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Jones

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[54] **MAIN BEAM JOINT FOR SUSPENDED CEILINGS**

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[52] **U.S. Cl.** ..... **52/758 A;** 52/645; 403/393

[51] **Int. Cl.** **F16b 7/22**

[58] **Field of Search** ..... 52/DIG. 5, 758 A, 645, 52/664, 667, 669; 403/393

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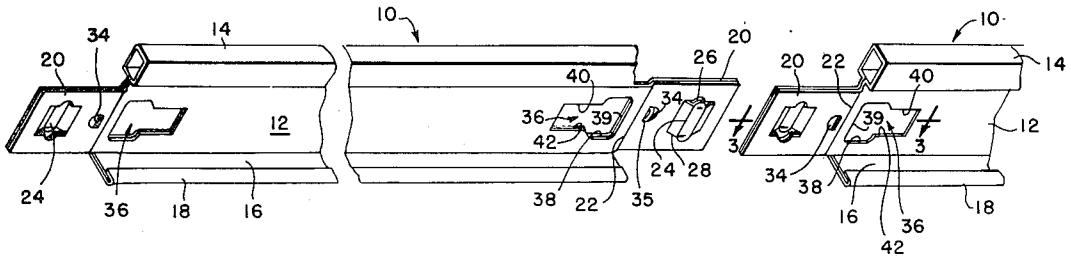
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Primary Examiner—Richard J. Scanlan, Jr.
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Attorney, Agent, or Firm—Smith, Harding, Earley & Follmer

[57] **ABSTRACT**

A main beam for use in a suspended ceiling system having a non-directional, integral coupling means provided at its ends. The coupling means comprises an extension from the central web of the beam provided with a tongue member projecting laterally from one side of the extension and providing a pair of spaced longitudinally extending edges adapted to ride on the edges of a longitudinally extending slot of a coupled main beam to provide stability and holding power. A fire-rated main beam construction comprising the non-directional, integral coupling means involves only minor modification to the coupling design.

11 Claims, 9 Drawing Figures



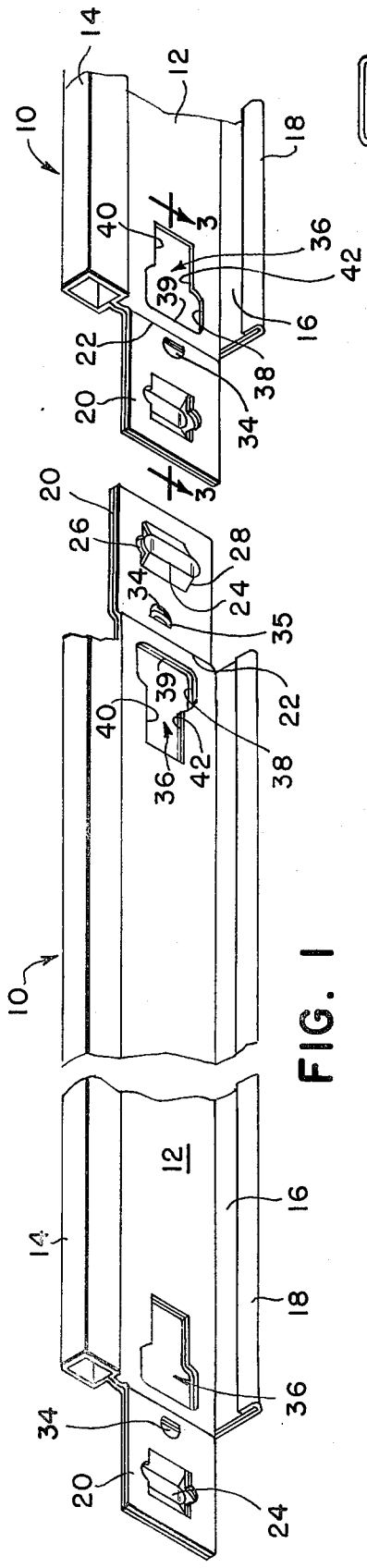


FIG. 1

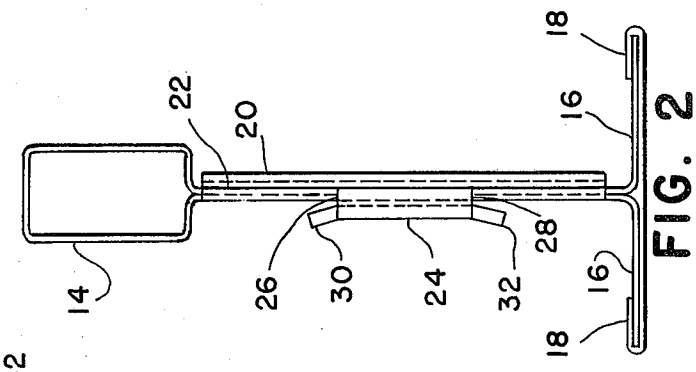


FIG. 2

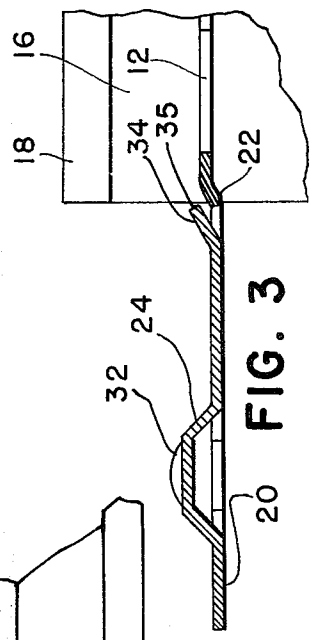


FIG. 3

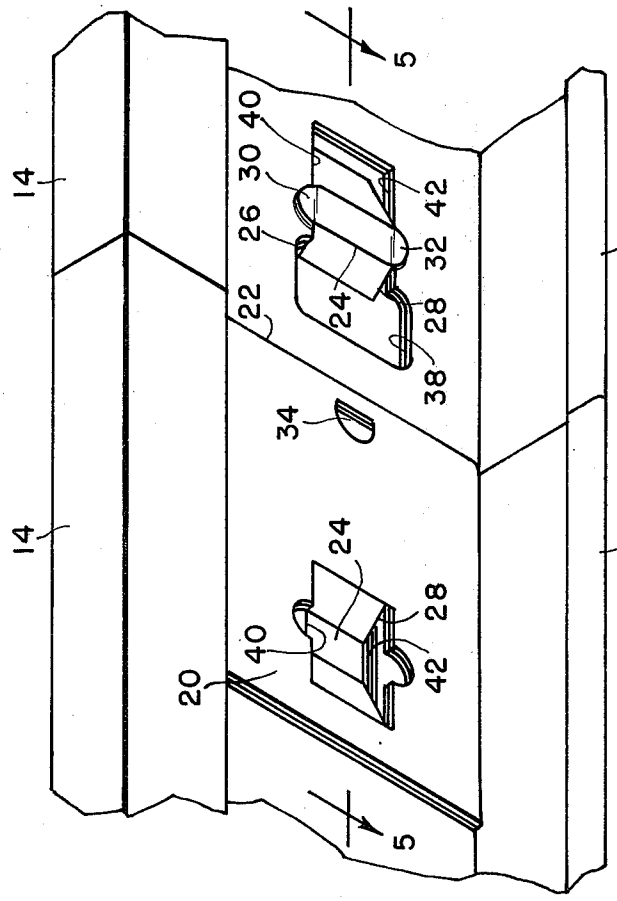


FIG. 4

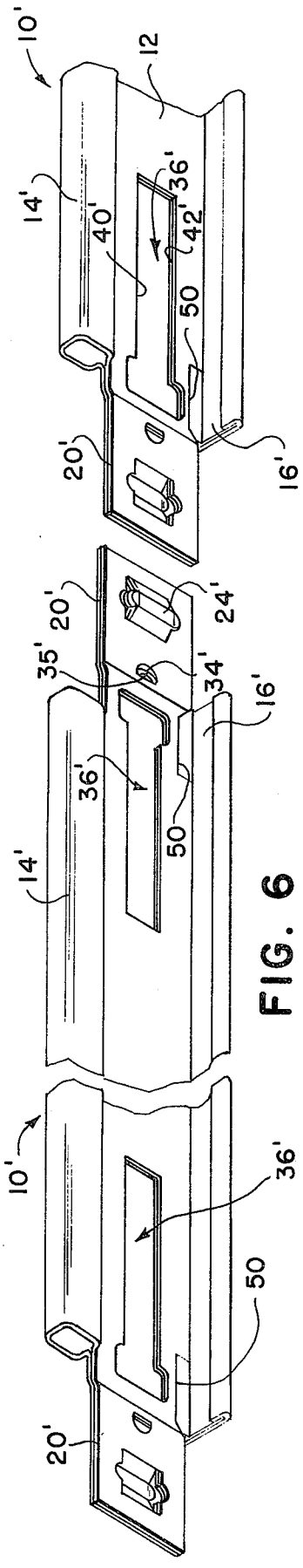


FIG. 6

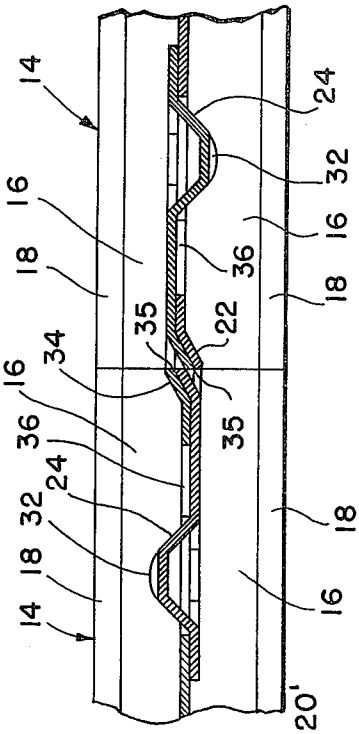


FIG. 5

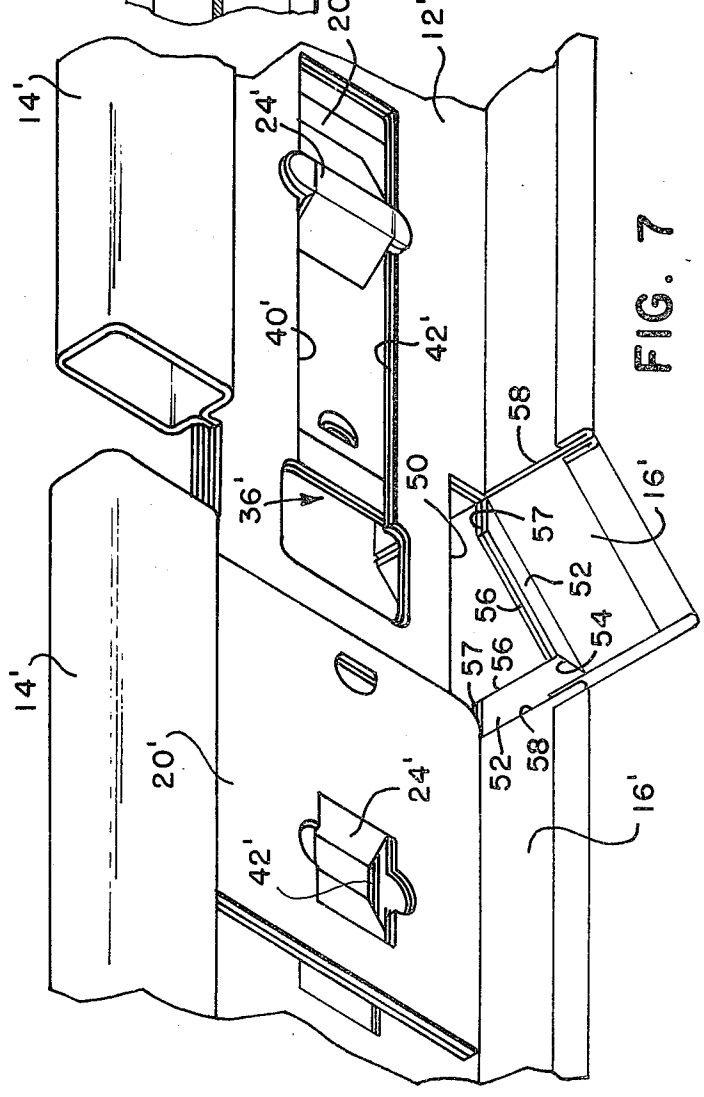


FIG. 7

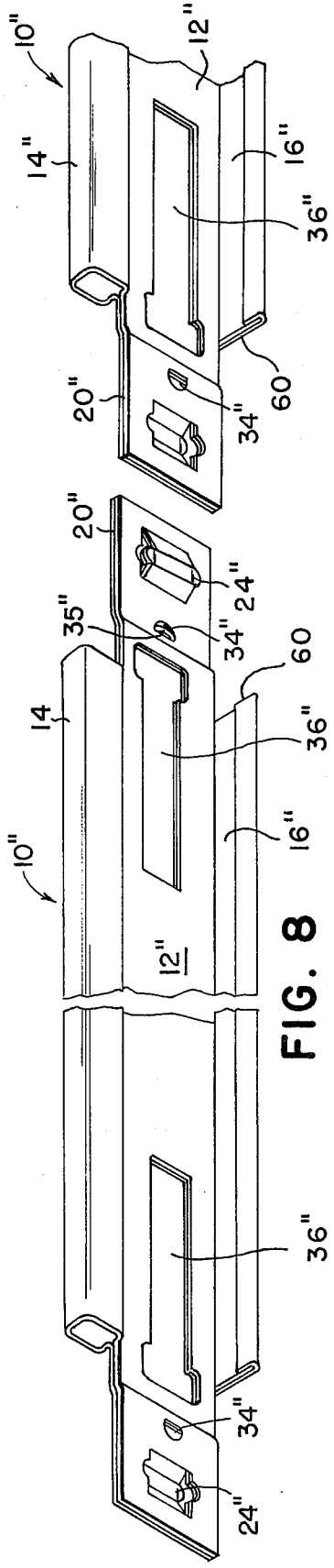


FIG. 8

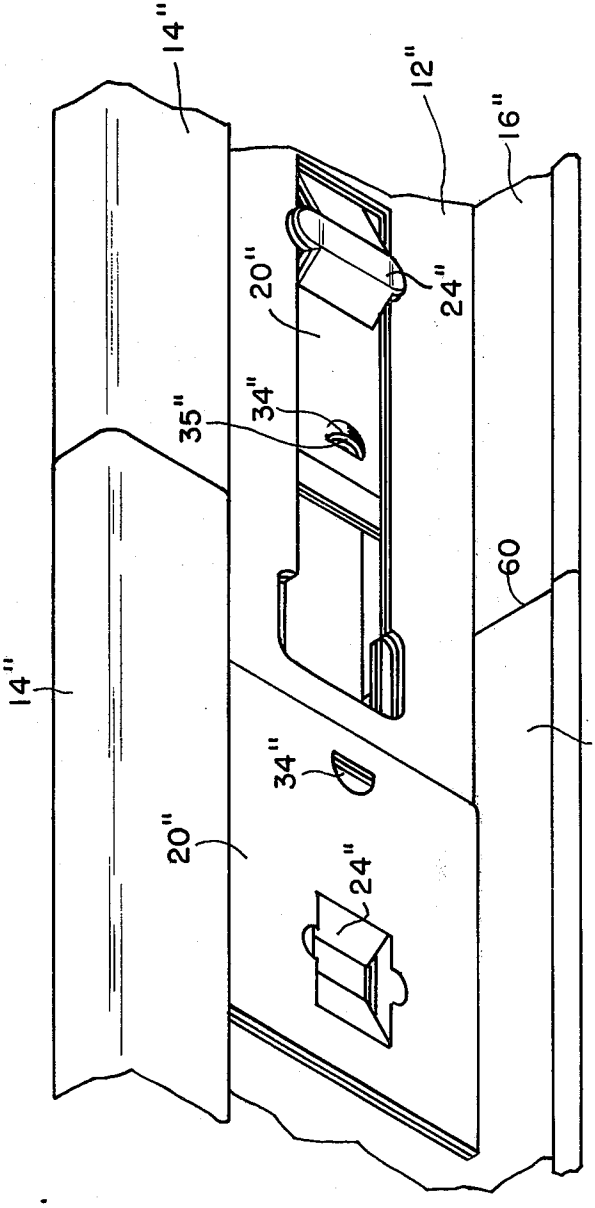


FIG. 9

MAIN BEAM JOINT FOR SUSPENDED CEILINGS

BACKGROUND OF THE INVENTION

This invention relates to a main beam for use in suspended ceiling systems and, more particulary, to a non-directional, integral coupling means for such main beams.

There has been provided in the prior art various designs for coupling the ends of main beams, such as for example, the designs shown in U.S. Pat. Nos. 3,142,367, 3,284,977, 3,297,345, 3,496,690 and 3,565,474.

The couplings of the prior art have not proved entirely satisfactory and involve several disadvantages. For example, some of the prior art couplings are directional, i.e. they can only be coupled in one end-to-end orientation of the beams. This causes difficulties in supplying inventories and increases installation time and cost. Other prior art couplings use a separate splicing member which involves an increase in material and installation costs. Another problem with prior art couplings is that they require close control in manufacturing because of the tight dimensions and the multiplicity of cutouts in a small space. Another problem of prior art couplings is that they are difficult to take apart once they are coupled and often have to be almost destroyed in order to uncouple the main beams. Still another problem with the prior art couplings is that they are difficult to install and to repair once they are damaged because of the awkward nature of the coupling and uncoupling movements required.

Another difficulty in the prior art couplings is that they have not provided an entirely satisfactory fire-rated design. A fire-rated main beam must be constructed to accommodate expansion of the main beam in a manner so as to maintain the support of the ceiling tiles even during a condition of excessive heat which causes the main beam to expand. By maintaining the fire retardant ceiling tiles in supported position, the fire is prevented from contacting the area above the ceiling tiles.

SUMMARY OF THE INVENTION

It is the general object of this invention to provide a main beam for suspended ceiling systems having a non-directional, integral coupling of improved design. The coupling in accordance with the invention is constructed so that it can be taken apart easily for disassembly purposes and for reuse. The uncoupling involves only a simple movement to release the locking means. Moreover, the coupling design provides high load strength, stability and holding power. Furthermore, the coupling design in accordance with the invention provides a short engaging and disengaging travel in a horizontal direction which is very advantageous to the installer and permits the location of the suspended ceiling very close to the ceiling from which it is suspended. Furthermore, it is easy to replace a damaged beam in the new integral coupling in accordance with the invention.

Briefly stated, the above object and features of the invention are achieved by the provision of a main beam comprising an elongated central web and means providing oppositely disposed bottom flanges at the lower edge of the central web and coupling means integral with the beam for connecting the ends thereof to the end of another main beam of similar construction. The coupling means includes an extension on the end of the central web provided with a tongue member projecting laterally from the extension and defining a pair of spaced longitudinally extending guide edges. At the end of the beam there is provided a slot in the central web providing a pair of longitudinally extending edges adapted to receive the tongue member of a coupled main beam in a manner such that the guiding edges of the tongue member ride on the longitudinal extending edges of the slot to provide a strong and stable connection.

Another object of the invention is to provide an integral, non-directional coupling design for a main beam which is adapted to accommodate relative axial movement between coupled main beams members such as would be produced by expansion thereof due to an excessive heat condition. To this end, the coupling design in accordance with the invention is modified only slightly to accommodate the relative axial movement between coupled main beams.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a perspective view of a pair of main beams in accordance with the invention;

FIG. **2** is an end view of the beam shown in FIG. **1**;

FIG. **3** is a section taken on line **3—3** of FIG. **1**;

FIG. **4** is a view showing two beams in accordance with the invention in a coupled condition;

FIG. **5** is a section taken on line **5—5** of FIG. **4**;

FIG. **6** is a perspective view of a pair of fire-rated main beams in accordance with the invention;

FIG. **7** is a perspective view of the embodiment shown in FIG. **6** after the main beams have been moved axially relative to one another from the normal coupled position;

FIG. **8** is a perspective view of another fire-rated coupling in accordance with the invention; and

FIG. **9** is a perspective view of the embodiment shown in FIG. **8** after the main beams have been moved axially relative to one another from the normal coupled position.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Although specific terms are used in the following description for clarity, these terms are intended to refer only to the structure shown in the drawings and are not intended to define or limit the scope of the invention.

Referring to the embodiment of the invention shown in FIGS. **1** to **5**, there is shown a pair of main beams **10** for use in a suspended ceiling grid structure wherein the main beams are arranged in spaced-apart, substantially parallel relationship with a plurality of cross tees extending between and interconnecting adjacent main beams. The main beam **10** has an inverted-T construction and includes a central web **12** with a bulb **14** at the top and a pair of oppositely disposed flanges **16** at the bottom. A capping **18** is mounted on the flanges **16** which are adapted to support ceiling tiles as is conventional.

At each end of the main beam **10** there is provided a similar non-directional integral coupling means whereby either end of the main beam may be coupled with either end of a similar main beam. The coupling means at each end comprises an extension **20** extending from the end of the central web **12** and joined thereto at a bend portion **22**. The extension **20** extends

parallel to the central web and is offset laterally relative thereto an amount approximating the thickness of the central web **12** as is apparent from a consideration of FIGS. **2** and **3**. A tongue member **24** is provided on each of the extensions **20** adjacent the free end thereof and projecting laterally from the extension in the direction opposite to the direction of the offset of the extension relative to the central web **12**. The tongue member **24** provides a pair of axially extending spaced guide edges **26** and **28**. Projecting from the guide edges **26** and **28** at a central location thereof are a pair of engaging lugs **30** and **32**, respectively. The tongue member **24** is constructed and arranged so that the lugs **30** and **32** are spaced from the extension **20** an amount greater than the thickness of the central web **12** as is apparent from a consideration of FIGS. **2** and **3**. The extension **20** is also provided with a locking lance **34**, having end edges **35**, which projects therefrom in the direction opposite to the offset direction of the extension **22** an amount slightly greater than the amount of the offset as is shown in FIG. **3**.

The coupling means at each end of the main beam also comprises a slot **36** provided in the central web **12** and comprising an enlarged portion **38** with an end edge **39** adjacent the bend portion **22** and an axially extending portion defined by a pair of spaced parallel edges **40** and **42** extending axially from the enlarged slot portion **38** toward the center of the main beam **10** a short distance. The enlarged slot portion **38** is adapted to receive the entire tongue member **24** including the engaging lugs **30** and **32**. The axially extending portion of the slot **36** is adapted to receive only the guide edges **26** and **28** of the tongue member **24**. The parts are constructed so that the guide edges **26** and **28** ride between slot edges **40** and **42** during a coupling action as will be described hereafter.

The coupling in accordance with the invention is non-directional and any end of a main beam **10** may be connected to either end of another main beam having the same coupling design. This minimizes inventory difficulties and simplifies installation procedures.

Two main beams constructed in accordance with the invention are coupled together by inserting the tongue member **24** of each beam into the enlarged portion **38** of the associated slot **36** of the other beam. The main beams are then pushed axially together whereby the tongue members **24** slide into the slot portion defined by the parallel edges **40** and **42** with the guiding edges **26** and **28** riding between the slot edges **40** and **42**. This coupling movement is terminated when the ends of flanges **16** and the bulbs **14** of the coupled main beams come into contact. At this point the end edge **35** of locking lance **34** of one of the abutting beams **10** is in a locking position with end edge **35** of the other abutting beam to thereby restrict a separating movement of the coupled main beams **10** and lock them in coupled condition (see FIG. **5**). At the end of the coupling movement, the locking lances **34** ride over one another with the flexibility of the parts permitting this to occur.

The coupling means in accordance with the invention provides high load strength by reason of the arrangement whereby the cut guide edges **26** and **28** of the tongue member **24** ride between the cut slot edges **40** and **42**, and the cut guide edges **28** are supported by the cut slot edges **42**. Also, if the connected beams **10** are not exactly horizontal, but instead are canted a little bit, upper slot cut edge **40** bears against upper tongue cut edge **26** to create a cantilever effect that holds the beam **10** securely and tends to position beams **10** horizontally. The coupling provides high stability and holding power. Also, the coupled main beams may be uncoupled easily by simply freeing the locking arrangement of the locking lances **34** by causing a slight flecture of the main beams relative to one another to separate lances **34** laterally, and then applying a separating movement until the tongue members **24** move into the large portion of the slot **36** from which they are easily removed. It will be apparent that this uncoupling is achieved without any damage to the main beams whereby they are reusable.

It is further noted that the coupling in accordance with the invention involves only a rather short engaging and disengaging travel in the horizontal direction. This is very advantageous to an installer and permits location of the suspended ceiling very close to the ceiling from which it is suspended. By way of example, this engaging and disengaging travel may be as little as 7/32 of an inch.

It is noted that in the coupled condition of the main beams, the engaging lugs **30, 32** prevent any relative lateral movement between the coupled main beams **10**. Moreover, the coupling means is constructed so that in the coupled condition the main beams **10** are aligned axially, there being a corresponding axial alignment between the associated central webs **12**, flanges **16**, and bulbs **14** as is apparent from FIGS. **4** and **5**.

In FIGS. **6** and **7** there is shown a pair of fire-rated main beams **10'** made in accordance with the invention. The main beams **10'** are very similar to the main beams **10** wherefore corresponding parts have been given like reference numerals with primes added. The only modifications to the main beam **10** in order to provide the fire-rated main beam **10'** are the cutting of the central web **12'** at a slit **50** at the end thereof, the lengthening of the axially extending portion of the slot **36'** provided by the spaced parallel edges **40'** and **42'** and the cutting back of the ends of the bulb **14'** so that it terminates at a location set back from the extension **20'**. Otherwise, main beam **10'** is similar to the main beam **10** and comprises an identical extension **20'**, tongue member **24'** and locking lance **34'**.

The slit **50** is cut in the web without the removal of any material and extends inwardly from the end of the central web **12'** to form a rib **52** extending perpendicular to the flanges **16'**. The rib **52** comprises an inclined edge portion **54** extending upwardly at an acute angle from the flanges **16'**, a straight edge portion **56** extending parallel to the flanges **16'**, and an edge portion **57** extending perpendicularly upwardly from the flanges **16'**.

The narrow portion of slot **36'** is lengthened a substantial amount to accommodate the axial relative movement of a tongue member **24'** fitted therein inwardly from the normal coupled position as will be described hereafter. Also, the bulb **14'** is cut back from the extension **20'** in an amount to accommodate axial movement of the bulbs **14'** toward each other.

During installation, the main beams **10'** are coupled in the same manner as the main beams **10** and assume the same coupled position as is illustrated in FIGS. **4** and **5**. However, upon the occurrence of a condition, such as a fire, causing the main beams to expand axially, the main beams **10'** move axially toward each other to a position such as is illustrated in FIG. **7**. The

main beams 10' are designed to accommodate this movement by reason of the construction described below. As the coupled main beams 10' move axially toward one another, the abutting ends of the flanges 16' of the coupled main beams 10' are bent downwardly along bend lines 58 extending transversely across the flanges 16' at the inner ends of the slits 50 as is shown in FIG. 7. The provision of the slits 50 insures that the flanges 16 move downwardly and not upwardly. The formation of the slit 50 to provide the inclined edge portion 54 on the end of the rib 52 also insures that the corner of the cutout rib 52 does not oppose the downward movement of the bent flanges 16'. During the axial movement, the tongue members 24' move along the extended slots 36', which movement is not blocked by the ends of the bulbs 14' which are cut back from the extensions 20'.

The axial relative movement of the main beams 10' occurs in a manner such that the ceiling tiles are maintained in their supported condition. This is the object of a fire-rated grid system since the maintaining of the fire retardant ceiling grid tiles in position prevents the flames from contacting the area above the ceiling tiles.

It is noted that the main beams 10' are compatible with the main beams 10 whereby they can be used in conjunction therewith. Accordingly, in an arrangement where a fire-rated system is installed adjacent to a non-fire-rated system, the installation is simple since it is easy to switch back and forth between the fire-rated and non-fire-rated system. This occurs quite often in actual practice, as in fire-rated rooms separated by non-fire-rated hallways, and is an advantageous feature of the design shown in FIGS. 6 and 7.

It is noted that the design shown in FIGS. 6 and 7 is adapted for an exposed grid structure, wherein the capping 18' is exposed. In FIGS. 8 and 9 there is shown a pair of fire-rated main beams 10'' made in accordance with the invention and adapted for use in a concealed grid structure wherein the flanges 16'' are positioned in grooves in the sidewalls of the ceiling tiles. The main beams 10'' are essentially the same as the main beams 10' wherefore corresponding parts have been given like reference numerals with double primes added. The only difference is that instead of having the slit portion 50, the entire flange portion at the region beneath this slit is removed. This leaves a space between the ends of the flanges 16'' of the beam in the normal coupled position. However, in a concealed grid system this is not visible since it is covered by the ceiling tile. The flange 16'' has its cut-off end 60 set back from the extension 20'' the same distance as the bulb 14'' as is shown in FIG. 8. By this arrangement the expansion of the main beams 10'' causes axial movement of the coupled main beams 10'' toward each other to a position as is illustrated in FIG. 9. This expansion is accommodated by the movement of the tongue members 24'' in the extended slots 36''. Moreover, since both the bulbs 14'' and the flanges 16'' are set back from the extension 20'' there is nothing to block the axial movement until these members come into abutment. The parts are designed to accommodate the necessary axial movement before this occurs. The main beams 10'' are also completely compatible with the main beams 10 and are usable therewith.

I claim:

1. A main beam for use in a suspended ceiling grid structure comprising an elongated central web, means providing oppositely disposed bottom flanges at the lower edge of said central web, and coupling means integral with the main beam for connecting the end of the main beam to the end of another similarly constructed main beams, said coupling means including an extension on the end of said central web and offset laterally relative thereto, a tongue member projecting laterally from said extension with a pair of spaced guide edges and a pair of engaging lugs extending from the guide edges, a longitudinally extending slot formed in said central web adjacent said extension having an enlarged entrance portion connected to a smaller sliding portion with the enlarged entrance portion receiving the tongue member and its lugs, said smaller sliding portion having a pair of spaced longitudinally extending slot edges which are spaced apart approximately the same amount as the guide edges of the tongue member and which receive said tongue guide edges in a manner such that the tongue guide edges ride between said slot edges and the tongue member lugs reach through the slot and engage the distal side of the slot and the slot gives sliding support to the tongue member.

2. A main beam according to claim 1 wherein both ends of said main beam are provided with a coupling means of the same construction so that said main beam is provided with a non-directional coupling means.

3. A main beam according to claim 1 wherein said tongue member is provided with engaging lugs extending outwardly from a portion thereof spaced laterally from said extension an amount greater than said lateral offset of said extension for cooperating with a coupled main beam to limit relative lateral movement therebetween.

4. A main beam according to claim 1 wherein said coupling means includes a locking lance formed on said extension, said locking lance being between said tongue member and said slot and projecting laterally from said extension in the direction opposite said lateral offset of said extension an amount greater than the amount of said offset.

5. A main beam according to claim 4 wherein said locking lance extends in a direction away from the end of said extension and has a vertical end edge facing away from the end of said extension which is arranged to cooperate with the locking lance of a coupled main beam of the same construction to restrict uncoupling movement therebetween.

6. A main beam according to claim 5 wherein both ends of said main beam are provided with a coupling means of the same construction so that said main beam is non-directional in its coupling operation.

7. A coupling according to claim 1 wherein the end of said bottom flanges is set back from the location where said extension joins said central web to accommodate relative movement of the beams toward each other beyond the normally coupled position thereof.

8. A main beam according to claim 7 wherein said slot is of sufficient length to accommodate said relative movement of said main beam without interfering with said tongue member.

9. A main beam according to claim 1 including expansion means for causing the end of said flange to bend downwardly away from said central web when a force is applied axially inwardly on the end of said flange, said expansion means including a slit in the central web located near the lower edge thereof and extending inwardly from the end thereof, whereby a pair

of coupled main beams are movable axially together beyond the normally coupled position thereof.

10. A main beam according to claim **1** wherein said slot is of sufficient length to accommodate said relative movement of said main beam without interfering with said tongue member.

11. A main beam according to claim **9** including camming means for camming said flange downwardly, said camming means including a lead-in slit portion slanting downwardly from the main slit portion.

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