

DESCRIPTION
SECONDARY BEAM JOINING METHOD,
SECONDARY BEAM JOINT DETAIL, AND SUPPORT MEMBER

Technical Field

[0001] The present disclosure relates to a secondary beam joining method, a secondary beam joint detail, and a supporting member.

Background Art

[0002] Buildings such as office blocks are applied with building structures to form a building framework. Generally, such building structures include structural members such as primary beams, columns, or walls, and also include secondary beams. Secondary beams are configured from steel H-beams, and are joined to the structural members. Herein, "secondary beam" refers to a beam member that is joined to a structural member at at least one of its two length direction ends, and is employed to support vertical force of the weight of the building itself and objects placed thereon, and to transmit this force to the structural member. "Primary beam" refers to a beam member that resists horizontal force acting on the building from earthquakes and wind. Members that are joined to secondary beams and that support vertical force similarly to secondary beams are generally referred to as "secondary-beam interconnectors"; however, for the purposes of the present invention secondary beams encompass such secondary-beam interconnectors. In cases in which the present invention is applied to secondary-beam interconnectors, secondary beams are included in the structural members.

[0003] Join portions between secondary beams and structural members employ web bolt joints that require little processing and are easily implemented on-site. Web bolt joining refers to joining only the web of the secondary beam to the structural member using bolts, without joining an upper flange or a lower flange of the secondary beam to the structural member. Web bolt joints are achieved by pin joints that only transmit shear force of the secondary beam to the structural member, and the joint component between the secondary beam and the structural member does not offer resistance to bending moment.

[0004] Fig. 23 schematically illustrates a secondary beam joint detail configured by pin joints between a secondary beam and structural members. Fig. 24 schematically illustrates a secondary beam joint detail configured by semi-rigid joints between a secondary beam and structural members. Fig. 25 schematically illustrates a secondary beam joint detail configured by rigid joints between a secondary beam and structural members. In Fig. 23 to Fig. 25, a secondary beam is labeled with the reference numeral 210, structural members are

labeled with the reference numeral 220, and a slab is labeled with the reference numeral 230. The symbol δ illustrates a secondary beam deflection amount, and the letter M illustrates the magnitude of bending moment of the secondary beam.

[0005] The secondary beam illustrated in Fig. 23 supported by pin joints exhibits greater deflection and bending moment at a central portion of the secondary beam than the secondary beams supported by semi-rigid joints or rigid joints illustrated in Fig. 24 and Fig. 25, which offer resistance to bending moment. Accordingly, the secondary beam cross-section needs to be increased to raise joint rigidity in order to suppress deflection, and a large secondary beam cross-section or a strong secondary beam is required in order to withstand the bending moment. This is a cause of increased secondary beam weight and increased cost per unit weight, pushing up building construction costs as a result.

[0006] In cavernous distribution warehouses, open plan office buildings, and the like, secondary beams with a span length in excess of 10 meters are sometimes employed in order to reduce the number of columns and thereby allow utilization of a larger space. In cases in which such long secondary beams are employed, deflection of the secondary beam central portion is suppressed by employing rigid joints for the joint component between the secondary beam and the structural members, such as by joining the secondary beam web to the structural members by welding or bolting, and also joining an upper flange and lower flange of the secondary beam to the structural members by welding or bolting.

[0007] With such rigid joints, joining the upper flange and the lower flange of the secondary beam to the structural members results in an increase in the number of bolts used, and necessitates additional tasks such as the installation of scaffolding for welders when welding, welding operations, and ultrasound weld testing of weld portions. This is a cause of increased construction costs and lengthier construction times.

[0008] In order to address the above issues, a secondary beam joint detail described in non-patent document 1 involves inserting a contact plate between a lower flange of a secondary beam and a structural member (column). Further, an upper flange of the secondary beam and a slab provided in the vicinity of the structural member are joined together using a shear connector. Compressive force on the secondary beam is transmitted to the structural member through the contact plate, and tensile force from the upper flange of the secondary beam is transmitted to the structural member through steel reinforcement bars arranged within the slab, thereby imparting the joint component between the secondary beam and the structural member with resistance to bending moment. This is achieved under the conditions that the secondary beam is a member that supports vertical force, and that in cases in which the joint component between the secondary beam and the column or other beam

offers resistance to rotation, tensile force acts on the upper flange of the secondary beam in the vicinity of the joint component, and compressive force acts on the lower flange of the secondary beam in the vicinity of the joint component.

[0009] This secondary beam joint detail is capable of suppressing deflection and bending moment at the central portion of the secondary beam in comparison to pin joints in which only the web of the secondary beam is joined to the structural member using bolts.

Moreover, reinforcement of the joint component between the secondary beam and the structural member is simpler than in rigid joints in which the web of the secondary beam is joined to the structural member using welding or bolts and the upper flange and the lower flange of the secondary beam are joined to the structural member using welding or bolts. This enables an increase in construction processes and costs to be suppressed to a minimum.

[0010] Note that non-patent document 1 discloses technology relating to a joining method for a beam and a tubular steel column.

[0011] Non-patent document 1: "Eurocode 4: Design of composite steel and concrete structures – Part 1-1: General rules and rules for buildings" (European Committee for Standardization, December 2004, page 90).

Patent Document 1: Japanese Patent Application Laid-Open (JP-A) No. H07-11706

SUMMARY OF INVENTION

Technical Problem

[0012] In a secondary beam joint detail in which the secondary beam is joined to a structural member, variation in secondary beam and structural member assembly may be expected to cause variation in the width of a gap between a lower flange of the secondary beam and the structural member. The secondary beam joint detail described in non-patent document 1 therefore has an issue in that in cases in which the width of the contact plate is narrower than a gap between the lower flange of the secondary beam and the structural member, the contact plate cannot be press-fitted into the gap, with the result that compressive force cannot be transmitted from the lower flange of the secondary beam to the structural member.

[0013] The provision of plural contact plates of different widths to each other to accommodate variation in gap width may be considered in order to enable compressive force to be transmitted from the lower flange of the secondary beam to the structural member even if variation exists between the width of the gap between the lower flange of the secondary beam and the structural member. However, such an approach invites the issue of increased costs resulting from wasted material and more challenging work.

[0014] In consideration of the above circumstances, an object of the present disclosure is to

enable compressive force to be transmitted from a lower flange of a secondary beam to a structural member while suppressing an increase in costs, even if variation is present in the width of a gap between the lower flange of the secondary beam and the structural member.

Solution to Problem

[0015] A secondary beam joining method according to a first aspect of the present disclosure includes: a joining process of arranging a secondary beam, configured by wide flange beam and extending along a horizontal direction, and a structural member in a state in which a gap is formed in the horizontal direction between a lower flange of the secondary beam and the structural member, and joining the secondary beam to the structural member at an upper side of the gap; a fixing process of inserting into the gap a first wedge component including a first inclined face that faces obliquely upward so as to oppose the structural member in the horizontal direction, and fixing the first wedge component to the lower flange; and a press-fitting process of moving a second wedge component toward a lower side while sliding an obliquely downward-facing second inclined face of the second wedge component against the first inclined face, and press-fitting the second wedge component between the structural member and the first wedge component.

[0016] In the secondary beam joining method according to the first aspect of the present disclosure, as the second wedge component moves toward the lower side while the second inclined face of the second wedge component slides against the first inclined face of the first wedge component, a contact region between the second inclined face and the first inclined face spreads toward the lower side. Thus, the second wedge component gradually moves toward the structural member side, and a combined width of the first wedge component and second wedge component increases. Accordingly, even if variation is present in the width of the gap between the lower flange of the secondary beam and the structural member, the combined width of the first wedge component and second wedge component can be adapted to the width of the gap, and so the first wedge component and the second wedge component can be disposed between the lower flange of the secondary beam and the structural member with a width adapted to the width of the gap. Thus, even if variation is present in the width of the gap between the lower flange of the secondary beam and the structural member, compressive force can be transmitted from the lower flange of the secondary beam to the structural member through the first wedge component and the second wedge component. Further, since there is no need to prepare plural first wedge components and second wedge components with different widths to each other to accommodate variation in the width of the gap, an increase in costs can be suppressed.

[0017] A secondary beam joining method according to a second aspect of the present

disclosure includes: a joining process of arranging a secondary beam, configured by wide flange beam and extending along a horizontal direction, and a structural member in a state in which a gap is formed in the horizontal direction between a lower flange of the secondary beam and the structural member, and joining the secondary beam to the structural member at an upper side of the gap; a fixing process of inserting into the gap a first wedge component including a first inclined face facing obliquely upward so as to oppose the lower flange, and fixing the first wedge component to the structural member; and a press-fitting process of moving a second wedge component toward a lower side while sliding an obliquely downward-facing second inclined face of the second wedge component against the first inclined face, and press-fitting the second wedge component between the lower flange and the first wedge component.

[0018] In the secondary beam joining method according to the second aspect of the present disclosure, as the second wedge component moves toward the lower side while the second inclined face of the second wedge component slides against the first inclined face of the first wedge component, a contact region between the second inclined face and the first inclined face spreads toward the lower side. Thus, the second wedge component gradually moves toward the secondary beam side, and a combined width of the first wedge component and second wedge component increases. Accordingly, even if variation is present in the width of the gap between the lower flange of the secondary beam and the structural member, the combined width of the first wedge component and second wedge component can be adapted to the width of the gap, and so the first wedge component and the second wedge component can be disposed between the lower flange of the secondary beam and the structural member with a width adapted to the width of the gap. Thus, even if variation is present in the width of the gap between the lower flange of the secondary beam and the structural member, compressive force can be transmitted from the lower flange of the secondary beam to the structural member through the first wedge component and the second wedge component. Further, since there is no need to prepare plural first wedge components and second wedge components with different widths to each other to accommodate variation in the width of the gap, an increase in costs can be suppressed.

[0019] A secondary beam joint detail according to a third aspect of the present disclosure includes: a joint component configured to join a secondary beam, configured by wide flange beam and extending along a horizontal direction, with a structural member at an upper side of a gap in a state in which the gap is formed in the horizontal direction between a lower flange of the secondary beam and the structural member; a first wedge component configured to be inserted into the gap and fixed to the lower flange and including a first inclined face that faces

obliquely upward so as to oppose the structural member in the horizontal direction; and a second wedge component that includes an obliquely downward-facing second inclined face configured to contact the first inclined face, and that is configured to be press-fitted between the structural member and the first wedge component.

[0020] In the secondary beam joint detail according to the third aspect of the present disclosure, as the second wedge component moves toward the lower side while the second inclined face of the second wedge component slides against the first inclined face of the first wedge component, a contact region between the second inclined face and the first inclined face spreads toward the lower side. Thus, the second wedge component gradually moves toward the structural member side, and a combined width of the first wedge component and second wedge component increases. Accordingly, even if variation is present in the width of the gap between the lower flange of the secondary beam and the structural member, the combined width of the first wedge component and second wedge component can be adapted to the width of the gap, and so the first wedge component and the second wedge component can be disposed between the lower flange of the secondary beam and the structural member with a width adapted to the width of the gap. Thus, even if variation is present in the width of the gap between the lower flange of the secondary beam and the structural member, compressive force can be transmitted from the lower flange of the secondary beam to the structural member through the first wedge component and the second wedge component. Further, since there is no need to prepare plural first wedge components and second wedge components with different widths to each other to accommodate variation in the width of the gap, an increase in costs can be suppressed.

[0021] A secondary beam joint detail according to a fourth aspect of the present disclosure includes: a joint component configured to join a secondary beam, configured by wide flange beam and extending along a horizontal direction, with a structural member at an upper side of a gap in a state in which the gap is formed in the horizontal direction between a lower flange of the secondary beam and the structural member; a first wedge component configured to be inserted into the gap and fixed to the structural member and including a first inclined face that faces obliquely upward so as to oppose the lower flange; and a second wedge component that includes an obliquely downward-facing second inclined face configured to contact the first inclined face, and that is configured to be press-fitted between the lower flange and the first wedge component.

[0022] In the secondary beam joint detail according to the fourth aspect of the present disclosure, as the second wedge component moves toward the lower side while the second inclined face of the second wedge component slides against the first inclined face of the first

wedge component, a contact region between the second inclined face and the first inclined face spreads toward the lower side. Thus, the second wedge component gradually moves toward the secondary beam side, and a combined width of the first wedge component and second wedge component increases. Accordingly, even if variation is present in the width of the gap between the lower flange of the secondary beam and the structural member, the combined width of the first wedge component and second wedge component can be adapted to the width of the gap, and so the first wedge component and the second wedge component can be disposed between the lower flange of the secondary beam and the structural member with a width adapted to the width of the gap. Thus, even if variation is present in the width of the gap between the lower flange of the secondary beam and the structural member, compressive force can be transmitted from the lower flange of the secondary beam to the structural member through the first wedge component and the second wedge component. Further, since there is no need to prepare plural first wedge components and second wedge components with different widths to each other to accommodate variation in the width of the gap, an increase in costs can be suppressed.

[0023] A supporting member according to a fifth aspect of the present disclosure is employed in a secondary beam joint detail including a joint component configured to join a secondary beam, configured by wide flange beam and extending along a horizontal direction, with a structural member at an upper side of a gap in a state in which the gap is formed in the horizontal direction between a lower flange of the secondary beam and the structural member. The supporting member includes a first wedge component including a first inclined face that faces obliquely upward so as to oppose the structural member in the horizontal direction, and that is configured to be inserted into the gap and fixed to the lower flange, and a second wedge component that includes a second inclined face that faces obliquely downward so as to contact the first inclined face, and that is configured to be press-fitted between the structural member and the first wedge component.

[0024] In the supporting member according to the fifth aspect of the present disclosure, as the second wedge component moves toward the lower side while the second inclined face of the second wedge component slides against the first inclined face of the first wedge component, a contact region between the second inclined face and the first inclined face spreads toward the lower side. Thus, the second wedge component gradually moves toward the structural member side, and a combined width of the first wedge component and second wedge component increases. Accordingly, even if variation is present in the width of the gap between the lower flange of the secondary beam and the structural member, the combined width of the first wedge component and second wedge component can be adapted to the width

of the gap, and so the first wedge component and the second wedge component can be disposed between the lower flange of the secondary beam and the structural member with a width adapted to the width of the gap. Thus, even if variation is present in the width of the gap between the lower flange of the secondary beam and the structural member, compressive force can be transmitted from the lower flange of the secondary beam to the structural member through the first wedge component and the second wedge component. Further, since there is no need to prepare plural first wedge components and second wedge components with different widths to each other to accommodate variation in the width of the gap, an increase in costs can be suppressed.

[0025] A supporting member according to a sixth aspect of the present disclosure is employed in a secondary beam joint detail including a joint component configured to join a secondary beam, configured by wide flange beam and extending along a horizontal direction, with a structural member at an upper side of a gap in a state in which the gap is formed in the horizontal direction between a lower flange of the secondary beam and the structural member. The supporting member includes a first wedge component that includes a first inclined face that faces obliquely upward so as to oppose the lower flange, and that is configured to be inserted into the gap and fixed to the structural member, and a second wedge component that includes a second inclined face that faces obliquely downward so as to contact the first inclined face, and that is configured to be press-fitted between the lower flange and the first wedge component.

[0026] In the supporting member according to the sixth aspect of the present disclosure, as the second wedge component moves toward the lower side while the second inclined face of the second wedge component slides against the first inclined face of the first wedge component, a contact region between the second inclined face and the first inclined face spreads toward the lower side. Thus, the second wedge component gradually moves toward the secondary beam side, and a combined width of the first wedge component and second wedge component increases. Accordingly, even if variation is present in the width of the gap between the lower flange of the secondary beam and the structural member, the combined width of the first wedge component and second wedge component can be adapted to the width of the gap, and so the first wedge component and the second wedge component can be disposed between the lower flange of the secondary beam and the structural member with a width adapted to the width of the gap. Thus, even if variation is present in the width of the gap between the lower flange of the secondary beam and the structural member, compressive force can be transmitted from the lower flange of the secondary beam to the structural member through the first wedge component and the second wedge component. Further,

since there is no need to prepare plural first wedge components and second wedge components with different widths to each other to accommodate variation in the width of the gap, an increase in costs can be suppressed.

Advantageous Effects of Invention

[0027] As described in detail above, the present disclosure enables compressive force to be transmitted from the lower flange of the secondary beam to the structural member while suppressing an increase in costs, even if variation is present in the width of the gap between the lower flange of the secondary beam and the structural member.

BRIEF DESCRIPTION OF DRAWINGS

[0028] Fig. 1 is a front view cross-section of a secondary beam joint detail according to a first exemplary embodiment.

Fig. 2 is an enlarged view of a supporting member and the vicinity thereof in Fig. 1.

Fig. 3 is an exploded perspective view of the supporting member in Fig. 1.

Fig. 4 is a cross-section sectioned along line F4-F4 in Fig. 1.

Fig. 5 is a diagram to explain a secondary beam joining method according to the first exemplary embodiment.

Fig. 6 is a diagram to explain an insertion direction of second wedge components in a press-fitting process in Fig. 5.

Fig. 7 is a diagram to illustrate press-fitting of a second wedge component in the press-fitting process in Fig. 5.

Fig. 8 is a diagram to illustrate a press-fitting process and supporting members according to a second exemplary embodiment.

Fig. 9 is an exploded perspective view of the supporting member in Fig. 8.

Fig. 10 is a diagram to illustrate a press-fitting process, a welding process, and a supporting member according to a third exemplary embodiment.

Fig. 11 is a diagram to illustrate a fixing process, a press-fitting process, and a supporting member according to a fourth exemplary embodiment.

Fig. 12 is a diagram to illustrate a press-fitting process and a supporting member according to a fifth exemplary embodiment.

Fig. 13 is a diagram to illustrate a press-fitting process and a supporting member according to a sixth exemplary embodiment.

Fig. 14 is a diagram to illustrate a press-fitting process and a supporting member according to a seventh exemplary embodiment.

Fig. 15 is a front view cross-section illustrating a secondary beam joint detail

according to an eighth exemplary embodiment.

Fig. 16 is a front view cross-section illustrating a secondary beam joint detail according to a ninth exemplary embodiment.

Fig. 17 is a perspective view illustrating a secondary beam joint detail according to a tenth exemplary embodiment.

Fig. 18 is a cross-section sectioned along line F18-F18 in Fig. 17.

Fig. 19 is a perspective view illustrating a secondary beam joint detail according to an eleventh exemplary embodiment.

Fig. 20 is a front view cross-section illustrating a secondary beam joint detail according to a twelfth exemplary embodiment.

Fig. 21 is a front view cross-section illustrating a secondary beam joint detail according to a thirteenth exemplary embodiment.

Fig. 22 is a front view cross-section illustrating a secondary beam joint detail according to a fourteenth exemplary embodiment.

Fig. 23 is a schematic diagram illustrating a secondary beam joint detail in which a secondary beam is joined to structural members by pin joints.

Fig. 24 is a schematic diagram illustrating a secondary beam joint detail in which a secondary beam is joined to structural members by semi-rigid joints.

Fig. 25 is a schematic diagram illustrating a secondary beam joint detail in which a secondary beam is joined to structural members by rigid joints.

DESCRIPTION OF EMBODIMENTS

[0029] First, explanation follows regarding a first exemplary embodiment of the present disclosure.

[0030] A building structure S illustrated in Fig. 1 is, for example, applied in a building such as an office block, and includes a primary beam 20 and a secondary beam 30. In the drawings, the arrow X direction, the arrow Y direction, and the arrow Z direction are orthogonal to one another. The arrow X direction and the arrow Y direction are both directions parallel to a horizontal direction. The arrow Z direction corresponds to a vertical direction, and the side toward which the arrow Z points corresponds to a vertical direction upper side.

[0031] The primary beam 20 is an example of a structural member. The primary beam 20 extends along the arrow Y direction. The primary beam 20 is configured by wide flange beam including an upper flange 21, a lower flange 22, and a web 23. When the primary beam 20 is viewed along the arrow Y direction, the upper flange 21 and the lower flange 22

extend along the arrow X direction, and the web 23 extends along the arrow Z direction.

The web 23 couples an arrow X direction central portion of the upper flange 21 and an arrow X direction central portion of the lower flange 22 together.

[0032] The secondary beam 30 extends along the arrow X direction. The secondary beam 30 is configured by wide flange beam including an upper flange 31, a lower flange 32, and a web 33. When the secondary beam 30 is viewed along the arrow X direction, the upper flange 31 and the lower flange 32 extend along the arrow Y direction, and the web 33 extends along the arrow Z direction. The web 33 couples an arrow Y direction central portion of the upper flange 31 and an arrow Y direction central portion of the lower flange 32 together. A height dimension H2 of the secondary beam 30 is substantially the same as a height dimension H1 of the primary beam 20, and the secondary beam 30 is disposed close to the primary beam 20 in the arrow X direction.

[0033] A secondary beam joint detail 10 (joint component structure) is applied at a joint between the secondary beam 30 and the primary beam 20. Namely, the primary beam 20 includes a shear plate 24. The shear plate 24 is formed in a rectangular shape with a plate thickness direction along the arrow Y direction. The shear plate 24 extends from the web 23 of the primary beam 20 toward the secondary beam 30. A location on the secondary beam 30 side of the shear plate 24 configures a leading end portion 24A of the shear plate 24, and a location on the web 23 side of the shear plate 24 configures a base end portion 24B of the shear plate 24. The base end portion 24B of the shear plate 24 is joined to the upper flange 21, the lower flange 22, and the web 23 of the primary beam 20 by welding.

[0034] The leading end portion 24A of the shear plate 24 projects further toward the secondary beam 30 side than the upper flange 21 and the lower flange 22 of the primary beam 20. The leading end portion 24A of the shear plate 24 is disposed between the upper flange 31 and the lower flange 32 of the secondary beam 30, and is superimposed on a location 33A on the primary beam 20 side of the web 33 of the secondary beam 30 in the arrow Y direction. Plural through holes 25 are formed penetrating the leading end portion 24A of the shear plate 24 in the arrow Y direction. The plural through holes 25 are configured in a row along the arrow Z direction. Plural through holes 35 are formed penetrating the location 33A on the primary beam 20 side of the web 33 of the secondary beam 30 in the arrow Y direction. The plural through holes 35 are formed at positions aligned with the plural through holes 25 formed in the shear plate 24.

[0035] Fastening members 11, including nuts and bolts, are employed to join the shear plate 24 and the web 33 of the secondary beam 30 together. Namely, the bolts of the fastening members 11 are inserted into the respective through holes 25, 35, and the nuts of the fastening

members 11 are screwed onto leading end portions of the bolts, thereby joining the shear plate 24 and the web 33 together. A portion where the shear plate 24 and the web 33 are joined together configures a joint component 12.

[0036] In a state in which the shear plate 24 and the web 33 are joined at the joint component 12, the upper flange 21 and the upper flange 31 oppose each other along the arrow X direction in a state in which a gap 41 is present along the arrow X direction. Similarly, the lower flange 22 and the lower flange 32 oppose each other along the arrow X direction in a state in which a gap 42 is present along the arrow X direction. The arrow X direction length of the shear plate 24 and the arrow X direction positions of the plural through holes 25, 35 are set such that the gaps 41, 42 are formed in the arrow X direction in this manner. The joint component 12 between the shear plate 24 and the web 33 is positioned at the lower side of the upper gap 41 and at the upper side of the lower gap 42.

[0037] A slab (for example a concrete flooring slab) is provided above the upper flange 21 of the primary beam 20 and the upper flange 31 of the secondary beam 30. The slab is omitted from illustration in Fig. 1. The slab is joined to the primary beam 20 and the secondary beam 30 by shear connectors provided to the upper flange 21 of the primary beam 20 and the upper flange 31 of the secondary beam 30. Examples in which a slab is provided above the upper flange 21 of the primary beam 20 and the upper flange 31 of the secondary beam 30 are explained later in eighth and ninth exemplary embodiments (see Fig. 15 and Fig. 16).

[0038] A supporting member 50 (reinforcing member) is disposed in the gap 42 between the lower flange 22 and the lower flange 32. The supporting member 50 includes a first wedge component 60 and a second wedge component 70. The first wedge component 60 and the second wedge component 70 are, for example, configured from steel or carbon fiber reinforced plastic. The first wedge component 60 is inserted into the gap 42 and is fixed to the lower flange 32. The second wedge component 70 is press-fitted between the lower flange 22 and the first wedge component 60.

[0039] As illustrated in the enlarged illustration of Fig. 2, the first wedge component 60 is formed with a groove 61 extending along the arrow Y direction. The groove 61 opens onto a face 62 on the lower flange 32 side of the first wedge component 60, and is also open at side faces 63 on both arrow Y direction sides of the first wedge component 60. An end portion 32A of the lower flange 32 is inserted into the groove 61 so as to fix the first wedge component 60 to the lower flange 32. A first inclined face 64 facing obliquely upward is formed on the second wedge component 70 side of the first wedge component 60. The first inclined face 64 opposes an end face 22A1 of the lower flange 22 along the arrow X direction

across the second wedge component 70.

[0040] The first inclined face 64 is formed with a downward-facing first step face 65. The first step face 65 is an example of a first guide face. The arrow X direction length (width) of the first step face 65 is, for example, from 5 mm to 20 mm. An upper side inclined face 64A of the first inclined face 64 is formed at the upper side of the first step face 65, and a lower side inclined face 64B of the first inclined face 64 is formed at the lower side of the first step face 65. The upper side inclined face 64A and the lower side inclined face 64B each form the same oblique angle θ_Z with respect to the arrow Z direction. The oblique angle θ_Z is, for example, from 5° to 30°, and is preferably from 10° to 15°.

[0041] A face 72 on the lower flange 22 side of the second wedge component 70 is a flat face with no grooves or the like, and extends along the arrow Z direction. A second inclined face 74 facing obliquely downward is formed on the first wedge component 60 side of the second wedge component 70. The second inclined face 74 is formed with an upward-facing second step face 75. The second step face 75 is an example of a second guide face. The second step face 75 is anchored to the first step face 65 from the lower side, thereby preventing the second wedge component 70 from coming out.

[0042] An upper side inclined face 74A of the second inclined face 74 is formed at the upper side of the second step face 75, and a lower side inclined face 74B of the second inclined face 74 is formed at the lower side of the second step face 75. Both the upper side inclined face 74A and the lower side inclined face 74B form the same oblique angle with respect to the arrow Z direction. The oblique angle formed by the upper side inclined face 74A and the lower side inclined face 74B with respect to the arrow Z direction is the same as the oblique angle θ_Z formed by the upper side inclined face 64A and the lower side inclined face 64B of the first wedge component 60 described above with respect to the arrow Z direction.

[0043] As previously described, the second wedge component 70 is press-fitted between the lower flange 22 of the primary beam 20 and the first wedge component 60. The first wedge component 60 is thus pressed toward the lower flange 32 side by the second wedge component 70, and a bottom face 61A of the groove 61 is placed in a press contact state with an end face 32A1 of the lower flange 32. The upper side inclined face 74A and the lower side inclined face 74B of the second inclined face 74 are placed in a press contact state with the upper side inclined face 64A and the lower side inclined face 64B of the first inclined face 64, and the face 72 on the lower flange 22 side of the second wedge component 70 is placed in a press contact state with the end face 22A1 of the lower flange 22.

[0044] As illustrated in Fig. 3, the first step face 65 and the second step face 75 each extend along the arrow Y direction. The first step face 65 and the second step face 75 are oblique

with respect to the arrow Y direction so as to extend toward the lower side on progression toward the side pointed to by the arrow Y. The first step face 65 and the second step face 75 each form the same oblique angle θ_Y with respect to the arrow Y direction. In Fig. 3, the arrow Y direction corresponds to the width direction of the secondary beam 30 (see Fig. 1 and Fig. 2). The opposite side to the side pointed to by the arrow Y corresponds to one width direction side of the secondary beam 30, and the side pointed to by the arrow Y corresponds to the other width direction side of the secondary beam 30.

[0045] As illustrated in Fig. 4, a pair of supporting members 50A, 50B are disposed in the gap 42 between the lower flange 22 and the lower flange 32. The pair of supporting members 50A, 50B are respectively disposed on both arrow Y direction sides of the shear plate 24 and the web 33. The pair of supporting members 50A, 50B are formed with Y direction symmetry to each other. The above explanation (with reference to Fig. 1 to Fig. 3) applies to the one supporting member 50A.

[0046] Explanation follows regarding a secondary beam joining method according to the first exemplary embodiment.

[0047] As illustrated in Fig. 5, the secondary beam joining method according to the first exemplary embodiment includes a joining process A, a fixing process B, and a press-fitting process C.

[0048] In the joining process A, the secondary beam 30 is disposed close to the primary beam 20 in the arrow X direction. When this is performed, the leading end portion 24A of the shear plate 24 is disposed between the upper flange 31 and the lower flange 32 of the secondary beam 30, and is superimposed on the location 33A on the primary beam 20 side of the web 33 of the secondary beam 30 in the arrow Y direction. Further, the plural through holes 25 formed in the shear plate 24 are aligned with the plural through holes 35 formed in the web 33 of the secondary beam 30. The fastening members 11, including nuts and bolts, are then used to join the shear plate 24 and the web 33 together. Namely, the bolts of the fastening members 11 are inserted through the respective through holes 25, 35, and the nuts of the fastening members 11 are screwed onto the leading end portions of the bolts, thereby joining the shear plate 24 and the web 33 together at the joint component 12.

[0049] In a state in which the shear plate 24 and the web 33 have been joined together at the joint component 12 in this manner, the arrow X direction gap 41 is formed between the upper flange 21 and the upper flange 31, and the arrow X direction gap 42 is formed between the lower flange 22 and the lower flange 32. In this manner, the secondary beam 30 is joined to the primary beam 20 at the joint component 12 at the upper side of the gap 42 in the joining process A in a state in which the arrow X direction gap 42 is formed between the lower flange

32 of the secondary beam 30 and the lower flange 22 of the primary beam 20.

[0050] In the fixing process B, the first wedge component 60 is inserted into the gap 42, and the end portion 32A of the lower flange 32 formed to the secondary beam 30 is inserted into the groove 61 of the first wedge component 60 so as to fix the first wedge component 60 to the lower flange 32. In this state, the obliquely upward-facing first inclined face 64 opposes the end face 22A1 of the lower flange 22 formed to the primary beam 20 across a gap in the arrow X direction.

[0051] In the press-fitting process C, the second wedge component 70 is press-fitted between the lower flange 22 and the first wedge component 60. When this is performed, as illustrated in Fig. 6, the second wedge component 70 of the one supporting member 50A is inserted toward the side pointed to by the arrow Y into the gap between the lower flange 22 and the first wedge component 60. The second wedge component 70 of the other supporting member 50B is inserted toward the opposite side to the side pointed to by the arrow Y into the gap between the lower flange 22 and the first wedge component 60. Note that the pair of supporting members 50A, 50B are formed with Y direction symmetry to each other, as described above. Explanation follows regarding the one supporting member 50A, and explanation regarding the other supporting member 50B is omitted.

[0052] As illustrated in Fig. 7, the second wedge component 70 is inserted toward the side pointed to by the arrow Y into the gap between the lower flange 22 and the first wedge component 60. When this is performed, the second step face 75 is positioned at the lower side of the first step face 65, and slides against the first step face 65. The upper section of Fig. 7 illustrates an initial stage during insertion of the second wedge component 70. In the initial stage during insertion of the second wedge component 70, one end of the first step face 65 (an end portion on the opposite side to the side pointed to by the arrow Y) and one end of the second step face 75 (an end portion on the side pointed to by the arrow Y) are placed in a state of contact, and the insertion amount of the second wedge component 70 toward the lower side is small.

[0053] The lower section of Fig. 7 illustrates a completed state of press fitting of the second wedge component 70. As illustrated from the upper section of Fig. 7 to the lower section of Fig. 7, when the second wedge component 70 is inserted toward the side pointed to by the arrow Y, the second step face 75 slides against the first step face 65, such that the second wedge component 70 moves toward the lower side. As the second wedge component 70 moves toward the lower side, a contact region between the second inclined face 74 and the first inclined face 64 spreads toward the lower side such that the second wedge component 70 gradually moves toward the lower flange 22 side, and the face 72 on the lower flange 22 side

of the second wedge component 70 contacts the end face 22A1 of the lower flange 22.

[0054] From this state, when the second wedge component 70 is pushed in toward the side pointed to by the arrow Y, the second wedge component 70 is press-fitted between the lower flange 22 and the first wedge component 60. In this state, the second step face 75 is anchored to the first step face 65 from the lower side, thus preventing the second wedge component 70 from coming out. In the first exemplary embodiment, the secondary beam 30 is fixed to the primary beam 20 in the manner described above.

[0055] Explanation follows regarding operation and advantageous effects of the first exemplary embodiment.

[0056] As described in detail above, in the first exemplary embodiment, the first step face 65 and the second step face 75 respectively formed to the first wedge component 60 and the second wedge component 70 are both oblique with respect to the arrow Y direction. When the second wedge component 70 is inserted along the arrow Y direction into the gap between the lower flange 22 and the first wedge component 60, the second step face 75 slides against the first step face 65 such that the second wedge component 70 moves toward the lower side. The first inclined face 64 and the second inclined face 74 respectively formed to the first wedge component 60 and the second wedge component 70 are both oblique with respect to the arrow Z direction. Thus, when the second wedge component 70 moves toward the lower side, the second inclined face 74 slides against the first inclined face 64 such that the second wedge component 70 moves gradually toward the primary beam 20 side, thus increasing a combined width of the first wedge component 60 and second wedge component 70 (namely, the width of the supporting member 50).

[0057] Accordingly, even if variation is present in a width W of the gap 42 between the lower flange 22 and the lower flange 32, the combined width of the first wedge component 60 and second wedge component 70 can be adapted to the width W of the gap 42, and so the first wedge component 60 and the second wedge component 70 can be disposed between the lower flange 22 and the lower flange 32 with a width that has been adapted to the width W of the gap 42. Thus, even if variation is present in the width W of the gap 42, compressive force can be transmitted from the lower flange 32 of the secondary beam 30 to the lower flange 22 of the primary beam 20 through the first wedge component 60 and the second wedge component 70. Further, since there is no need to prepare plural first wedge components 60 and second wedge components 70 with different widths to each other to accommodate variation in the width W of the gap 42, an increase in costs can be suppressed.

[0058] Moreover, in the first exemplary embodiment, the second wedge component 70 is inserted along the arrow Y direction into the gap between the lower flange 22 and the first

wedge component 60, and the second step face 75 slides against the first step face 65, thus moving the second wedge component 70 toward the lower side. Accordingly, for example, the second wedge component 70 can still be inserted into the gap between the lower flange 22 and the first wedge component 60 even in cases in which no space is available at the upper side or lower side of the gap between the lower flange 22 and the first wedge component 60 for insertion of the second wedge component 70 along the arrow Z direction.

[0059] In the first exemplary embodiment, the second step face 75 is anchored to the first step face 65 from the lower side. This enables the second wedge component 70 to be suppressed from coming out at the upper side.

[0060] Explanation follows regarding a second exemplary embodiment of the present disclosure.

[0061] In the second exemplary embodiment illustrated in Fig. 8, the configurations of the first wedge component 60 and the second wedge component 70 are modified from those of the first exemplary embodiment described above (see Fig. 2) in the following manner.

Namely, the first inclined face 64 is formed with plural of the first step faces 65. The plural first step faces 65 are formed at intervals from the upper side to the lower side of the first inclined face 64. Similarly, the second inclined face 74 is formed with plural of the second step faces 75. The plural second step faces 75 are formed at intervals from the upper side to the lower side of the second inclined face 74.

[0062] As illustrated in Fig. 9, the first step faces 65 and the second step faces 75 extend along the arrow Y direction, and the first wedge component 60 and the second wedge component 70 are each formed with a uniform cross-section profile along the arrow Y direction. Note that in Fig. 8 and Fig. 9, the sizes of the first step faces 65 and the second step faces 75 are exaggerated. The arrow X direction lengths (widths) of the first step faces 65 and the second step faces 75 are, for example, from 1 mm to 2 mm.

[0063] As illustrated in Fig. 8, in the second exemplary embodiment, the press-fitting process C is modified as follows from that of the first exemplary embodiment described above (see Fig. 5 to Fig. 7). Namely, in the press-fitting process C, the second wedge component 70 is inserted into the gap between the lower flange 22 and the first wedge component 60 from the upper side. When this is performed, the second wedge component 70 is moved toward the lower side as the second inclined face 74 slides against the first inclined face 64. As the second wedge component 70 moves toward the lower side, a contact region between the second inclined face 74 and the first inclined face 64 spreads toward the lower side, such that the second wedge component 70 gradually moves toward the lower flange 22 side, and the face 72 on the lower flange 22 side of the second wedge

component 70 contacts the end face 22A1 of the lower flange 22.

[0064] From this state, as the second wedge component 70 is pushed in toward the lower side, each of the second step faces 75 rides over one or plural of the first step faces 65 according to the amount by which the second wedge component 70 is pushed in, and the second wedge component 70 is press-fitted between the lower flange 22 and the first wedge component 60. In this state, the plural second step faces 75 are anchored to the plural first step faces 65 from the lower side, thus preventing the second wedge component 70 from coming out. In the second exemplary embodiment, the secondary beam 30 is fixed to the primary beam 20 in the manner described above.

[0065] Moreover, in the second exemplary embodiment, as the second wedge component 70 moves toward the lower side, the second inclined face 74 slides against the first inclined face 64 such that the second wedge component 70 moves gradually toward the primary beam 20 side, thus increasing the combined width of the first wedge component 60 and second wedge component 70 (namely, the width of the supporting member 50).

[0066] Accordingly, even if variation is present in the width W of the gap 42 between the lower flange 22 and the lower flange 32, the combined width of the first wedge component 60 and second wedge component 70 can be adapted to the width W of the gap 42, and so the first wedge component 60 and the second wedge component 70 can be disposed between the lower flange 22 and the lower flange 32 with a width adapted to the width W of the gap 42. Thus, even if variation is present in the width W of the gap 42, compressive force can be transmitted from the lower flange 32 of the secondary beam 30 to the lower flange 22 of the primary beam 20 through the first wedge component 60 and the second wedge component 70. Further, since there is no need to prepare plural first wedge components 60 and second wedge components 70 with different widths to each other to accommodate variation in the width W of the gap 42, an increase in costs can be suppressed.

[0067] In the second exemplary embodiment, the plural second step faces 75 are anchored to the plural first step faces 65 from the lower side. This enables the second wedge component 70 to be suppressed from coming out at the upper side.

[0068] Explanation follows regarding a third exemplary embodiment of the present disclosure.

[0069] In the third exemplary embodiment illustrated in Fig. 10, the configuration of the second exemplary embodiment (see Fig. 8) described above additionally includes a weld portion 81 to fix an upper portion of the first wedge component 60 and an upper portion of the second wedge component 70 together. In the third exemplary embodiment, a welding process D is additionally provided following the press-fitting process C accompanying the

addition of the weld portion 81. In the welding process D, the upper portion of the first wedge component 60 and the upper portion of the second wedge component 70 are fixed together at the weld portion 81.

[0070] In the third exemplary embodiment, in addition to the operation and advantageous effects of the second exemplary embodiment, the second wedge component 70 can be even more effectively suppressed from coming out at the upper side due to fixing the upper portion of the first wedge component 60 and the upper portion of the second wedge component 70 together at the weld portion 81.

[0071] Note that in the third exemplary embodiment, the weld portion 81 may be provided to a location other than the respective upper portions of the first wedge component 60 and the second wedge component 70.

[0072] The weld portion 81 of the third exemplary embodiment may be applied to the first wedge component 60 and the second wedge component 70 of the first exemplary embodiment.

[0073] Explanation follows regarding a fourth exemplary embodiment of the present disclosure.

[0074] In the fourth exemplary embodiment illustrated in Fig. 11, the configurations of the first wedge component 60 and the second wedge component 70 of the first exemplary embodiment described above (see Fig. 2) are modified as follows. Namely, the face 62 on the lower flange 32 side of the first wedge component 60 is a flat face without grooves or the like, and extends along the arrow Z direction. The face 62 on the lower flange 32 side of the first wedge component 60 is fixed to the end portion 32A of the lower flange 32 by weld portions 82 at the upper side and the lower side of the lower flange 32. Moreover, the first inclined face 64 of the first wedge component 60 and the second inclined face 74 of the second wedge component 70 are each formed by a flat face, with no steps or the like.

[0075] Moreover, in the fourth exemplary embodiment, the fixing process B and the press-fitting process C of the first exemplary embodiment described above (see Fig. 5 to Fig. 7) are modified as follows. Namely, in the fixing process B, the first wedge component 60 is inserted into the gap 42, and the face 62 on the lower flange 32 side of the first wedge component 60 is abutted against the end face 32A1 of the lower flange 32. In this state, the face 62 on the lower flange 32 side of the first wedge component 60 is fixed to the end portion 32A of the lower flange 32 by the weld portions 82 at the upper side and the lower side of the lower flange 32.

[0076] In the press-fitting process C, the second wedge component 70 is inserted into the gap between the lower flange 22 and the first wedge component 60 from the upper side.

When this is performed, the second wedge component 70 is moved toward the lower side as the second inclined face 74 slides against the first inclined face 64. As the second wedge component 70 moves toward the lower side, a contact region between the second inclined face 74 and the first inclined face 64 spreads toward the lower side, such that the second wedge component 70 gradually moves toward the lower flange 22 side, and the face 72 on the lower flange 22 side of the second wedge component 70 contacts the end face 22A1 of the lower flange 22. When the second wedge component 70 is pushed in toward the lower side from this state, the second wedge component 70 is press-fitted between the lower flange 22 and the first wedge component 60.

[0077] In the fourth exemplary embodiment, as the second wedge component 70 moves toward the lower side, the second inclined face 74 slides against the first inclined face 64 such that the second wedge component 70 gradually moves toward the primary beam 20 side, thus increasing the combined width of the first wedge component 60 and second wedge component 70 (namely, the width of the supporting member 50).

[0078] Accordingly, even if variation is present in the width W of the gap 42 between the lower flange 22 and the lower flange 32, the combined width of the first wedge component 60 and second wedge component 70 can be adapted to the width W of the gap 42, and so the first wedge component 60 and the second wedge component 70 can be disposed between the lower flange 22 and the lower flange 32 with a width adapted to the width W of the gap 42. Thus, even if variation is present in the width W of the gap 42, compressive force can be transmitted from the lower flange 32 of the secondary beam 30 to the lower flange 22 of the primary beam 20 through the first wedge component 60 and the second wedge component 70. Further, since there is no need to prepare plural first wedge components 60 and second wedge components 70 with different widths to each other to accommodate variation in the width W of the gap 42, an increase in costs can be suppressed.

[0079] In the fourth exemplary embodiment, the second wedge component 70 may be prevented from coming out by forming the first inclined face 64 and the second inclined face 74 with roughened faces, or by fixing the first wedge component 60 and the second wedge component 70 together by welding or adhesion.

[0080] The weld portions 82 of the fourth exemplary embodiment may also be applied to the first wedge component 60 of the first exemplary embodiment to the third exemplary embodiment.

[0081] Explanation follows regarding a fifth exemplary embodiment of the present disclosure.

[0082] In the fifth exemplary embodiment illustrated in Fig. 12, the configuration of the

supporting member 50 of the first exemplary embodiment described above (see Fig. 2) is modified as follows. Namely, the first wedge component 60 is formed with a first groove 66 extending along the arrow Y direction, and the second wedge component 70 is formed with a second groove 76 extending along the arrow Y direction. The first groove 66 opens onto the first inclined face 64, and is also open at the side faces 63 of the first wedge component 60. Similarly, the second groove 76 opens onto the second inclined face 74, and is also open at side faces 73 of the second wedge component 70. The positions of the first groove 66 and the second groove 76 are set such that an upper side wall face 66A of the first groove 66 is positioned at the upper side of a lower side wall face 76A of the second groove 76 in a state in which the second wedge component 70 has been inserted between the lower flange 22 and the first wedge component 60.

[0083] The supporting member 50 also includes a third wedge component 90. The third wedge component 90 is inserted between the upper side wall face 66A of the first groove 66 and the lower side wall face 76A of the second groove 76. The third wedge component 90 includes a first sliding face 91 that slides against the upper side wall face 66A, and a second sliding face 92 that slides against the lower side wall face 76A. The third wedge component 90 is formed in a trapezoidal block shape, configured such that the first sliding face 91 is a sloped face, and the second sliding face 92 is a perpendicular face. The first sliding face 91 is oblique with respect to the second sliding face 92, and a width of a region between the first sliding face 91 and the second sliding face 92 increases on progression from a leading end side of the third wedge component 90 to a rear end side of the third wedge component 90.

[0084] Moreover, in the fifth exemplary embodiment, the press-fitting process C is modified as follows from that of the first exemplary embodiment described above (see Fig. 5 to Fig. 7). Namely, the press-fitting process C includes a first stage C1 to a third stage C3. At the first stage C1, the second wedge component 70 is inserted between the lower flange 22 and the first wedge component 60 from the upper side. Note that the second wedge component 70 may also be inserted along the arrow Y direction between the lower flange 22 and the first wedge component 60. At the second stage C2, the third wedge component 90 is inserted between the upper side wall face 66A of the first groove 66 and the lower side wall face 76A of the second groove 76.

[0085] At the third stage C3, the third wedge component 90 is pushed in. As the third wedge component 90 is pushed in, the first sliding face 91 slides against the wall face 66A and the second sliding face 92 slides against the wall face 76A, such that the lower side wall face 76A is pushed downward with respect to the wall face 66A. The second wedge component 70 thus moves toward the lower side, and the second wedge component 70 is

press-fitted between the lower flange 22 and the first wedge component 60. In this state, the second wedge component 70 is prevented from coming out due to the third wedge component 90 being interposed between the wall face 66A and the lower side wall face 76A.

[0086] In the fifth exemplary embodiment, as the third wedge component 90 is inserted between the upper side wall face 66A of the first groove 66 and the lower side wall face 76A of the second groove 76, the wall face 76A is pushed toward the lower side with respect to the wall face 66A such that the second wedge component 70 moves toward the lower side. As the second wedge component 70 moves toward the lower side, the second inclined face 74 slides against the first inclined face 64 such that the second wedge component 70 moves gradually toward the primary beam 20 side, thus increasing the combined width of the first wedge component 60 and second wedge component 70 (namely, the width of the supporting member 50).

[0087] Accordingly, even if variation is present in the width W of the gap 42 between the lower flange 22 and the lower flange 32, the combined width of the first wedge component 60 and second wedge component 70 can be adapted to the width W of the gap 42, and so the first wedge component 60 and the second wedge component 70 can be disposed between the lower flange 22 and the lower flange 32 with a width adapted to the width W of the gap 42. Thus, even if variation is present in the width W of the gap 42, compressive force can be transmitted from the lower flange 32 of the secondary beam 30 to the lower flange 22 of the primary beam 20 through the first wedge component 60 and the second wedge component 70. Further, since there is no need to prepare plural first wedge components 60 and second wedge components 70 with different widths to each other to accommodate variation in the width W of the gap 42, an increase in costs can be suppressed.

[0088] Furthermore, in the fifth exemplary embodiment, the third wedge component 90 is inserted along the arrow Y direction between the upper side wall face 66A of the first groove 66 and the lower side wall face 76A of the second groove 76, thus moving the second wedge component 70 toward the lower side such that the second wedge component 70 is press-fitted between the lower flange 22 and the first wedge component 60. Accordingly, for example, the second wedge component 70 can still be press-fitted into the gap between the lower flange 22 and the first wedge component 60 even in cases in which no space is available at the upper side or lower side of the gap between the lower flange 22 and the first wedge component 60 to press-fit the second wedge component 70 into the gap between the lower flange 22 and the first wedge component 60.

[0089] In the fifth exemplary embodiment, the third wedge component 90 is interposed between the upper side wall face 66A and the lower side wall face 76A in a state in which the

second wedge component 70 has been press-fitted into the gap between the lower flange 22 and the first wedge component 60. This enables the second wedge component 70 to be suppressed from coming out at the upper side.

[0090] Explanation follows regarding a sixth exemplary embodiment of the present disclosure.

[0091] In the sixth exemplary embodiment illustrated in Fig. 13, the configurations of the first wedge component 60 and the second wedge component 70 of the first exemplary embodiment described above (see Fig. 2) are modified as follows. Namely, the first inclined face 64 and the second inclined face 74 are each formed as a flat face with no steps, grooves, or the like. The face 72 on the lower flange 22 side of the second wedge component 70 is formed with plural protrusions 77 projecting toward the lower flange 22 side. The plural protrusions 77 are formed at intervals from the upper side to the lower side of the face 72 on the lower flange 22 side.

[0092] More specifically, each of the protrusions 77 is formed in a step shape including a step face 77A and an inclined face 77B. The step face 77A is formed so as to face upward. The inclined face 77B of each of the protrusions 77 is positioned at the lower side of the step face 77A, and is oblique with respect to the arrow Z direction so as to head toward the second inclined face 74 side on progression toward the lower side. The size of the protrusions 77 is exaggerated in Fig. 13. The arrow X direction length of the protrusions 77 (width of the step faces 77A) is, for example, from 1 mm to 2 mm. In a state in which the second wedge component 70 has been press-fitted between the lower flange 22 and the first wedge component 60, the plural protrusions 77 bite into the end face 22A1 of the lower flange 22.

[0093] In the sixth exemplary embodiment, the press-fitting process C is modified as follows from that of the first exemplary embodiment described above (see Fig. 5 to Fig. 7). Namely, in the press-fitting process C, the second wedge component 70 is inserted into the gap between the lower flange 22 and the first wedge component 60 from the upper side. When this is performed, the second wedge component 70 moves toward the lower side while the second inclined face 74 slides against the first inclined face 64.

[0094] As the second wedge component 70 moves toward the lower side, a contact region between the second inclined face 74 and the first inclined face 64 spreads toward the lower side such that the second wedge component 70 gradually moves toward the lower flange 22 side, and the face 72 on the lower flange 22 side of the second wedge component 70 (the plural protrusions 77) contacts the end face 22A1 of the lower flange 22. When the second wedge component 70 is pushed in toward the lower side from this state, the second wedge component 70 is press-fitted between the lower flange 22 and the first wedge

component 60 in a state in which the plural protrusions 77 bite into the end face 22A1 of the lower flange 22. In this state, the second wedge component 70 is prevented from coming out by the plural protrusions 77 biting into the end face 22A1 of the lower flange 22.

[0095] In the sixth exemplary embodiment, as the second wedge component 70 moves toward the lower side, the second inclined face 74 slides against the first inclined face 64 such that the second wedge component 70 moves gradually toward the primary beam 20 side, thus increasing the combined width of the first wedge component 60 and second wedge component 70 (namely, the width of the supporting member 50).

[0096] Accordingly, even if variation is present in the width W of the gap 42 between the lower flange 22 and the lower flange 32, the combined width of the first wedge component 60 and second wedge component 70 can be adapted to the width W of the gap 42, and so the first wedge component 60 and the second wedge component 70 can be disposed between the lower flange 22 and the lower flange 32 with a width adapted to the width W of the gap 42. Thus, even if variation is present in the width W of the gap 42, compressive force can be transmitted from the lower flange 32 of the secondary beam 30 to the lower flange 22 of the primary beam 20 through the first wedge component 60 and the second wedge component 70.

Further, since there is no need to prepare plural first wedge components 60 and second wedge components 70 with different widths to each other to accommodate variation in the width W of the gap 42, an increase in costs can be suppressed.

[0097] Furthermore, in the sixth exemplary embodiment, the second wedge component 70 is press-fitted between the lower flange 22 and the first wedge component 60 in a state in which the plural protrusions 77 bite into the end face 22A1 of the lower flange 22. This enables the second wedge component 70 to be suppressed from coming out at the upper side.

[0098] Note that the plural protrusions 77 of the sixth exemplary embodiment may also be applied to the second wedge component 70 of the first to the fifth exemplary embodiments.

[0099] Moreover, possible combinations of the configurations of the first exemplary embodiment to the sixth exemplary embodiment may be implemented as appropriate.

[0100] Explanation follows regarding a seventh exemplary embodiment of the present disclosure.

[0101] In a secondary beam joint detail 100 according to the seventh exemplary embodiment illustrated in Fig. 14, the placement of the first wedge component 60 and the second wedge component 70 of the secondary beam joint detail 10 according to the sixth exemplary embodiment described above (see Fig. 13) is modified as follows. Namely, the first wedge component 60 is disposed on the primary beam 20 side, and the second wedge component 70 is disposed on the secondary beam 30 side. The end face 22A of the lower flange 22 is

inserted into the groove 61 in the first wedge component 60, thereby fixing the first wedge component 60 to the lower flange 22. The second wedge component 70 is press-fitted between the lower flange 32 and the first wedge component 60, and the plural protrusions 77 bite into the end face 32A1 of the lower flange 32.

[0102] Moreover, in the seventh exemplary embodiment, the fixing process and the press-fitting process are performed as follows. Namely, in the fixing process, the first wedge component 60 is inserted into the gap 42, and the end face 22A of the lower flange 22 formed to the primary beam 20 is inserted into the groove 61 of the first wedge component 60, thereby fixing the first wedge component 60 to the lower flange 22. In the press-fitting process, the second wedge component 70 is inserted into the gap between the lower flange 32 and the first wedge component 60 from the upper side. When this is performed, the second wedge component 70 is moved toward the lower side while the second inclined face 74 slides against the first inclined face 64.

[0103] As the second wedge component 70 moves toward the lower side, a contact region between the second inclined face 74 and the first inclined face 64 spreads toward the lower side such that the second wedge component 70 moves gradually toward the lower flange 32 side, and the face 72 on the lower flange 32 side of the second wedge component 70 (the plural protrusions 77) contact the end face 32A1 of the lower flange 32. When the second wedge component 70 is pushed in toward the lower side from this state, the second wedge component 70 is press-fitted between the lower flange 32 and the first wedge component 60 in a state in which the plural protrusions 77 bite into the end face 32A1 of the lower flange 32. In this state, the second wedge component 70 is prevented from coming out due to the plural protrusions 77 biting into the end face 32A1 of the lower flange 32.

[0104] In the seventh exemplary embodiment, as the second wedge component 70 moves toward the lower side, the second inclined face 74 slides against the first inclined face 64 such that the second wedge component 70 moves gradually toward the secondary beam 30 side, thus increasing the combined width of the first wedge component 60 and second wedge component 70 (namely, the width of the supporting member 50).

[0105] Accordingly, even if variation is present in the width W of the gap 42 between the lower flange 22 and the lower flange 32, the combined width of the first wedge component 60 and second wedge component 70 can be adapted to the width W of the gap 42, and so the first wedge component 60 and the second wedge component 70 can be disposed between the lower flange 22 and the lower flange 32 with a width adapted to the width W of the gap 42. Thus, even if variation is present in the width W of the gap 42, compressive force can be transmitted from the lower flange 32 of the secondary beam 30 to the lower flange 22 of the primary

beam 20 through the first wedge component 60 and the second wedge component 70.

Further, since there is no need to prepare plural first wedge components 60 and second wedge components 70 with different widths to each other to accommodate variation in the width W of the gap 42, an increase in costs can be suppressed.

[0106] Furthermore, in the seventh exemplary embodiment, the second wedge component 70 is press-fitted between the lower flange 22 and the first wedge component 60 in a state in which the plural protrusions 77 bite into the end face 32A1 of the lower flange 32. This enables the second wedge component 70 to be suppressed from coming out at the upper side.

[0107] Note that in the first to the fifth exemplary embodiments described above, the first wedge component 60 may be disposed on the primary beam 20 side and the second wedge component 70 may be disposed on the secondary beam 30 side, similarly to in the seventh exemplary embodiment described above.

[0108] Explanation follows regarding an eighth exemplary embodiment of the present disclosure.

[0109] In the eighth exemplary embodiment illustrated in Fig. 15, the building structure S includes the primary beam 20, a pair of the secondary beams 30, plural of the supporting members 50, and a slab 110. The pair of secondary beams 30 are respectively disposed on both arrow X direction sides of the primary beam 20.

[0110] The secondary beam joint detail 10 is applied to the joints between the respective secondary beams 30 and the primary beam 20. Namely, the primary beam 20 includes a pair of the shear plates 24. The pair of shear plates 24 extend from the primary beam 20 toward the sides of the respective secondary beams 30. The respective secondary beams 30 are joined to the corresponding shear plates 24. The joint component 12 between the respective secondary beams 30 and the shear plates 24 are configured with arrow X direction symmetry.

[0111] The height dimension H2 of the secondary beams 30 is smaller than the height dimension H1 of the primary beam 20, and the lower flanges 32 of the secondary beams 30 are positioned at the upper side of the lower flange 22 of the primary beam 20. The web 23 of the primary beam 20 is formed with a pair of ribs 26. The pair of ribs 26 extend toward the sides of the respective secondary beams 30. With the exception of the points described above, the configurations of the primary beam 20 and the pair of secondary beams 30 are otherwise similar to in the first exemplary embodiment described above (see Fig. 1).

[0112] The gaps 42 are formed between the lower flanges 32 of the respective secondary beams 30 and the corresponding ribs 26. A supporting member 50 is disposed in each of the gaps 42. The first wedge component 60 and the second wedge component 70 of each of the supporting members 50 are, for example, applied with the configuration of the fourth

exemplary embodiment described above (see Fig. 11).

[0113] The slab 110 is provided above the primary beam 20 and the pair of secondary beams 30. The slab 110 is configured by plural steel reinforcement bars 112 and concrete 113. The primary beam 20 and the pair of secondary beams 30 are joined to the concrete 113 by plural shear connectors 114 provided to upper faces of the primary beam 20 and the pair of secondary beams 30. Plural deck plates 115 are also provided to the upper faces of the primary beam 20 and the pair of secondary beams 30.

[0114] In the eighth exemplary embodiment, the supporting members 50 are inserted into the gaps 42 between the lower flanges 32 of the respective secondary beams 30 and the ribs 26 of the primary beam 20, thus enabling compressive force to be transmitted from the lower flanges 32 of the secondary beams 30 to the primary beam 20. Moreover, since the upper flange 21 of the primary beam 20 and the upper flanges 31 of the secondary beams 30 are joined to the concrete 113 of the slab 110 using the shear connectors 114, tensile force can be transmitted from the upper flanges 31 of the secondary beams 30 to the primary beam 20 through the steel reinforcement bars 112 arranged within the slab 110.

[0115] This enables deflection and bending moment at a central portion of each of the secondary beams 30 to be suppressed in comparison to a pin joint in which only the web 33 of the secondary beam 30 is joined to the primary beam 20 using bolts. Moreover, reinforcement of the joint component 12 between the secondary beam 30 and the primary beam 20 is simpler than in a rigid joint in which the web 33 of the secondary beam 30 is joined to the primary beam 20 using welding or bolts and the upper flange 31 and the lower flange 32 of the secondary beam 30 are joined to the primary beam 20 using welding or bolts. This enables an increase in construction processes and costs to be suppressed to a minimum.

[0116] Note that although the first wedge component 60 and second wedge component 70 are applied with the configuration of the fourth exemplary embodiment as an example in the eighth exemplary embodiment, the first wedge component 60 and the second wedge component 70 may be applied with the configuration of any out of the first, second, third, fifth, sixth, or seventh exemplary embodiment described above.

[0117] Explanation follows regarding a ninth exemplary embodiment of the present disclosure.

[0118] In the ninth exemplary embodiment illustrated in Fig. 16, the configuration of the secondary beam joint detail 10 of the eighth exemplary embodiment described above (see Fig. 15) is modified as follows. Namely, the webs 33 and the lower flanges 32 of the respective secondary beams 30 are extended in the arrow X direction to positions close to the web 23 of the primary beam 20, and the gaps 42 are formed between the lower flanges 32 of the

secondary beams 30 and the web 23 of the primary beam 20. A supporting member 50 is disposed in each of the gaps 42. As an example, the first wedge component 60 and the second wedge component 70 of the supporting member 50 are applied with the configuration of the fourth exemplary embodiment described above (see Fig. 11).

[0119] In the ninth exemplary embodiment, the supporting members 50 are inserted into the gaps 42 between the lower flanges 32 of the secondary beams 30 and the web 23 of the primary beam 20, thereby enabling compressive force to be transmitted from the lower flanges 32 of the secondary beams 30 to the primary beam 20. Since the upper flange 21 of the primary beam 20 and the upper flanges 31 of the secondary beams 30 are joined to the concrete 113 of the slab 110 using the shear connectors 114, tensile force can be transmitted from the upper flanges 31 of the secondary beams 30 to the primary beam 20 through the steel reinforcement bars 112 arranged within the slab 110.

[0120] This enables deflection and bending moment at a central portion of each of the secondary beams 30 to be suppressed in comparison to a pin joint in which only the web 33 of the secondary beam 30 is joined to the primary beam 20 using bolts. Moreover, reinforcement of the joint component 12 between the secondary beam 30 and the primary beam 20 is simpler than in a rigid joint in which the web 33 of the secondary beam 30 is joined to the primary beam 20 using welding or bolts and the upper flange 31 and the lower flange 32 of the secondary beam 30 are joined to the primary beam 20 using welding or bolts. This enables an increase in construction processes and costs to be suppressed to a minimum.

[0121] Note that although the first wedge component 60 and second wedge component 70 are applied with the configuration of the fourth exemplary embodiment as an example in the ninth exemplary embodiment, the first wedge component 60 and the second wedge component 70 may be applied with the configuration of any out of the first, second, third, fifth, sixth, or seventh exemplary embodiment described above.

[0122] Explanation follows regarding a tenth exemplary embodiment of the present disclosure.

[0123] As illustrated in Fig. 17 and Fig. 18, in the tenth exemplary embodiment, the building structure S includes a column 120, plural of the secondary beams 30, plural of the supporting members 50, and the slab 110. The column 120 is an example of a structural member, and extends along the arrow Z direction. As sectioned along a horizontal direction, the column 120 has a square cross-section profile, and the plural secondary beams 30 extend from plural side faces 121 formed to the column 120 in directions normal to the respective side faces 121. As illustrated in Fig. 18, the column 120 is made of steel-reinforced concrete configured by plural steel reinforcement bars 122 and concrete 123.

[0124] The secondary beam joint detail 10 is applied to each of the joints between the column 120 and the respective secondary beams 30. Namely, a support plate 124 is provided to each of the side faces 121 of the column 120. Plural studs 125 extending toward the interior of the column 120 are joined to each of the support plates 124, and the support plates 124 and the concrete 123 are joined together by the plural studs 125.

[0125] As illustrated in Fig. 17, the support plates 124 are exposed to the side faces 121 of the column 120, and thus configure part of the side faces 121. A shear plate 24 is joined to each of the support plates 124. The respective shear plates 24 extend from the side faces 121 (the support plates 124) in directions normal to the side faces 121. The respective secondary beams 30 are joined to the shear plates 24. The joint component 12 between the secondary beams 30 and the shear plates 24 have the same configuration as each other. The configuration of the joint component 12 between the secondary beams 30 and the shear plates 24 is similar to that of the first exemplary embodiment described above (see Fig. 1).

[0126] As illustrated in Fig. 17 and Fig. 18, a gap 42 is formed between the lower flange 32 of each of the secondary beams 30 and the corresponding support plate 124. The supporting member 50 is disposed in the gap 42. As an example, the first wedge component 60 and the second wedge component 70 of the supporting member 50 are applied with the configuration of the fourth exemplary embodiment described above (see Fig. 11).

[0127] The slab 110 is provided above the plural secondary beams 30. The slab 110 is configured by plural of the steel reinforcement bars 112 and the concrete 113. In Fig. 17, for the sake of convenience, only some of the plural steel reinforcement bars 112 employed in the slab 110 are illustrated. As illustrated in Fig. 18, the plural secondary beams 30 and the concrete 113 are joined together by plural of the shear connectors 114 provided to the upper faces of the secondary beams 30. The slab 110 and the column 120 are connected together by connection members 116.

[0128] In the tenth exemplary embodiment, the supporting members 50 are inserted into the gaps 42 between the lower flanges 32 of the respective secondary beams 30 and the side faces 121 of the column 120, enabling compressive force to be transmitted from the lower flanges 32 of the secondary beams 30 to the column 120. Moreover, since the upper flanges 31 of the secondary beams 30 and the slab 110 are joined together by the shear connectors 114, and the slab 110 and the column 120 are connected together by the connection members 116, tensile force can be transmitted from the upper flanges 31 of the secondary beams 30 to the column 120 through the steel reinforcement bars 112 arranged in the slab 110 and the connection members 116.

[0129] This enables deflection and bending moment at a central portion of each of the

secondary beams 30 to be suppressed in comparison to a pin joint in which only the web 33 of the secondary beam 30 is joined to the column 120 using bolts. Moreover, reinforcement of the joint component 12 between the secondary beam 30 and the column 120 is simpler than in a rigid joint in which the web 33 of the secondary beam 30 is joined to the column 120 using welding or bolts and the upper flange 31 and the lower flange 32 of the secondary beam 30 are joined to the column 120 using welding or bolts. This enables an increase in construction processes and costs to be suppressed to a minimum.

[0130] Note that although the first wedge component 60 and second wedge component 70 are applied with the configuration of the fourth exemplary embodiment as an example in the tenth exemplary embodiment, the first wedge component 60 and the second wedge component 70 may be applied with the configuration of any out of the first, second, third, fifth, sixth, or seventh exemplary embodiment described above.

[0131] Explanation follows regarding an eleventh exemplary embodiment of the present disclosure.

[0132] In the eleventh exemplary embodiment illustrated in Fig. 19, the column 120 is made from steel-encased steel-reinforced concrete configured by a steel frame, steel reinforcement bars, and concrete. In the eleventh exemplary embodiment, the configuration of the secondary beam joint detail 10 of the tenth exemplary embodiment described above (see Fig. 17 and Fig. 18) is modified as follows. Namely, the respective shear plates 24 project from the concrete side faces 121 of the column 120 in directions normal to the respective side faces 121. The respective secondary beams 30 are joined to the shear plates 24. The configuration of the joint component 12 between the secondary beams 30 and the shear plates 24 is similar to that of the first exemplary embodiment described above (see Fig. 1).

[0133] A gap 42 is formed between the lower flange 32 of each of the secondary beams 30 and the corresponding side face 121 of the column 120. The supporting member 50 is disposed in the gap 42. As an example, the first wedge component 60 and the second wedge component 70 of the supporting member 50 are applied with the configuration of the fourth exemplary embodiment described above (see Fig. 11).

[0134] Similarly to the tenth exemplary embodiment described above, the eleventh exemplary embodiment enables deflection and bending moment at a central portion of each of the secondary beams 30 to be suppressed in comparison to a pin joint in which only the web 33 of the secondary beam 30 is joined to the column 120 using bolts. Moreover, reinforcement of the joint component 12 between the secondary beam 30 and the column 120 is simpler than in a rigid joint in which the web 33 of the secondary beam 30 is joined to the column 120 using welding or bolts and the upper flange 31 and the lower flange 32 of the

secondary beam 30 are joined to the column 120 using welding or bolts. This enables an increase in construction processes and costs to be suppressed to a minimum.

[0135] Note that the column 120 may be made of a steel frame instead of steel-reinforced concrete or steel-encased steel-reinforced concrete.

[0136] Although the first wedge component 60 and the second wedge component 70 are applied with the configuration of the fourth exemplary embodiment as an example in the eleventh exemplary embodiment, the first wedge component 60 and the second wedge component 70 may be applied with the configuration of any out of the first, second, third, fifth, sixth, or seventh exemplary embodiment described above.

[0137] Explanation follows regarding a twelfth exemplary embodiment of the present disclosure.

[0138] In the twelfth exemplary embodiment illustrated in Fig. 20, the building structure S includes the column 120, a wall 130, a secondary beam 30, plural of the supporting members 50, and the slab 110. The column 120 and the wall 130 are examples of structural members, and extend along the arrow Z direction. The secondary beam 30 is disposed between the column 120 and the wall 130, and extends along the arrow X direction. The column 120 is made of steel-reinforced concrete configured by plural steel reinforcement bars 122 and concrete 123. Similarly, the wall 130 is made of steel-reinforced concrete configured by plural steel reinforcement bars 132 and concrete 133.

[0139] The secondary beam joint detail 10 is applied to each of the joints between the secondary beam 30 and the column 120 and the wall 130. Namely, a side face 121 of the column 120, and a side face 131 of the wall 130 are respectively provided with support plates 124, 134. Plural studs 125, 135 are joined to the respective support plates 124, 134. The support plate 124 and the concrete 123 of the column 120 are joined together by the plural studs 125. Similarly, the support plate 134 and the concrete 133 of the wall 130 are joined together by the plural studs 135.

[0140] The support plate 124 of the column 120 is exposed from the side face 121 of the column 120, and thus configures part of the side face 121 of the column 120. Similarly, the support plate 134 of the wall 130 is exposed from the side face 131 of the wall 130, and thus configures part of the side face 131 of the wall 130. Shear plates 24 are joined to the support plates 124, 134. One end of the secondary beam 30 is joined to the shear plate 24 provided to the column 120, and the other end of the secondary beam 30 is joined to the shear plate 24 provided to the wall 130. The joint component 12 between the secondary beam 30 and the respective shear plates 24 have the same configuration as each other. The configuration of the joint component 12 between the secondary beam 30 and the respective shear plates 24 is

similar to that of the first exemplary embodiment described above (see Fig. 1).

[0141] The gaps 42 are formed between the lower flange 32 of the secondary beam 30 and the respective support plates 124, 134. The supporting members 50 are disposed in the respective gaps 42. As an example, the first wedge component 60 and the second wedge component 70 of the supporting member 50 are applied with the configuration of the fourth exemplary embodiment described above (see Fig. 11).

[0142] The slab 110 is provided above the secondary beam 30. The slab 110 is configured by plural of the steel reinforcement bars 112 and the concrete 113. The secondary beam 30 and the concrete 113 are joined together by plural of the shear connectors 114 provided to the upper face of the secondary beam 30. The slab 110 is also connected to the column 120 and the wall 130 by respective connection members 116.

[0143] In the twelfth exemplary embodiment, the supporting members 50 are inserted into the gaps 42 between the lower flange 32 of the secondary beam 30 and the column 120 and wall 130, enabling compressive force to be transmitted from the lower flange 32 of the secondary beam 30 to the column 120 and the wall 130. Moreover, since the upper flange 31 of the secondary beam 30 and the slab 110 are joined together by the shear connectors 114, and the slab 110 is connected to the column 120 and the wall 130 by the connection members 116, tensile force can be transmitted from the upper flange 31 of the secondary beam 30 to the column 120 and the wall 130 through the steel reinforcement bars 112 arranged in the slab 110 and the connection members 116.

[0144] This enables deflection and bending moment at a central portion of the secondary beam 30 to be suppressed in comparison to pin joints in which only the web 33 of the secondary beam 30 is joined to the column 120 and the wall 130 using bolts. Moreover, reinforcement of the joint component 12 between the secondary beam 30 and the column 120 and wall 130 is simpler than in rigid joints in which the web 33 of the secondary beam 30 is joined to the column 120 and the wall 130 using welding or bolts and the upper flange 31 and the lower flange 32 of the secondary beam 30 are joined to the column 120 and the wall 130 using welding or bolts. This enables an increase in construction processes and costs to be suppressed to a minimum.

[0145] Note that although the first wedge component 60 and second wedge component 70 are applied with the configuration of the fourth exemplary embodiment as an example in the twelfth exemplary embodiment, the first wedge component 60 and the second wedge component 70 may be applied with the configuration of any out of the first, second, third, fifth, sixth, or seventh exemplary embodiment described above.

[0146] Explanation follows regarding a thirteenth exemplary embodiment of the present

disclosure.

[0147] In the thirteenth exemplary embodiment illustrated in Fig. 21, the building structure S is configured including a primary beam 140 instead of the column 120 of the twelfth exemplary embodiment described above (see Fig. 20). The primary beam 140 is an example of a structural member, and extends along the arrow Y direction. The primary beam 140 is made of steel-reinforced concrete configured by plural steel reinforcement bars 142 and concrete 143.

[0148] The secondary beam joint detail 10 is applied to a joint between the secondary beam 30 and the primary beam 140. Namely, a support plate 144 is provided to a side face 141 of the primary beam 140. Plural studs 145 are joined to the support plate 144. The support plate 144 of the primary beam 140 and the concrete 143 are joined together by the plural studs 145. The support plate 144 of the primary beam 140 is exposed from the side face 141 of the primary beam 140, and thus configures part of the side face 141 of the primary beam 140.

[0149] A shear plate 24 is joined to the support plate 144, and one end of the secondary beam 30 is joined to the shear plate 24 provided to the primary beam 140, and the other end of the secondary beam 30 is joined to the shear plate 24 provided to the wall 130. The joint component 12 between the secondary beam 30 and the respective shear plates 24 have the same configuration as each other. The configuration of the joint component 12 between the secondary beam 30 and the shear plates 24 is similar to that of the first exemplary embodiment described above (see Fig. 1).

[0150] The gaps 42 are formed between the lower flange 32 of the secondary beam 30 and the respective support plates 134, 144. The supporting members 50 are disposed in the respective gaps 42. As an example, the first wedge component 60 and the second wedge component 70 of the supporting member 50 are applied with the configuration of the fourth exemplary embodiment described above (see Fig. 11). The slab 110 is connected to the primary beam 140 and the wall 130 by respective connection members 116.

[0151] In the thirteenth exemplary embodiment, the supporting members 50 are inserted into the respective gaps 42 between the lower flange 32 of the secondary beam 30 and the primary beam 140 and wall 130, enabling compressive force to be transmitted from the lower flange 32 of the secondary beam 30 to the primary beam 140 and the wall 130. Moreover, since the upper flange 31 of the secondary beam 30 and the slab 110 provided between the primary beam 140 and the wall 130 are joined together by the shear connectors 114, and the slab 110 is connected to the primary beam 140 and the wall 130 by the connection members 116, tensile force can be transmitted from the upper flange 31 of the secondary beam 30 to the primary beam 140 and the wall 130 through the steel reinforcement bars 112 arranged in the

slab 110 and the connection members 116.

[0152] This enables deflection and bending moment at a central portion of the secondary beam 30 to be suppressed in comparison to pin joints in which only the web 33 of the secondary beam 30 is joined to the primary beam 140 and the wall 130 using bolts.

Moreover, reinforcement of the joint component 12 between the secondary beam 30 and the primary beam 140 and the wall 130 is simpler than in rigid joints in which the web 33 of the secondary beam 30 is joined to the primary beam 140 and the wall 130 using welding or bolts and the upper flange 31 and the lower flange 32 of the secondary beam 30 are joined to the primary beam 140 and the wall 130 using welding or bolts. This enables an increase in construction processes and costs to be suppressed to a minimum.

[0153] Note that the primary beam 140 of the thirteenth exemplary embodiment may be made of a steel frame instead of steel-reinforced concrete.

[0154] Although the first wedge component 60 and the second wedge component 70 are applied with the configuration of the fourth exemplary embodiment as an example in the thirteenth exemplary embodiment, the first wedge component 60 and the second wedge component 70 may be applied with the configuration of any out of the first, second, third, fifth, sixth, or seventh exemplary embodiment described above.

[0155] Explanation follows regarding a fourteenth exemplary embodiment of the present disclosure.

[0156] In the fourteenth exemplary embodiment illustrated in Fig. 22, the secondary beam joint detail 10 is modified from that of the eighth exemplary embodiment described above (see Fig. 15) in the following manner. Namely, welding is employed for the joint between the shear plate 24 provided to the primary beam 20 and the web 33 of each of the secondary beams 30, and a leading end side edge of the shear plate 24 is joined to the web 33 at a weld portion 151. The fastening members 11 are employed for temporary fastening during welding of the shear plate 24 and the web 33.

[0157] Similarly to in the eighth exemplary embodiment described above, the fourteenth exemplary embodiment enables deflection and bending moment at a central portion of each of the secondary beams 30 to be suppressed in comparison to a pin joint in which only the web 33 of the secondary beam 30 is joined to the primary beam 20 using bolts. Moreover, reinforcement of the joint component 12 between the secondary beam 30 and the primary beam 20 is simpler than in a rigid joint in which the web 33 of the secondary beam 30 is joined to the primary beam 20 using welding or bolts and the upper flange 31 and the lower flange 32 of the secondary beam 30 are joined to the primary beam 20 using welding or bolts. This enables an increase in construction processes and costs to be suppressed to a minimum.

[0158] Although the first wedge component 60 and the second wedge component 70 are applied with the configuration of the fourth exemplary embodiment as an example in the fourteenth exemplary embodiment, the first wedge component 60 and the second wedge component 70 may be applied with the configuration of any out of the first, second, third, fifth, sixth, or seventh exemplary embodiment described above.

[0159] Moreover, possible combinations of the configurations of the eighth exemplary embodiment to the fourteenth exemplary embodiment described above may be implemented as appropriate.

[0160] Although explanation has been given regarding the first to the fourteenth exemplary embodiments of the present disclosure, the present disclosure is not limited to the above, and obviously various modifications may be implemented within a range not departing for the spirit of the present disclosure.

CLAIMS

1. A secondary beam joining method comprising:

a joining process of arranging a secondary beam, configured by wide flange beam and extending along a horizontal direction, and a structural member in a state in which a gap is formed in the horizontal direction between a lower flange of the secondary beam and the structural member, and joining the secondary beam to the structural member at an upper side of the gap;

a fixing process of inserting into the gap a first wedge component including a first inclined face that faces obliquely upward so as to oppose the structural member in the horizontal direction, and fixing the first wedge component to the lower flange; and

a press-fitting process of moving a second wedge component toward a lower side while sliding an obliquely downward-facing second inclined face of the second wedge component against the first inclined face, and press-fitting the second wedge component between the structural member and the first wedge component.

2. A secondary beam joining method comprising:

a joining process of arranging a secondary beam, configured by wide flange beam and extending along a horizontal direction, and a structural member in a state in which a gap is formed in the horizontal direction between a lower flange of the secondary beam and the structural member, and joining the secondary beam to the structural member at an upper side of the gap;

a fixing process of inserting into the gap a first wedge component including a first inclined face facing obliquely upward so as to oppose the lower flange and fixing the first wedge component to the structural member; and

a press-fitting process of moving a second wedge component toward a lower side while sliding an obliquely downward-facing second inclined face of the second wedge component against the first inclined face, and press-fitting the second wedge component between the lower flange and the first wedge component.

3. The secondary beam joining method of claim 1 or claim 2, wherein:

the first wedge component includes a downward-facing first guide face inclined toward the lower side on progression from one width direction side toward another width direction side of the secondary beam;

the second wedge component includes an upward-facing second guide face inclined toward the lower side on progression from the one width direction side toward the other width

direction side of the secondary beam; and

in the press-fitting process, the second wedge component is moved toward the lower side by sliding the second guide face against the first guide face while moving the second wedge component from the one width direction side toward the other width direction side of the secondary beam.

4. The secondary beam joining method of claim 1 or claim 2, wherein:

the first inclined face is formed with a downward-facing first step face;

the second inclined face is formed with an upward-facing second step face; and

in the press-fitting process, the second wedge component is prevented from coming out by anchoring the second step face to the first step face from the lower side.

5. The secondary beam joining method of claim 1 or claim 2, wherein:

the first wedge component is formed with a first groove opening onto the first inclined face and also open at a side face of the first wedge component;

the second wedge component is formed with a second groove opening onto the second inclined face and also open at a side face of the second wedge component; and

in the press-fitting process, the second wedge component is moved toward the lower side by inserting a third wedge component between an upper side wall face of the first groove and a lower side wall face of the second groove.

6. The secondary beam joining method of claim 1, wherein:

a face on a structural member side of the second wedge component is formed with a protrusion projecting toward the structural member; and

in the press-fitting process, the second wedge component is prevented from coming out by causing the protrusion to bite into the structural member.

7. The secondary beam joining method of claim 2, wherein:

a face on a lower flange side of the second wedge component is formed with a protrusion projecting toward the lower flange; and

in the press-fitting process, the second wedge component is prevented from coming out by causing the protrusion to bite into the lower flange.

8. The secondary beam joining method of any one of claim 1 to claim 7, wherein:

the structural member is a primary beam configured from wide flange beam;

the lower flange of the secondary beam is positioned further toward the upper side than a lower flange of the primary beam;

a web of the primary beam is formed with a rib extending in the horizontal direction with the gap formed between the rib and the lower flange of the secondary beam; and

the first wedge component and the second wedge component are disposed in the gap between the lower flange of the secondary beam and the rib.

9. The secondary beam joining method of any one of claim 1 to claim 7, wherein:

the structural member is a primary beam configured from wide flange beam;

the lower flange of the secondary beam is positioned further toward the upper side than a lower flange of the primary beam;

the gap is formed between the lower flange of the secondary beam and a web of the primary beam; and

the first wedge component and the second wedge component are disposed in the gap between the lower flange of the secondary beam and the web.

10. The secondary beam joining method of any one of claim 1 to claim 7, wherein:

the structural member is a steel-reinforced concrete column or a steel-encased steel-reinforced concrete column;

the gap is formed between the lower flange of the secondary beam and a side face of the column; and

the first wedge component and the second wedge component are disposed in the gap between the lower flange of the secondary beam and the side face.

11. The secondary beam joining method of any one of claim 1 to claim 7, wherein:

the structural member is a wall made from steel-reinforced concrete;

the gap is formed between the lower flange of the secondary beam and a side face of the wall; and

the first wedge component and the second wedge component are disposed in the gap between the lower flange of the secondary beam and the side face.

12. The secondary beam joining method of any one of claim 1 to claim 7, wherein:

the structural member is a primary beam made from steel-reinforced concrete;

the gap is formed between the lower flange of the secondary beam and a side face of the primary beam; and

the first wedge component and the second wedge component are disposed in the gap between the lower flange of the secondary beam and the side face.

13. A secondary beam joint detail comprising:

a joint component configured to join a secondary beam, configured by wide flange beam and extending along a horizontal direction, with a structural member at an upper side of a gap in a state in which the gap is formed in the horizontal direction between a lower flange of the secondary beam and the structural member;

a first wedge component configured to be inserted into the gap and fixed to the lower flange and including a first inclined face that faces obliquely upward so as to oppose the structural member in the horizontal direction; and

a second wedge component that includes an obliquely downward-facing second inclined face configured to contact the first inclined face, and that is configured to be press-fitted between the structural member and the first wedge component.

14. A secondary beam joint detail comprising:

a joint component configured to join a secondary beam, configured by wide flange beam and extending along a horizontal direction, with a structural member at an upper side of a gap in a state in which the gap is formed in the horizontal direction between a lower flange of the secondary beam and the structural member;

a first wedge component configured to be inserted into the gap and fixed to the structural member and including a first inclined face that faces obliquely upward so as to oppose the lower flange; and

a second wedge component that includes an obliquely downward-facing second inclined face configured to contact the first inclined face, and that is configured to be press-fitted between the lower flange and the first wedge component.

15. The secondary beam joint detail of claim 13 or claim 14, wherein:

the first wedge component includes a downward-facing first guide face inclined toward a lower side on progression from one width direction side toward another width direction side of the secondary beam;

the second wedge component includes an upward-facing second guide face inclined toward the lower side on progression from the one width direction side toward the other width direction side of the secondary beam; and

the second guide face is configured to contact the first guide face.

16. The secondary beam joint detail of claim 13 or claim 14, wherein:
the first inclined face is formed with a downward-facing first step face;
the second inclined face is formed with an upward-facing second step face; and
the second step face is anchored to the first step face from a lower side.
17. The secondary beam joint detail of claim 13 or claim 14, wherein:
the first wedge component is formed with a first groove opening onto the first inclined face and also open at a side face of the first wedge component;
the second wedge component is formed with a second groove opening onto the second inclined face and also open at a side face of the second wedge component; and
a third wedge component is inserted between an upper side wall face of the first groove and a lower side wall face of the second groove.
18. The secondary beam joint detail of claim 13, wherein:
a face on a structural member side of the second wedge component is formed with a protrusion projecting toward the structural member; and
the protrusion is configured to bite into the structural member.
19. The secondary beam joint detail of claim 14, wherein:
a face on a lower flange side of the second wedge component is formed with a protrusion projecting toward the lower flange; and
the protrusion is configured to bite into the lower flange.
20. The secondary beam joint detail of any one of claim 13 to claim 19, wherein:
the structural member is a primary beam configured from wide flange beam;
the lower flange of the secondary beam is positioned further toward the upper side than a lower flange of the primary beam;
a web of the primary beam is formed with a rib extending in the horizontal direction with the gap formed between the rib and the lower flange of the secondary beam; and
the first wedge component and the second wedge component are disposed in the gap between the lower flange of the secondary beam and the rib.
21. The secondary beam joint detail of any one of claim 13 to claim 19, wherein:
the structural member is a primary beam configured from wide flange beam;

the lower flange of the secondary beam is positioned further toward the upper side than a lower flange of the primary beam;

the gap is formed between the lower flange of the secondary beam and a web of the primary beam; and

the first wedge component and the second wedge component are disposed in the gap between the lower flange of the secondary beam and the web.

22. The secondary beam joint detail of any one of claim 13 to claim 19, wherein:

the structural member is a steel-reinforced concrete column or a steel-encased steel-reinforced concrete column;

the gap is formed between the lower flange of the secondary beam and a side face of the column; and

the first wedge component and the second wedge component are disposed in the gap between the lower flange of the secondary beam and the side face.

23. The secondary beam joint detail of any one of claim 13 to claim 19, wherein:

the structural member is a wall made from steel-reinforced concrete;

the gap is formed between the lower flange of the secondary beam and a side face of the wall; and

the first wedge component and the second wedge component are disposed in the gap between the lower flange of the secondary beam and the side face.

24. The secondary beam joint detail of any one of claim 13 to claim 19, wherein:

the structural member is a primary beam made from steel-reinforced concrete;

the gap is formed between the lower flange of the secondary beam and a side face of the primary beam; and

the first wedge component and the second wedge component are disposed in the gap between the lower flange of the secondary beam and the side face.

25. A supporting member employed in a secondary beam joint detail including a joint component configured to join a secondary beam, configured by wide flange beam and extending along a horizontal direction, with a structural member at an upper side of a gap in a state in which the gap is formed in the horizontal direction between a lower flange of the secondary beam and the structural member, the supporting member comprising:

a first wedge component that includes a first inclined face that faces obliquely

upward so as to oppose the structural member in the horizontal direction, and that is configured to be inserted into the gap and fixed to the lower flange; and

a second wedge component that includes a second inclined face that faces obliquely downward so as to contact the first inclined face, and that is configured to be press-fitted between the structural member and the first wedge component.

26. A supporting member employed in a secondary beam joint detail including a joint component configured to join a secondary beam, configured by wide flange beam and extending along a horizontal direction, with a structural member at an upper side of a gap in a state in which the gap is formed in the horizontal direction between a lower flange of the secondary beam and the structural member, the supporting member comprising:

a first wedge component that includes a first inclined face that faces obliquely upward so as to oppose the lower flange, and that is configured to be inserted into the gap and fixed to the structural member; and

a second wedge component that includes a second inclined face that faces obliquely downward so as to contact the first inclined face, and that is configured to be press-fitted between the lower flange and the first wedge component.

27. The supporting member of claim 25 or claim 26, wherein:

the first wedge component includes a downward-facing first guide face inclined toward a lower side on progression from one width direction side toward another width direction side of the secondary beam; and

the second wedge component includes an upward-facing second guide face inclined toward the lower side on progression from the one width direction side toward the other width direction side of the secondary beam and configured to contact the first guide face.

28. The supporting member of claim 25 or claim 26, wherein:

the first inclined face is formed with a downward-facing first step face;

the second inclined face is formed with a second step face projecting toward the first wedge component and configured to be anchored to the first step face from a lower side.

29. The supporting member of claim 25 or claim 26, wherein:

the first wedge component is formed with a first groove opening onto the first inclined face and also open at a side face of the first wedge component;

the second wedge component is formed with a second groove opening onto the

second inclined face and also open at a side face of the second wedge component; and

the supporting member further includes a third wedge component configured to be inserted between an upper side wall face of the first groove and a lower side wall face of the second groove.

30. The supporting member of claim 25, wherein a face on a structural member side of the second wedge component is formed with a protrusion projecting toward the structural member.

31. The supporting member of claim 26, wherein a face on a lower flange side of the second wedge component is formed with a protrusion projecting toward the lower flange.