

[54] **CONNECTOR FOR STRUCTURAL STEEL**

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[22] Filed: **April 15, 1970**

[21] Appl. No.: **28,681**

[52] U.S. Cl. .... **287/189.36 R**, 287/20.924, 287/56, 52/721, 287/189.35

[51] Int. Cl. .... **F16b 7/04**

[58] Field of Search.....287/189.36 R, 189.36 C, 189.36 D, 287/189.36 F, 189.36 H, 20.92 C, 20.92 G, 189.35, 23, 56, 20.924, 189.36 B; 52/721

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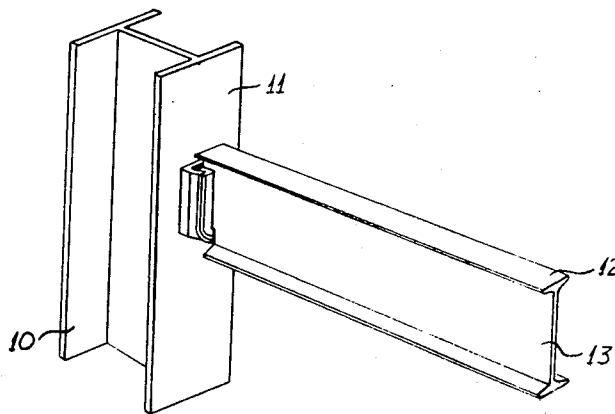
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[57] **ABSTRACT**

A connector assembly for joining structural steel members together to form a structure. The features of the invention are:

- a. a support piece for rigid connection of a rear surface thereof to a vertical face of a first structural steel member, said support piece having a pair of outwardly projecting side walls defining first surfaces that converge outwardly to form a frontal slot therebetween and also converge downwardly to cause said slot to become a retaining socket, said support piece also having a first face inclined downwardly and outwardly; and
- b. a wedge piece for rigid connection of a rear surface thereof to an end of a second structural steel member and for interlocking engagement with said socket, said wedge piece having a pair of side walls defining second surfaces that diverge outwardly and converge downwardly to mate with said first surfaces in a wedging action preventing relative lateral movement between said pieces, said wedge piece also including a second face inclined downwardly and inwardly to mate with said first face whereby to hold the wedge piece firmly in said support piece against relative longitudinal movement.

**6 Claims, 12 Drawing Figures**



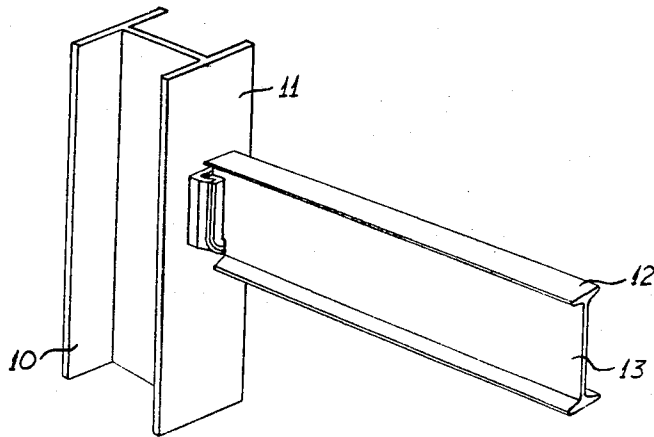


FIG. 1

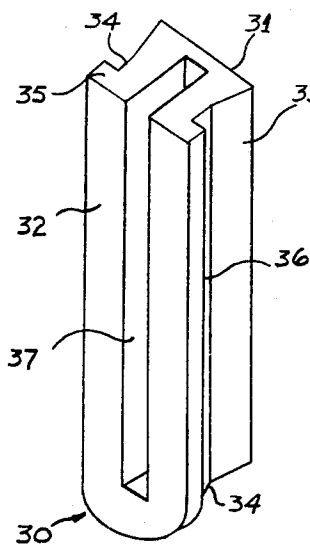


FIG. 3

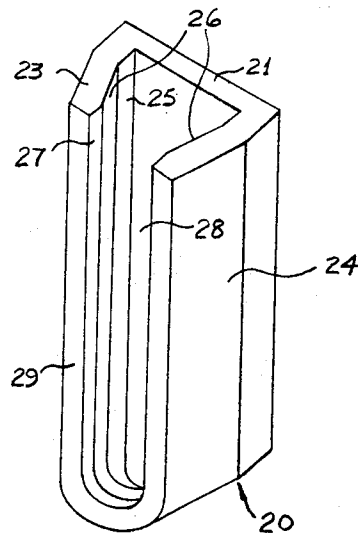


FIG. 2

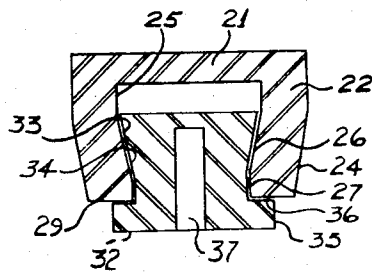


FIG. 4

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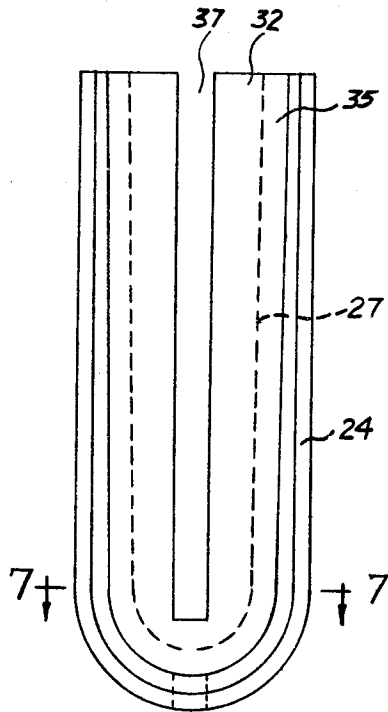


FIG. 5

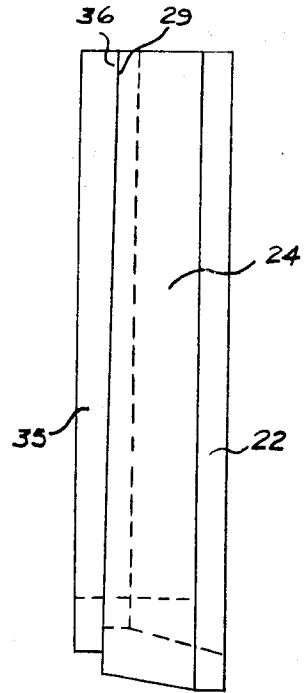


FIG. 6

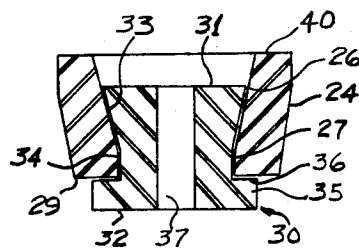


FIG. 7

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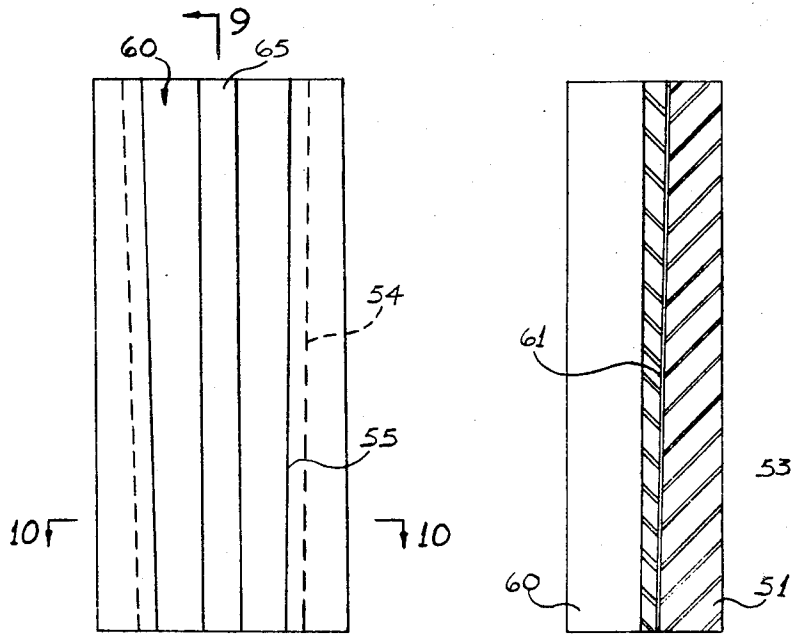


FIG. 8

FIG. 9

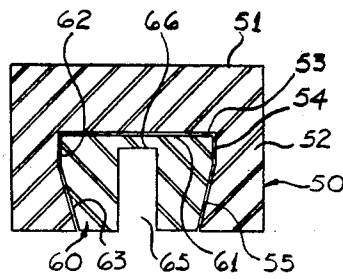


FIG. 10

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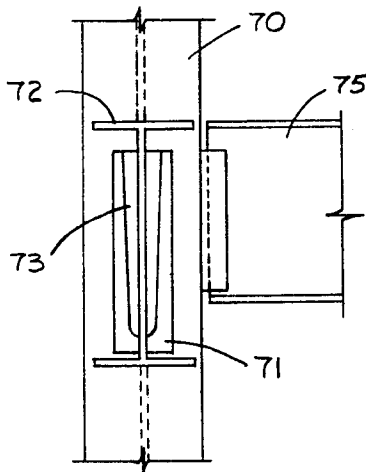


FIG. 11

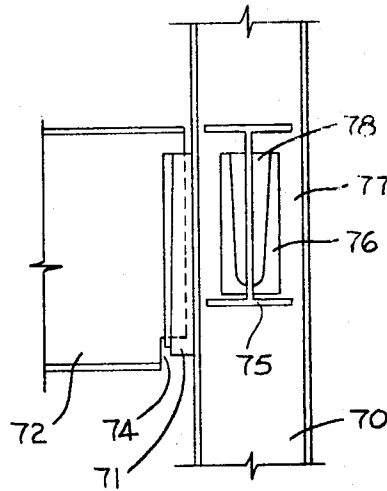


FIG. 12

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## CONNECTOR FOR STRUCTURAL STEEL

This invention relates to a connector assembly for structural steel members, particularly for joining various structural steel members together to form a building or similar structure.

At the present time when a building is fabricated with a steel framework, each of the individual structural steel members is shown on drawings and the joints between each of these members are detailed. In addition, calculations are made to determine the loads to be carried at each of these joints and the joints are constructed to carry these loads. This requires a tremendous amount of work in the drafting office of the structural steel company. Even after the calculations have been done, a considerable amount of work is involved in determining how many bolts or rivets are required to make the connection and then the drawing must show the exact location of each of the holes so that the bolts or rivets can be placed in the structure easily during erection.

These finished drawings are then sent to the shop where the various structural steel members are cut to length and the location of the holes marked and drilled. On the site, when the members are being erected a considerable amount of time and skill is required in positioning the members and holding them in this position long enough so that the bolts or rivets can be inserted to complete the connection.

It will be readily evident that this is a very long, tedious and expensive operation, yet this is the manner in which most steel buildings are constructed today.

Attempts have been made in the past to overcome this difficulty and provide a simpler means for connecting structural members together. One such attempt is described in Stromberg, U.S. Pat. No. 2,008,087, issued July 16, 1935. In this old patent an assembly is described consisting of a tapered plate welded to the end of a small structural member and this plate is designed to be inserted into a supporting socket having converging sides which mate with the tapered sides of the plate. It will be seen that the tapered plate is held between the converging sides of the socket so that there is little or no relative movement between the two members being joined in a vertical or lateral direction. However, since the tapered plate must fit into the socket, there must be some play with the result that the member to which the tapered plate is connected can move longitudinally and it will be readily evident that if this play is permitted in all of the members making up the structure, the resulting structure is not rigid.

Another serious disadvantage of the prior art connector assembly is that no erection clearance has been provided for inserting the tapered plate into the socket and this can be a very serious problem when large structural members are being positioned in a highrise structure.

It is therefore, an object of the present invention to overcome the deficiencies in the prior art connector assembly and provide an assembly which can be easily assembled while providing a rigid structural steel framework.

The connector assembly of this invention includes a support piece which can be rigidly connected by a rear surface thereof to a vertical face of a structural steel member. This support piece has a pair of outwardly

projecting side walls defining surfaces that converge outwardly to form a frontal slot therebetween. These converging surfaces also converge downwardly to cause the slot to become a retaining socket. The support piece is also provided with a face which is inclined downwardly and outwardly.

The second component of the invention is a wedge piece which can be rigidly connected via a rear surface thereof to an end of a second structural steel member and is adapted for interlocking engagement with the above mentioned socket. This wedge piece has a pair of walls defining surfaces that diverge outwardly and converge downwardly to mate with the above mentioned converging surfaces of the support piece in a wedging action so as to prevent lateral movement between the support piece and the wedge piece. This wedge piece also includes a face which is inclined downwardly and inwardly to mate with the above mentioned downwardly and outwardly inclined face of the support piece, thereby holding the wedge piece firmly in the support piece against relative longitudinal movement.

The support piece can be fabricated with a rear wall joining the two outwardly projecting side walls or this rear wall can be eliminated and the two side walls can be joined at the bottom by means of a bottom wall. This bottom wall can be square or rounded and it is, of course, possible to provide both a bottom wall and rear wall for the support piece.

The downwardly and outwardly inclined face of the support piece can either be the front face of the piece or the outer face of the rear wall.

The wedge piece is preferably provided with a slot extending from the rear surface thereof, into which the web of a structural steel beam fits and it can also have laterally extending flanges forming extensions of its rear surface. The frontal faces of these laterally extending flanges can be inclined downwardly to mate with the inclined frontal face of the support piece. When the support piece is provided with an inclined face on the rear wall, a corresponding incline can be provided on the front face of the wedge piece.

The following is a description by way of example of certain embodiments of the present invention, reference being had to the accompanying drawings in which:

FIG. 1 is a perspective view of a typical structural steel connection employing the connector assembly of the present invention;

FIG. 2 is a perspective view of one embodiment of a support piece of the invention;

FIG. 3 is a perspective view of a corresponding wedge piece according to the invention;

FIG. 4 is a sectional view through the support and wedge pieces of FIGS. 2 and 3 in the assembled position;

FIG. 5 is a front elevation of another embodiment of the invention showing a support piece and wedge piece in assembled position;

FIG. 6 is a side elevation of FIG. 5;

FIG. 7 is a sectional view through line 7—7 of FIG. 5;

FIG. 8 is a front elevation of yet another embodiment of the invention showing a support piece and wedge piece in assembled position;

FIG. 9 is a sectional view through line IX—IX of FIG. 8;

FIG. 10 is a sectional view through line X—X of FIG. 8;

FIG. 11 is a front elevation of an assembly showing the use of the connectors of the invention; and

FIG. 12 is an end elevation of the view according to FIG. 11.

FIG. 1 shows a column 10 having a flange face 11 and a support piece A is welded to this face 11. An I-beam 12 with a web 13 having a wedged piece B according to this invention welded thereto is shown connected to the column 10.

FIG. 2 shows one embodiment of a support piece according to this invention. From this it will be seen that the support piece 20 includes a back wall 21 and short side wall portions 22 perpendicular to the back wall 21, these perpendicular portions 22 merging into outwardly converging wall portions 23. The outwardly converging wall portions 23 have outwardly converging inner faces 26 and outwardly converging outer faces 24, as well as inner edge faces 27 perpendicular to back wall 21 and defining a frontal opening. The inner faces 26 and edge faces 27 also converge downwardly to form a retaining socket therebetween and are joined at the bottom by curved portions to form a U-shaped socket. The wall portions 23 also have front edge faces 29 which are inclined downwardly and outwardly.

Short inner faces 25 perpendicular to back wall 21 provide an erection clearance to simplify insertion of the wedge piece.

The wedge piece 30 shown in FIG. 3 mates with the support piece 20 of FIG. 2 as illustrated in FIG. 4. This wedge piece 30 includes a front face 31, a rear face 32 and side walls having faces 33 which diverge outwardly towards front face 31. The side walls also include parallel faces 34 and these faces 33 and 34 all converge downwardly to mate with faces 26 and 27 of the support piece 20 in assembled position. Laterally extending flanges 35 are provided adjacent rear face 32 and the frontal faces 36 of these flanges taper downwardly towards the rear of wedge piece 30 to mate with the tapering faces 29 of support piece 20. The wedge piece 30 is also provided with a slot 37 extending therethrough to receive a web of a structural steel beam. The particular slot shown in this Figure does not extend all the way to the bottom of the wedge piece and this means that a small recess must be cut out of a beam flange to accommodate the wedge piece.

Because of this arrangement of tapering faces, it will be seen that the wedge piece 30 connected to the end of a beam can easily be set into the socket of support piece 20 fixed to a column face and allowed to drop down into position. Then, when the structural members are properly aligned the wedge can be driven down into the socket so that the two structural components are rigidly joined together by contacting metal faces in both lateral and longitudinal directions.

FIGS. 5, 6 and 7 show a similar embodiment to that described in FIGS. 2, 3 and 4 but with the rear wall 21 of support piece 20 eliminated. This means that the rear faces 40 of the side walls are welded directly onto the face of a column. FIG. 5 also quite clearly illustrates the gradual convergence of the mating side walls of the support piece and wedge piece while FIG. 6 clearly illustrates the gradual incline of the mating faces between flange 35 and frontal faces 29 of the support piece 20. The angle of these converging and inclined faces is normally quite small, eg. about  $\frac{1}{2}^\circ$  with respect to a vertical plane.

Another embodiment of the invention is illustrated in FIGS. 8, 9 and 10 and in this arrangement the support piece 50 has a rear wall portion 51 for attachment to a structural steel column and projecting side walls 52. A socket is formed consisting of rear face 53, parallel side faces 54 and outwardly converging faces 55. It will be seen from FIG. 8 that faces 54 and 55 converge downwardly and it will also be seen from FIG. 9 that the rear face 53 is inclined downwardly and outwardly.

The wedge piece 60 is formed with a front face 61, parallel side faces 62 and rearwardly converging side faces 63. The front face 61 is inclined to mate with inclined face 53 of support piece 50 while side faces 62 and 63 converge downwardly to mate with faces 54 and 55 of support piece 50. The wedgepiece also includes a slot 65 to receive the web of a structural steel beam.

In this particular arrangement it will be seen that no bottom closure has been provided for either the support piece 50 or the wedgepiece 60, the side walls of the support piece being joined only by the rear wall 51 and the portions of the wedge piece 60 joined by the narrow portions 66. Since the slot 65 is open at both top and bottom in this arrangement, it can be fitted at any location along the end of a beam web and no special cut-outs in the web or flange are necessary.

A typical detail of a beam to column connection is shown in FIGS. 11 and 12. The column 70 has a support piece 71 welded to a flange face and a beam 72 is connected to support piece 71 via wedge piece 73. A recess 74 is cut in the bottom corner of beam 72 to accommodate the wedge piece 73.

A second beam 75 is shown connected to a web face 77 of column 70. For this connection a support piece 76 is welded to web face 77 and a corresponding wedge piece 78 is attached to the end of beam 75.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. A connector for structural steel members comprising in combination:
  - a. a support member having a rear surface for rigid connection to a vertical face of a first structural steel member, said support member comprising first and second outwardly projecting side walls including portions defining first surfaces which extend outwardly and converge to form a frontal slot therebetween, downwardly extending portions of said surfaces forming said slot converging to form a retaining socket, said support member further including a first face inclined downwardly and outwardly;
  - b. a wedge member for interlocking with said support member and including a rear surface for rigid connection to an end of a second structural steel member, said wedge member further comprising first and second side walls defining surfaces which diverge outwardly for mating with said first surfaces of said support member, said side walls being wedgingly received in said frontal slot to prevent lateral movement between said members, said wedge member further including a second face which is inclined inwardly and downwardly to mate with said first face of said support member to maintain the wedge member firmly in engagement with said support member and thereby prevent

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relative longitudinal motion between said members;

the front edge faces of the side walls of the support member being inclined downwardly and outwardly, and the side walls of said wedge member including laterally extending flanges, said flanges having downwardly and inwardly inclined frontal faces for mating with the front edge faces of the support member, the side walls of said support member further including further portions intermediate said surface defining portions and the rear surface of the support member for providing an erection clearance at the rear of the said socket for accommodating the portion of the wedge member extending beyond the flanges when the wedge member is initially inserted into the socket.

2. An assembly according to claim 1 wherein the outwardly projecting side walls of the support member are

joined at their rear edges by a connecting wall.

3. An assembly according to claim 2, wherein the connecting wall has a downwardly and outwardly inclined front face and said wedge member has a downwardly and inwardly inclined front face to mate with the connecting wall of the support member.

4. An assembly according to claim 1 wherein the wedge member includes a slot to receive the end of a beam web.

5. An assembly according to claim 1 wherein the side walls of the support member are joined at the bottom.

6. An assembly as claimed in claim 1 wherein said support member is integral with the vertical face of said first structural steel member and said wedge member is integral with the end of said second structural steel member.

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