ends of the main grid members **13, 21** are held intact while the slot **55** collapses and the vertical flange portion **57** and the horizontal flanges **17, 19** bend as shown in dot-dash lines in FIG. 1. During this time, the clips **65, 67** and their slots **75, 77** slide longitudinally relative to each other. It will be understood that the other end (not shown) of the main grid member **21** can be formed similarly to the illustrated end of the main grid **13** to control and confine expansion thereof.

In addition to holding the main grids **13, 21** together, the splicer **29** controls the direction of bending of the vertical flange portion **57** and the horizontal flanges **17, 19**. As shown, the splicer flange **63** seats against the grid horizontal flange **19** so that during heat expansion of the main grid **13**, the flange **19** cannot bend upwardly. As described, the ceiling panels (not shown) which are in place in the grid system prevent lateral bending thereof so that bending must take place in a downward direction as shown by the dot-dash lines in FIG. 1. In this way, the supported ceiling panels can remain in place in the grid system for a longer time, since downward bending of the horizontal flanges **17, 19** will not unseat them, and a fire in the enclosure will be less apt to spread to the overhead structure. Also, where the main grids **13, 21** are used along one side edge of a ceiling so that ceiling panels are in place only on one of the horizontal flanges such as the flange **17**, the splicer web **61** lends support to the main grid **13** on the other side and prevents lateral bending thereof.

During heating of the main grid members **13, 21**, as during a fire, for example, some elongation occurs along substantially the entire length thereof. To accommodate this, the tabs **47, 49** on the cross grid members **31, 33** are relatively flexible so that they can bend laterally with elongation of the main grid members **13, 21** and hold the ceiling panels supported thereon in place. Flexibility of the tabs **47, 49** can be enhanced by cutting a slot **85** in the vertical webs **35, 37** of the cross grids **31, 33**. In any event, unit elongation of the main grids **13, 21** between cross grids **31, 33** is not so great as to pose a serious problem and the flexibility of the tabs **47, 49** is sufficient to maintain integrity of the system during a fire.

It will be seen that by the present invention there is provided an improved grid member assembly for a ceiling grid system which controls and confines heat elongation thereof to a particular area thereof and while a preferred embodiment of the present invention has been illustrated and described above in detail, various additions, substitutions, modifications and omissions may be made thereto without departing from the spirit of the invention as encompassed by the appended claim.



What is claimed is:

A control expansion grid member assembly comprising a pair of main T-members butted end-to-end and each having a vertical flange and horizontal bottom flanges, one of said T-members being provided in its vertical flange and adjacent the butted end thereof with a cut-out area which extends downwardly from the upper edge of the flange to a point adjacent to said horizontal flanges, the bottom of said cut-out area being spaced above said horizontal flanges to define a relatively narrow portion of said vertical flange between the bottom of the cut-out portion and said horizontal flanges which serves a strengthening and stiffening function, said relatively narrow vertical flange portion having a generally V-shaped notch therein intermediate the sides of said cut-out area, whereby thermal expansion of said T-member causes the portion thereof below said cut-out area to fold downwardly in a V-shape with the apex of the fold at said notch, a splicer bridging the joint between said main T-members and extending across said cut-out area, and clip and slot means fastening said splicer to the vertical flanges of said T-members, certain of said clip and slot means being at the side of said cut-out area remote from the butted end of said one T-member and the slot portions of said certain clip and slot means extending from the clip portions thereof in a direction away from said cut-out area to permit said one T-member to move relative to said splicer and into said cut-out area under thermal expansion conditions, the portion of said splicer extending across said cut-out area being provided with means for attachment of a cross T-member the remote side of said cut-out area extending transversely of the T-member in substantially a straight line from the bottom of said area and said cross T-member attachment means being located generally in-line with said V-notch and disposed a substantial distance from said remote side of said cut-out area.

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EDWARD C. ALLEN, *Primary Examiner.*