Jan. 11, 1944. E. C. CROWLEY 2,339,220

BUILDING CONSTRUCTION

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Fig. 1.

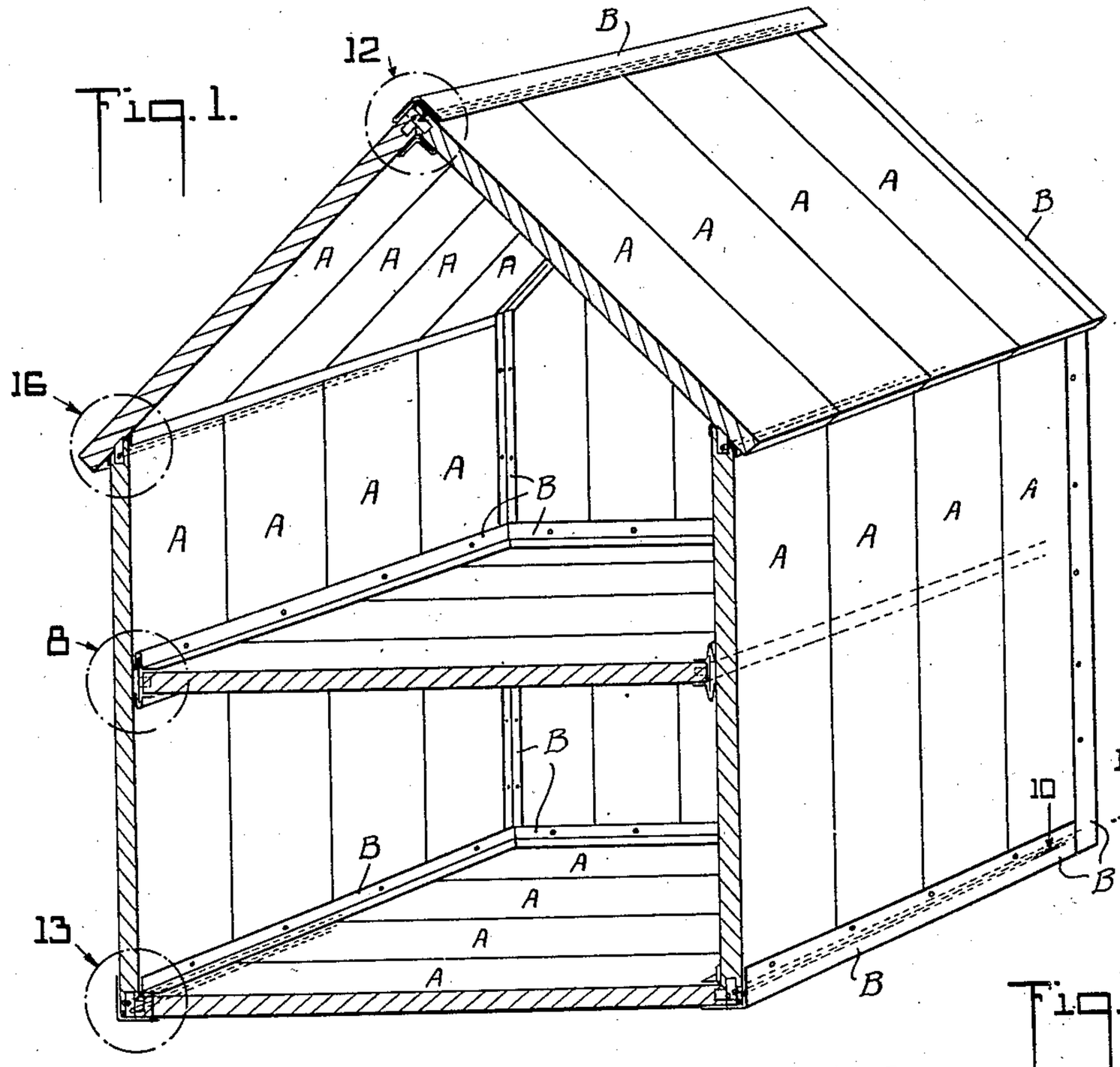


Fig. 3.

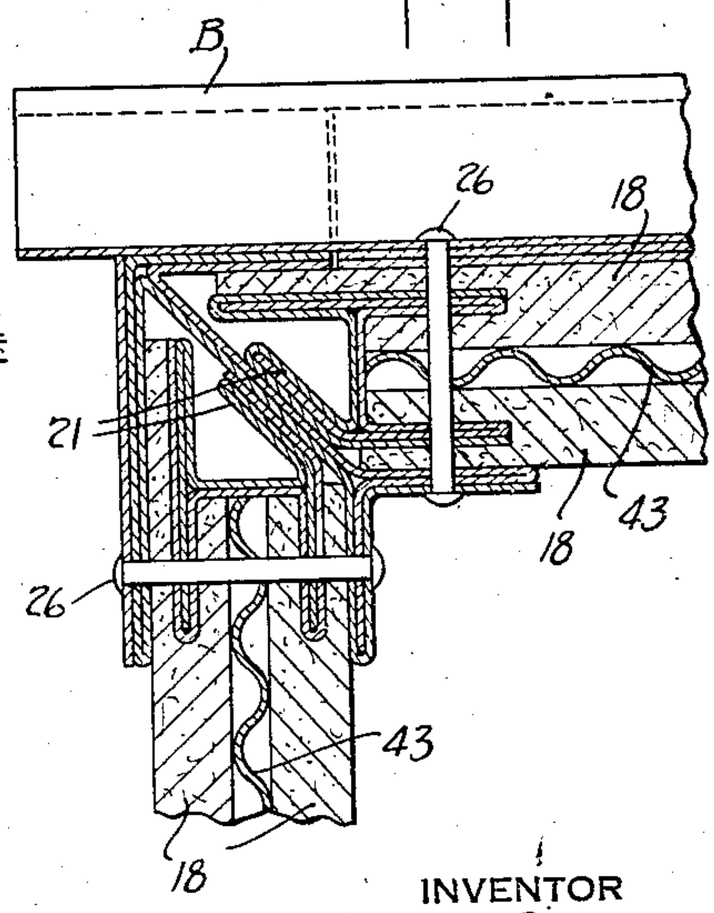
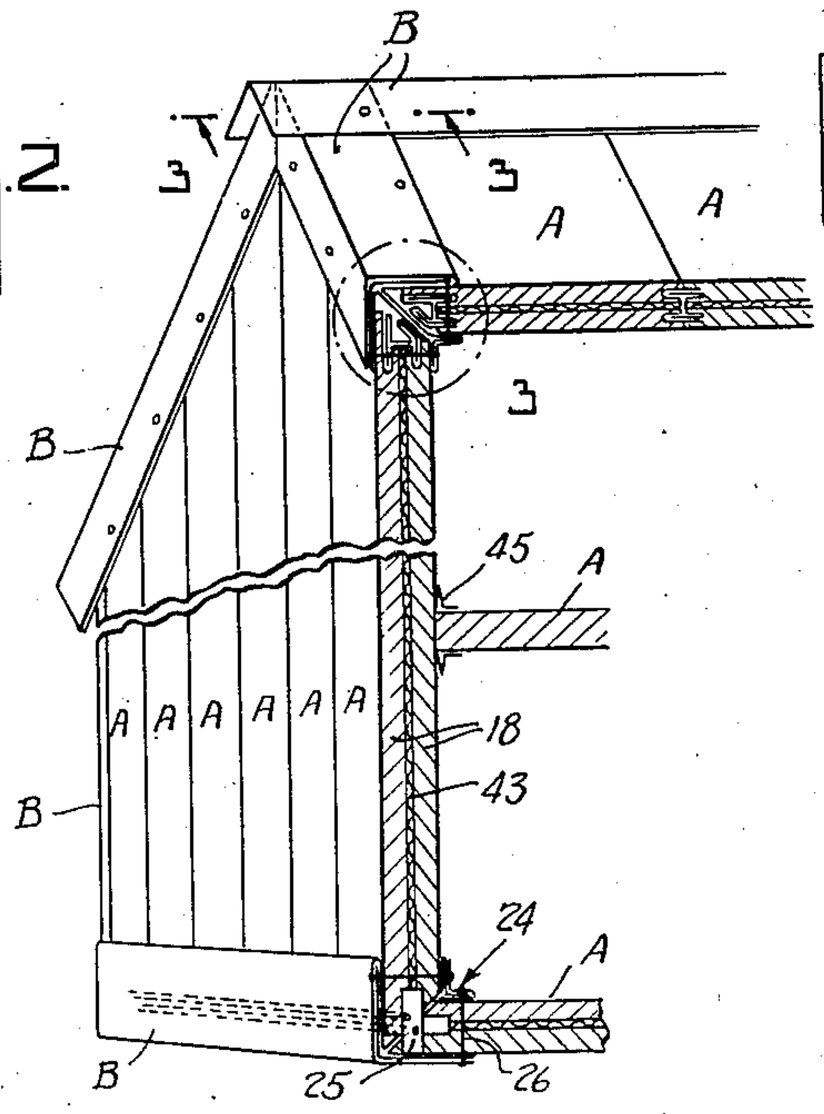


Fig. 2.



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BUILDING CONSTRUCTION

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Fig. 4.

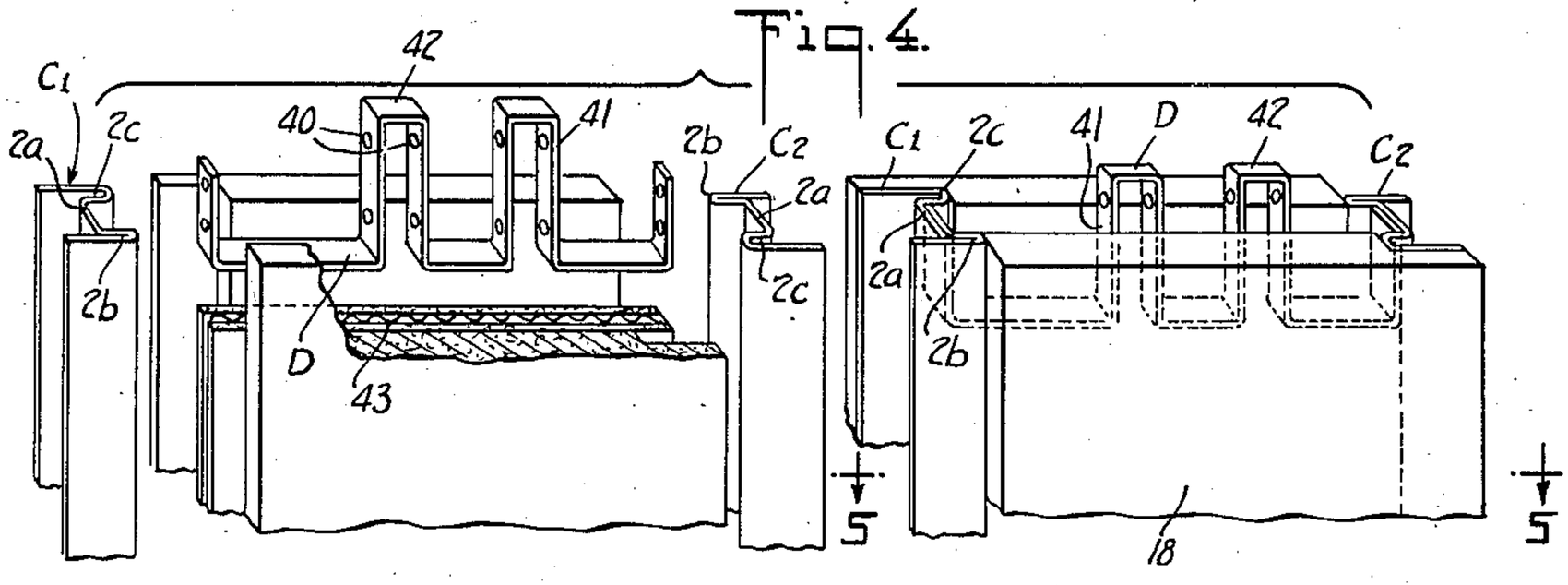

Fig. 5.

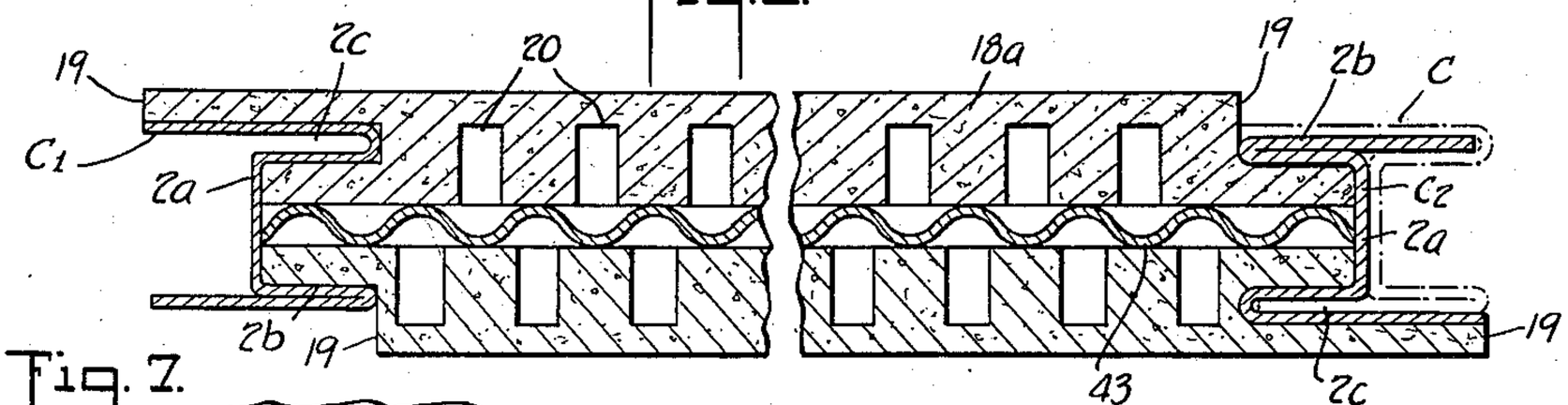

Fig. 7.

Fig. 6.

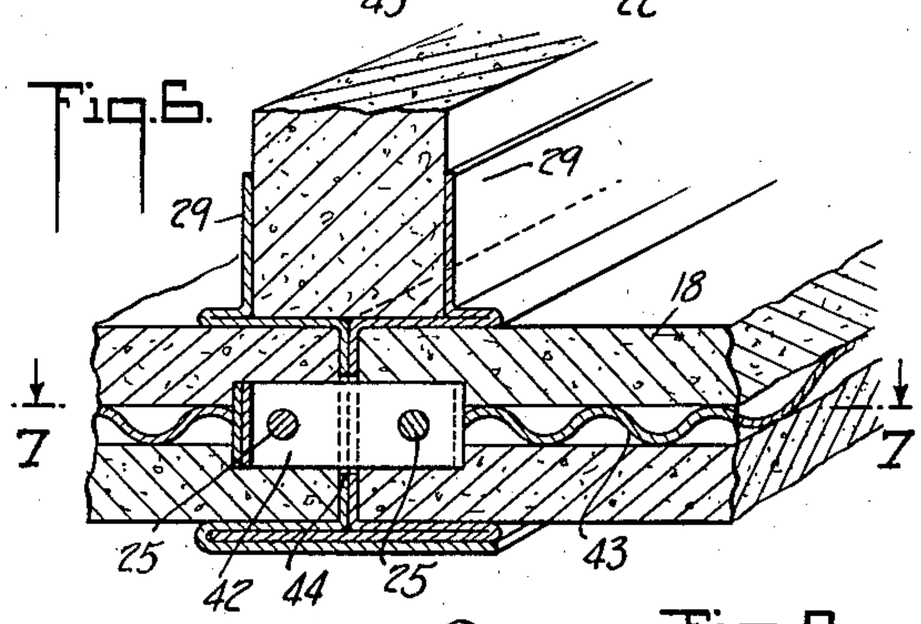

Fig. 9.

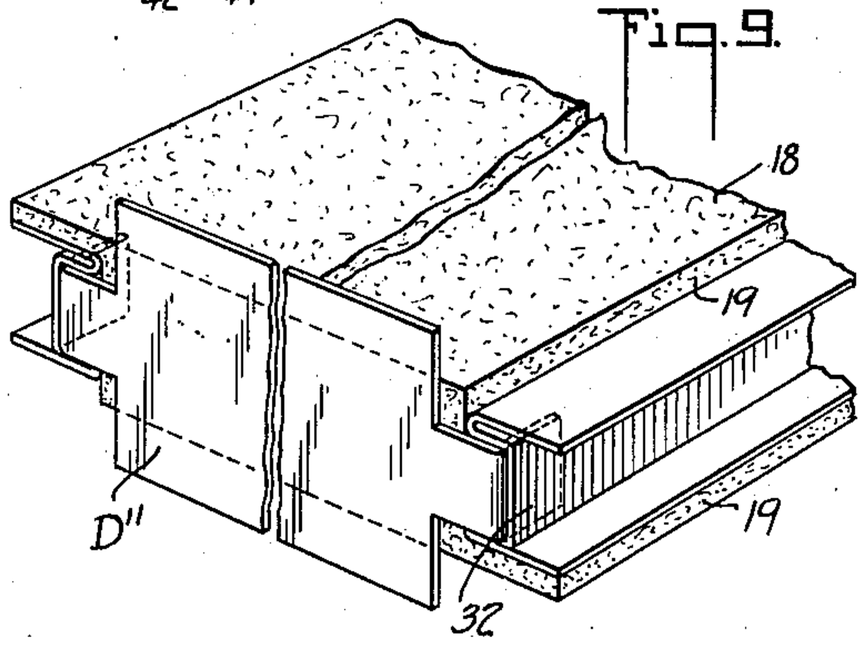

Fig. 8.

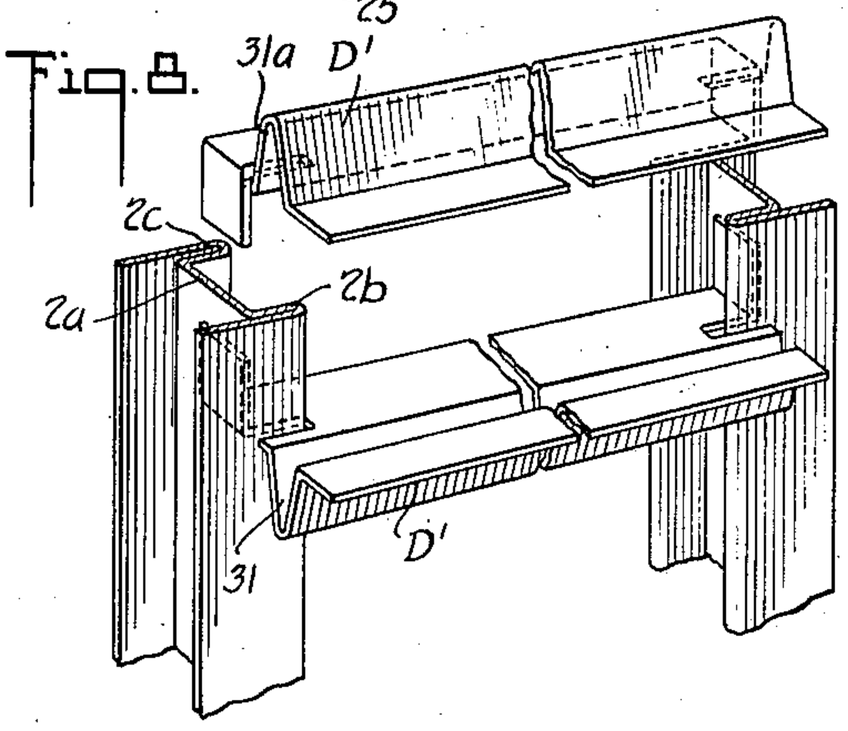

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Fig. 12.

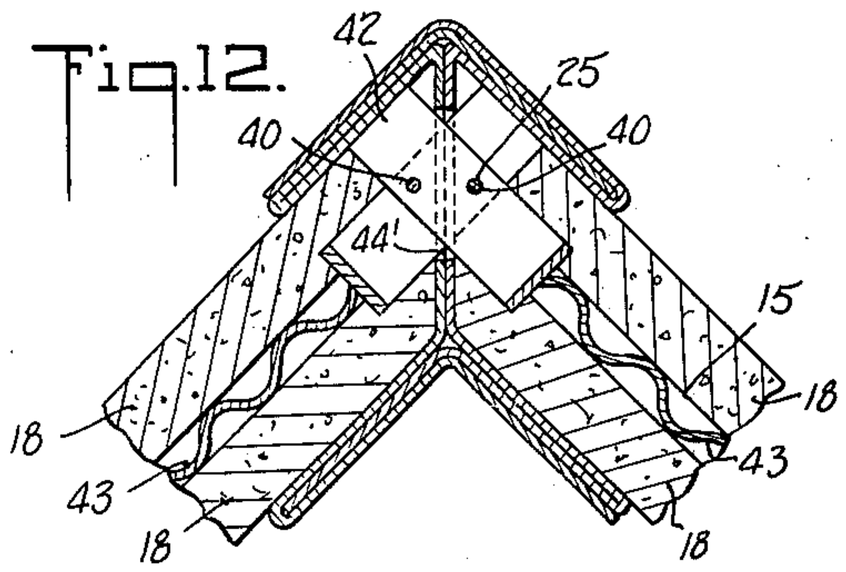

Fig. 13.

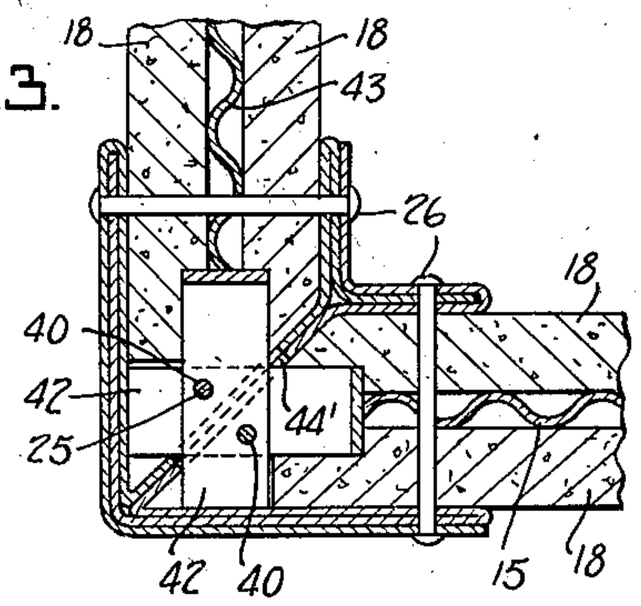

Fig. 14.

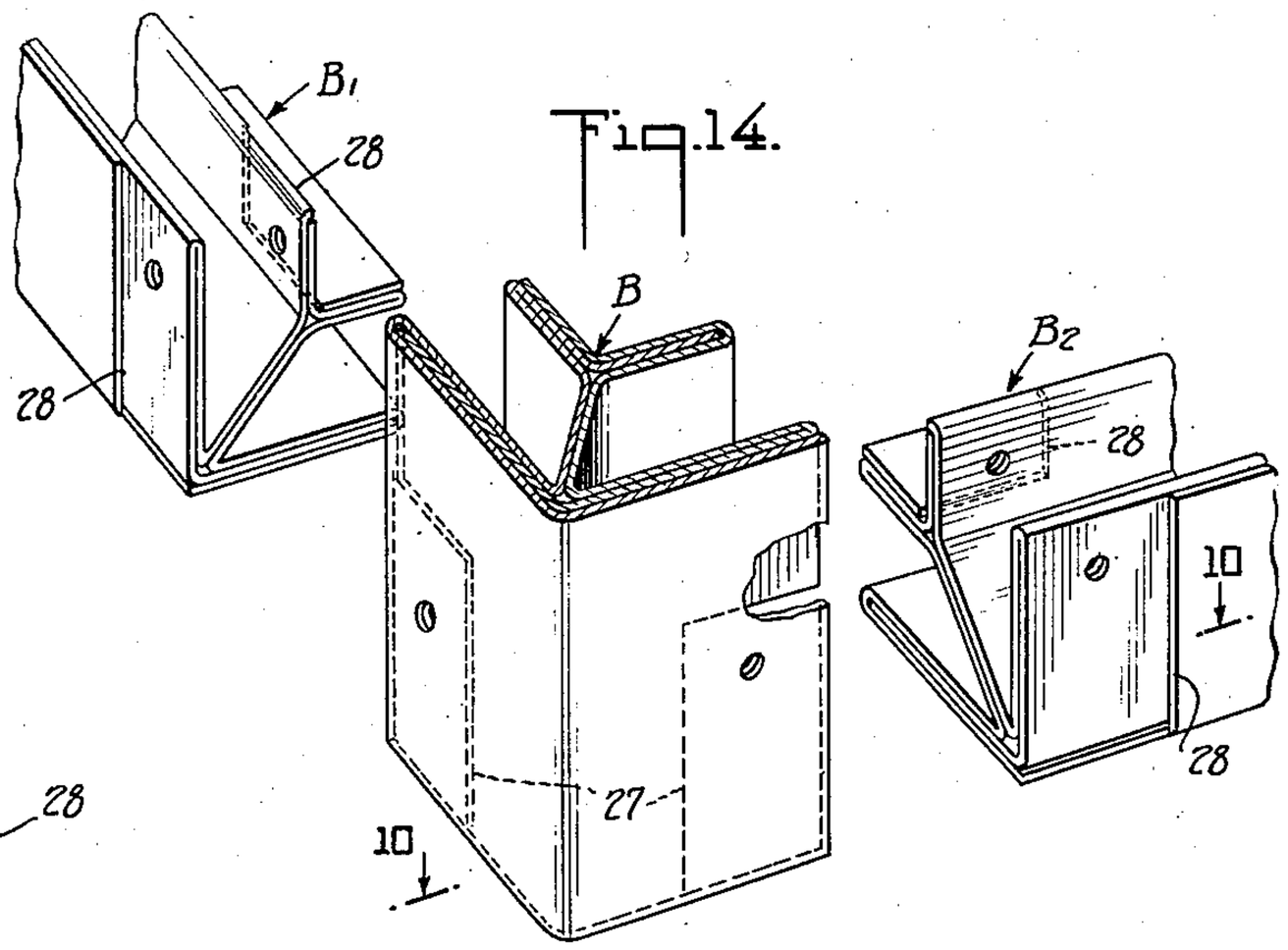

Fig. 10.

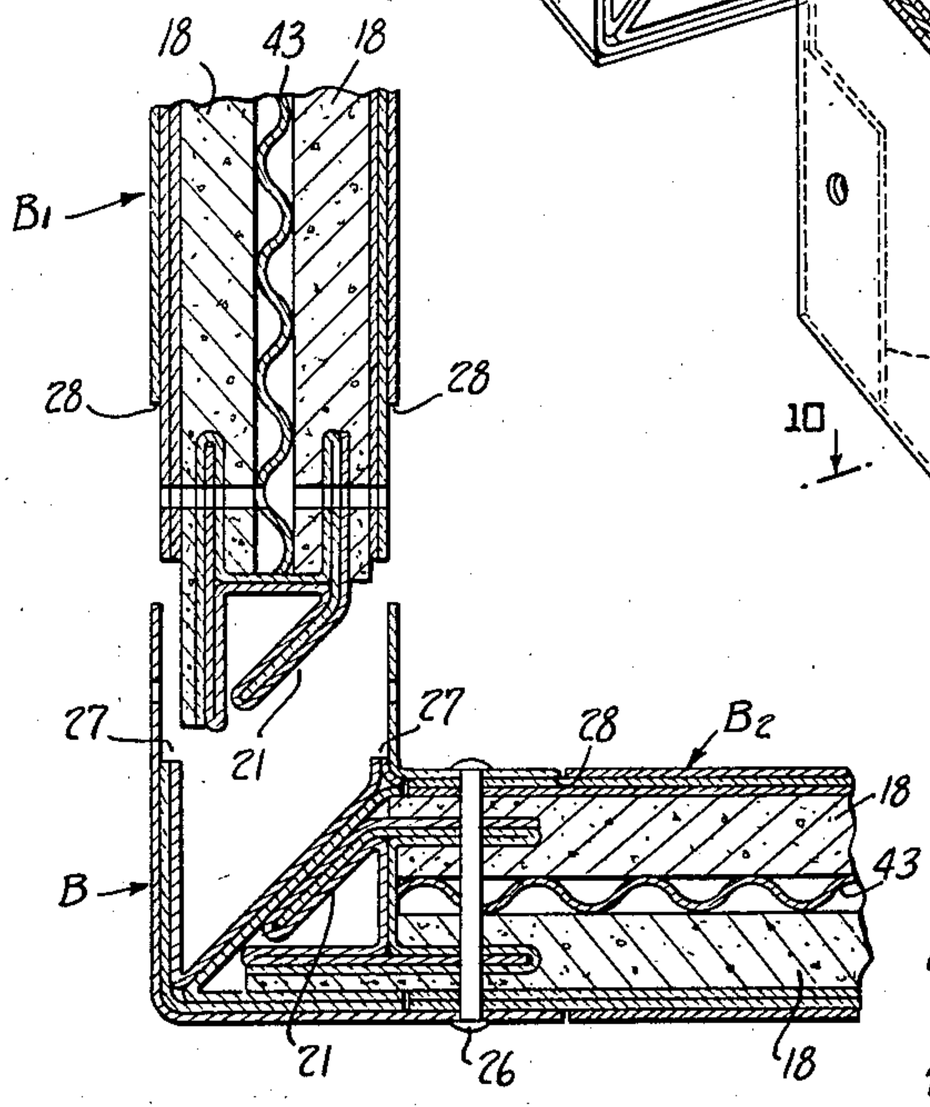

Fig. 11.

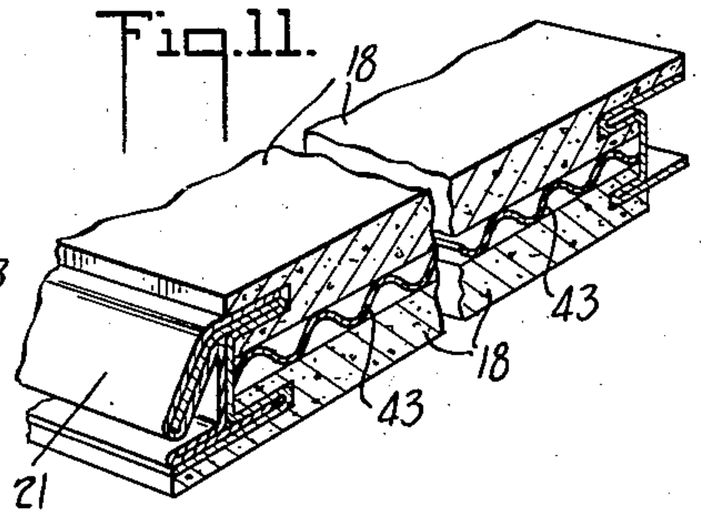

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Fig. 15.

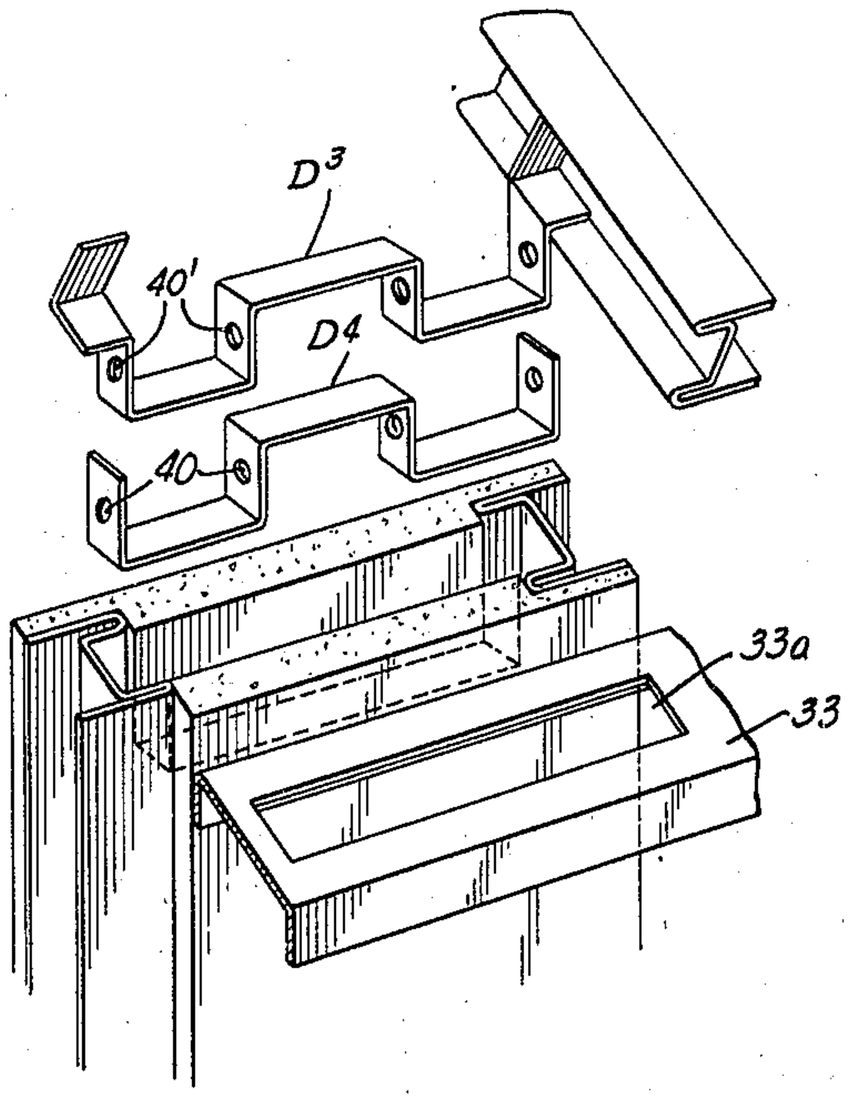


Fig. 16.

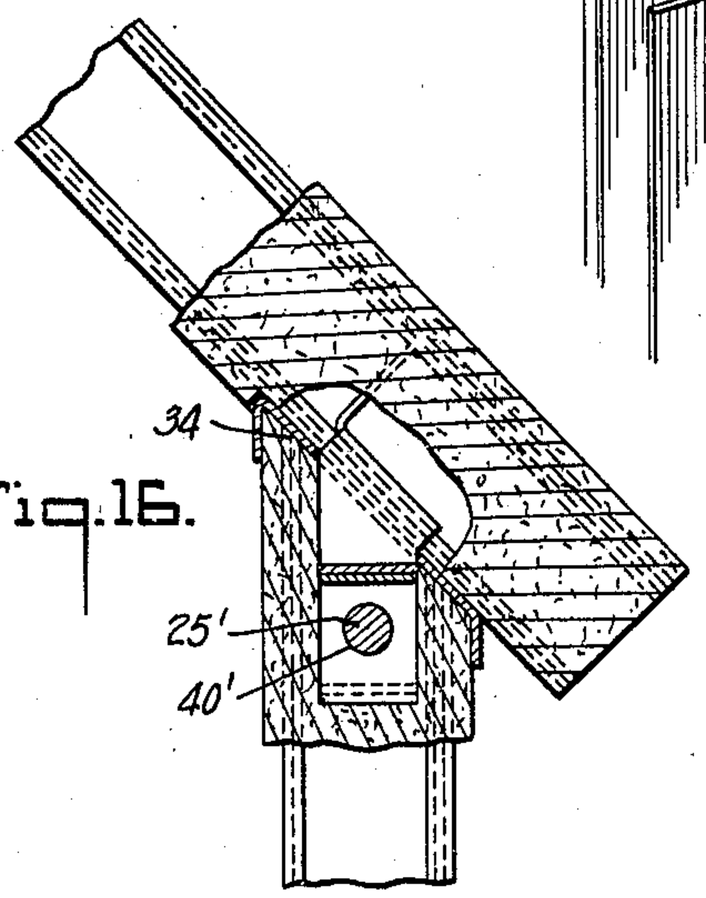
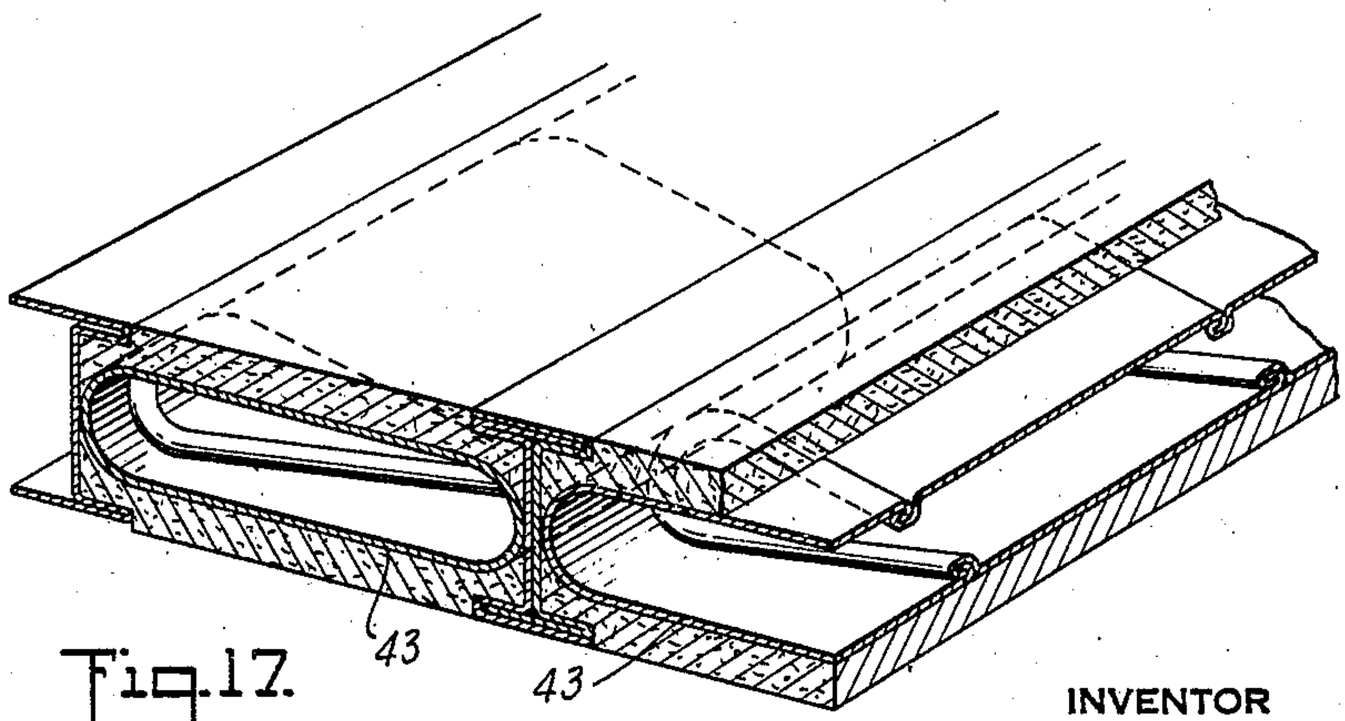


Fig. 17.



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Patented Jan. 11, 1944

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UNITED STATES PATENT OFFICE

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BUILDING CONSTRUCTION

Edward Chase Crowley, Rhinebeck, N. Y.

Application March 25, 1941, Serial No. 385,065

18 Claims. (Cl. 72—1)

This invention relates to a new form of prefabricated and sectionalized construction and necessarily involves the assembled use of novel paneled beams, elbow beams, beams and beam joints.

The essential features of this invention are shown in the drawings as applied to a house with a gable roof, and openings in said construction for doors, windows, chimneys and stairwells are purposely omitted because provisions therefore are well known, subject to the proviso that all such openings should be in some multiple of paneled beam width to preserve line and joint continuity.

An object of this invention is to provide a demountable structure composed of a small number of different kinds of parts, completely shop fabricated including insulation and all interior and exterior exposed surfaces and trim, so arranged that the work in the field to assemble a ready to use structure is limited to sliding together and locking the various parts and sealing the joints in the insulating material.

A further object is to provide structural elements that are comparatively light in weight and easy to handle.

A further object is to form structures by the interlocked and joined assembly of said prefabricated paneled beams, elbow beams, H beams and joints in such manner as to make the joints the strongest part of the structure and to so tie the various parts together that the assembly thereof acts as a single unit in its resistance to stress and strain and response to gravity, and to distribute the weight of the structure evenly along horizontal lines.

A further object is to keep down manufacturing costs by providing the said structural elements in respective uniform widths with appropriate depths of beam webs and gauge thicknesses of metal as constants, and by providing the variables, i. e., the respective and different lengths of the respective beams and metal cores by making the same from single piece lengths of flat metal which may be easily rolled into appropriate outline longitudinally by machine in any lengths desired.

The invention consists of novel parts, constructions, arrangements, combinations, and improvements herein shown and described. The accompanying drawings illustrate the invention and the best form contemplated for applying these same. This form, however, is to be considered as explanatory rather than restrictive, serving the purpose of explaining the inventive concept and features involved in my invention.

Referring to the drawings, wherein like numerals of reference indicate similar parts:

Figure 1 is a diagrammatic perspective view of a completed building, parts being in section;

Figure 2 is a perspective view of a completed end wall, parts being in section;

Figure 3 is an enlarged sectional view on the line 3—3 of Fig. 2 showing the joint between the end wall and roof;

Figure 4 is a perspective view of two panels utilized in forming a side wall and with the parts shown in disassembled relation;

Figure 5 is a horizontal sectional view on the line 5—5 of Figure 4;

Figure 6 is a perspective sectional view of the end joints of two floor panels taken on line 6—6 of Figure 7;

Figure 7 is a horizontal sectional view on line 7—7 of Figure 6;

Figure 8 is a perspective view illustrating the supports on the side walls adaptable for supporting the second story floor;

Figure 9 is an end perspective view of a second floor panel;

Figure 10 is a horizontal sectional view on the line 10—10 of Figures 1 and 14 showing the parts in a partially assembled relation;

Figure 11 is a perspective view of a corner panel;

Figure 12 is a vertical sectional view of the ridge of the roof;

Figure 13 is a vertical sectional view showing the juncture of the floor panel and side wall;

Figure 14 is a perspective view of a corner joint showing the metallic members in separated relation;

Figure 15 is a perspective view of the elements forming the joint at the eave of the house, the metallic parts being disassembled;

Figure 16 is a cross-sectional view of the eave joint; and

Figure 17 is a perspective view showing a joint formed by two floor panels having as a stiffening member a hollow tube with two flat surfaces and two rounded ends formed by winding a strip of metal in lockseam formation.

Figure 1 shows the paneled beams or unitary panels assembled with elbow beams to form a gable roof structure with one end wall removed. The paneled beams or unitary panels are designated by the letter A whether used in the first or second floors, side walls or roof. The elbow beams are designated by the letter B and therein shown at the roof ridge and the right and left hand junctures of the first floor panels with the

side wall panels and at the vertical corners in the rear.

Figure 2 shows the assembly of these paneled beams A and elbow beams B to form junctures of the end wall with the gabled roof and the first and second floors of the structure.

Most of the joints shown in said Figures 1 and 2 are further shown in amplified detail in separate figures. Such joints are enclosed by circles in said Figures 1 and 2, bearing numbers corresponding to the figure numbers giving the details of such joints—the numbered circles in said Figures 1 and 2 showing the application and position of such joints in use.

The paneled beams or unitary panels A shown are of a uniform width throughout the drawings and a substantially uniform thickness, this thickness depending on the type of transverse metallic web used. The lengths of the panels vary but, in every instance, this length is sufficient to extend in a single length from side wall to side wall, or ground to eave, or floor to floor, or eave to ridge, or ground to ridge, as the case may be.

These paneled beams are rectangular in outline and have on their longitudinal edges strips of metal rolled into an H-beam contour (see C_1 and C_2 in Figs. 4 and 5). These strips and contours are identical but they are disposed in reverse and complementary positions for engagement with adjacent panels as outlined at C at the righthand side of said Figure 5.

In further detail, these longitudinal strips have in H-beam contour two parallel flanges joined in a single line to centrally disposed vertical web 2*a* by means of two loops 2*b* and 2*c* both on the same side of the web, one loop 2*c* being open and the other 2*b* closed. The said loops project inwardly toward the center of the panel and having a recessed portion between them for the receptions and support of other panel members. The straight portions of said flanges project outwardly presenting two tongues and one groove 2*c* for interlocking engagement with adjacent panels, the respective grooves on each longitudinal edge of the panel being diagonally opposite each other. The contour of said edges is so arranged that when adjacent strips are slid together they form a doubled H beam having three layers of metal in its flanges and two layers of metal in its web, and also form a joint C having no exposed crevices.

The ends of said panel edges are perforated in alinement with perforations in the cross-members to permit a rod to pass transversely through both said panel edges and said cross-members (see Fig. 7) and, at points in the construction where these ends form angular joints with the ends of other panels, these ends are beveled as shown in Figures 12 and 13.

At the ends of these rectangular paneled beams are metal cross members D welded to the ends of said longitudinal metal strips on the insides thereof between the said flanges as shown in Fig. 4. In most cases, these cross members are perforated as at 40, and rabbeted as at 41, are thinner in cross-section than said longitudinal strips, and have a portion thereof projecting outwardly beyond the ends of said longitudinal strips to form tenons 42. The exceptions to said general rule are illustrated in Figs. 15 and 16 where the eave joint is formed by a cross member D^3 projecting downward from the outside of a roof panel to dove-tail with a cross member D^4 projecting downward in the inside of a side wall panel; and further illustrated by Figs. 8 and 9 where the modified type of cross member D'' shown on Fig. 9 is necessary to use to slide into the second floor support D' shown in Fig. 8.

The said paneled beams have a metallic transverse web and stiffening member. This transverse web is shown in Figs. 2 to 13 as a strip of corrugated metal 43. Fig. 17 shows this transverse web in the modified form 43' of a hollow tube with two flat sides and two rounded ends made by spirally winding a strip of metal in lock-seam formation.

I prefer the corrugated type of web for all construction up to two stories and attic on account of its light weight and cheapness. For structures having three to six stories inclusive, I prefer the tubular type of web on account of its greater strength and the greater utility of said tubes for accommodation of plumbing, lighting and heating arrangements.

The said paneled beams A have a layer of non-metallic material 18 on each side of said web. This material is molded to fit into the flanged recesses on the insides of said longitudinal metallic strips and to snugly fit and conform to the outline of the open loop 2*c* and flanges C_1 on the diagonally opposite corners of said paneled beams as shown in Fig. 5. The said material is further molded to present rabbeted open corners over each diagonally opposite flange having a closed loop (2*b*), so that, when adjacent paneled beams A are joined together, in parallel relationship, the said metal strips and part of said cross-members and said web are completely covered by said material which is co-extensive in length and width with said paneled beam A, except as aforesaid, the said material forming diagonally opposite butt joints (19, Fig. 5) on each side of said metal strips when adjacent panels are joined as aforesaid, said butt joints being readily sealed to form an air tight enclosure.

The aforesaid arrangement, of said paneled beams A, presents completely prefabricated longitudinal structure sections having an unusually good form of insulation and presenting both interior and exterior finished and ready to use surfaces covering said metal structure, which is disposed as a girdle and not as a border in the recesses between said surfaces at the sides and ends of said paneled beams. Obviously, these layers of material may be of one composition for outside exposure and another composition for inside exposure. The surface of these layers may be of smooth, rough, plain or designed and colored form, as desired. These surfaces may be flat as shown in the drawings herein, or may be arched or otherwise, as desired.

There may be only one layer of material instead of the two shown or the web may be completely immersed in and surrounded by the material.

In Fig. 5, I show a modification of the sides of said two layers of material which are respectively adjacent to said web. The modification consists of molding grooves 20 on said sides of said insulating material 18*a* to add additional air spaces to the air spaces afforded by the corrugations in said web and gives a reduction in the weight and amount of material in said layers.

In Fig. 11 there is illustrated a modification of the H beam described above. The modification consists in changing the angular relationship of

one-half of a flange 21 to the vertical web by dropping it from a 90° angle to an angle of approximately 45°. For convenience, this form of beam may be specifically identified as a deformed H-beam construction. In other respects this beam is the same as the said H beam, being similarly made of two rolled sections of metal forming when joined together a doubled beam having three layers of metal in its flanges and two layers of metal in its vertical web.

Said modified type of beam embodying the deformed H construction, is used to reinforce the outer edges of marginal paneled beams A and to aid in forming braced joints in conjunction with elbow beams at all places where said marginal beams meet other paneled beams to form corners, such as the vertical corner shown in Figure 10, where the sides of marginal paneled beams in an end wall and side wall respectively converge into a vertical elbow beam, and such as the corner shown in Fig. 3 where a roof panel A with such modified deformed H-beam construction as a part thereof converges into one side of an elbow beam B, while on the other side of said elbow beam B and also converging therewith is another modified deformed H-beam longitudinally disposed over the beveled ends of end wall paneled beams A to form joint 3 which thus shows the use of two deformed H-beams to form this joint in connection with an elbow beam.

In Figs. 6 and 7, is shown a further modification of said H-beam joint. These views show the junction of the ends of two first floor paneled beams with the end of a vertically disposed interior partition panel. As only one set of floor panels is called for in the unitary space enclosure of Fig. 1, this three-way beam joint is not shown there and is useful only in more elaborate structures or in addition to the simple illustrative structure of Fig. 1. The beam shown in Fig. 6 is made of two metal strips joined together to form a base flange having three layers of metal and a vertical web having two layers of metal which are first bent at right angles to the web and extended in opposite directions to form sockets for the reception and support of the ends of the respective horizontal beams. These metal strips are bent backward upon themselves to stiffen said flange and form part of the metal trim on each side of the base of said vertical panel. Said strips are then bent transversely into parallel separated relationship to form separated flanges 29, 29 as indicated to receive the partition panel and from the rest of said trim. And in such case, the tenons 42 on the ends of the floor panels are carried through mortise openings 44 in the web of the H-beam and said ends are spliced together with rods disposed therethrough as more fully hereinafter described in connection with elbow beams, the mode of joinder shown in Figure 7 being common to both types of beams.

The elbow beam mentioned above is so called because it functions as an elbow in making two-way connections with and giving support to all other members meeting at corners. It, like the beams described above, is a skeleton beam formed by joining together two rolled sections of metal strip and in such doubled relationship it likewise has flanges composed of three layers of metal and a web composed of two layers of metal. It differs from the other beams, however, in that the flanges on both sides of the web are disposed in oppositely sloping angles of less than 90° to the vertical web thereof. Where the elbow beam is used to join first floor panels to side wall panels or to join end wall panels to floor or roof panels or to join a flat roof to side walls, this angular relationship of flanges to web is approximately 45°. Where the elbow beam is used at the ridge of a gable roof, this angular relationship of flanges to web is fixed by the predetermined slope of roof. For convenience in illustration the ridge shown in the drawings is approximately 45°. In practice, the ridge may be at any angle desired. This ridge 12 is shown in position on Figure 1 and in detail in Fig. 12.

The said elbow beam is literally the foundation on which rests the whole of the construction described herein. I have described above its use in connection with the sides of said modified H beams to form vertical corner joints and horizontal corner joints between roof and floor panels and end wall panels. In addition to such usage, the said elbow beam is used at the ridge 12 (see Figs. 1 and 12) and at the corners formed by the meeting of first floor beams with side wall beams 13 (see Figs. 1 and 13). At joints 12 and 13, the respective panels involved meet in an end to end relationship with the tenons 42 on all of such ends passing through mortise openings 44' provided in the webs of elbow beams used in such panel dispositions with said tenons 42 in an offset and rabbeted relationship (see Fig. 7), such that the perforations in the projecting tenons and the other perforations in the cross members and panel ends are alined to form two parallel rows of perforations 40—40, one row being on each side of said elbow beam web. Strong rods 25 (Fig. 7) preferably in pairs, are longitudinally disposed through said rows of perforations, thereby splicing together the ends of such converging paneled beams A to form a continuous beam which is reinforced and supported by disposing the said panel ends in the mortise openings 44' provided by the flanges of said elbow beam at the points of said convergence.

At all points of usage, the said elbow beam forms the corner closure and weather cap and both inside and outside trim.

All parts of the completely assembled and ready to use structure are demountably attached together to form a unit mass with the weight thereof transmitted to and borne principally by the horizontally disposed ground floor members in even distribution. The vertically disposed corner elbow beams bear little imposed weight. The weight of the end wall panels is transmitted to the elbow beam B at the bottom thereof as shown in Figure 2. The long horizontal corner joint 24 is formed by the elbow beam connection of bottom ends of end wall panels to sides of floor panels with their member D at the side of such floor panels instead of being in its usual location at the end thereof. The long diagonal corner joint 3 is formed by the elbow beam connection of top ends of end wall panels to sides of roof panels. This involves the unusual condition of disposing a deformed H-beam longitudinally over the top ends of vertically disposed end wall panels, either in separate pieces as end cross-members for each individual wall panel or with one deformed H-beam spread over the tops of a series of wall panels. Obviously either form may be used. The joint 45, formed by letting the sides of second floor panels into end wall panels, as well as joints 3 and 24, are all shown on said Fig. 2. The end wall panels may be tied in at

their tops and bottoms to the vertically disposed elbow beams and to the respective horizontally disposed elbow beams and panels by the bolts 26 shown in Figures 2, 3, 10 and 13.

Figures 10 and 14 show how portions of the layers of metal in vertical elbow beams and side wall elbow beams and end wall beams are cut away to form a compact corner joint and to prevent the formation of an open gap between the vertical elbow beam and the insulating material on the side wall and end wall panels which would be formed if all three elbow beams retained their full thicknesses at such corner point. It will be seen from Figure 13 that the side wall panels and the first floor panels carry their insulating material right into the elbow beam joining them and that the elbow beam carries all three of the layers of metal constituting its flanges in lines exterior to said insulatinng material. Figure 2 shows the same situation with respect to the end wall panels and elbow beams. Obviously, if the vertical elbow beam had to fit over these bulges a gap would be presented and, therefore, two of the inner layers 27 of metal in said vertical elbow beam B and two of the outer layers of metal 28 in said side wall elbow beam B_1 and said end wall elbow beam B_2 are cut away as shown on said Figs. 10 and 14 for the purposes aforesaid. This cutting process also permits the use of elbow beams of uniform cross-sectional dimensions.

The tied-in joint 8 (Figure 1) formed by the junction of the second floor paneled beams with the side wall paneled beams is shown in detail in Figures 8 and 9. Figure 8 shows the two additional spaced apart cross members D'—D', welded to the insides of the longitudinal edges of the side wall paneled beams, the lower of said cross members having a groove portion thereof extending downwards as at 31, and the upper of said cross members having a groove portion thereof extending upwards as at 31*a*. Figure 9 shows the end of a second floor paneled beam with a unitary cross member connector plate D'' welded thereon as at 32, of appropriate dimensions to be slid horizontally into said grooves and to hold the floor panel firmly in braced relationship to the side wall panel.

The eave joint formed by the junction of the roof paneled beams with the side wall paneled beams 16 is shown in position on Figure 1 and in detail on Figures 15 and 16. The entire row of side wall panels has a longitudinally extending channeled cap 33 with openings thereon as at 33*a* to permit the passage therethrough of the downwardly extending rabbeted cross member D^3 on the outside of and near the end of the roof panel for the purpose of obtaining a bearing on the rabbeted cross member D^4 which extends downward on the inside of said wall panel and to bring into alinement the perforations 40 and 40' on each of said cross members to permit the passage therethrough of the longitudinally extending rod 25'. The side wall paneled beams are beveled at an angle as shown at 34 to correspond with the angle of slope of the roof to permit the longitudinal metal edges of the roof panels to bear upon the upturned metal edges of the side wall panels. The aforesaid means of joining said cross members firmly together within the recesses on the upper ends of said side wall panels prevents either lateral or vertical movement of said roof and side wall panels and holds all of said panels together in unitary massed formation.

Any one of the said forms of cross members D, D', D'', or D^4 serves to restrain movement of a panel stiffening member such as 43.

I claim:

1. As a new form of construction, the formation of a prefabricated demountable structure by the interlocked and joined assembly of a plurality of unitary panels and an elbow beam having flanges composed of three layers of material and a web composed of two layers of material made by longitudinally joining together two sections of strip material, each section having in contour two parallel flanges bent at their centers to form oppositely sloping angles to the web, and connected in a single line to a centrally disposed vertical web by means of two loops, both in the same side of the web, one loop being open and the other closed, the said elbow beam presenting two angularly disposed mortises sloping in opposite directions from said web.

2. As a new joining element for structural elements having their sides or ends meeting at an angle, an elbow beam having flanges composed of three layers of material and a web composed of two layers of material made by longitudinally joining together two sections of strip material, each section having in contour two flanges bent at their centers to form oppositely sloping angles to the web, and connected in a single line to a centrally disposed vertical web by means of two loops, both in the same side of the web, one loop being open and the other closed, the said elbow beam presenting two angularly disposed mortises sloping in opposite directions from said web into which mortises the ends or sides of said meeting structural elements are disposed to form corner joints, the exposed outside flange of the elbow beam constituting a weather cap for the joint so formed and both flanges constituting trim on the inside and outside of the structure.

3. A building construction comprising, in combination with an elbow beam having flanges and web, and mortise openings in said web, a plurality of paneled beams each having a double locked spliced and braced combination miter, rabbet and mortise and tenon arched joint formed by the end to end angular assembly of said paneled beams in oppositely sloping parallel rows on each side of the web of said elbow beam, the ends of said paneled beams being disposed within said mortises of the elbow beam with the beveled ends of the long sides of the paneled beams making right angled contacts on each side of the web of the elbow beam, and cross members having projecting tenons, said cross members being situated on the narrow sides of said paneled beams extending angularly through the said mortise openings in the web of the elbow beam in offset rabbeted relationship from one side of said web to the underside of the outer flange on the opposite side of said web, the projecting parts of said tenons having parallel rows of perforations, perfortions in one said tenon being in alinement with perforations in the tenon of the oppositely disposed paneled beam ends and cross members and forming two parallel rows of perforations, one on each side of said elbow beam web, a rod extending through each row of perforations, the said rods splicing together the ends of the angularity disposed paneled beams to form a continuous beam with an elbow.

4. A building construction comprising in combination with an H-beam having flanges and a web and mortise openings in said web, a plurality of paneled beams each having a double locked, spliced and braced combination rabbet, mortise

and tenon longitudinal joint formed by the end to end horizontal assembly thereof with said structural element, said paneled beams being arranged in opposite parallel rows on each side of the web of said structural element beam, said web having a plurality of mortise openings therein, the ends of said paneled beams being disposed within the mortises made by said beam flanges, with the ends of the long sides of the paneled beams making right angled contacts on each side of the web of the said beam, and cross members having projecting tenons, said cross members being situated on the narrow sides of the paneled beams extending horizontally through the said mortise openings in the web of said beam in offset rabbeted relationship from one side of said web to the cross members in the other side of said web, the projecting parts of said tenons having parallel rows of perforations, perforations in one said tenon being in alignment with perforations in the tenon of the oppositely disposed paneled beam ends and cross members and forming two parallel rows of perforations, one on each side of said web, a rod extending through each row of perforations, the said rods splicing together the ends of the horizontally disposed paneled beams to form a continuous horizontal beam.

5. As a new joining element for structural members having their sides or ends meeting at an angle, a solid elbow beam made by joining together two strips of material, each of which has a web and two pairs of sloping flanges, one pair being on each side of said web, to provide a web and flanges on each side of said web.

6. As a new structural element, a solid deformed H-beam having two pairs of flanges composed of three layers of material on each side of a web composed of two layers of material, with at least one of said flanges extending from said web at an angle thereto which is other than a right angle and at least two of said flanges extending from said web at a right angle thereto, said element being made by joining together two strips of material in closely fitting formation.

7. In building construction, sidewall panels and roofing panels, each formed with longitudinal edge beams, means for joining said roofing panels to side wall panels with the edge beams of the former supported by the edge beams of the latter, comprising rabbeted cross members secured to said roofing panels and extending downwardly therefrom, other rabbeted cross members secured to the side wall panels at the upper ends thereof and constructed for receiving in nested relation said first-named cross members, a channeled plate extending across the top of said wall panel and embracing the outer faces thereof, said plate having an opening therein coextensive in width and length with said first-named cross member to permit the passage therethrough of said cross member and a locking rod extending through the rabbeted portions of both said cross members and the edge beams of said side wall panels, said rod and the edges of said plate opening holding both said panels firmly in joined relationship.

8. As a new joining element for structural members having their ends meeting in a T formation, a flanged beam having mortise openings between its flanges, which face in three different directions, and composed of two strips of material joined together in continuous lines to form a horizontally disposed base flange having three layers of material therein, a centrally and vertically disposed web having two layers of material therein, and an upper horizontally disposed flange having the material thereof carried forward in looped and bent formation to constitute two single-layer, spaced apart vertically extending flanges.

9. In building construction, a detachable joint formed by the sliding engagement of a fabricated unitary panel having disposed at an end thereof a unitary cross member and connector plate member having its longitudinal edges extending beyond said panel, with two spaced apart unitary ledges and anchor plates, each of which has a projecting flange with a loop therein forming a recess, said loops being oppositely disposed and the end of said panel being disposed between said flanges with the extended edges of said unitary cross member and connector plate member disposed in said recesses.

10. In building construction, a perforated unitary panel, prefabricated with alined perforations for simultaneous end to end and side to side locking with other similar adjacent panels, rods traversing the alined perforations in the respective panels, a body portion consisting of at least one surfacing sheet, an individual edge member for each of the two longitudinal edges of said body portion with parallel perforations at the ends of each of said members, two cross members including unitary cross member and projecting tenon fastened to the ends of said longitudinal edge members on the insides thereof and composed of a band of material disposed on edge in a plane below and substantially parallel to said surfacing sheet, said band being bent to form a projecting tenon having a plane bearing surface disposed at a right angle to said longitudinal edge members, said band having two parallel rows of perforations therein, with one of said rows in alinement with said perforations in said longitudinal edge members.

11. In building construction, a detachable elbow joint formed by disposing the tenoned end of at least one perforated unitary panel such as set forth in claim 10 between a pair of the flanges on one side of the web of a beam having a pair of flanges on each side of the web thereof and openings in said web, and so disposing a tenon of said unitary panel through an opening in the web of said beam that one of the two rows of perforations in said tenon is disposed on one side of said web in parallel therewith, while the other row of perforations in said tenon, which is in alinement with perforations in the longitudinal edge members of said panel, is disposed on the opposite side of said web and in parallel therewith, and by disposing a rod through at least one of said rows of perforations.

12. In building construction, the joined and locked assembly of three elbow beams of substantially uniform cross section, each of which has a web and a pair of flanges sloping from each side of said web to provide a continuous elbow beam of the same cross section throughout and extending both vertically and in two different horizontal directions from a central point, the ends of the respective beams which meet at said central point being perforated to permit the disposition of rods therethrough to lock the beams together when the perforations are alined and the flanges at said ends being reduced in thickness at the appropriate portions thereof for the dovetailed assembly of the respective flanges on each of the horizontally disposed beams to form flanges in common with the flanges of the vertically disposed beam of uniform thickness with the

unreduced flanges of the respective beams and to provide recesses of uniform width and depth for the reception of other structural members.

13. In building construction, an angular arch wherein all pressure borne by said arch and all resistance to such pressure is distributed in couples on each side of the apex thereof, with the resistance couples in opposed and balanced relation to the pressure couples, comprising an elbow beam disposed to form the apex of said arch, which beam has a web with openings therein and a pair of spaced apart flanges sloping at an angle from each side of said web, and at least one panel having one projecting tenon at an end thereof disposed at such end between one of said pairs of flanges and at least one similar panel similarly disposed on the opposite side of said web, with the tenons of the respective panels passing in offset relation through said openings from side to side of said elbow beam and the other portions of said panels extending from said apex in respective planes parallel to the respective pairs of flanges, and means to lock said panels in such relation to said elbow beam and distribute in couples as aforesaid the pressure applied to said arch and the resistance thereto.

14. In building construction, a unitary corner panel for use at the marginal ends of walls, roofs, and floors to form corner joints between wall and wall, or between wall and roof, or between wall and floor, comprising a body portion having at least one surfacing sheet, and four individual edge members, comprising a deformed H-beam member, such as set forth in claim 6, an H-beam element, and two connecting members.

15. As a new member in building construction, a substantially rectangular girdle providing side and end connector elements for connecting said girdle with other structural members or elements in slip joints and providing side and end binding and support for a panel body, said girdle comprising two end cross-members joining in spaced apart relation two longituidnal members consisting of longitudinal and completely complementary sections of a symmetrically flanged and webbed beam, each section being perforated at the ends thereof and being made from a single strip of material and presenting outwardly extending flanges and inwardly extending flanges, the inwardly extending flanges being in looped formation, one longitudinal beam section having an open loop at the top and a closed loop at the bottom thereof and one longitudinal beam section having an open loop at the bottom and a closed loop at the top thereof, said beam sections being disposed to form snugly fitting slip joint engagement with complementary beam sections of adjacent similar girdles and thereby assemble said symmetrically flanged and webbed beam on either longitudinal side of said girdle with a like member on another girdle, at least one of said end cross-members having as a unitary part thereof a connector element consisting of a projection of said cross-member to form one or more tenons, said cross-member having one row of perforations therein alined with said perforations in said longitudinal beam sections and another parallel row of perforations in said tenons to permit the passage of a rod transversely through said cross-member and longitudinal members, and a rod transversely through said cross-member, and the cross-member and longitudinal members of a like girdle assembled therewith.

16. In building construction, a unitary panel comprising a generally rectangular body presenting two outer surfacing portions and having an open loop recess with inner and outer walls on each opposite longitudinal side thereof, the outer walls of the said recesses being formed by said surfacing portions and projecting laterally beyond said inner walls, and a girdle having two end cross members joining in spaced apart relation two longitudinal and completely complementary sections of a symmetrically flanged and webbed beam, each section being made from a single strip of material and presenting two outwardly extending flanges and a plurality of inwardly extending flanges, the inwardly extending flanges being in looped formation, one longitudinal beam section having an open loop at the top and a closed loop at the bottom thereof and one longitudinal beam section having an open loop at the bottom and a closed loop at the top thereof, said beam sections being disposed to form snugly fitting slip joint engagement with complementary beam sections of adjacent similar girdles and thereby assemble said symmetrically flanged and webbed beam on either longitudinal side of said girdle with a like member on another girdle, said body being mounted upon and supported by the flanges and webs of the said longitudinal members of said girdle, said girdle being disposed about the periphery of said body between the planes of said surfacing portions with flange formations thereof completely underlying the entire length of each of said outer walls of said recesses and with one of said inwardly extending looped flanges thereof disposed in each one of said recesses in said body.

17. In building construction, a unitary panel comprising a body portion, end cross members and longitudinal edge members consisting of two identical beams, each beam being formed of a strip of material shaped into an H contour in cross section with two parallel flanges joined in a single line to a centrally disposed web by means of two loops, both on the same side of the web, one loop being open and the other loop closed, said beams being disposed in reverse positions on the opposite longitudinal edges of said panel, with the looped portions thereof extending inwardly toward the medial line of the panel, the two ends of said strip extending outward to form parallel separated flanges and the respective open loops diagonally opposite each other and the respective closed loops diagonally opposite each other so that, when similar panels are joined together on their longitudinal edges in a detachable sliding contact joint, there is formed a solid H-beam and beam joint therebetween having three closely fitting layers of material in its flanges and two closely fitting layers of material in its web and wherein said two layers are disposed in identical vertical elevation, said body portion consisting of surfacing sheets disposed to extend beyond and over said longitudinal members and cross members in substantially parallel planes, and a bracing, spacing and supporting member disposed in the interior of said panel between the aforesaid surfacing sheets, and wherein said surfacing sheets are locked in position by said beams and said bracing, spacing and supporting member in mutually bracing, supporting and reinforcing relationship.

18. As a new member in building construction, a substantially rectangular girdle comprising two identical longitudinal members and two end cross members, each of said longitudinal members constituting one longitudinal and complementary

half of a symmetrically flanged and webbed beam and consisting of material shaped into an H contour in cross section with two flanges joined in a single line to a centrally disposed web by means of two loops, both on the same side of the web, one loop being open with the outer portion thereof spaced away from said web and the other loop being closed with the outer portion thereof resting upon said web, the said end cross members being dissimilar to the longitudinal members and being joined to the webs of said longitudinal members and holding said longitudinal members in spaced apart but reversed relation with their respective webs disposed in parallel planes, with their respective open loops diagonally opposite each other and with said open loops being unobstructed at each of their end portions and with the respective flanges extending freely outwardly with each flange in a different but adjacent plane to form snugly fitting slip joint engagement with complementary beam sections of adjacent similar girdles and thereby permit either the longitudinal or lateral assembly of such a symmetrically flanged and webbed beam on each longitudinal side of said girdle with a like member on another girdle with both such assembled beams disposed at the same level.

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