



## GRID TEE FOR SUSPENSION CEILINGS OR THE LIKE

### BACKGROUND OF THE INVENTION

This invention relates generally to grid tees for suspension ceilings or the like, and more particularly to a novel and improved grid tee which provides improved material efficiency and reduces the material requirements to provide a given strength and rigidity.

### Prior Art

Various forms of grid tees for suspension ceilings are known. Generally, such tees are produced by bending one or more strips to relatively thin metal to produce the required shape. Such tees usually provide a central web having a bulb along its upper edge and oppositely extending flanges along its lower edge. Examples of such tees are illustrated and described in U.S. patents Nos. 3,193,063; 3,207,057; 3,221,846; and 3,501,185.

In suspension ceilings, the grid tees are interconnected in a grid to define panel receiving openings in which panels are positioned and supported. In addition, various types of lighting fixtures and other accessories are often supported on the grid. Such other accessories, for example, include air boots, return air vents, air diffusers, and special purpose devices and supports.

Industry standards require sufficient rigidity so that the grid tees will not sag more than the predetermined

5 small amount under load, and so that the assembly will support specified loads without failure such as roll failure. Still further, the grid tees for a given use often have to meet specified dimensional and envelope requirements.

10 Various grid tee designs have been established to meet these and other requirements in an efficient and economical manner. U.S. Patent No. 4,206,578, assigned to the assignee of the present invention, discloses a symmetrical grid tee which makes efficient use of the material from which it is manufactured, so that greater strength and rigidity are achieved from a given amount of material.

15 In the grid tee illustrated in such patent, three separate strips of metal are formed into a tee, so that a relatively thin, double web is provided and material is concentrated at the extremities where it is most effective at producing strength and rigidity. Such illustrated tee, however, provides three separate strips which must be  
20 handled and formed. Such patent is incorporated herein by reference.

#### SUMMARY OF THE INVENTION

25 In accordance with the present invention, a novel and improved grid tee structure is provided which makes efficient use of the material of the tee and which can be easily and economically produced.

30 More specifically, the present invention provides a grid tee for suspension ceilings comprising a thin strip of metal bent to form a generally planar central web, a bulb along one extremity of said web and oppositely extending panel supporting flanges along the opposite extremity of said web, wherein said bulb has a lateral width substantially less than the total lateral width of said flanges, said strip of metal provides at least two  
35 reverse bends at the extremity of said bulb remote from said web, said reverse bends interconnecting at least

(18)

three bulb layers of said metal extending laterally with respect to said bulb at the extremity thereof remote from said web, said bulb layers being in substantial face-to-face contact, said bulb layers operating to concentrate metal at the bulb extremity of said tee to improve the strength and stiffness thereof to resist loads encountered when panels are supported on said flanges, said metal providing substantially right angle bends at the ends of said bulb layers so that said bulb provides spaced metal portions substantially parallel to said web on opposite sides thereof extending from said bulb layers in the direction of said web, said spaced metal portions on opposite sides of said web extending to intumed bends to provide inwardly extending metal portions extending to said web at the bulb extremity thereof thereby providing said bulb with a hollow substantially closed bulb shape having said bulb layers along the extremity thereof remote from said web, and at least one of said inwardly extending metal portions being joined to said web.

In accordance with a specific aspect of this invention, a non-symmetrical, single layer web grid tee is structured to provide a shear center which is located substantially at the plane of the web, so that the tee does not tend to encounter roll failure and so that substantial strength and rigidity are provided without requiring excessive material. Since the web does not contribute materially to the strength of the grid, grids having a single web tend to be more material efficient with respect to the web portion, and if the grid section is structured for sufficient rigidity and provides a central shear center, a superior grid is provided.

The invention will now be further described with reference to the accompanying drawings.

#### BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a cross section of a grid tee in accordance with one embodiment of this invention in which

the tee is symmetrical with respect to a central plane along the web of the tee and in which folds are provided in the bulb material to concentrate material in the bulb extremity of the grid tee;

5           FIG. 1A is an enlarged, fragmentary view of the upper edge of the bulb of the tee illustrated in FIG. 1;

          FIG. 2 is a cross section of a second embodiment grid tee which is similar in most respects to the embodiment of FIG. 1, but differs therefrom in that the  
10 height of the bulb is reduced; and

          FIG. 3 is a cross section of a grid tee in accordance with another embodiment of this invention, in which the tee is formed of a single strip of metal, provides a single layer web, provides a shear center in  
15 the plane of the web, and concentrates material at the bulb extremity.

#### DETAILED DESCRIPTION OF THE DRAWINGS

In U.S. Patent No. 4,206,578, a grid tee section is illustrated in which efficient material use is obtained  
20 by concentrating material at the extremities of the grid. In the illustrated embodiment of that patent, however, two separate strips of material form the bulb, with material concentrated at the bulb extremity, and a separate cap is provided at the flange extremity of the grid to concentrate  
25 material at such extremity. On the other hand, with the present invention, efficient use of the material is accomplished without requiring as many separate strips of material in the fabrication of the grid tee.

In the embodiment of FIGS. 1 and 1A, the grid tee  
30 is formed of two strips of material, and is symmetrical with respect to the central plane along the web thereof.

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Such embodiment provides a first strip of metal 10 which extends in from one edge 11 to a raised stiffening rib 12, and therefrom to a right angle bend at 13 to provide one flange portion 14. From the bend, the strip 10 extends out to a second right angle bend at 16, and between the bends 13 and 16, the strip provides one layer 15 of a central web 17.

A bulb 18 is formed from the strip 10 to provide opposed lateral portions 19 and 21, spaced and parallel sidewalls 22 and 23, and an upper portion 24. This upper portion provides three laterally extending layers to concentrate material at the upper extremity of the grid. In the illustrated embodiment, best illustrated in FIG. 1A, the material of the strip 10 is formed with right angle bends 26 and 27, which respectively connect the sidewalls 22 and 23 to lateral portions 28 and 31, which are substantially coplanar and cooperate to provide the outermost of the three layers. At the inner extremities of the portions 28 and 31, reverse bends are provided at 32 and 33 to provide the second layer consisting of the two lateral portions 34 and 36. At the outer extremities of each of the portions 34 and 36, reverse bends 37 and 38 are again provided to join with the inner layer or third lateral portion 39.

Referring again to FIG. 1, the strip 10 is formed to provide the other layer 41 of the central web 17, which extends in face-to-face adjacency with the first layer 15 to a right angle bend at 42. From the bend 42, the strip is formed with a second flange portion 43, which is similar but opposite to the flange portion 14. The flange portion 43 therefore provides a stiffening rib 44 and extends to an edge 46. In this embodiment, the strip 10 is completely symmetrical with respect to a central plane 47, which extends along the abutting faces of the two portions of the central web 17.

The grid tee is completed by a second strip of metal 48 which extends along the lower surface of the flange portions 14 and 43 and is formed with reverse bends at 49 and 51 so that its edges embrace and clamp at 52 and 53 over the outer edges of the flange portions 14 and 43, respectively. Therefore, the shear center is located along the central web 17. The shear center of this grid tee is located at about SC1. The shear center or center of twist for a transverse section of a beam is the point of intersection of the bending axis and the plane of the transverse section. Any transverse force applied through the shear center causes no torsion of the beam. Since the grid tees in a suspension ceiling grid are generally symmetrically loaded with respect to the central web, the shear center should be located in the web plane or as close thereto as possible so the twist or roll failures are minimized.

With this structure, double layers of material are provided at the flange extremity of the grid and triple layers of material are provided at the bulb extremity of the grid. By concentrating the material formed in the grid at the extremities in this manner, increased rigidity and strength are provided for a given amount of material forming the grid. Further, in this embodiment, such multiple layers of material at the bulb extremities are achieved without requiring a separate strip, which would otherwise have to be incorporated into the structure to provide this efficient structure.

The embodiment of FIG. 2 is identical to the embodiment of FIG. 1 except for the fact that the height of the bulb is decreased. In this embodiment, similar reference

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numerals are utilized to refer to similar components of the grid, but a prime (') is added to indicate that reference is being made to the embodiment of FIG. 2. Here, the central web 17' is again formed of two abutting  
5 layers 15' and 41'. Similarly, the bulb 18' provides spaced and parallel walls 22' and 23'. However, the length of the two walls 22' and 23' is much less than the length of the corresponding walls 22 and 23 of the embodiment of FIG. 1. In this embodiment, however, three  
10 layers are provided at the upper extremity of the bulb in the same manner as illustrated in FIGS. 1 and 1A. The oppositely extending flange portions 14' and 43' are again formed as in the first embodiment, and a separate strip of metal 48' is mounted on these portions to provide a double  
15 layer at the flange extremity of the grid.

It can be noted from comparing FIGS. 1 and 2 that this invention can therefore be incorporated in grids wherein the particular portions of the components of the grid are changed with respect to each other, while still  
20 achieving the high strength efficiency of the overall structure. Here again, multiple layers are provided at the bulb extremity and at the flange extremity of the grid and a high degree of rigidity is provided with a minimum amount of material. The shear center of this grid tee  
25 embodiment is located at about SC2.

FIG. 3 illustrates an embodiment of this invention which provides a single layer web. Such embodiment, therefore, reduces the amount of web material which does not contribute materially to the strength of  
30 the grid. Referring to FIG. 3, the grid of such embodiment is formed of a single strip of metal 61 shaped to provide a single layer central web 62, a closed bulb 63 at the upper edge of the web 62, and opposed, symmetrical flanges 64 and 66 at the lower extremity of the web. The  
35 strip of metal 61 is formed to extend from a first edge 67 along an inclined portion 68 to a bend 69 at one lateral

extremity of the bulb 63. From the bend 69, the strip extends in a direction laterally spaced from but parallel to the web 62 along a portion 71. At the upper extremity of the wall portion 71, the metal is again bent to provide  
 5 three laterally extending layers 72, 73, and 74 adjacent to the upper extremity of the web. These layers are formed in the same manner as in the embodiment of FIGS. 1 and 2, and are therefore not described in detail herein. The bulb 63 provides an oppositely extending wall portion 76  
 10 substantially parallel to and spaced from the wall portion 71, which extends to a bend at 77 to provide an inclined wall portion 78. At the bend 79, the wall portion 78 is integrally joined with the upper edge of the web 62.

At the lower edge of the web 62, the material 61  
 15 is bent with a right angle bend at 81, and extends therefrom along a lateral portion 82 to a reverse bend at 83 at the extremity of the flange 66. From the reverse bend at 83, the strip extends back along the underside of the grid past the central web 62 to provide the lateral flange 64.  
 20 From a reverse bend at 84, the strip extends back to an edge 86 adjacent to the web 62. It should be noted that, here again, a substantial amount of material is concentrated adjacent to the upper extremity of the bulb and at the flange extremity for efficient material usage in which  
 25 substantial rigidity is provided with a minimum material requirement. In this embodiment, however, the grid is again symmetrical with respect to the central web 62, so the shear center is located at about SC3 along the plane of the web. The flange 64 is not directly connected to the  
 30 central web, but is only connected to the central web through the flange 66. Similarly, the bulb 63, although basically symmetrical in shape, is not connected to the web at 67.

With the present invention, which the open sides  
 35 of the bulb and the flange are on opposite sides of the web, and the shear center of the section is along the center of

the grid, less material is required to produce a grid of a given resistance to roll failure. Further, with the embodiment of FIG. 3, three layers are provided at the bulb extremity by reverse bends, and the flange 66 is  
5 formed with double layers to concentrate material at the flange extremity of the grid for rigidity.

(23)



CLAIMS:

1. A grid tee for suspension ceilings comprising a thin strip of metal bent to form a generally planar central web, a bulb along one extremity of said web and oppositely extending panel supporting  
5 flanges along the opposite extremity of said web, wherein said bulb has a lateral width substantially less than the total lateral width of said flanges, said strip of metal provides at least two reverse bends at the extremity of said bulb remote from said web, said  
10 reverse bends interconnecting at least three bulb layers of said metal extending laterally with respect to said bulb at the extremity thereof remote from said web, said bulb layers being in substantial face-to-face contact, said bulb layers operating to concentrate metal at the  
15 bulb extremity of said tee to improve the strength and stiffness thereof to resist loads encountered when panels are supported on said flanges, said metal providing substantially right angle bends at the ends of said bulb layers so that said bulb provides spaced metal  
20 portions substantially parallel to said web on opposite sides thereof extending from said bulb layers in the direction of said web, said spaced metal portions on opposite sides of said web extending to inturned bends to provide inwardly extending metal portions extending  
25 to said web at the bulb extremity thereof thereby providing said bulb with a hollow substantially closed bulb shape having said bulb layers along the extremity thereof remote from said web, and at least one of said inwardly extending metal portions being joined to said  
30 web.

2. A grid tee as set forth in Claim 1, wherein said strip of metal provides a plurality of flange layers at the flange extremity of said grid.



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11

3. A grid tee as set forth in Claim 2, wherein said bulb is joined to said web only on one side thereof, and said flanges are joined to said web only on the other side thereof.

4. A grid tee as set forth in any preceding claim, wherein said web is a single layer central web.

5. A grid tee as set forth in any preceding claim, wherein said metal is bent to provide four reverse bends with two reverse bends being opposite and substantially abutting, two of said bulb layers being provided by separate substantially coplanar laterally extending metal portions.

6. A grid tee as set forth in Claim 5, wherein said opposite reverse bends abut along the plane of said web.

7. A grid tee as set forth in any preceding claim, wherein the shear center of said grid is substantially along the plane of said web.

8. A grid tee for suspension ceilings, substantially as hereinbefore described with reference to Figs. 1 and 1a, Fig. 2 or Fig. 3 of the accompanying drawings.

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