Sept. 7, 1954 W. E. WILSON 2,688,167

CONSTRUCTION OF KNEED BENTS

Filed Dec. 6, 1948 3 Sheets-Sheet 1

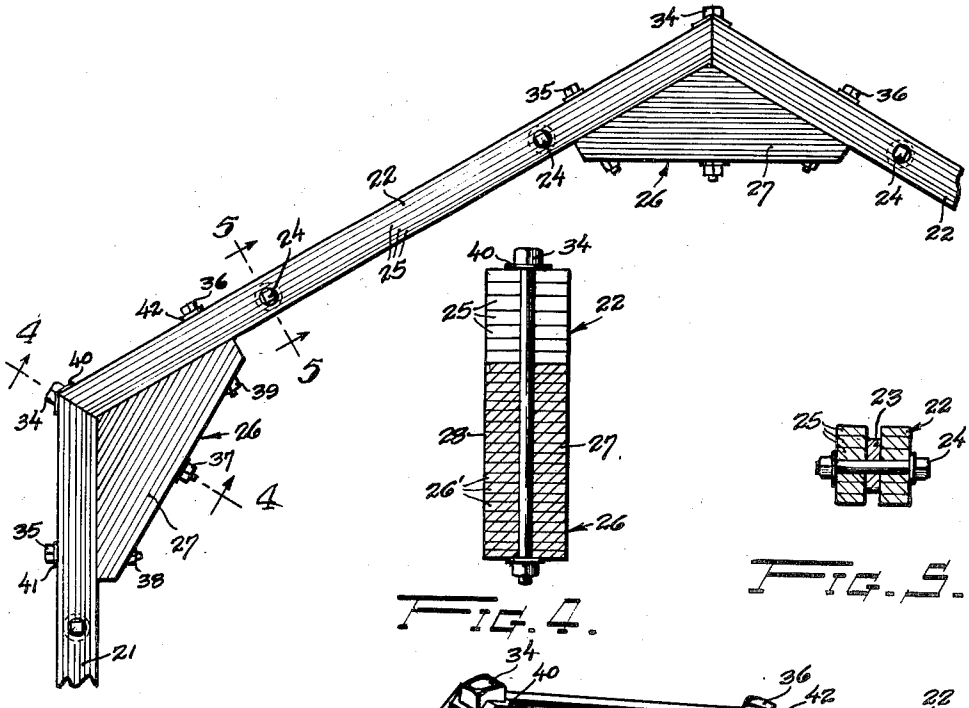


FIG. 1.

FIG. 4.

FIG. 5.

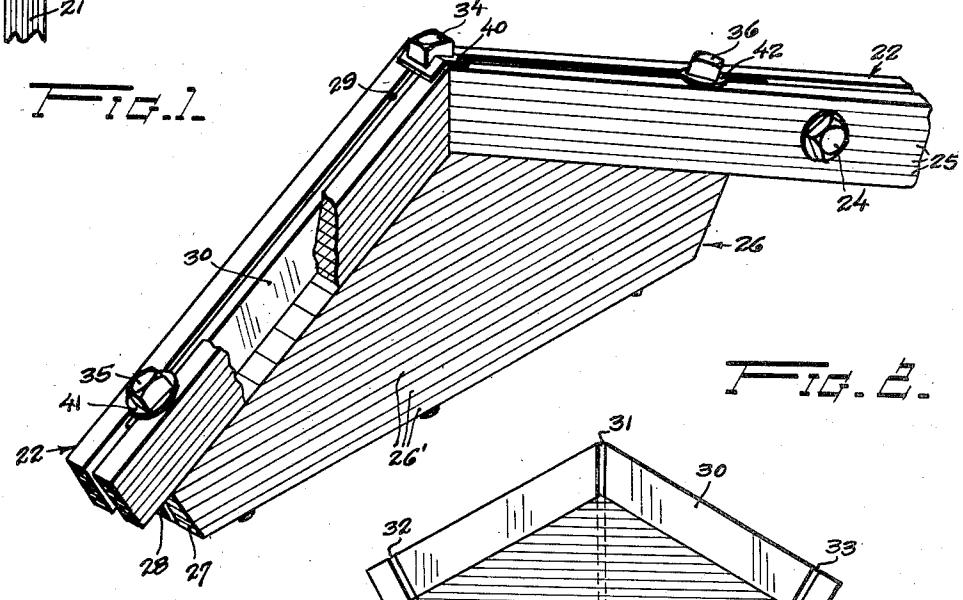


FIG. 2.

FIG. 3.

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CONSTRUCTION OF KNEED BENTS

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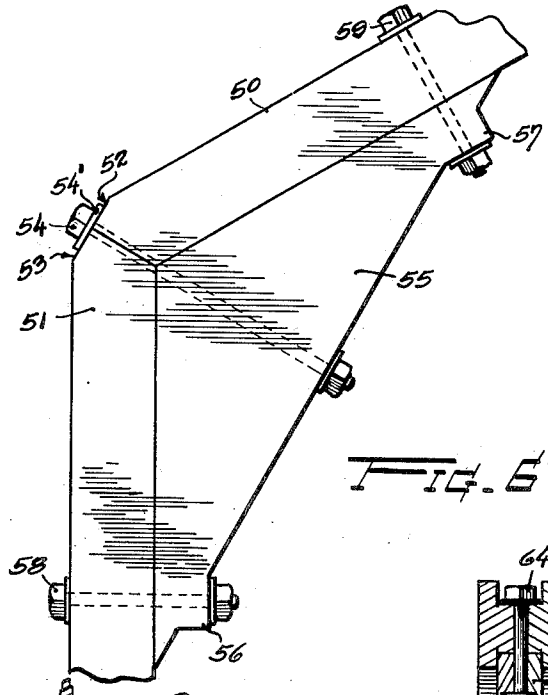


FIG. 6.

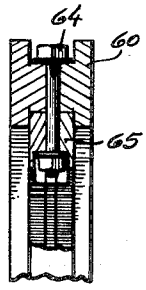


FIG. 8.

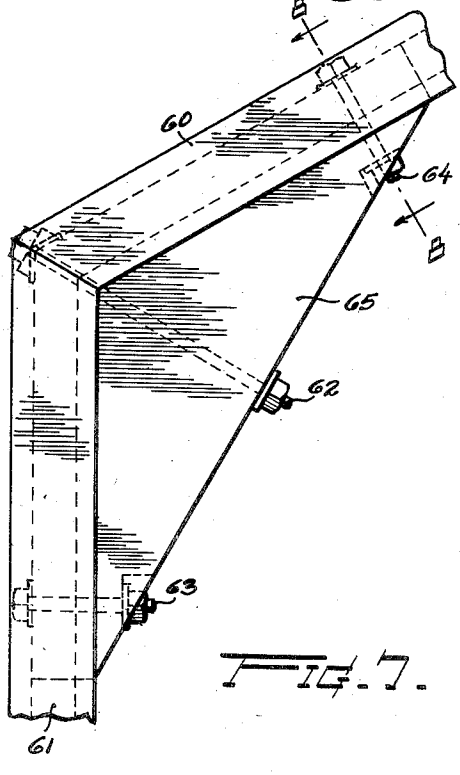


FIG. 7.

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CONSTRUCTION OF KNEED BENTS

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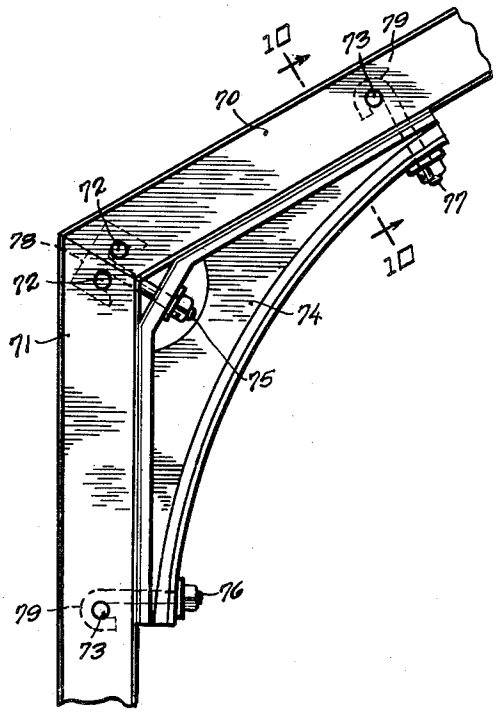


FIG. 9.

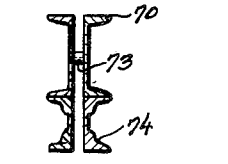


FIG. 10.

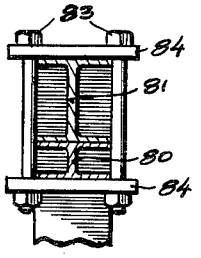


FIG. 12.

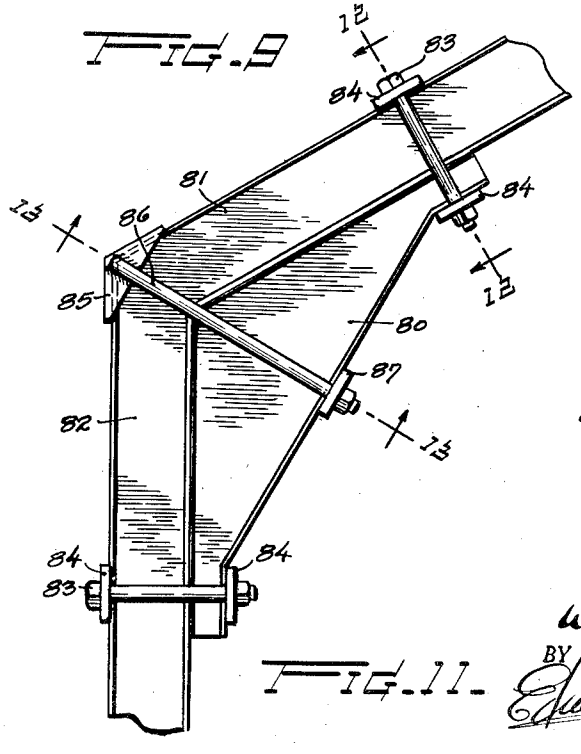


FIG. 11.

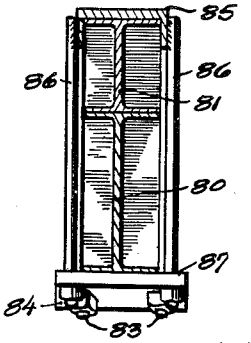


FIG. 13.

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UNITED STATES PATENT OFFICE

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CONSTRUCTION OF KNEED BENTS

Win E. Wilson, Tacoma, Wash.

Application December 6, 1948, Serial No. 63,725

6 Claims. (Cl. 20—92)

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This invention relates to building construction, and more especially pertains to the bents which make up the skeleton structure therefor, with the principal object being to devise an improved system of joining the angularly disposed components of the bent one to another in an unusually rigid assembly.

It is a further and particular object to provide an association of parts for this purpose embodying a perfected knee-block arranged and adapted to exactly fit the inside angle described at the juncture of post and rafter or rafter and rafter and which is so tied to these meeting members as to positively lock the members in place and pass all moments originating therein into the knee.

The invention has the further object still of devising a frame structure of this nature the components of which are of simple and inexpensive construction readily adapting themselves to prefabrication and which can be easily and quickly erected on the building site.

As a still further object, the invention aims to provide a frame structure the component parts of which are or may be standardized and which admits of using these several standardized parts in the erection of variously shaped roofs.

The invention has the yet further and important object of providing frame-building members which, while adapting themselves to the use of wood, metal or reinforced concrete as the material of their composition, are by preference made of laminated wood with scrap stock being suitable for the purpose and with the laminae so applied as to give unusual rigidity to the produced member.

With other still more particular objects and advantages in view and which, with the foregoing, will appear and be understood in the course of the following description and claims, the invention consists in the perfected method of joining the angularly disposed members which compose the transverse framing bent of a building and in the novel construction, adaptation and combination of parts hereinafter described and claimed.

In the accompanying drawings:

Figure 1 is a fragmentary side elevational view portraying a framing structure produced in accordance with the preferred teachings of the present invention, the elements as they are here illustrated being of laminated wood composition.

Fig. 2 is a fragmentary perspective view thereof taken to an enlarged scale and confined to the showing of a single joint, in this instance the ridge joint.

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Fig. 3 is a side elevational view showing the knee-block alone and with the scale being enlarged from that of Fig. 1 but reduced from that of Fig. 2.

Figs. 4 and 5 are transverse vertical sectional views on lines 5—5 and 4—4, respectively, of Fig. 1, and employing a scale corresponding to the scale used in Fig. 3.

Fig. 6 is a fragmentary side elevational view illustrating a modified knee assembly particularly lending itself to the use of reinforced concrete.

Fig. 7 is a fragmentary side elevational view showing still another embodiment of the invention which lends itself equally well to the use of wood or reinforced concrete.

Fig. 8 is a transverse vertical sectional view on line 8—8 of Fig. 7.

Figs. 9 and 11 are fragmentary side elevational views portraying further embodiments of the invention, these embodiments being such as best adapt themselves to the use of metal as the material of their composition.

Figs. 10, 12 and 13 are transverse sectional views on respective lines 10—10 of Fig. 9 and lines 12—12 and 13—13 of Fig. 11, the former said view, for maximum clarity in illustration, deleting the tie-bolt which secures the knee-block to the rafter member.

With reference being had to said drawings, and first describing the embodiment of Figs. 1 through 5, inclusive, the numerals 21 and 22 designate post and rafter members of a framing bent having their ends in contiguity and with these contiguous ends indicated as being each cut on an angle of 30° to give, by their meeting abutment, a 30° pitch to the roof line. These rafter and post members are each comprised of two complementing sections placed side-by-side and clamped in separated parallelism by spacing washers 23 employed in conjunction with nutted bolts 24, and the said sections are each preferably of glue-bonded laminated wood construction with the laminae 25 lying transverse to the plane of the bent and running lengthwise of the sections.

Designated by 26 are knee-blocks applied much in the manner of gussets to each of the frame angles, and in fabricating these blocks there are employed a pair of identical cheek plates 27—28 which, side elevation considered, are each made in the form of an isosceles triangle whose major angle is the mating counterpart of the frame angles, and received between and glued or otherwise integrated with these cheek plates is a web 30 having a thickness corresponding to the longitudinal slot 29 which occurs between the paired complements of each of the two frame members

21 and 22. This web is made to project beyond the sloping faces of the cheek plates, and the exposed tongue thereby described accommodates itself in the slot of the frame members. As will be clearly apparent from an inspection of Fig. 3 the web either is made up from four separated sections or may be a single piece drilled to provide three bolt-holes running top to bottom of the web with one said bolt-hole, denoted 31, lying substantially on the bisecting line of the block while the others, denoted 32 and 33, are placed in spaced proximity of the end extremities and run perpendicular to the sloping faces. As with the spaced components of the longitudinal frame members 21 and 22, the cheek-plates are of laminated construction with the laminae 26' placed in substantially the same manner, and this is to say on edge with the wide sides placed at right angles to the plane in which the frame angles lie and running lengthwise of the block.

When assembling the described framing pieces of a bent, rafter to rafter or rafter to post, the ends of the longitudinals are slipped over the tongue of the knee-block and brought into abutting engagement, whereupon bolts 34, 35 and 36, which each carry a suitable washer under the head ends thereof, are passed from the outside of the frame through the bolt-holes 31, 32 and 33. The bolts are of a length to extend through the knee-block and project beyond the inside face of the latter, and these bolts are then drawn tight by nuts 37, 38 and 39, respectively, each establishing its purchase against the usual washer. The washers, denoted by 40, 41 and 42, which underlie the bolt heads are or may be integrated with the bolt heads and act in each instance to span the slot 23 and bear upon the paired complements of the post or rafter, as the case may be, and the washer 40, through the instrumentality of giving the same an angular bend, is made common to each of the two abutting members. It will be seen that the two complements of respective said abutting members are each held rigid with the knee-block by two bolts placed one at the end limit of the abutting member and the other in longitudinally removed relation therefrom closely adjacent to the end limit of the knee-block. The first said bolt restrains the related member against forces tending to rock on the knee and jack-knife the abutting members, and the second said bolt restrains the related member against forces working in a counterdirection, wherefor it becomes self-evident that irrespective of the direction in which a bending moment acts the same is resisted by a bolt in tension, and the responsible moment is passed into the knee.

Proceeding with a description of the other embodiments which I have elected to illustrate, that of Fig. 6 portrays an arrangement in which angularly disposed member 50 and 51 of the bent have the lip extremities of their abutting ends cut back as at 52—53 to produce coinciding flats, and thus admitting of the use of a plane washer 54' in lieu of the bent washer 40 to establish a tensioning purchase from the single centrally placed bolt 54 to the end extremities of both said members 50 and 51. The knee-block 55 in this embodiment, considered as to configuration, is distinguished from the embodiment of Figs. 1–5 only in the fact of its presenting bosses, as 56 and 57, upon which the nuts for the other two bolts 58 and 59 bear. This particular embodiment, while admitting to the use of wood as the material of its composition, especially lends itself to production from reinforced concrete cast to shape. So cast, the members 50 and 51 would desirably be terminally bifurcated, and this is to say that the slots which accommodate the tongue element of the knee-block would occur only in the ends of the members.

Referring to Figs. 7 and 8, the embodiment therein illustrated and which also lends itself to the use of reinforced concrete has the two angularly disposed members 60 and 61 rabbeted top and bottom for the self-evident purpose of recessing the heads of the bolts 62, 63 and 64, and the body proper of the knee-block 65, and namely the matching edge portions of the knee-block are made to fit snugly in the groove described by the bottom rabbets.

In Figs. 9 and 10, the angularly disposed members 70 and 71 are shown as being produced from channel-iron stock with two said channel irons being placed in separated back-to-back relation in the instance of each said member, and each having transverse pins, as 72 and 73, projected across the opening and placed one in closely spaced proximity of the end extremity and the other in longitudinally removed relation therefrom. The knee-block, designated by 74, is similarly composed of two pieces of channel-iron stock placed in separated back-to-back relation, and is brought firmly to bear against the underside flanges of the members 70 and 71 by nutted bolts 75, 76 and 77. The bolt 75 and a T-head 78 which is made common to and engages over each of the two pins 72, and the bolts 76 and 77 each present a hook end 79 which engages a related one of the two pins 73.

Still another arrangement which adapts itself to the use of steel sections is portrayed in Figs. 11, 12 and 13, I-bars being in this instance employed and the tie from the knee-block 80 to the angularly disposed members 81 and 82 being accomplished by shackle-bolts. The shackling assembly applied to each end of the knee-block is comprised simply of nutted bolts 83 bearing, top and bottom of the joint, against transversely applied strap-irons 84. The centrally placed shackle employs a boxing cap 85 which sectionally is of angular shape and there is welded to each of the skirting end walls thereof a bolt 86 fitted with a nut which is brought to bear against a strap-iron 87.

It is thought that the invention will have been clearly understood from the foregoing detailed description having express reference to the several embodiments which I have elected to illustrate. Various other arrangements which depart therefrom in point of shape and general arrangement of parts without sacrifice of the inventive concept will readily occur to those versed in the art, and it is my intention that no limitations be implied and that the hereto annexed claims be given a scope fully commensurate with the broadest interpretation to which the employed language fairly admits.

What I claim is:

1. The knee structure for a kneed bent comprising, in combination with meeting angularly disposed framing pieces establishing a miter juncture by their meeting engagement and having their meeting ends longitudinally slotted in the plane of the bent, a gusset-forming knee-block preformed to lie in the inside angle between said pieces and finding an exact bearing fit against the furcate extremities of the pieces, a tongue extension integrated with said knee-block and fitting in said slots, said block and its tongue extension presenting through-holes for the reception of bolts, and tensioning bolts received

through said bolt-holes and connecting the knee-block to the meeting pieces to rigidly tie the same together and restrain the tied pieces against bending moments acting in any direction within the plane of the bent.

2. The structure of claim 1 in which one of said tensioning bolts occupies an axis bisecting the angle of junction and is made common to both of the meeting pieces and takes a direct purchase upon each.

3. The knee structure for a kneed bent comprising, in combination with meeting angularly disposed framing pieces establishing a miter juncture by their meeting engagement, a gusset-forming knee-block lying in the inside angle between said pieces and finding a mating fit with the latter, said pieces and knee-block presenting a mating tongue and groove in the plane of the bent, and tensioning means acting in the plane of the bent and rigidly tying the pieces and the knee-block together.

4. The structure of claim 1 wherein said knee-block comprises opposed cheeks separated by and secured to a web having a thickness equal to that of the bolts, said web presenting the said tongue extension and being formed from a plurality of in-line pieces each separated from the next adjacent piece by a distance equal to the thickness of the bolts to provide the said through-holes.

5. The knee structure for a kneed bent comprising, in combination with meeting angularly disposed framing pieces and having their meeting ends longitudinally slotted in the plane of the bent, a gusset-forming knee-block arranged to lie in the inside angle between said pieces, preformed such as to find an exact bearing fit against the furcate extremities of the pieces, and having an integral tongue extension accommodated within said slots, and tensioning means

rigidly tying the knee-block to each of said pieces to restrain the tied pieces against bending moments acting in any direction within the plane of the bent.

6. The knee structure for a kneed bent comprising, in combination with meeting angularly disposed framing pieces establishing a miter juncture by their meeting engagement and having their meeting ends longitudinally slotted in the plane of the bent, a gusset-forming knee-block arranged to lie in the inside angle between said pieces, pre-formed such as to find an exact bearing fit against the furcate extremities of the pieces, and having an integral tongue extension accommodated within said slots, and tensioning means rigidly tying the knee-block to each of said pieces to restrain the tied pieces against bending moments acting in any direction within the plane of the bent.

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