April 20, 1965 H. H. BOOHER 3,178,780

STRUCTURAL JOINT CONNECTOR

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FIG. 1.

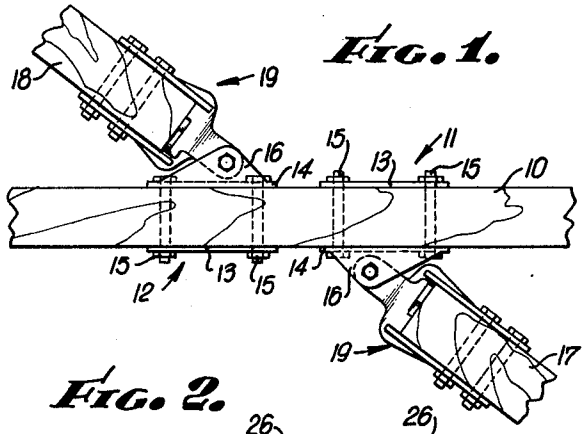


FIG. 4.

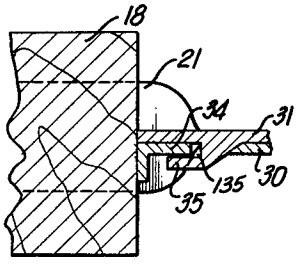


FIG. 2.

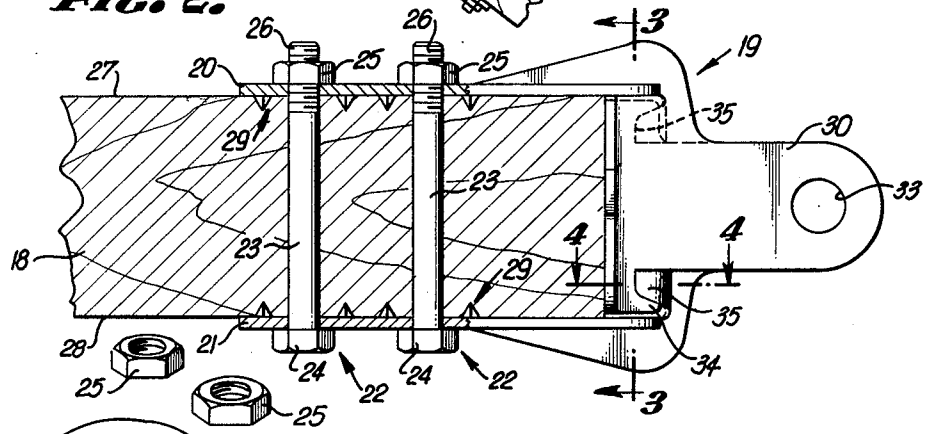


FIG. 5.

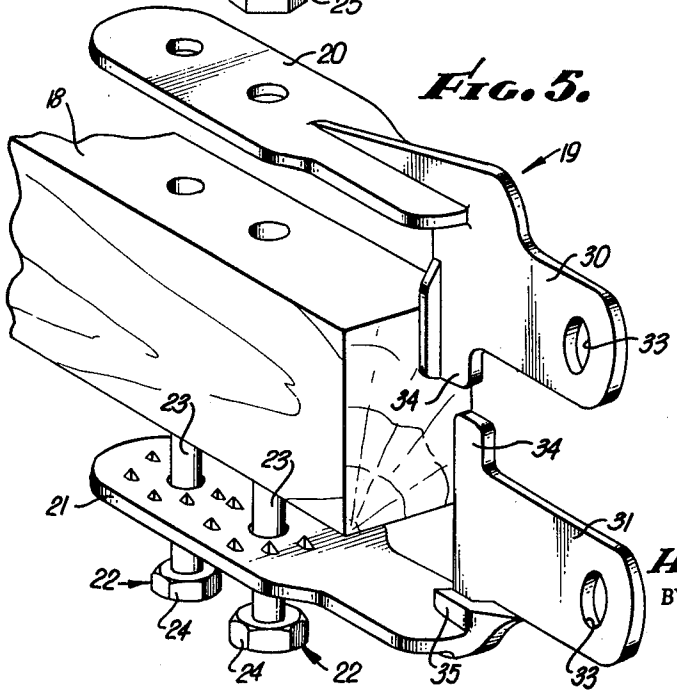
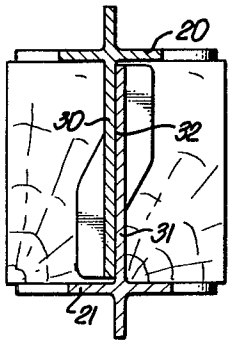


FIG. 3.



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FIG. 6.

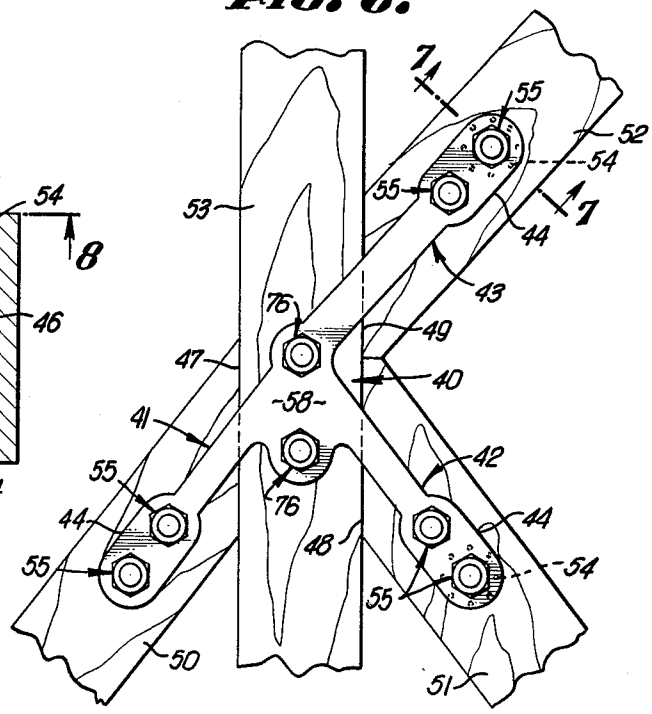


FIG. 7.

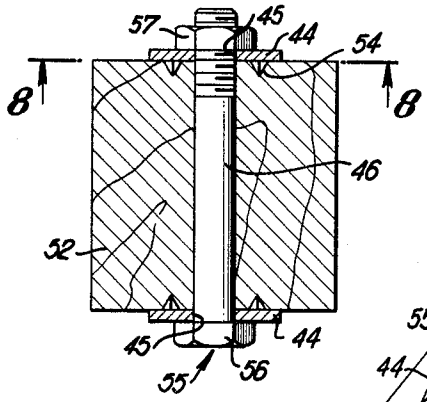


FIG. 9.

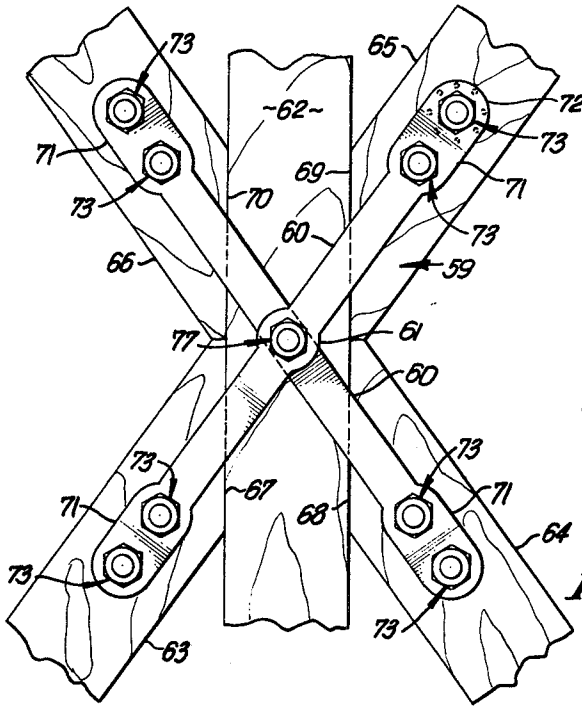
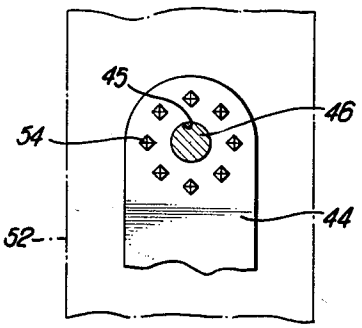


FIG. 8.



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United States Patent Office 3,178,780 Patented Apr. 20, 1965

3,178,780

STRUCTURAL JOINT CONNECTOR

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Filed June 7, 1961, Ser. No. 115,499
3 Claims. (Cl. 20—92)

This invention relates generally to structural joint connectors applicable to wooden framing, and more particularly concerns novel connectors characterized as having pyramidal teeth developing superior holding power or capacity when the connector is fastened to wooden framing.

Broadly speaking, conventional toothed connectors currently in use employ various forms of stamped metal which stampings have slender or flat teeth. When such a connector is attached to wooden framing the teeth actually separate the grain of the wood which weakens the wood and therefore makes it less suitable for the intended purpose.

The present invention is predicated upon the concept of developing superior holding power obtained by pyramidal tooth compression of the wood fibers when the tooth is forced into the wood during attachment of the connector thereto. Compression of the wood fibers increases the natural physical properties such as compression parallel to the grain, of the wood along the sloping face or faces of the pyramidal teeth. This also insures a positive fit and consequent full bearing area. Thus, when force is transmitted between a tooth and the wood and in any resulting direction, a component of the force is developed along the sloping face of the tooth which is resisted by tension in the bolt or other device attaching the connector plate to the wooden framing. Accordingly, increased tension in the bolt results in additional length of bearing on the wood against which the bolt bears. Thus, a superior structural connector is provided by virtue of the pyramidal toothed plates and the bolt or bolts acting as a unit, each contributing beneficially to the other.

More specifically, the invention contemplates the provision of rigid plate means having a locus from which a holder such as a bolt shank extends in use into the framing from the side of the plate facing the framing, together with pyramidal teeth integral with the plate means and projecting from the side thereof proximate to the mentioned locus to penetrate the framing when the plate means is forcibly advanced into adjacency to the framing, and also tongues having interfitting lug and socket parts to hold the plates and teeth thereon in load bearing position, in unusually effective manner. Typically, the pyramidal teeth are spaced apart about the mentioned locus, and are alike, each having an approximately square base and a height that is approximately the same as the square dimension of the base. Also, different teeth spaced about any particular locus of the holder have triangular faces that extend in parallel planes, as will be described.

Other objects of the invention include the provision of pyramidal teeth integral with a pair of spaced rigid plates between which the holder or bolt extends in use through the framing, the teeth extending oppositely from the respective plates to penetrate the framing when the plates are forcibly advanced toward one another and into the framing. Additionally, the pyramidal teeth are typically spaced apart about a pair of bolts having spaced parallel axes and the pair of rigid plates interconnected by the bolts carry a pair of tongues extending in and held in closely spaced overlapping at opposite sides of a plane through the parallel axes of the bolts, the tongues forming a pivot for the connector. Finally, the rigid plates

may comprise arms having extensions containing openings through which the bolts extend, the pyramidal teeth being arranged about the mentioned openings, and the plate arms extending sufficiently to overlap the loci of wooden frame member joints, so that the extensions with which the teeth are integral are spaced in use from the frame joints.

These and other objects and advantages of the invention, as well as the details of an illustrative embodiment, will be more fully understood from the following detailed description of the drawings, in which:

FIG. 1 is a section showing pivoted connectors each attached to a wooden frame member, and both pivotally connected to an intermediate wooden frame member through auxiliary plates;

FIG. 2 is an enlarged view showing a pivot connector of FIG. 1 having pyramidal teeth in accordance with the invention;

FIG. 3 is a section taken on line 3—3 of FIG. 2;

FIG. 4 is a section taken on line 4—4 of FIG. 2;

FIG. 5 is an exploded perspective showing of the FIG. 2 connector and wooden frame member;

FIG. 6 is a plan view of another type connector incorporating the invention and rigidly joining together several wooden frame members;

FIG. 7 is a section taken on line 7—7 of FIG. 6;

FIG. 8 is an enlarged plane view of an arm extension of the FIG. 6 connector and showing the arrangement of pyramidal teeth about the holder shank associated with the connector; and

FIG. 9 is a view like FIG. 6 showing another type connector incorporating the invention and rigidly joining together several wooden frame members.

Referring first to FIGS. 1 through 5, a principal wooden frame member is shown at **10** with two pairs **11** and **12** of connector assemblies rigidly attached thereto as illustrated. Each connector assembly includes a pair of metallic plates **13** and **14** with holders such as bolts **15** joining together the plates **13** and **14** of each assembly.

Each plate **14** incorporates a flange **16** which projects outwardly away from the plate and the wooden frame member **10**, the two flanges projecting at opposite sides of the frame member **10** so as to accommodate pivotal joining of frame members **17** and **18** to the intermediate frame member **10**.

Such pivotal joinder of the frame members **17** and **18** to the intermediate frame member **10** is accommodated by a structural joint connector **19** which is better shown in FIGS. 2 through 5 to include a pair of spaced rigid plates **20** and **21** which are generally parallel and holder means typically in the form of a bolt or bolts **22** having shanks **23** which extend in use through the framing **18** between the plates. Each bolt also typically incorporates a head **24** and a nut **25** which upon tightening to the threaded extent **26** of the bolt effects forcible closing together of the plates **20** and **21** against the opposite sides **27** and **28** of the frame member **18**.

In accordance with the invention, a group or groups of pyramidal teeth **29** are integrally carried by the plates **20** and **21** and they project from the sides thereof facing the wooden framing to penetrate the latter when the plates are forcibly advanced into adjacency to the framing. Additionally, the pyramidal teeth are proximate the locus of the bolt shank **23**, and they preferably are arranged so as to be circularly spaced apart about the bolt shank in use, there being approximately equally spacing between the teeth, and the teeth being approximately equally spaced from the shank **23**. The pyramidal teeth are furthermore alike, and for best results each tooth has an approximate square base and a height that is approximately the same as the square dimension of the base.

Typically each tooth is about ¼ inch square at the base and ¼ inch high. Furthermore, the tooth forms four triangular faces, each face leaning toward the center or axis of the tooth at an angle of 26°34′ to the base. Finally, the teeth of each group extending about any particular shank **23** have parallel triangular faces, for best results as is clear from FIG. 5. Accordingly, a positive fit and a consequent full bearing area are provided for, and superior holding power is developed by pyramidal tooth compression of the wood fibers when the tooth is forced into the wood by the bolt. While different bolt and frame member sizes may be used, it is contemplated that the ¼ inch pyramidal tooth dimensions will, for best results, be used in combination with ½ inch diameter bolts and frame members which vary in cross section about 3 inches by 3 inches and 4 inches by 6 inches. Testing of such connectors shows their uniform holding quality through a wide variance in wood grades, and the ability of such connectors to hold to complete destruction under tension testing of the frame member and connector.

Further in accordance with the invention, the axes of the bolt shanks **23** extend in a plane, and the connector **19** includes a pair of tongues **30** and **31** respectively integral with the plates **20** and **21**, the tongues extending in closely spaced overlapping relation at opposite sides of the said plane through the shank axes, all as best illustrated in FIGS. 3 through 5. The mentioned plane as shown at **32** in FIG. 3 at the interface between the tongues **30** and **31**. The latter form a pivot member receiving aperture **33** shown in FIG. 2 and which is in the plane **32** at opposite sides of which equal numbers of the pyramidal teeth lay, thereby bearing the force distribution with respect to the pivot. The axis of aperture **33** is normal to plane **32**, as is clear from the drawings.

As best shown in FIG. 4, the tongues **30** and **31** carry interfitting lugs **34** and **35** which slideably interfit when the plates **20** and **21** are brought together, two sets of such interfitting lugs being provided as best illustrated in FIG. 2. Accordingly, the lugs interlock the tongues and therefore the plates near the pivot **33** for rigidizing the connector. As is clear, the tongues are formed at substantially right angles to the plates, with the tongues having a lug and socket formed thereon or proximate thereto and in mutually offset relation, so that for example the lug **34** of one tongue enters the socket **135** defined by the lug **35** of the other tongue when the tongues are assembled in closely spaced relation.

Referring now to FIGS. 6 through 8, another type connector incorporating the invention is generally designated at **40**, the connector rigid plates each comprising arms **41**, **42** and **43** having like extensions **44** containing openings **45** through which the holders such as the bolt shanks **46** extend. The arms **41** through **43** have sufficient length or extent to overlap the loci **47** through **49** of wooden frame member joints so that the extensions **44** are spaced in use from the joints. As shown in FIG. 6, the joint loci **47** through **49** are formed between the diagonal wooden frame members **50** through **52** and the main wooden frame members **53**.

The arm extensions **44** carry pyramidal teeth **54** which are like those previously described in connection with FIGS. 2 through 5, in that the teeth are alike with each having an approximately square base and a height that is approximately the same as the square dimension of the base. The teeth are furthermore spaced about the loci of the bolt shanks **46**, the bolts being generally designated at **55** and typically including heads **56** and nuts **57**. The fact that the faces of different teeth spaced about any particular bolt shank have triangular faces that extend in parallel planes is clearly illustrated in FIG. 8.

The connector **40** is joined to the principal frame member **53** as by means of bolts **55** extending through the intermediate plate portions **58** of the connector at opposite sides of the frame member **53**. In this connection,

it will be understood that pyramidal teeth are carried by the intermediate plate sections **58** and spaced about the bolts therethrough in the same manner as described in connection with FIG. 7.

Another form of connector quite similar to that shown in FIG. 6 is shown at **59** in FIG. 9, the connector in this instance including two rigid plates comprising two arms **60** which overlap at **61** at one side of the central frame member **62**, it being understood that another pair of overlapping rigid plates just like those shown are located at the opposite sides of the frame assembly. The latter includes diagonal frame members **63** through **66** which are joined to the central frame member **62** as shown, with joints **67** through **70** therebetween. Here again, the arms of the frame members have extensions **71** which are just like the extensions **44** described in connection with FIG. 6 and incorporate pyramidal teeth **72** just like those shown at **54**. Correspondingly, bolts or holders **73** just like the holders **55** are provided to hold the plates against opposite sides of the frame members and thereby cause the pyramidal teeth to compressively penetrate the wooden framing without separating the grain of the wood.

With regard to FIGS. 6, 7, 8 and 9, it will be understood that pyramidal teeth project into the wood from each of the extensions **44** and **71**, and around each bolt hole; however, no teeth surround the bolts **76** in FIG. 6 or the pivot bolt **77** in FIG. 9. In FIG. 1, pyramidal teeth project into the wooden member **10** from the plates **13** and **14**, and in surrounding relation to the bolts **15**.

I claim:

1. For combination with an elongated one-piece wooden frame member having parallel opposite sides, a metallic connector attached to an end portion of said member, said connector including a pair of plates respectively located adjacent said member opposite sides and extending lengthwise therealong to transmit lengthwise loading to said member, said connector including pyramidal teeth integral with each of said plates and projecting therefrom to penetrate into said member at said opposite sides thereof thereby to compress the wood fibers, said member having lengthwise spaced transverse openings therethrough between said plates, and generally parallel metallic fasteners having connection to the plates and extending through said openings and transmitting force acting to clamp said plates to said member opposite sides, said teeth being spaced from and about each fastener, said connector including means extending beyond the terminal end of the frame member for interconnecting said plates, said means including a pair of tongues respectively integral with the plates and extending in closely spaced assembled relation at the end of said member and having aligned aperture, the tongues being disposed in overlapping relation at substantially right angles to the plates, the first tongue having a lug in the plane of the tongue and extending therefrom, the second tongue having a socket at the side thereof, the lug of the first tongue being received in the socket of the second tongue.

2. For combination with an elongated one-piece wooden frame member having parallel opposite sides, a metallic connector attached to an end portion of said member, said connector including a pair of plates respectively located adjacent said member opposite sides and extending lengthwise therealong to transmit lengthwise loading to said member, said connector including pyramidal teeth integral with each of said plates and projecting therefrom to penetrate into said member at said opposite sides thereof to compress the wood fibers, said member having an opening therethrough between the plates, a metallic fastener having connection to the plates and extending through said opening and transmitting force acting to clamp said plates to said member opposite sides, said teeth being spaced from and about the fastener, said connector including means extending beyond

the terminal end of the frame member for interconnecting the plates, said means including a pair of tongues respectively integral with the plates and extending in closely spaced assembled relation at the end of said member and having aligned apertures, the tongues being disposed in overlapping relation at substantially right angles to the plates, the first tongue having a lug in the plane of the tongue and extending therefrom, the second tongue having a socket at the side thereof, the lug of the first tongue being received in the socket of the second tongue.

3. The combination as defined in claim 1 in which said teeth are alike, each having an approximately square base adjacent the plate and a maximum projected height that is approximately the same as the square dimension of the base.

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