

E. V. KNIGHT,
WOODEN BEAM.
APPLICATION FILED MAR. 22, 1918.

1,377,891.

Patented May 10, 1921.
2 SHEETS—SHEET 1.

Fig. 1.

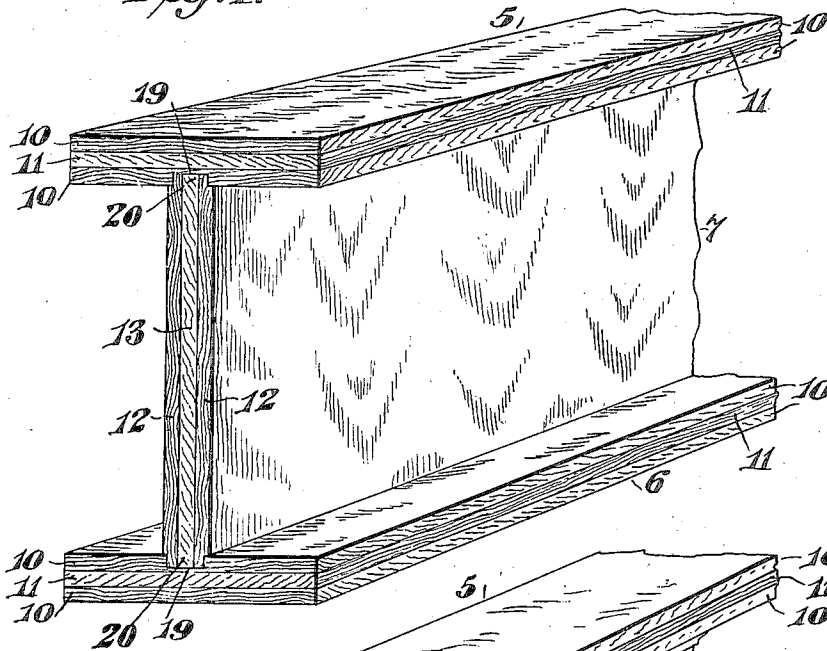
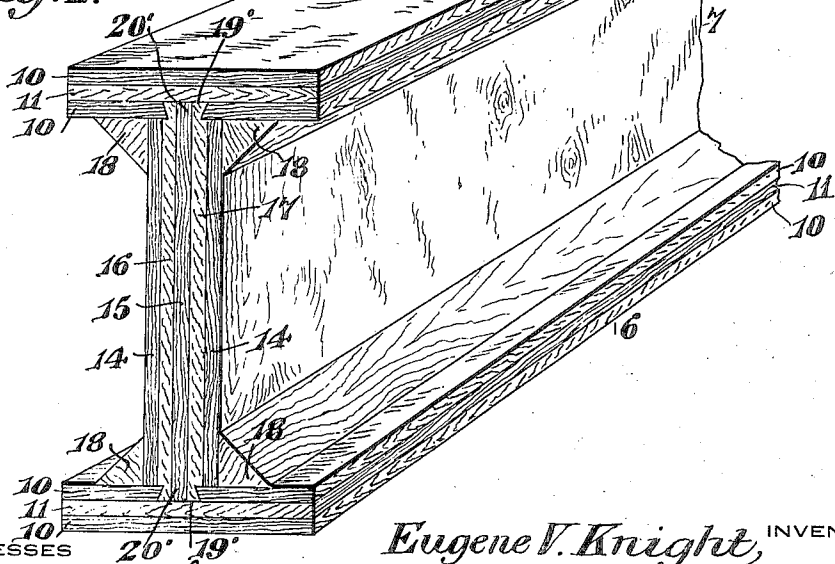


Fig. 2.



WITNESSES

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2 SHEETS—SHEET 2.

Fig. 3.

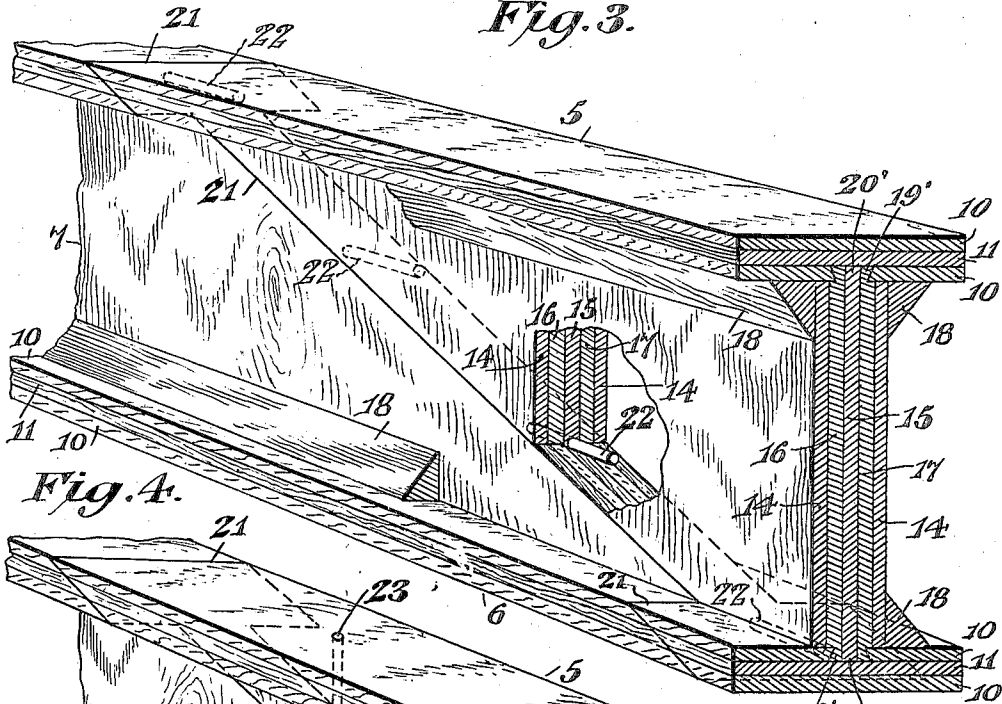
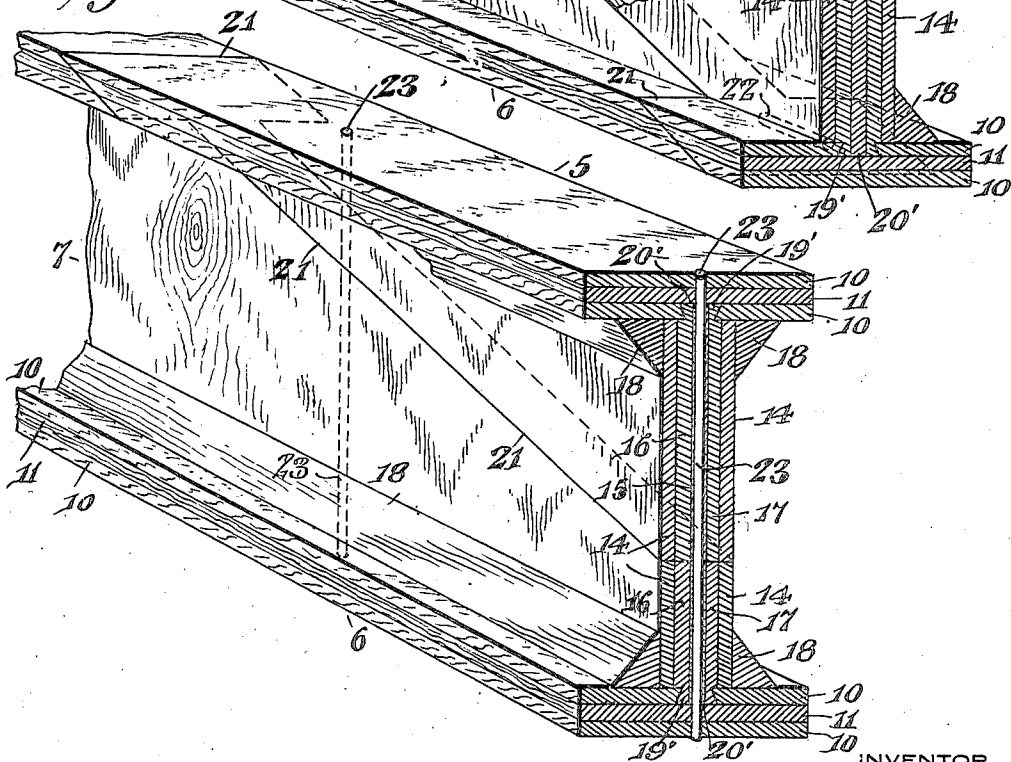


Fig. 4.



WITNESSES

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EUGENE V. KNIGHT, OF NEW ALBANY, INDIANA.

WOODEN BEAM.

1,377,891.

Specification of Letters Patent.

Patented May 10, 1921.

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To all whom it may concern:

Be it known that I, EUGENE V. KNIGHT, a citizen of the United States, residing at New Albany, in the county of Floyd and State of Indiana, have invented a new and useful Wooden Beam, of which the following is a specification.

This invention relates to wooden beams, and is concerned with the mode of constructing such beams.

The primary object of this invention is to provide a built-up wooden beam which shall have great strength and the ability to stand up under exceptionally severe working conditions. Another object is to provide a wooden beam which may be used to supplant all solid wood beams wherever and however employed.

It is a further object to provide a beam of such construction that short and odd lengths and thicknesses of wood may be used without disadvantage.

Still another object is to produce a built-up beam which may be made, in part at least, of woods hitherto considered inferior for certain purposes.

Specifically, it is an object of this invention to produce a wooden beam which may be used to supplant the solid spruce beams now employed universally in aeroplanes.

It is well known that the present demand for high grade spruce for aeroplane construction greatly exceeds the available supply, that difficulty is encountered in getting sufficient lengths of the clear, fine-grained spruce which is demanded, and that the wastage in obtaining the finest part of the spruce wood is enormous, running to ninety per cent. or over. It is also known that a great many other woods have been tried in place of spruce but that no other wood has yet been found which is equal to spruce for aeroplane construction.

My invention is particularly designed to make more available the present supply of spruce, to cut down the enormous waste, to enable the utilization of short lengths and odd sizes and thicknesses of spruce, which are at present discarded, and to permit the partial substitution of other woods for spruce in beam construction. To attain these ends, my invention consists in making a wooden beam from a plurality of thin plies or laminations of wood permanently cemented or glued together under pressure, as will now be described.

In order to fully comprehend my invention, its objects and possibilities, reference should be made to the accompanying drawing forming a part of this specification, wherein I have shown four forms which my invention may assume.

In the drawing—

Figure 1 is a perspective view of an I-beam constructed in accordance with my invention; and

Fig. 2 is a similar view of a modified and preferred form of I-beam construction.

Fig. 3 is another form embodying the same construction of beam as that shown in Fig. 2, with the exception that dowels are used at the spliced joint between the meeting ends of the beam.

Fig. 4 is another form wherein is shown metal or iron rods as reinforcing and connecting means at the split joint.

Referring specifically to Fig. 1 of the drawing, the numerals 5 and 6 indicate, respectively, the upper and lower flanges of a wooden I-beam, and 7 the web thereof. Upper flange 5 and lower flange 6 are, in each of the illustrated I-beams, composed of three wood plies or laminations, the two outer ones 10 being set cross-grained to the inner one 11. The web 7 is likewise made up of three laminations, the two outer ones 12 being cross-grained to the inner, 13. The inner face of each flange 5, 6 in Fig. 1, has a longitudinal groove or channel 19, which may be of any desirable depth and shape. This channel 19 runs centrally through the face of each flange and as shown is rectangular. It receives the longitudinal tongue 20 formed on either lateral edge of the web 7 so as to make up a rabbet joint, as shown.

Fig. 2 shows an I-beam with the same 3-ply flanges 5, 6, that the I-beam of Fig. 1 has, but with a 5-ply web, 7. However, such a beam may have 5-ply flanges and a 7-ply web, or any other number of plies in the flanges and web. In this form as in the first, each lamination is set cross-grained to the next one. Thus the outer laminations 14 are cross-grained to 16 and 17, while they in turn are cross-grained to the center one 15. A dovetail groove 19' is provided in the inner face of each flange which receives the dovetail tongue 20' formed on either lateral edge of the web 7, thus forming a dovetail joint. A modified mortise and tenon joint might, however, be employed instead. This form of I-beam is also provided with rein-

forcing blocks 18 which are right triangular in cross-section. These blocks add strength and rigidity to the joint, as well as imparting a finish to the same.

5 In the construction of Fig. 1, the channels 19 are shown as having a depth slightly less than the thickness of one ply or lamination. A preferable construction is that shown in
10 Figs. 2, 3 and 4, where the channels 19' have a depth exactly equal to the thickness of a single ply. Thus, only the lamination which is adjacent the web of the beam is cut through to form the channel. If the channel were deeper so as to extend part way into the
15 second lamination, the beam might be seriously weakened at the joint. It is desirable not to weaken the beam; hence in most cases the interlocking tongues will only engage with a single ply. In some cases, where the
20 beams are quite large, the tongues may be passed through two plies, but for most purposes an interlocking joint formed by the tongue engaged with a single ply will suffice.

The beams are formed as follows: The desired number of laminations or plies are
25 coated with a strong cement or glue and are laid face to face and subjected to a considerable pressure until complete hardening and permanent adhesion is secured. Then the
30 grooves and tongues are formed in the usual way, are coated with cement or glue, are fitted together, and are subjected to pressure until a permanent joint is effected. The cement or glue used should be some substance
35 which is not affected by atmospheric conditions. A glue having casein as its base would be acceptable. Without pressure no cement or glue will bring about a dependable adherence to the plies and joints, hence the necessity of using considerable pressure.
40

The advantages of my invention will now be made apparent. Because I employ thin plies of wood permanently cemented or glued to each other, I am enabled to use various
45 lengths of such plies without materially weakening the beam. Thus the use of plies permits the utilization of wood which would otherwise be discarded and permits using practically all the good wood from a log.
50 Moreover, the use of plies set cross-grained to each other adds greatly to the strength and life of the beam. Again, the laminations may be partly of one wood and partly of another without serious results, thus effecting
55 an economy by permitting the partial substitution of cheaper woods for more expensive woods. Furthermore, the laminations may be cemented or glued together while made to assume a curved form, which will be retained when the cement hardens. Thus the
60 beam may be made into any desired shape, within limits, without necessitating cutting away some of the wood and hence weakening the beam. Because constructed as described,
65 the beam will have greater strength than

ordinary beams for the same weight, and will be highly economical as well.

It is to be distinctly understood that while the drawing illustrates an I-beam constructed in accordance with my invention, I do not
70 wish to be limited to I-beams, but consider the invention equally applicable to the construction of H-beams. Nor do I wish to be limited to any particular joint in connecting the various parts of the beam together, and I
75 desire to employ all the joints known to the woodworking art, if such employment be advantageous. I contemplate employing not only various wood joints, but also metal rods to help hold the flanges and webs together.
80 Such rods may pass through the web and enter each flange or may be otherwise arranged. Nor do I care to be limited to the use of 3-ply or 5-ply beam parts, because any other
85 number more than three may be desirable under certain conditions. Neither do I wish to be limited to plies of equal thickness. Nor do I plan to confine my invention to aeroplane construction. Many other arts may be
90 advanced by the use of beams such as herein described. This invention is to be considered limited not by any preferred embodiment which has been specified above, but only by the following definitive claims.

In Figs. 3 and 4 of the drawings there is
95 shown the same construction of beam illustrated in Fig. 2, and illustrating a split joint 21 between the meeting ends of the beam, the joint being made on diagonal lines and the meeting ends being connected by dowels 22.
100 In Fig. 4, the joint is shown as connected by wooden or metal pins 23, which extend from the top to the bottom of the beam and serve the double function of connecting the meeting ends of the beam at the joint and stiffening
105 the web.

What is claimed is—

1. In a wooden beam, a flange and a web each built up from a plurality of laminations cemented together, the flange having
110 a longitudinal groove in one face, and the web having a tongue made of a plurality of laminations, said tongue fitting into said groove and holding the flange and web together by interlocking action, the web and
115 flange being cemented together at the joint.

2. A wooden beam consisting of a web and a pair of flanges, said web having
120 tongues and the flanges having complementary grooves formed therein to receive said tongues, the web and flanges each being composed of a plurality of plies cemented together, each groove having a depth of one
125 ply, said web having a greater number of plies than said flanges but having less than its total number of plies making up the interlocking tongues.

3. In a wooden beam, a web, channeled flanges, the web and flanges consisting each
130 of a plurality of plies cemented together,

the web being provided with tongues formed from less than the total number of its plies, which tongues fit into said channels and interlock the web and flanges together, the web and flanges being cemented together at their interlocking joints, and reinforcing blocks running the length of the beam, said blocks being triangular in cross section and being cemented to the web and flanges at the angle formed by the junction thereof.

4. In a wooden beam, a web, channeled flanges, the web and flanges each consisting of a plurality of plies adhesively connected, the web being provided at its edges with tongues each of which is formed of several of the plies; said tongues fitting into the channels of the flanges so as to interlock therewith, the web and flanges being cemented together at their joints, and pins passing through the central ply of the web and having their ends extended through the tongues and channels into the flanges.

5. In a wooden beam, a web, channeled flanges, the web and flanges each consisting of a plurality of plies cemented together, the web being provided at its edges with tongues, each of said tongues being formed of several of the plies and fitting into the channels of the flanges so as to interlock therewith, the web and flanges being cemented together at their joints, pins passing centrally through the web and having their ends extending through the tongues and channels into the flanges, and reinforcing blocks running the length of the beam and cemented to both the web and flanges at the angles formed by the junction thereof.

In testimony that I claim the foregoing as my own, I have hereto affixed my signature in the presence of two witnesses.

EUGENE V. KNIGHT.

Witnesses:

WM. E. FALK,
J. C. WILLIAMS.