

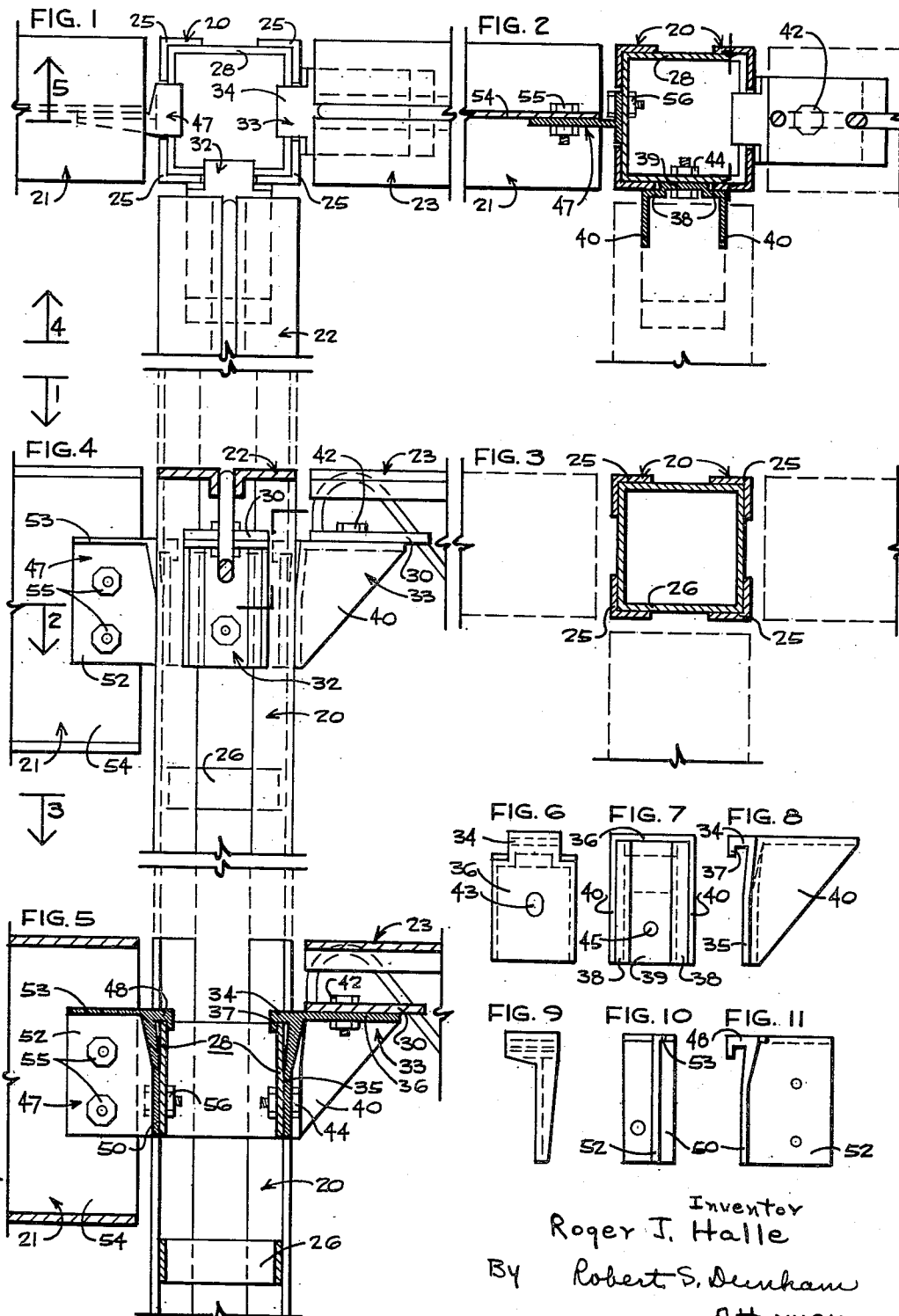
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CONNECTING MEANS FOR STRUCTURAL ELEMENTS

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2,994,415 CONNECTING MEANS FOR STRUCTURAL ELEMENTS

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This invention relates to means for connecting and supporting frame or structural elements in the art of building, and to assemblies of structural elements with such means. More specifically, the invention relates to an assembly of one or more horizontal beams with a column of so-called strap, lattice or similar type, the beam or beams being connected to and supported by the column through novel auxiliary structure as hereinbelow described. The auxiliary structure includes a novel hanger device for engagement with and support by the column structure and having means for supporting the end portion of a beam.

As indicated, the invention is particularly designed for so-called strap, lattice or similar type columns, such as conventionally constituted by four upright angle members arranged to form corner portions of a column having square or rectangular shape in cross-section, such column further including means joining the corner elements so as to provide a column having vertical openings in its side faces or walls. In the strap type of column, the means joining the angle members comprise collars or other strap arrangements in welded, riveted or other connection to the flanges of the angle members; in so-called lattice columns, some or all of the usual connecting members are disposed at an angle to the vertical and horizontal, e.g. crossing back and forth between the corners in slanting directions.

An important object of the invention is to provide novel and effective means for attaching beams to such a column in a convenient and secure manner, preferably with load transmitted to the column through bearing supports of considerable transverse dimension. Further objects are to provide a means for the connection of beams, whereby buildings may be erected in a relatively rapid and expedient way without requiring special skill and with adequate provision for erection tolerances.

A further specific object of the invention, in its presently preferred forms, is to provide novel and advantageous arrangements for connecting beams of the so-called open web, bar joist or I-type to columns of the strap or other open design as described, it being understood, however, that in more general aspects, the invention is applicable to the attachment of other kinds of beams, such as box-section beams, channel beams and the like.

To these and other ends, the invention, in its presently preferred embodiments, includes the provision of transverse strap means in the column at a suitable locality for attachment of one or more beams, such strap means having a transverse upper edge structure crossing the vertical space between the corner elements of the column. The invention further comprises a bracket or hanger device having a horizontal arm arranged to rest in bearing upon and across said edge means, and a vertical arm extending downwardly from the region of the horizontal arm, for abutment with the column structure, the hanger device also having outwardly projecting means for supporting the end portion of a beam, so as to transmit the load thereof to the column. There may also be such web means for bracing as may be desired, for example between the above-mentioned vertical arm and the outwardly-projecting beam-supporting means. A specific feature of the invention, e.g. in provision for supporting bar joints or the like, comprises the provision

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of the beam-supporting means as a plate-like horizontal arm, which preferably projects from the region of the short horizontal arm, for example as a continuation of the latter, to receive in bearing an appropriate horizontal structural part of the beam.

As will become further apparent below, this hanger arrangement including the outer arm, permits the transfer of load from the beam to the column in bearing, rather than through bolts, rivets or the like in shear. It also provides for abundant tolerance in the mutual dimensioning and disposition of the parts, i.e. to take account of reasonable dimensional variations in the manufacture of beams and columns and in the erection of buildings therewith.

The hanger device is susceptible of modification to suit various types of building elements, for example as in the case of I-beams where the hanger may, if desired, have its beam-supporting means constituted by a vertical, projecting flange to be bolted to the upright web of such beam. In this instance, it is possible to forego some features of the preferred embodiment described above, such as unusual provision for tolerances, and support in bearing rather than through bolts, rivets or the like in shear.

It will be understood that, unless otherwise stated, the term "beam" is employed generically herein to include horizontal building elements which may variously be described by their functions as beams, girders or joists.

Examples of the invention are illustrated in the accompanying drawing, wherein:

FIG. 1 is a plan view of a column having three beams connected thereto in accordance with the invention, the connection at the left hand side being of somewhat different structure from the others;

FIG. 2 is a horizontal sectional view of the assembly shown in FIG. 1, taken on line 2 of FIG. 4;

FIG. 3 is a horizontal section, taken on line 3 of FIG. 4;

FIG. 4 is a vertical section on the line 4 of FIG. 1, showing most of the structure in elevation;

FIG. 5 is a vertical section on line 5 of FIG. 1;

FIGS. 6, 7 and 8 are respectively a plan, a front elevation and a side elevation of a hanger device such as shown at the right hand side of FIGS. 1, 2, 4 and 5, and at the lower side of FIGS. 1 and 2; and

FIGS. 9, 10 and 11 are respectively a plan, a front elevation and a side elevation of a hanger device such as shown at the left hand side of FIGS. 1, 2, 4 and 5.

FIGS. 1 to 5 inclusive show a column 20 having three beams 21, 22 and 23 connected to its upper end portion, for example so that the uppermost surfaces of the beams are flush with the top of the column. The column 20 itself is of the so-called strap type, being composed of four angle-section members 25 of steel or the like disposed respectively at the corners of the square cross-section of the column. These members are held in an assembled, unitary structure by strap means such as the internal collar 26 (FIGS. 3, 4 and 5), which can be made of steel or other suitable metal, having a square plan to fit the internal faces of the members 25 and welded, riveted or otherwise secured to the latter. It will be understood that other similar strap elements of steel plate or the like (not shown), or equivalent bracing and connecting structure, may be disposed along the column at appropriately spaced localities, the drawing showing, for simplicity, only the uppermost portion of the column. Also, it will be understood that such straps can be composed of separate pieces for each side or face of the column.

In accordance with the present invention, a suitable strap structure, made either in the form of a continuous

square collar 28 as shown, or made of separate pieces for each side, is mounted within the column at a locality suitable for support of beams, for example near the top of the assembly. Although this collar may be identical with elements such as the collar strap 26, and may in any event serve the function of connecting the column elements 25 at its locality, it may be advantageous to make the collar means 28 somewhat longer in the vertical direction of the column than may ordinarily be necessary for the simple tying function of other strap means, such as 26. This strap or collar structure 28, made of steel or other suitable metal, is normally welded or otherwise secured to the corner elements 25 in a permanent manner, it being thus understood that for use in various building operations, columns can advantageously be prefabricated to include such strap structures 28 at localities intended for attachment of beams.

By way of example, the beams 22, 23 in FIGS. 1 to 4 are shown as of the open web type commonly called open web or bar joists, being made to include a bearing plate 30 or similar element having a flat under surface of considerable extent, adjacent the end of the beam. Such elements 30 may be disposed intermediate the upper and lower boundaries or flanges of the beam, for example as shown at a locality spaced somewhat below the top flange, the location of the strap or collar means 28 and of the coacting supporting structure (described below) being correspondingly governed by the position of the bearing means 30 or the like on the beams to be attached to the column. In case a hanger device of the type shown supports a beam by directly carrying a flange of the beam, no bearing plate would be used.

For support of the beams 22, 23 a pair of identical hanger devices 32, 33 are shown. Each of these hangers 32 and 33 consists of a unitary bracket-like structure of steel or other appropriate composition, having a short horizontal arm 34, a vertical arm or plate structure generally designated 35, and a further horizontal arm or plate 36, the latter being essentially a continuation of the horizontal arm 34. The vertical structure 35 extends integrally downward in a generally perpendicular direction from the region of juncture of the horizontal arms 34, 36.

As will be seen, the horizontal arm 34 is shaped to enter the space between two corner members 25 of the column and to rest in bearing upon and along the upper horizontal edge of the strap structure 28, the horizontal arm 34 having at its extremity a shallow downward flange 37 hooking over the strap part 28. Although in some cases the depending vertical arm 35 can be otherwise shaped (e.g. as either to abut only the strap 28 or only the members 25), this portion is shaped with outer, vertically extending plate sections 38, 38 to engage flatwise the faces of the adjacent column members 25, and with a central, vertically extending plate section 39 which is offset relative to sections 38, in a direction inwardly of the column, by a distance equal to the thickness of the members 25. The central portion 39 has a width suitable to enter the opening between the members 25, so that it may abut the vertically extending face of the strap 28.

As shown, the outwardly projecting horizontal arm 36, having a considerable length, and a width greater than the horizontal arm 34, in particular equal to the total width of the depending vertical arm 35, has a flat upper surface to receive the bearing plate 30 of the beam 23. Preferably the hanger device includes bracing means, such as the pair of plate parts 40, of triangular shape, extending from the sides of the horizontal arm 36 to the sides of the vertical arm 35. For greater strength and for provision of a larger and easier fitted recess under the horizontal arm 34, the upper portion of the vertical arm 35 may slope slightly away from the column in a direction as shown, and for like improvement of strength and rigid-

ity, may be somewhat thickened at the upper part of its central section 39, as indicated in FIGS. 5 and 8.

To retain the beam on the hanger 33, the plate 30 may be secured to the horizontal hanger arm 36 by a bolt 42, the corresponding hole in at least one of these members, such as the hole 43 in the arm 36 (FIG. 6), being slotted or otherwise enlarged for adjustment of attachment. Similarly the vertical arm 35 may be attached to the collar or strap element 28 by a like bolt 44, with similar possibility of adjustment of the bolt, as by appropriately dimensioning the bolt hole 45 in the arm section 39, FIG. 7. Since the load of the beam is transferred directly in bearing to the horizontal arm 36 of the hanger, and since load and thrust from the hanger are transferred directly to the column structure in direct bearing at the upper edge of the strap 28, and by similar abutment to the vertical face of the strap 28, there is no substantial load transmitted through the bolts 42, 44. Hence the adjustment of fit of the bolts can provide a substantial measure of tolerance in the mutual assembly of the elements, e.g. in erecting a building, the bolts being simply tightened to retain the parts against lateral displacement.

Although a hanger device can be arranged to support, in direct bearing, one or both portions of the upper flange of an I-beam, in the general manner of the hangers 32, 33 supporting the beams 22, 23, the left hand side of FIGS. 1, 2, 4 and 5, and FIGS. 9 through 11, show a modified hanger or bracket 47 for supporting the I-beam 21. This device has a short horizontal arm 48, with a depending flange 49 functioning, like the horizontal arm 34 and flange 37, to rest upon and hook over the upper edge of the strap 28. The device 47 also has a vertical arm 50 extending downward outside of the strap from a junction with the horizontal arm 48. Although the vertical arm 50 may have outer portions to abut the adjacent column members 25, as in the case of portions 38 of the hangers 32, 33, such vertical arm 50 is shown as consisting of a single portion designed to enter the space between the members 25 and to abut the outer face of the strap 28.

A wide vertical flange 52 extends outwardly from the horizontal arm 48 and the vertical flange 50, and is reinforced at its upper edge by a narrow horizontal flange 53, essentially coplanar with the horizontal arm 48. The vertical flange 52 is fastened to the vertical web 54 of the beam 21, as by appropriate bolts 55, while the vertical arm 50 is retained in place by a bolt 56 through the collar 28. For appropriate tolerance and convenience of assembly, the bolt 56 may have an adjustable fit as in the case of the bolt 44 of the hangers 32, 33, but in the instance of the bolts 55 a snug fit is desired, since these bolts transfer load from the beam 21 to the vertical flange 52 of the hanger device. It will be noted that to accommodate the central location of the web 54 of the I-beam 21, the vertical flange 52 is laterally somewhat displaced from the center of the hanger device 47 and its arms 48 and 50.

It will now be seen that the described arrangements afford an economical and rapid way of connecting any desired number of beams to corresponding sides of a strap or similar type column 20, by means of elements, such as the hangers 32, 33 and 47, which can be designed in various forms appropriate to the type of beam to be carried. Each of the hanger devices 32, 33 and 47 is dimensioned so that its total width is no greater than that of the adjacent face of the column, and so that its vertical cross-section, parallel to the column face, lies within a rectangle which defines the cross-sectional dimensions of the supported beam. Although for many uses the hangers can be otherwise dimensioned, the dimensional relationships just described are of special importance for accommodating certain types of wall panels to the building frame.

For use in constructing the frame of a desired building,

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the columns 20 are fabricated to include straps or collars 28 at desired beam-receiving localities. As a result, in actually erecting the building, the attachment of beams is a simple matter. The appropriate hanger device, such as one of the hangers 32, 33 and 47 is assembled to the column, by inserting the short horizontal arm 34 or 48 through the opening above the strap 28 and into resting engagement of such arm with the horizontal upper edge of the defined strap. Then, the beam to be supported is brought into place. As shown with the hangers 32 and 33, the open web joist type of beams 22, 23 are simply swung into resting position on the arms 36, the assembly being then completed so far as support of the load is concerned. For rigidity and permanence, bolts 42, 44 are applied. In this device, maximum realization of the benefits of ready assembly and full tolerance are achieved, and at the same time all load is transferred by direct bearing.

If hangers of the type shown at 47 are to be used, as in receiving an I-beam or the like, the construction operation for the building is quite similar. The horizontal arm 48 of the hanger 47 is inserted in the same manner, to rest in bearing along the upper edge of the strap 28. With the hanger 47 thus in place, the beam 21 is brought up and its web 54 is bolted to the vertical flange 52 of the hanger. While this last attachment involves transfer of load in shear through the bolts to the hanger, the arrangement is rapid and convenient and has the advantage that between the hanger and the column, load is transferred in bearing rather than in shear.

While two examples have been shown, it is to be understood that the invention is not limited to the specific forms herein shown and described, but may be carried out in other ways without departure from its spirit.

I claim:

1. In a building structure, a column and beam assembly, comprising a column structure having a vertically extending opening along a wall thereof, said column structure including transverse flat strap means in the wall, having a transverse upper edge accessible at and crossing said opening, a hanger device adapted to hang at one side only of said column structure in directly fitting relation thereto, said hanger device having a horizontal arm extending into said opening and resting in bearing, upon and along the length of said edge, a substantially planar vertical arm abutting an outwardly facing surface of the column structure below said edge and in the vicinity of both sides of said opening, and beam-supporting means projecting outwardly from the structure constituted by said horizontal and vertical arms, and a beam connected to and supported by said beam-supporting means, said horizontal arm having an extent in the direction inward of the column substantially less than the crosswise dimension of the column in said direction, and said horizontal arm being shaped, free of structure projecting downwardly at its line of crossing said transverse edge, so that it is disposed wholly above said edge at said line of crossing.

2. In a building structure, the combination defined in claim 1, wherein the beam-supporting means comprises a horizontal arm extending outwardly from the region of the first-mentioned horizontal arm, said beam resting in bearing on said second horizontal arm.

3. In a building structure, a column and beam assembly, comprising a column rectangular in plan and comprising vertical members at the corners of the column, mutually spaced in horizontal directions to provide vertically extending openings in the walls of the column, said column including transverse flat strap means mutually secured to and securing the upright members and trav-

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ersing the vertically extending openings, said transverse means having horizontal edge means accessible at and crossing said openings, a hanger device adapted to hang at one side only of said column in directly fitting relation thereto, said hanger device having a short horizontal arm resting in bearing upon and along lengthwise of one of said edge means, a substantially vertical arm extending below said horizontal arm and crosswise of the column and arranged to seat against outwardly facing vertical surface areas of the column below said last-mentioned edge means and at the vicinity of the opposed vertical members which adjoin said last-mentioned edge means, and beam-supporting means projecting outwardly from the structure constituted by said hanger arms, and a beam secured to and supported by said beam-supporting means, said horizontal arm having an extent in the direction inward of the column substantially less than the crosswise dimension of the column in said direction, and said horizontal arm being shaped free of structure projecting downwardly at its line of crossing said one of the edge means, so that it is disposed wholly above said edge at said line of crossing.

4. In a building structure, the combination defined in claim 3, wherein the beam-supporting means comprises a horizontal arm extending outwardly from the region of the first-mentioned horizontal arm, said beam resting in bearing on said second horizontal arm.

5. In a building structure, a column and beam assembly, comprising a column rectangular in plan and comprising vertical angle-section members at the corners of the column, mutually spaced in horizontal directions to provide vertically extending openings in the walls of the column, said column including a plurality of vertically spaced transverse means mutually secured to and securing the upright members, one of said transverse means comprising flat strap means traversing a vertically extending opening at a region within the column, said strap means being secured to inner faces of the adjacent corner members and having a horizontal edge accessible at and crossing said last-mentioned opening, a hanger device adapted to hang at one side only of said column in directly fitting relation thereto, said hanger device having a short horizontal arm resting in bearing, upon and along lengthwise of said horizontal edge, a substantially vertical arm extending below said horizontal arm and crosswise of the column and arranged to seat against outwardly facing vertical surface areas of the column below said edge and at the vicinity of the aforesaid corner members which are adjacent to the strap means, and beam-supporting means projecting outwardly from the structure constituted by said hanger arms and having its upper boundary substantially no higher than the upper boundary of said short horizontal arm, and a beam secured to and supported by said beam-supporting means, said horizontal arm having an extent in the direction inward of the column substantially less than the crosswise dimension of the column in said direction, and said horizontal arm being shaped free of structure projecting downwardly at its line of crossing said horizontal edge, so that it is disposed wholly above said edge at said line of crossing.

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