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 [33] **Great Britain**
 [31] **46995/67 and 16101/68**

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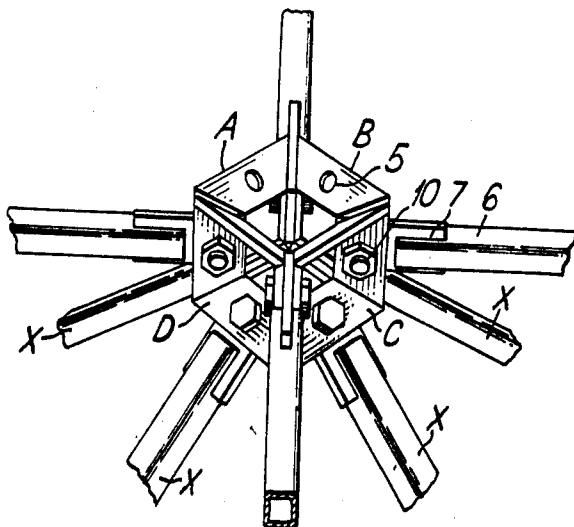
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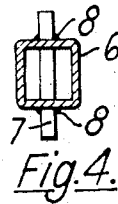
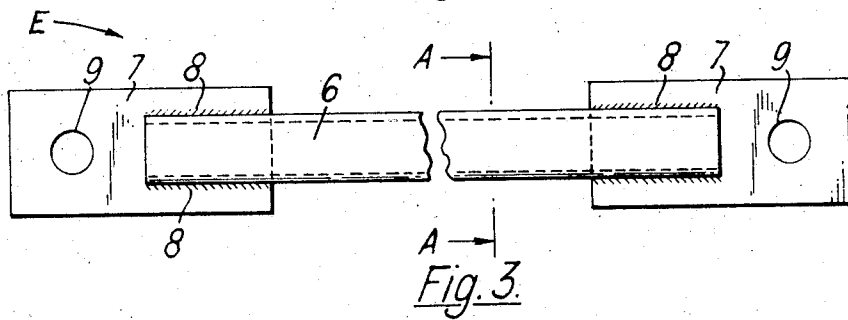
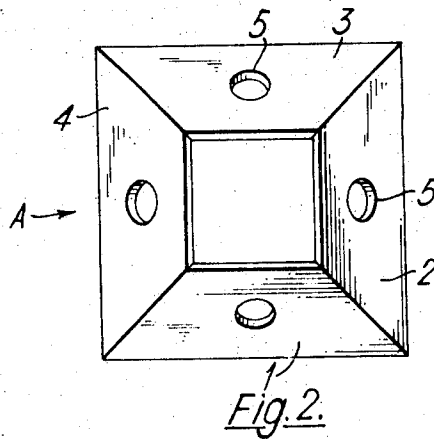
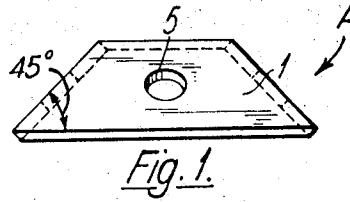
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[54] **FRAME JOINT**
1 Claim, 14 Drawing Figs.
 [52] U.S. Cl.....**287/189.36,**
52/648
 [51] Int. Cl.....**E04h**
12/10, F16b 9/02
 [50] Field of Search.....**52/648-**
—655, 694, 80, 280, 984; 287/189.36, 189.36C,
189.36D; 14/13; 289/189.36F

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ABSTRACT: A jointing member for limbs of a frame is in the form of a hollow tapered unit open at its wider end, comprising more than two flat wall surfaces each inclined to each neighboring flat wall surface by an angle differing substantially from 90°, and some of said wall surfaces being apertured to receive bolting means. The member may be shaped as a truncated pyramid. In setting up a frame a flattened end of a frame limb is held between facing wall surfaces of two of said jointing members, by bolting means passing through the jointing members and the frame limb.





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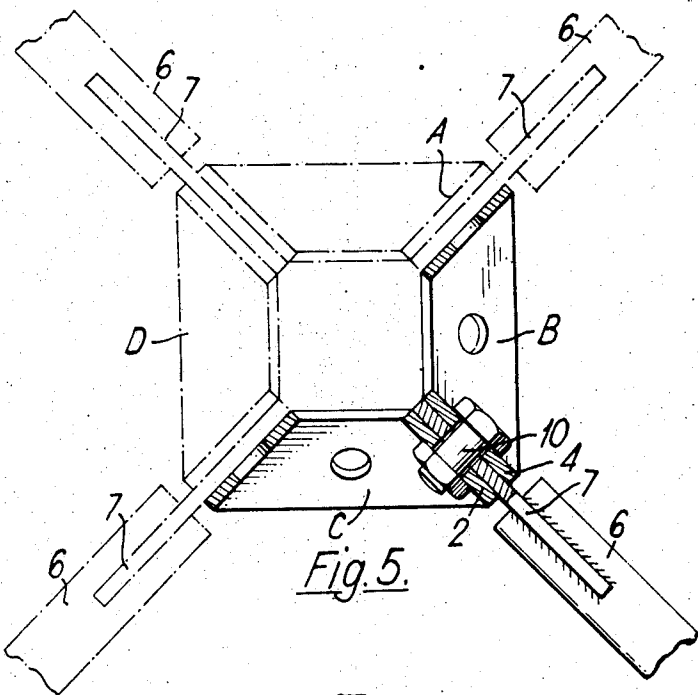


Fig. 5.

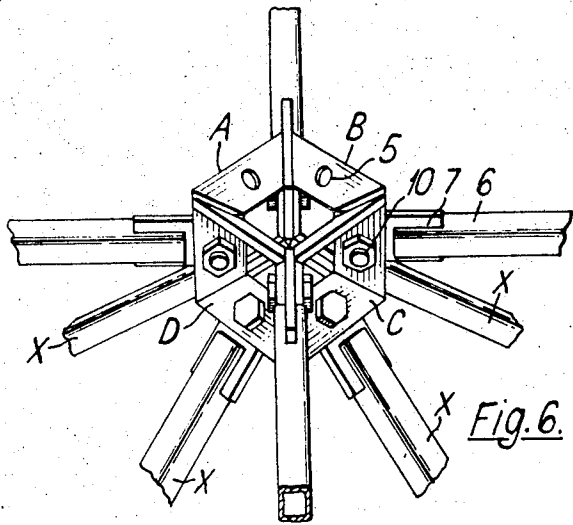


Fig. 6.

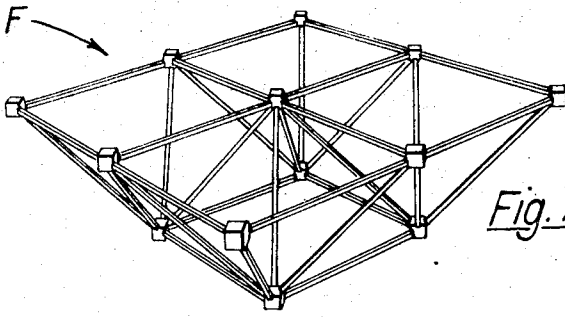


Fig. 7.

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Fig. 8.

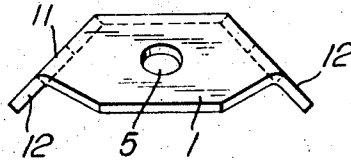


Fig. 9.

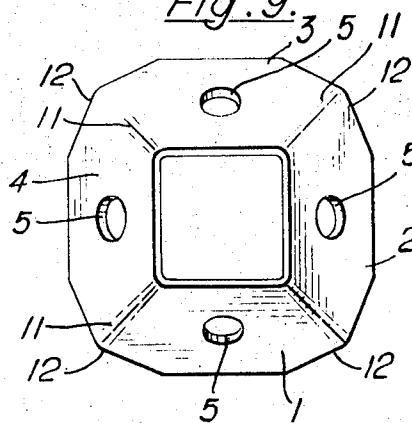


Fig. 10.

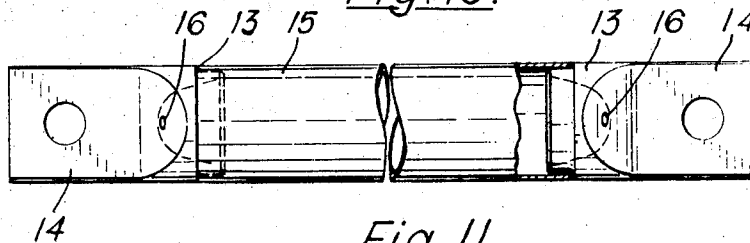
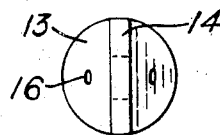
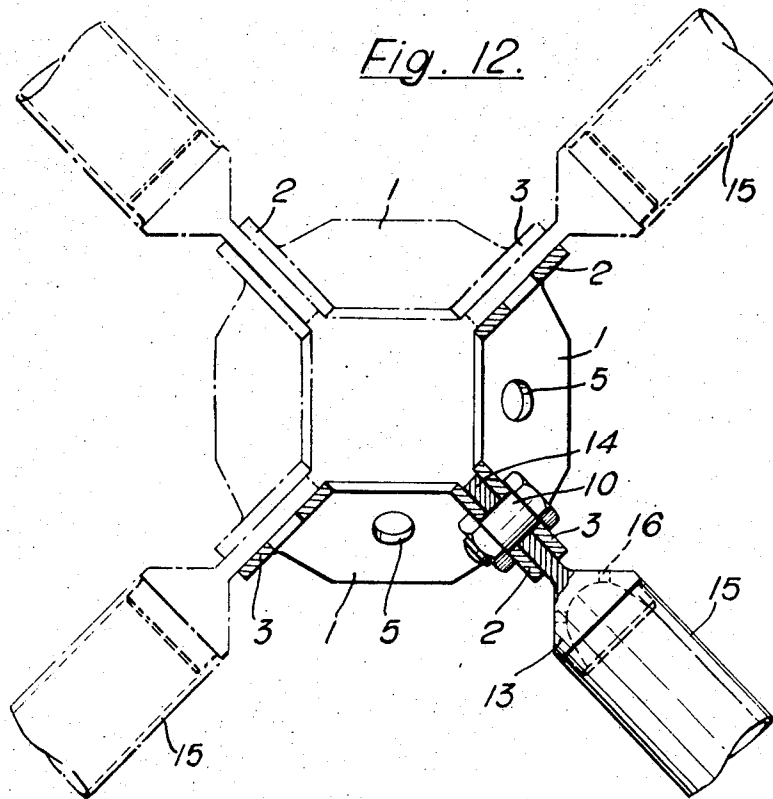


Fig. 11.



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Fig. 13.

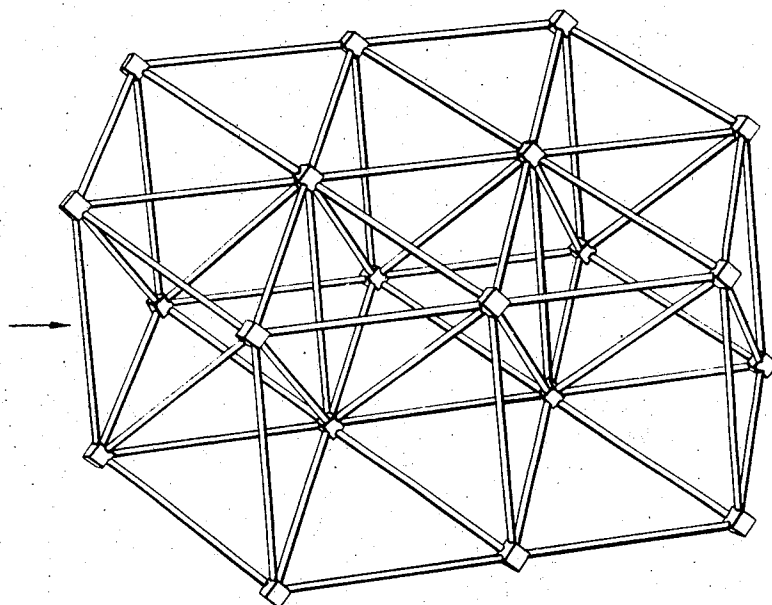
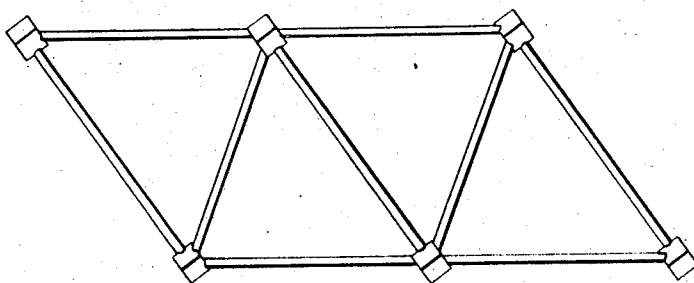


Fig. 14.



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FRAME JOINT

This invention relates to frames and frame joints, and is concerned more especially with the construction of frames for building and other structural purposes.

The invention consists in a jointing member for a frame comprising a plurality of relatively inclined plate surfaces, of which one or more is/are apertured to cooperate by bolting, pinning or the like with a similar surface of another like jointing member, in order to clamp between them the end of a limb, spar or the like constituting part of a frame.

In one convenient form a jointing member in accordance with the invention is dished e.g. of hollow truncated pyramidal form and each of the inclined sidewalls may be centrally apertured. By bringing together two such jointing members with a wall of one approaching face-to-face contact with a wall of the other, the apertured end of a limb to be incorporated in a frame may be inserted between the adjacent faces of the jointing members, and a bolt or like passed through the three aligned apertures, to hold the two jointing members and the frame limb rigidly together. Other frame limbs may be similarly secured to other faces of the two jointing members (using other cooperating jointing members), and in this way a frame can readily be built up.

The invention also consists in a frame limb for use with jointing members such as referred to above, comprising at one, or at each end, a flat or flattened apertured area suitable for clamping between the faces of jointing members.

The limb is preferably of hollow metal tube. One or each end may be flattened and bored; or a flat metal strip with a hole may be fitted and welded in a transverse slot in the end of the tube to extend axially beyond the end of the tube.

A modified jointing member in accordance with the present invention may incorporate either or both of two modifications namely;

- a. edges between adjacent inclined sides of the pyramidal member, previously meeting at a sharp angle, may be radiused or of smooth curvature; and/or
- b. the corners of the base of the pyramid member are omitted or removed.

These modified jointing members may be used, to erect a frame, with frame limbs or spars, such as referred to above formed of tube or rod with metal strip secured in end slots for attachment by a screw or bolt between adjacent faces of two jointing members. Alternatively there may be fitted to the end of a limb or spar a connector comprising a spigot head for receiving a spar end and an associated flat strip for attaching between jointing members. The spigot head and associated strip may be integrally formed e.g. by forging, or by diecasting a metal such as aluminum.

The invention further consists in a frame whenever built of limbs and jointing members, such as specified above, assembled and secured together.

The invention will be clearly understood from the following description of one form (given, however, merely by way of example) which it may assume, and this description will be more readily followed by reference to the accompanying drawings wherein;

FIGS. 1 and 2 represent respectively side and plan views of one form of frame jointing element in accordance with the invention;

FIG. 3 represents a side view of a frame limb according to the invention for use with joint elements such as shown in FIGS. 1 and 2;

FIG. 4 represents a transverse section along the line A-A of FIG. 3;

FIG. 5 represents in plan and partly in section a node of a frame built up from elements such as shown in FIGS. 1-4;

FIG. 6 represents in perspective, and in somewhat reduced scale, a frame node such as shown in FIG. 5;

FIG. 7 represents one form of frame assembly in accordance with the invention;

FIGS. 8 and 9 represent respectively in side elevation and plan view, another jointing member for a frame in accordance with the invention;

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FIGS. 10 and 11 represent respectively in side and end views a spar for use in erecting a frame in accordance with the present invention;

FIG. 12 represents a view of a joint of a frame set up in accordance with the present invention;

FIG. 13 represents one form of frame which may be set up incorporating joints and spars in accordance with the invention; and

FIG. 14 represents a side view in the direction of the arrow, of the frame illustrated in FIG. 13.

In carrying the invention into effect in one convenient manner components for assembly to form a frame structure may comprise a plurality of jointing elements or cleats, A such as shown in FIGS. 1 and 2, and a plurality of frame limbs or spars E as such as shown in FIGS. 3 and 4, of the aforesaid drawings.

A jointing element or cleat A of the kind shown in FIGS. 1 and 2 is in the form of a hollow truncated pyramid open at each end. This may be pressed or stamped from sheet metal, but if desired may be made in any other convenient way. The sidewalls 1, 2, 3, 4 are inclined at 45° (FIG. 1) to the base plane of pyramid, but may in other forms be inclined at any other desired angle. At or near to its midpoint each wall is bored as at 5.

To cooperate with jointing members such as shown in FIGS. 1 and 2 may be provided spars or limbs E for a frame such as shown in FIGS. 3 and 4. Each spar comprises a metal tube 6 of any desired length, and of any desired cross section (shown in FIG. 4 as substantially square). At each end the spar is formed with a transverse slot in its median plane, and in this slot is fitted one end of a metal strip 7, which is fillet welded in position as at 8. The length of the strip 7 projecting beyond the end of the tube 6 is bored as at 9.

In assembling a frame in accordance with the invention, using components as shown in FIGS. 1-4, nodes of the frame are built up as shown in FIGS. 5 and 6. Four jointing units A, B, C, D, each of the kind shown in FIGS. 1 and 2, are packed together with their narrow open ends juxtaposed to form a cubic structure (FIG. 6). Between abutting faces of the jointing members (e.g. between faces 2 and 4 respectively of cleats C and B in FIG. 5) is inserted the end strip 7 of a frame spar E (FIGS. 3 and 4) so that the holes 5 of the two cleat faces and the hole 9 of the strip 7 are aligned. A screwed bolt 10 is passed through these holes and tightened to grip the spar and cleats firmly together. Other spars 6 may be secured between the corresponding faces of the other jointing members BA, AD, DC so that as seen in FIG. 5 four spars in the same plane project in diagonal directions from the corners of the cubic node assembly.

A fifth jointing member may be fitted into the base of the assembly of four cleats shown in FIG. 5 and may clamp the ends of spars X directed downwards at the angle of the walls 1, 2, 3, 4 (i.e. at 45° in the form illustrated). Equally a sixth joint member fitted into the top of the assembly shown in FIGS. 5 and 6 may clamp the ends of additional spars upwardly inclined at an angle (45° in the present case).

The opposite end of each spar 6 may be clamped in jointing members forming another frame node so that a frame F such as shown in FIG. 7 (or in various other forms) may be built up, as desired.

In a slightly modified frame construction, if it is desired that the spars 6 of the frame shall have some degree of pivotal movement there may be fitted in spaced positions between the abutting faces (such as 2, 4, FIG. 5) of cooperating jointing members space blocks (not shown) holding the faces slightly apart, and if desired the bolts 10 in such a case may be replaced by comparatively loose pins. The spacers may be separate components, but are preferably secured secured, e.g. by welding to the faces of the jointing members.

Another form of jointing member or connector cleat, in accordance with this invention, shown in FIGS. 8 and 9, comprises, as previously, a pyramidal disposition of four sidewalls, 1, 2, 3, 4 each having one or more bolt holes 5, but the edges of the pyramid between adjacent sides, instead of being sharp-

angled, as described above with reference to FIGS. 1—7 are smooth-curved or rounded as at 11. Furthermore the corners of the pyramid base of the member are cutoff or omitted in a plane substantially perpendicular to the edge of the pyramid showing a "cutback" edge 12 at each corner.

Cleats or jointing members such as shown in FIGS. 8 and 9 may be used in precisely the manner described above to clamp between them the flat ends of frame spars when building a frame.

A modified form of spar which may be used is illustrated in FIGS. 10 and 11. An end piece or connector for such a spar may comprise a spigot head 13 with a flat tail 14 integral therewith, in a diametrical plane of the spigot head, (FIG. 11). A tube 15, or rod, forming the length of a spar is fitted at each end to a spigotted head 13 of an end piece or connector and secured thereto e.g. by welding or by screw-threaded engagement. The head 13 may be formed with vent holes 16 for galvanizing operations after welding, whereafter the holes 16 may be plugged in any suitable manner. Each end piece or connector 13, 14 may be a unit formed by forging, or by die casting a suitable metal e.g. aluminum or in any other convenient way. Bolt hole or holes in the flat section should correspond with those in the jointing members.

A joint of a frame formed with the use of components shown in FIGS. 8—11 is illustrated in FIG. 12, which shows four jointing members or cleats of the kind illustrated in FIG. 9 brought together in quadrature, with end connectors 14 of four different spars 15 located between adjacent faces (2, 3 respectively) of neighboring jointing members and all secured together by bolts such as 10. The other ends of the spars 15 are connected to other jointing members or cleats in similar manner to erect a frame.

In the form of frame which may be erected, as illustrated in FIG. 7 and described above the connected spars form pyramidal frame elements in association. In an alternative form of frame in accordance with this invention shown in FIGS. 13 and 14 the sides may incorporate spars arranged in square assemblies (forming the bases of pyramidal frame elements) but other faces of the complete frame incorporate triangular arrays of three spars each (FIG. 14), constituting either one side of a pyramid arrangement, or one side of a tetrahedral arrangement, incorporated in the complete frame.

In some frames built of jointing members and spars according to this invention it may be desired to omit one or more of the spars (e.g. one of the spars 15 shown in FIG. 12), and in that case a spacer member or washer of the same thickness as,

and similar dimensions to, the tail piece 14 of a spar connector, may be provided to be fitted between adjacent faces of the jointing members.

The jointing members or cleats, and the flat ends of the spars may be keyed to provide extra grip, and high tensile bolts may be used to hold them together.

Whereas the jointing members are described above as having four sides in pyramid array, members having other numbers of sides at appropriate angles may be employed. Preferably all have radiused corner edges 11, and the base corners "trimmed", as at 12, but alternatively the corners may be flattened to form an octagonal pyramid shape.

In another form of jointing member there may be provided five sides, at appropriate set angles, and such a member in association with eleven like members will accommodate a cluster of up to 30 spars.

From the above description it will be seen that the invention provides simple and effective components from which frames of various forms, as desired, can be built up quickly and easily, and requiring little or no skill.

In some circumstances, e.g. when the invention is applied to toys or constructional model kits, the various components may be made of plastics or other suitable materials.

It should, however, be understood that the invention is not limited solely to details of the form described above which may be modified to meet various conditions and requirements encountered, without departing from the scope of the invention.

I claim:

1. A frame for structural purposes comprising a cluster of jointing members, each jointing member comprising a hollow flat-walled body of truncated pyramidal shape, open at its wider end, said body being formed of four substantially identical conjoined sidewalls which are at an angle of substantially 45° to the base plane of the pyramid, each sidewall being inclined to each adjacent sidewall by an angle differing substantially from 90°, each of said sidewalls being apertured for attachment to a similar sidewall of another, like, jointing member, said members being in packed array with their sidewalls facing the sidewalls of adjacent jointing members of the packed array, and frame limbs having their ends located between at least some of said pairs of facing sidewalls and clamped therein by bolting means, said frame limbs projecting outwardly from the said cluster of jointing members in at least three mutually substantially perpendicular planes.

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