# United States Patent

[11] 3,628,300



[72] Inventor Nariyoshi Tsurumi
Tokyo, Japan



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[73] Assignee Hitachi Shipbuilding and Engineering Co., Ltd.
Osaka, Japan



[32] Priorities June 28, 1969
[33] Japan
[31] 44/51306;
Apr. 25, 1970, Japan, No. 45/35555


[54] **JOINT BETWEEN H-SHAPED MEMBERS AND METHOD FOR PRODUCING THE JOINT**
15 Claims, 14 Drawing Figs.


[52] U.S. Cl. ..... 52/721, 29/155, 52/726, 287/189.36 B
[51] Int. Cl. ..... E04c 3/06, B23p 17/00
[50] Field of Search ..... 287/2, 108, 189.36 R, 189.36 B; 52/726, 729; 61/53; 29/155 R, 155 C



[56] References Cited

UNITED STATES PATENTS

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|---|---|---|---|
| 1,688,949 | 10/1928 | Wait | 287/189.36 R |
| 2,708,828 | 5/1955 | Pruyn | 52/726 |



*Primary Examiner*—John E. Murtagh
*Attorney*—Dawson, Tilton, Fallon & Lungmus



ABSTRACT: Method for joining two H-shaped steel members each provided with longitudinal cutouts in a web and in each end of opposite flanges by using in combination a joint having a web and flanges to be fitted into the cutouts. After the H-shaped steel members and the joint are fitted together, the flanges of the H-shaped steel members and the joint in engagement with each other are welded together.

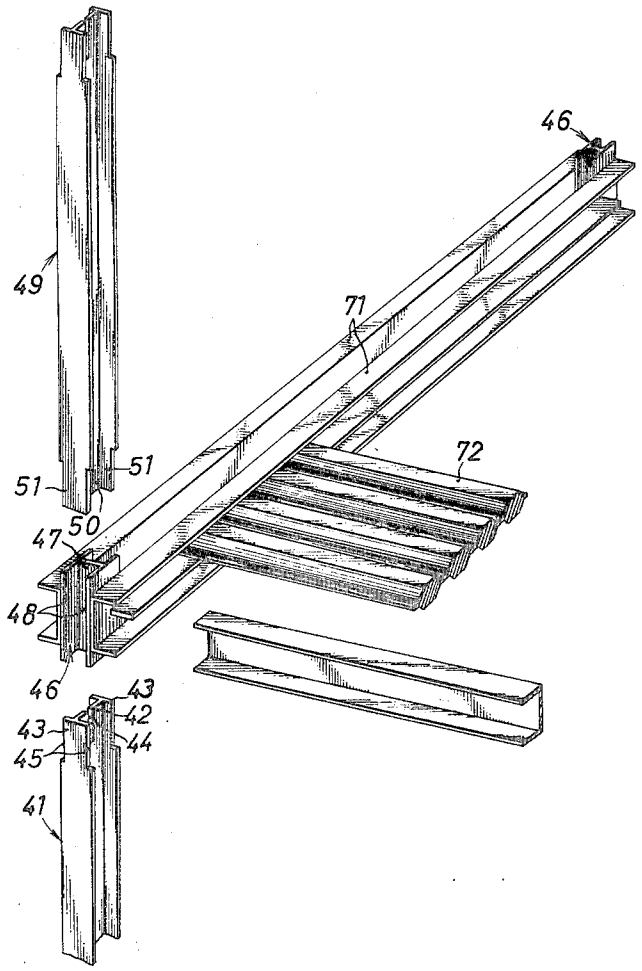



FIG. 1

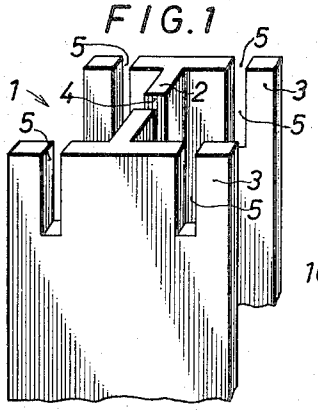


FIG. 3

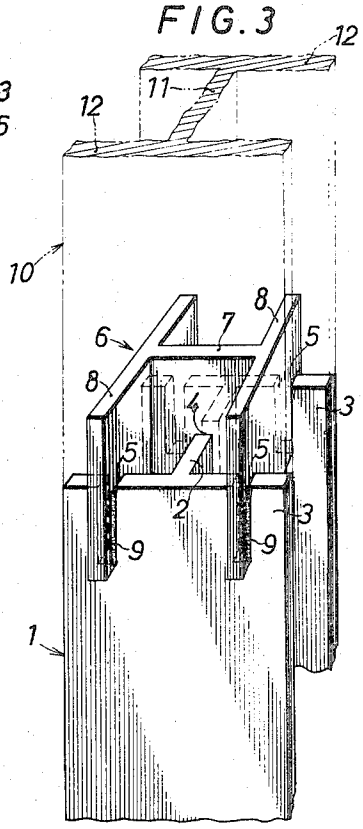


FIG. 4

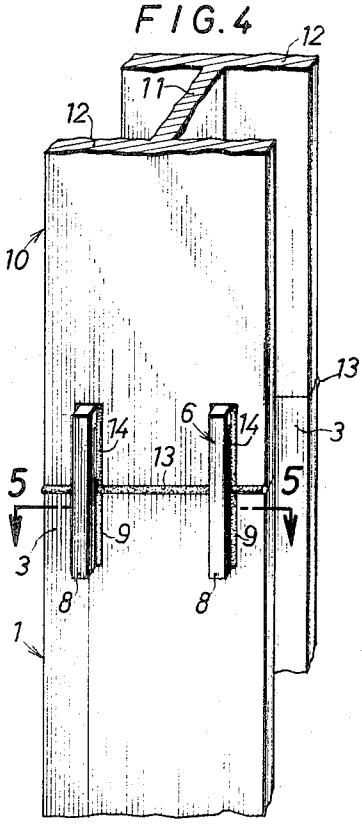


FIG. 2

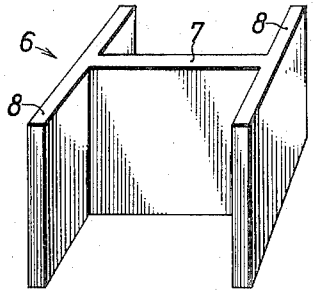


FIG. 5

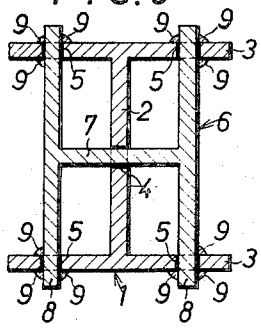


FIG. 6

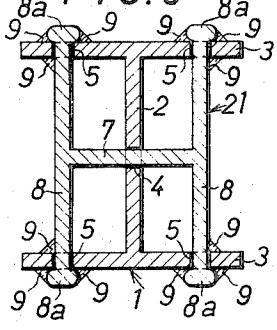


FIG. 8

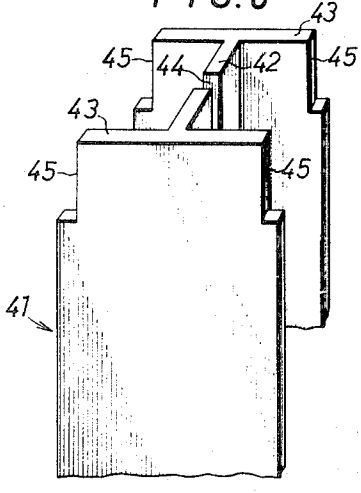


FIG. 7

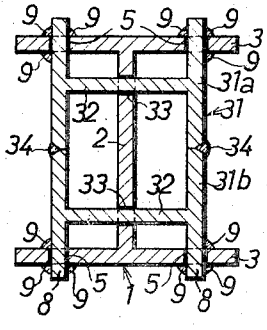


FIG. 9

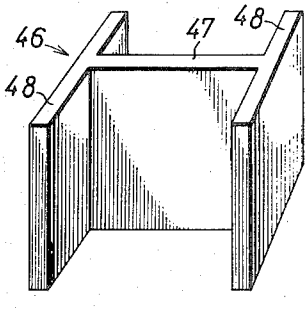


FIG. 10

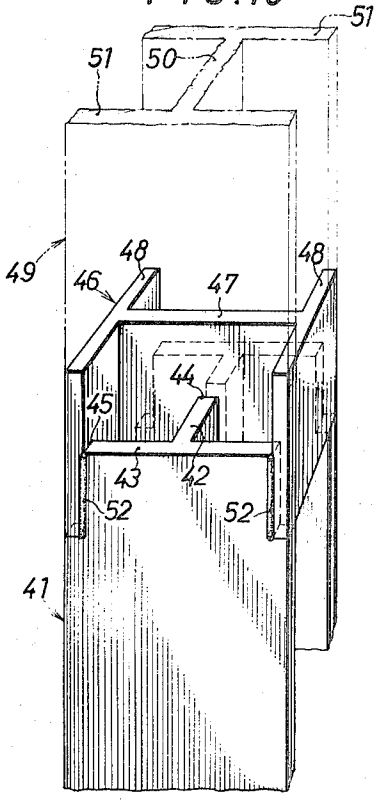



FIG. 11

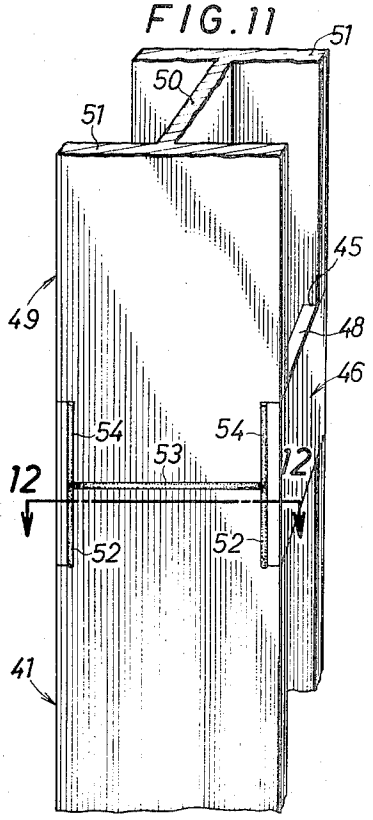



FIG. 12

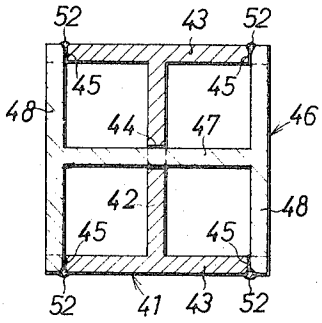



FIG. 13

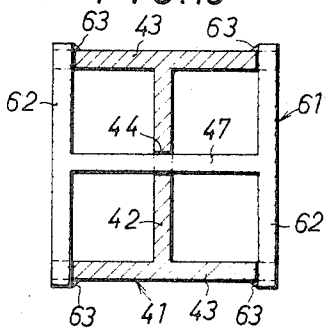
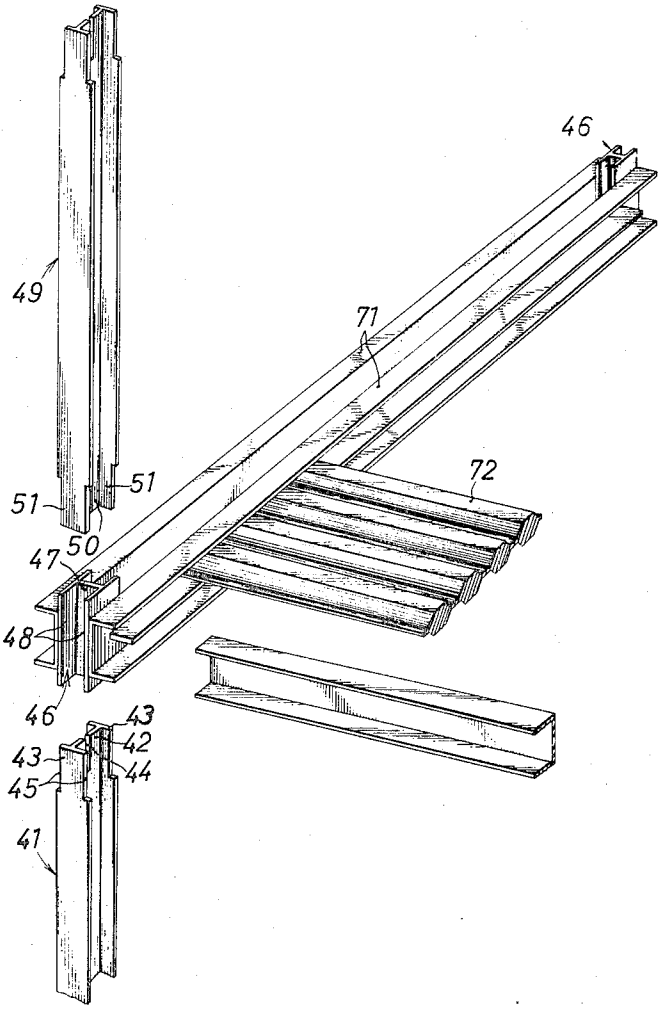



FIG. 14



# JOINT BETWEEN H-SHAPED MEMBERS AND METHOD FOR PRODUCING THE JOINT

## BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a method for joining H-shaped steel members and more particularly to a method for joining in the longitudinal direction H-shaped steel members which are used as columns in framework structures for tall buildings.

2. Description of the Prior Art

In joining H-shaped steel members conventionally known is a method in which the webs and flanges at the ends of the members to be joined together are fitted with gusset plates extending over both ends and the steel members are connected together by rivets or bolts and nuts at the construction site. However, this method is not only poor in efficiency and troublesome but it is also difficult to effect connection with high accuracy since joining operation has to be carried out while an H-shaped steel is hoisted by a crane or the like. For instance, the webs of the H-shaped steel members butted against each other may not be aligned correctly, with the result that perfect connection for direct transmission of a load is not always achieved. In addition, since it is nearly impossible to produce all H-shaped steel members in exactly the same shape and dimensions, it is difficult to snagly fit a flat gusset plate to each flange surface of the two H-shaped steel members to be joined together when they are employed to construct a framework of building, this making it almost infeasible to carry out a perfect construction work. Furthermore it is known to bring the respective webs of the H-shaped steel members to be jointed into fitting contact with each other and weld their flanges together without using gusset plates, but this method can not achieve satisfactory joining strength due to the fact that the length of the welds is not sufficient. Particularly in the case where the H-shaped steel members are used as columns of buildings, there is a need to effect metal-to-metal contact between the sections at the junction so as to insure transmission of an upper load to the lower structure. This is of an increasing importance with taller buildings. However, in accordance with a conventional method, a small clearance is liable to be formed between such sections at the junction, with the result that the upper load is delivered downward through gusset plates or welds to result in possible breakage of the junction and a serious accident. Further in fabricating a framework structure for a building, it is desired to join a beam member to a junction of H-shaped steel columns but with conventional joining method such connection of the beam member at the junction has to be avoided, since the junction is a weak point in the structure.

## SUMMARY OF THE INVENTION

The problems described above have been overcome by assembling H-shaped steel members to be joined and a joint, each of the H-shaped steel members being provided at its end with at least one longitudinal cutout in a web and longitudinal cutouts formed in the opposite sides of flanges in facing relationship and disposed symmetrically of the web, the joint being provided with a web and flanges to be fitted into the cutouts in the webs and flanges of the H-shaped steel members, about half the length of the joint being adapted to be incorporated into each H-shaped steel member. For assemblage, the center of width of web in the joint is fitted into the cutouts in the webs of the H-shaped steel members to be joined together and the opposite ends of flanges of the joint into the cutouts in the opposite flanges of the H-shaped steel members, the H-shaped steel members butting against each other. The butting portions of the H-shaped steel members and the junctions of the H-shaped steel members with the flanges of the joint are welded together. To carry out welding operation, one half side of the joint may be welded to one H-shape steel member previously in a factory and then at a construction steel member previously in a factory and then at a construction sit the other H-shaped steel member may be fitted to the joined body to weld it to the joint and the first H-shaped steel member. Alternately, H-shaped steel members to be jointed together and joint may be carried separately to a construction site, where they are brought together for welding.



## BRIEF DESCRIPTION OF THE DRAWINGS

The present invention will become more apparent from the following description with reference to the accompanying drawings, in which:

FIG. 1 is a perspective view showing an end of an H-shaped steel member to be joined by the method of the present invention;

FIG. 2 is a perspective view showing a joint in accordance with the present invention;

FIG. 3 is a perspective view showing the H-shaped steel member in FIG. 1 and the join in FIG. 2 as they are joined and welded together;

FIG. 4 is a perspective view showing the H-shaped steel members joined together in accordance with the method of the present invention;

FIG. 5 is a view in cross section taken along the line 5—5 in FIG. 4;

FIG. 6 is a view in cross section corresponding to FIG. 5 and showing the H-shaped steel members joined together by a joint which has protuberances at the ends of flanges;

FIG. 7 is a view in cross section corresponding to FIG. 5 and showing the H-shaped steel members joined together by a joint which has two webs;

FIG. 8 is a perspective view showing the end of an H-shaped steel member to be joined in accordance with another method of the present invention;

FIG. 9 is a perspective view showing a joint to be joined with the H-shaped steel member illustrated in FIG. 8;

FIG. 10 is a perspective view showing the H-shaped steel member in FIG. 8 and the joint in FIG. 9 as they are fitted and welded together;

FIG. 11 is a perspective view showing H-shaped steel members in FIG. 8 as they are joined together;

FIG. 12 is a view in cross section taken along the line 12—12 in FIG. 11;

FIG. 13 is a view in cross section corresponding to FIG. 12 and showing H-shaped steel members joined together by a joint which has flanges whose width is such that the flanges project slightly outward from the flanges of the H-shaped steel members when fitted thereto; and

FIG. 14 is a perspective view showing an embodiment in which a beam is joined with H-shaped steel members by means of a joint, the H-shaped members being shown in separated form.

## DESCRIPTION OF THE PREFERRED EMBODIMENTS

An H-shaped steel member 1 shown in FIG. 1 comprises a web 2 and flanges 3, the web 2 being formed with a longitudinal cutout 4 at the middle of its width. Formed in each of the flanges 3 in facing relationship are longitudinal cutouts 5 disposed close to the opposite ends of the flange 3 symmetrically of the web 2.

A joint 6 shown in FIG. 2 is H-shaped in cross section the same as the H-shaped steel member and provided with a web 7 and flanges 8, the length of the joint 6 being determined in view of the strength at the junction. The depth of the cutouts 4 and 5 is about half of the length of the joint 6.

For assemblage of the H-shaped steel member 1 with the joint 6, it will be seen in FIG. 3 that the lower half of the joint 6 is fitted coaxially into the end of one of the H-shaped steel members to be jointed together, utilizing the cutouts 4 and 5, the webs of the joint 6 and the steel member 1 being at a right angle with each other (see FIG. 5). When the joint 6 and the H-shaped steel member 1 are fitted together in this manner, the flanges 8 of the former project slightly outward from the flanges 3 of the latter. The external parts of the junctions of

the flanges 3 and 8 are then welded together. The welds are designated at 9.

Next, the other H-shaped steel member 10 having an end of the same shape as the end of the H-shaped steel member 1 is brought into fitting engagement with the upper half of the joint 6 in the same manner as with the foregoing as shown in a chain line in FIG. 3 for connection with the joint 6. At this time, the web 2 of the H-shaped steel member 1 butts against the web 11 of the H-shaped steel member 10 and the flanges 8 of the H-shaped steel member 1 against the flanges 12 of the H-shaped steel member 10. To insure such butting contact, the cutouts 4 and 5 of the H-shaped steel members 1 and 10 may preferably be made slightly longer than the half of length of the joint 6. Finally, the butting portions of the flanges 3 and 12 are welded together and the external parts of the junctions between the flanges 12 of the H-shaped steel member 10 and the flanges 8 of the joint 6 which are projecting outwardly of the flanges 12 are welded. Designated at 13 and 14 are welds thus provided.

In making the above assemblage, the cutouts 4 and 5 in the H-shaped steel members 1 and 10 serve as guide for the fitting engagement of the web 7 and flanges 8 of the joint 6 with the cutouts, so that the fabrication can be effected smoothly and readily with a very small error of connection. In addition, a very great total length of the welds insures strong welding effects.

FIG. 6 illustrates a modified embodiment of joint. The joint 21, being provided with protuberances 8a at the opposite ends of flanges 8, permits more reliable welding operation.

Another modified embodiment of joint is shown in FIG. 7. Between opposite flanges 8, the joint 31 has two webs 32 which are disposed symmetrically with respect to the middle of width of the flanges 8. The ends of webs 2, 11 of the H-shaped steel members 1, 10 will be formed with two cutouts 33 for fitting engagement with webs 32 of the joint 31. The joint 31 is made up of two H-shaped steel members which are jointed with each other at one side end of the respective flanges by being welded in horizontal direction. The numeral 34 indicates the weld. The use of the joint 31 in joining the H-shaped steel members 1 and 10 results in a junction of a greater strength.

FIGS. 8 to 12 show another embodiment of this invention. An H-shaped steel member 41 in FIG. 8 comprises a web 42 and flanges 43, a longitudinal cutout 44 being formed at the middle of width of the web 42. Unlike the groovelike cutouts 5 in the H-shaped steel member 1 in FIG. 1, longitudinal cutouts 45, each of which is open at one side, are formed at the opposite ends of the flanges 43.

A joint 46 seen in FIG. 9 is similar to the joint 6 in FIG. 2 in that it is of H-shaped cross section and in that it comprises a web 47 and flanges 48. However, as an important feature of this embodiment, the joint 46 as apparent from FIG. 12 is of such dimensions that when joined with the H-shaped steel member 41 the joint 46 forms a square along with the member 41.

The assemblage and welding of the H-shaped steel member 41 and the joint 46 and further assemblage and welding of a resultant joined with body with the other H-shaped steel member 49 provided with a web 50 and flanges 51 will be carried out substantially in the same manner as already described with reference to FIGS. 3 to 5, the procedures to be followed being readily understood from FIGS. 10 to 12. In these figures, numerals 52, 53 and 54 indicate welds. In these figures, numerals 52, provided in this embodiment is V groove weld.

The junction described above is less likely to deteriorate the appearance since the joining portions have no external projections.

FIG. 13 shows a joint 61, another modification, which has flanges 62 whose width is such that the flanges project slightly outward from the flanges 43 of the H-shaped steel member 41 when brought into engagement therewith. In this case, fillet welds 63 are provided.

FIG. 14 illustrates framework construction in which the H-shaped steel members are to be joined with beams 71 by utilizing a joint 46, the beam 71 further supporting floor members 72. In the case where H-shaped steel members 41 and 49 joined together by the joint 46 are to be used as a column with which beams will be connected, the beams 71 may be connected to the flanges 48 of the joint 46 on their side faces which are positioned on the opposite sides of the webs of the H-shaped steel members 41 and 49 when the joint 46 is connected with the members 41 and 49. Employed as the beams 71 are two channels whose opposite ends are welded to the external sides of flanges 48 of the joints 46. Welding may be conducted at the construction site, or the joints 46 and the beams 71 may be welded together at a factory prior to the joining of the H-shaped steel members 41 and 49. If there is a need to join floor members 72, the floor members 72 may be fixed to the beams 71. This can of course be performed in a factory in advance.

Because beams 71 can be very readily fixed to the planes on the sides of webs of H-shaped steel members 41, 49 by utilizing the faces of flanges 48 of the joint 46, framework construction for tall buildings can be carried out from a floor to an adjacent upper floor in sequence. The present method makes it possible, for instance, to furnish interior fittings on a floor while framework is being constructed on upper floors, hence a substantial reduction of construction period can be achieved.

Because the H-shaped steel members can be joined together with a great ease at a construction site in accordance with this invention, troublesome procedures conventionally experienced such as application of gusset plates and connection by rivets or bolts and nuts can be dispensed with to insure savings in labor and marked reduction of construction period. In addition, since the H-shaped steel members are joined together with an intermediate joint which is approximately identical therewith in section but is disposed in a different direction, the junction is extremely high in strength and well capable of withstanding stress such as torsion. The fact that the H-shaped steel members are in contact with each other at respective ends produces a good result of transmitting the load directly through the junction. For these reasons, when the H-shaped steel members are used as columns in a framework structure of a building, the junctions do not impair but rather serve to increase the strength of the structure. Connection of beams to the junctions which has conventionally been difficult to make is also insured.

What I claim as my invention is:

1. A method for joining H-shaped steel members comprising assembling H-shaped steel members to be joined together and a joint so as to butt said H-shaped steel members, each of said H-shaped steel members being provided at its end with at least one cutout in a web cutouts formed in respective flanges symmetrically on the opposite side of said web, said joint being provided with at least one web and two flanges to be fitted into said cutouts and welding the butting portions of the flanges of said H-shaped steel members and junctions of the flanges of said H-shaped steel members with the flanges of said joint.

2. The method as claimed in claim 1 wherein the depth of said cutouts is at least half the length of said joint.

3. The method as claimed in claim 1 wherein said cutouts in each flange of said H-shaped steel member are positioned on the opposite sides of said web and formed in the shape of groove inwardly of the opposite edges of said flange.

4. A method for joining H-shaped steel members comprising assembling H-shaped steel members to be joined together and a joint so as to butt said H-shaped steel members, each of said H-shaped steel members being provided at its end with at least one cutout in a web and cutouts formed in respective flanges symmetrically on the opposite sides of said web, said joint being provided with at least one web and two flanges to be fitted into said cutouts and having such a width that when said flanges are fitted into each other said joint slightly projects outward from the flanges of said H-shaped steel members and welding the butting portions of the flanges of said H-shaped

steel members and junctions of the flanges of said H-shaped steel members with the flanges of said joint.

5. The method as claimed in claim 4 wherein each flange of said joint is provided with protuberances each formed along the entire length of each end thereof.

6. A method for joining H-shaped steel members comprising assembling H-shaped steel members to be joined together and a joint so as to butt said H-shaped steel members, each of said H-shaped steel members being provided at its end with cutouts in a web symmetrically of the middle thereof and cutouts formed in respective flanges symmetrically on the opposite sides of said web, said joint being provided with two webs and two flanges to be fitted into said cutouts and welding the butting portions of the flanges of said H-shaped steel members an junctions of the flanges of said H-shaped steel members with the flanges of said joint.

7. A method for joining H-shaped steel members comprising steps of forming the end of each of two H-shaped steel members to be joined together a cutout in the middle of a web and cutouts in opposite flanges symmetrically on the opposite sides of the web; disposing a joint of H-shaped cross section coaxially with one of said H-shaped steel members with a web thereof intersecting said web at a right angle to bring the web and flanges in the lower half of said joint into fitting engagement with the cutouts in said H-shaped steel member, externally welding the junction of the web of said H-shaped steel member and the web of said joint; fitting the upper half of said joint into the cutouts of the other H-shaped steel member to butt both H-shaped steel members; and externally welding the butting portions of the flanges of aid H-shaped steel members and the junctions of the flanges of said joint with the flanges of said H-shaped steel member joined later.

8. A method for joining H-shaped steel members comprising assembling H-shaped steel members to be joined together and a joint so as to butt said H-shaped steel members, each of said H-shaped steel members being provided at its end with at least one cutout in a web and cutouts opened at a side and formed at both edges of respective flanges symmetrically of said web, said joint being provided with at least one web and two flanges to be fitted to said cutouts and having such a width that when said flanges are engaged with each other said joint does not project outwardly from the flanges of said H-shaped steel members and welding the butting portions of the flanges of said H-shaped steel members and junctions of the flanges of said H-shaped steel members with the flanges of said joint.

9. The method as claimed in claim 8 wherein the welding is conducted to provide V groove welds.

10. The method as claimed in claim 8 wherein the flange of said joint being provided with a beam member welded to its outer face in advance.

11. The method as claimed in claim 8 wherein floor members are welded to said beam member in advance.

12. A method for joining H-shaped steel members comprising steps of forming in the end of each of two H-shaped steel members to be joined together a cutout in the middle of a web and cutouts at both edges of opposite flanges symmetrically of the web; welding in advance a beam member to the outer face of at least one flange of a joint of H-shaped cross section; disposing said joint coaxially with one of said H-shaped steel members with a web thereof intersecting said web at a right angle to bring the web and flanges in the lower half of said joint into fitting engagement with said cutouts in said H-shaped steel member without projecting said joint outward; externally welding the junction of the web of said H-shaped steel member and the web of said joint; fitting the upper half of said joint to said cutouts of the other H-shaped steel member without projecting said joint outward to thereby butt both H-shaped steel members; and externally welding the butting portions of the flanges of said H-shaped steel members and the junctions of the flanges of said joint and the flanges of said H-shaped steel member joined later.

13. A structure comprising two H-shaped steel members and a joint, each of said H-shaped steel members being provided at its end with at least one cutout in a web and cutouts formed in respective flanges symmetrically on the opposite sides of said web, said joint having a length not exceeding twice the depth of said cutouts, each half of said joint being in fitting engagement with the cutouts of each H-shaped steel member, said H-shaped steel members being welded together in butting contact with each other.

14. A structure comprising two H-shaped steel members, a joint of H-shaped cross section and a beam member, each of said H-shaped steel members being provided at its end with at least one cutout in a web and cutouts opened at a side and formed at both edges of respective flanges symmetrically of said web, said joint having a length not exceeding twice the depth of said cutouts, each half of said joint being in fitting engagement with the cutouts of each H-shaped steel member, said H-shaped steel members being welded together in butting contact with each other, at least one flange of said joint being provided with a beam member fixed to its outer face.

15. A structure comprising two H-shaped steel members and a joint, each of said H-shaped steel members being provided at its end with two cutouts formed in its web symmetrically with respect to the middle of width thereof and cutouts formed in each of its flange symmetrically on the opposite sides of the web, said joint being provided with two webs and two flanges to be fitted into said cutouts and having a length not exceeding twice the depth of said cutouts, said two H-shaped steel members being welded together in butting contact with each other with each half of said joint fitted in said cutouts of each H-shaped steel member.

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