Aug. 13, 1968 R. BIFFANI 3,396,499

STRUCTURAL MEMBERS FOR BUILDING CONSTRUCTION

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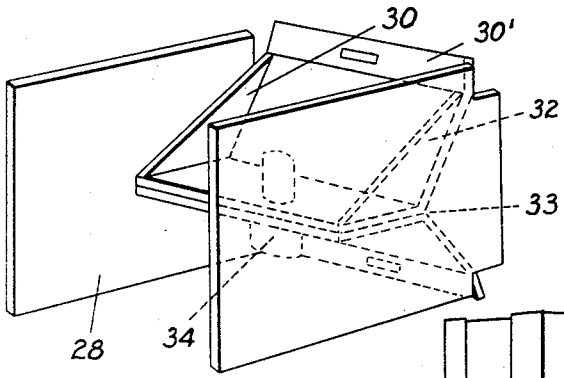

Fig. 9

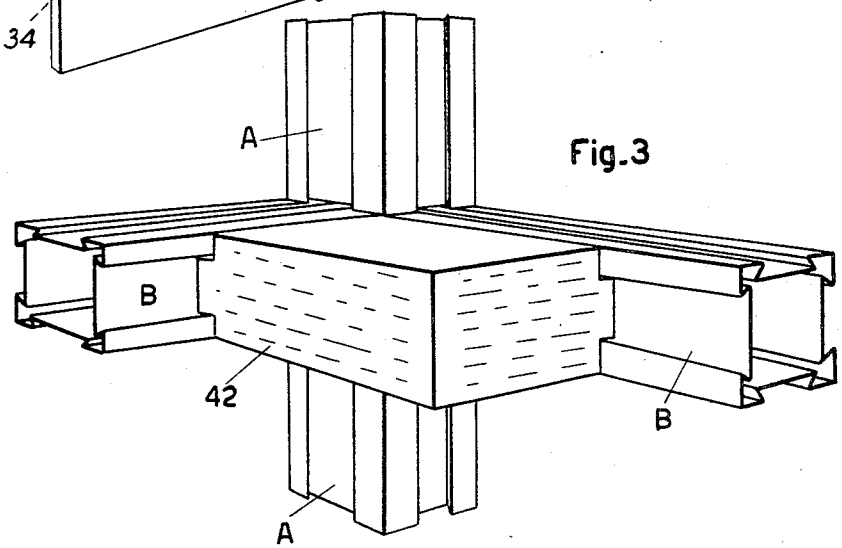

Fig.3

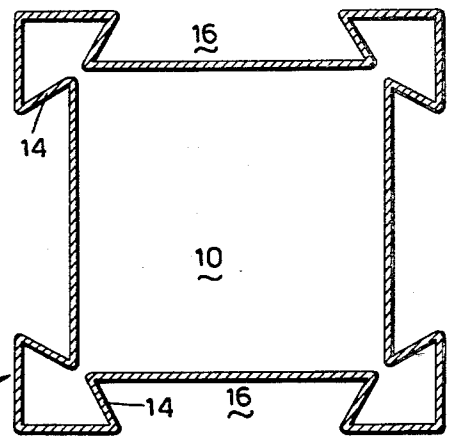

Fig. 1

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STRUCTURAL MEMBERS FOR BUILDING CONSTRUCTION

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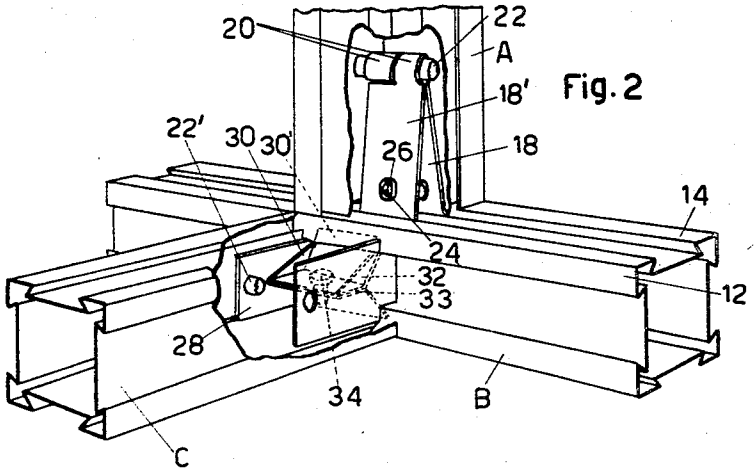

Fig. 2

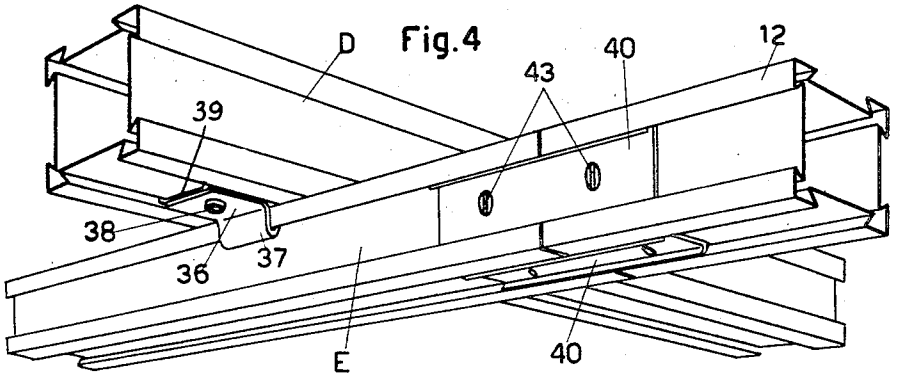

Fig. 4

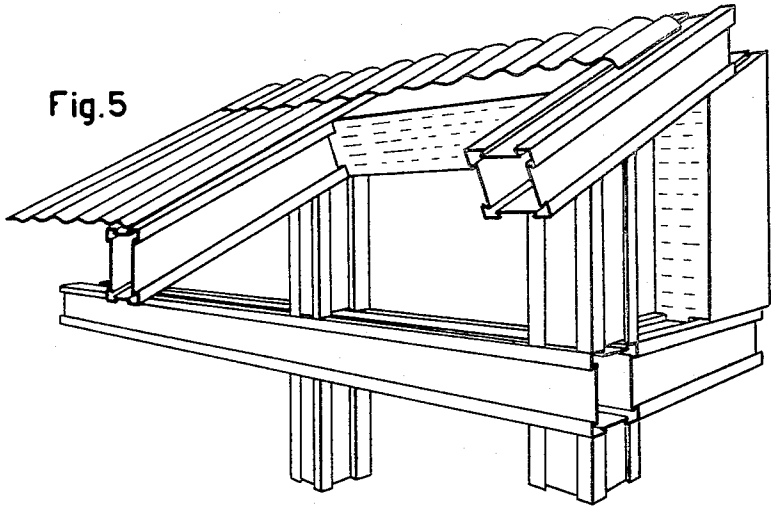

Fig. 5

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Fig.6

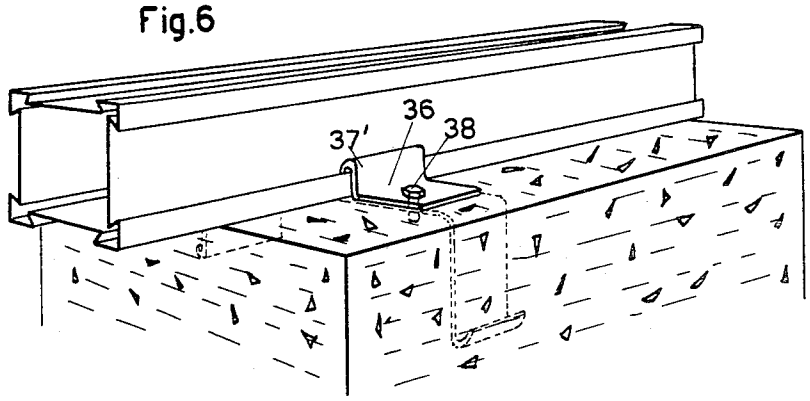
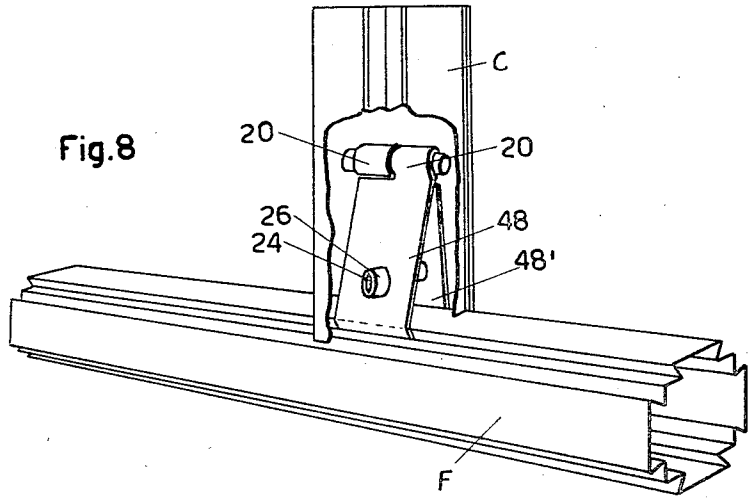


Fig.8



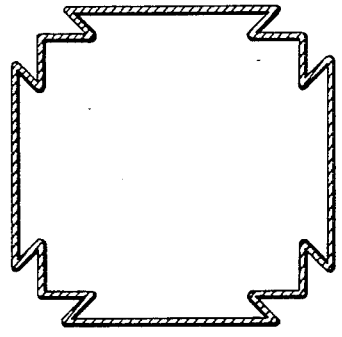


Fig.7

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STRUCTURAL MEMBERS FOR BUILDING CONSTRUCTION

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ABSTRACT OF THE DISCLOSURE

A beam of a building is substantially square in cross section and is provided at its corners with opposite inclined surfaces forming channels and ridges or triangularly shaped extensions. The butt joining of these beams is effected by pairs of hinged arms having ends or fins which are forced by screws into firm engagement with the beams.

The present invention concerns structural buildings more especially metal frames and more generally the carpentry work thereof so as to solve the problem of the weight and dimensions of the separate members of a structure in the most satisfactory way.

Obviously the first and most important problem to be solved is that of the load-bearing beams.

According to the present invention, the load-bearing beams are formed of a single type of structural shape adapted to be connected to the other members of the structure, inasmuch as the beam is provided with a plurality of dovetails each of which occupies a longitudinal face of the structural shape.

In one embodiment of the invention the beam has a substantially square cross-section with four triangular appendixes at the four corners thereof, each of the corners being integrally attached to the midpoint of the base of each of the triangular appendixes. The four dovetails formed as above are suited for all the connections and joints of the beam to other structural shapes as required for obtaining any other, structure, as it will be made clearer hereinafter.

The invention will now be described further, by way of example, with reference to the accompanying drawings, in which:

FIG. 1 is a cross-section through a preferred embodiment of beam constructed in accordance with the invention;

FIG. 2 is a dovetail, in perspective, showing the means for attaching together a horizontal beam, a vertical beam and another horizontal beam perpendicular to the former horizontal beam;

FIG. 3 is a detail in perspective showing a connection between a supporting pillar and two horizontal orthogonal beams and the method for retaining, fastening and locking them without supplementary means, as well as insulating or sealing panels, floor ceiling or roof panels, or partitions;

FIG. 4 is a perspective view showing the jointing of two superimposed orthogonal beams;

FIG. 5 is a diagrammatical view of a roof supporting framework;

FIG. 6 is a detail of the clamp for fastening a beam onto a foundation sill;

FIG. 7 is a cross-section through another form of beam;

FIG. 8 is a detail of a clamp for connecting the end of a structure perpendicular to a beam, when the latter is in the form of a beam of the type shown in FIG. 7; and

FIG. 9 is a detail of the clamp shown in FIG. 2.

The profile of the main member of the structure shown in FIG. 1, comprises a tube **10** of substantially square cross-section at the corners of which four triangles are located in such a way that the points of attachment of the

corners with the triangles are at midpoint of the greater sides **14** of the latter which will be referred to as the base of the triangle. The structural shape of the beam members can be produced by means of known forming machines; by hot or cold drawing, extrusion, rolling, welding, or in any other way. Furthermore the beams can be made of light alloy or synthetic resin.

FIG. 2 shows how a beam A is butt jointed to one of the faces of another beam B perpendicularly thereto, by means of a clamp which includes two flat arms with suitably bent ends for engaging the inner oblique sides **14** of the dovetail. The end of each of the arms opposite to the dovetail engaging end is formed as an eye **20** which extends for half the width of the arm, **18, 18'**. A pin **22** is inserted through the eye of both arms to form a hinge. The ends of the pin extend through two opposite holes **22'** in the side walls of the beam A, whereby the end of the latter is fastened to beam B.

A screw **24** with round head **26** in which an hexagonal recess is formed for receiving a wrench to drive it, is screwed into a nut which is welded on the inner face of arm **18**; the free end of the screw bears against the inner side of the other arm **18'** whereby the two lower edges of the arms **18, 18'** are forced into firm engagement with the oblique faces of the dovetail. The ends of pin **22**, which extend through holes on opposite walls of the beam A, prevent any movement of the latter with respect to beam B.

In FIGS. 2 and 9 a second type of clamp is shown for butt jointing a beam B to a similar beam C. This second type of clamp comprises a U-shaped plate **28**, that is a plate with two parallel sides and a third side perpendicular to the former two and connecting them to each other. The two parallel sides are cut away at the corners adjacent to the third side, whilst the latter is narrower than the other two, this being made for the purpose of introducing the third side into the dovetail of a beam so that the whole outside surface of the third side lies against the flat surface of the dovetail.

Between the two parallel sides of the U-shaped plate and crosswise to them, there are inserted a pair of elements similar one to the other; these elements are bent along a line which divides them into two portions or sides which form a dihedral **30**; one of the two sides of the dihedral has a fin **30'** attached to the edge thereof for engaging the oblique face **14** of the dovetail; a triangular end plate **32** is welded at each end of each dihedral to prevent any widening of the dihedrals angle under the stresses exerted on said elements. The two dihedrals are positioned in the U-shaped plate **28** in such a way that, whilst fins **30'** engage the dovetail oblique surfaces at the edge of one side of each dihedral the other side faces the corresponding side of the other dihedral; the outside corners of the two dihedrals meet along a line about which the two dihedrals can rock across a small angle.

A firm hold of fins **30'** with the dovetail oblique faces is achieved by means of a screw **34** which forces the sides of the two dihedrals which face one another, because the outside corners **33** of the dihedrals meet along the same line, so that the dihedrals are compelled to rotate about the line, and the fins **30'** are forced inside the dovetail. A pin **22** extends through two holes in the opposite faces of beam C and through corresponding holes in the sides of the U-shaped plate **28**; this pin ensures the connection of beam C to the U-shaped plate; the third side of the latter is trapped under fins **30'** and firmly held against beam B thereby ensuring the joint between the two beams.

A third form of clamp for connecting two superimposed orthogonal beams is shown in FIG. 4 and comprises a plate with a flat face **36** and a channel shaped portion **37** which clings on the triangular corners **12** of the beam and mates with the profile thereof. This type

of clamp is installed on an underplate 39 by means of screws 38. The underplate 39 is long enough to extend under plate 36 and under the plate symmetrical to plate 36 at the other side of beam B.

The holes on plate 36 through which screws 38 are inserted, are preferably of elongated form in order to facilitate the assembly of the joint components.

FIG. 4 also shows a fourth type of joints for the structure. This joint comprises an iron plate 40 which acts as a butt strap; the parallel longitudinal edges of the plate are bent to form a pair of elongated narrow fins to be inserted into holding engagement on a corresponding section of the dovetail.

The butt-strap plate is provided with two or more holes for receiving as many screws as engage a corresponding threaded hole on the beam face, the screws are alternately of the self-tapping type, whereby the plate is fastened to the two aligned beams E and E' and the latter are butt jointed together. These butt-strap plates are obviously applied to all of the faces of the two beams free from obstructions.

The clamp shown in FIG. 8 is similar to that shown in FIG. 2 and its use is for butt-jointing a vertical beam C to a horizontal beam F. In the case of the FIG. 8 clamp it must cling to a projection dovetail, instead of a recessed dovetail of the type shown in FIG. 2, the edges of arms 48 and 48', which correspond to arms 18 and 18' of the clamp shown in FIG. 2 are bent inwardly instead of outwardly and, in order to make a firm holding engagement thereof against the two oblique faces of the dovetail, a bolt 24 is provided which engages a threaded hole of arm 48' or a nut which is welded on the inner face of arm 48'. The bolt forces the two arms of the clamp one towards the other, so that a firm holding action is achieved between the arm ends and the oblique faces of the dovetail.

FIG. 6 shows, as already mentioned, a detail of the clamp for fastening a beam into a foundation sill. The clamp 36 is attached to an anchoring strap 37' buried into the sill by means of the same screw 38 which forces the clamp 36 into holding engagement with the beam.

FIG. 3 and 5 show diagrammatically how the roof and the floor elements of a building can be connected with the beam and how panels 42 of suitable material can be installed by skillful use of the above described clamps.

Obviously the dimensions of the panels and consequently the distance between two successive beams which hold a row of panels, will be determined according to the load to be supported by the structure.

I claim:

1. A constructional element comprising at least two hollow members of substantially square cross section extending at right angles to each other, each of said members having each face with a pair of oppositely facing longitudinally extending surfaces to define on each face a longitudinally extending dovetail portion, the member including four triangles, one at each of the four corners thereof, the connection of each triangle to the faces of the member being at the midpoint of one side of the triangle, said dovetail portion consisting of a dovetail channel located between each adjacent pair of triangles and having oblique side faces, means forming a butt joint of one of said members with the other one of said members and comprising a pair of flat arms; a pin hingedly connecting said arms at one end, a thrusting screw, the arms being forced apart by said thrusting screw so that the ends of the arms opposite to the pin are forced into holding engagement with said oblique side faces of the dovetail channel, said pin extending through holes on the opposite sides of one of said members so as to prevent any movement thereof with respect to the other member butt joined thereto.

2. A constructional element comprising at least two hollow members of substantially square cross section extending at right angles to each other, each of said members having each face with a pair of oppositely facing longitudinally extending surfaces to define on each face a longitudinally extending dovetail portion, the member including four triangles, one at each of the four corners thereof, the connection of each triangle to the faces of the member being at the midpoint of one side of the triangle, said dovetail portion consisting of a dovetail channel located between each adjacent pair of triangles and having oblique side faces, means forming a butt joint of one of said members with the other one of said members and comprising two similar angular plates for butt joining the two members, said plates being in juxtaposition, whereby two corresponding sides of the plates face one another and the other two sides of the same plates diverge, two fins provided at the edges of said other two sides and engaging said oblique side faces of the dovetail channel, a screw forcing the two facing sides toward each other, the two otuside corners of the angular plates abutting one against the other, whereby the two fins are forced into the dovetail channel, a U-shaped plate, the two angular plates being inserted crosswise between two sides of said U-shaped plate, the third side of the U-shaped plate lying against a surface of the dovetail channel underneath the fins and being held firmly by the fins, and a pin connecting the other two sides of the U-shaped plate to said other member, said pin extending through holes formed in the sides of the U-shaped plates and through holes formed on the opposite sides of said other member.

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