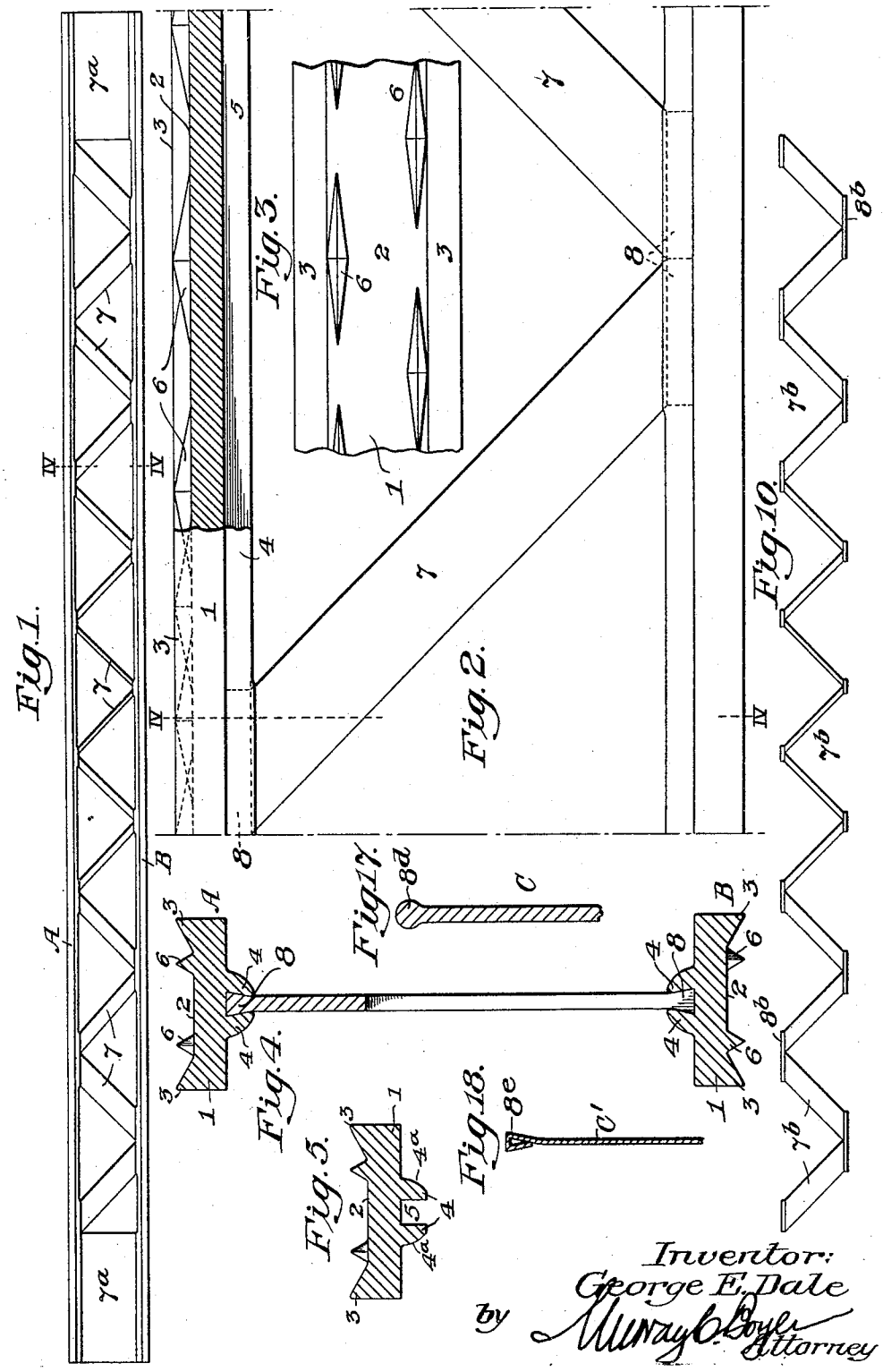
Sept. 22, 1931. G. E. DALE 1,824,076

STRUCTURAL REENFORCING AND BUILDING MEMBER

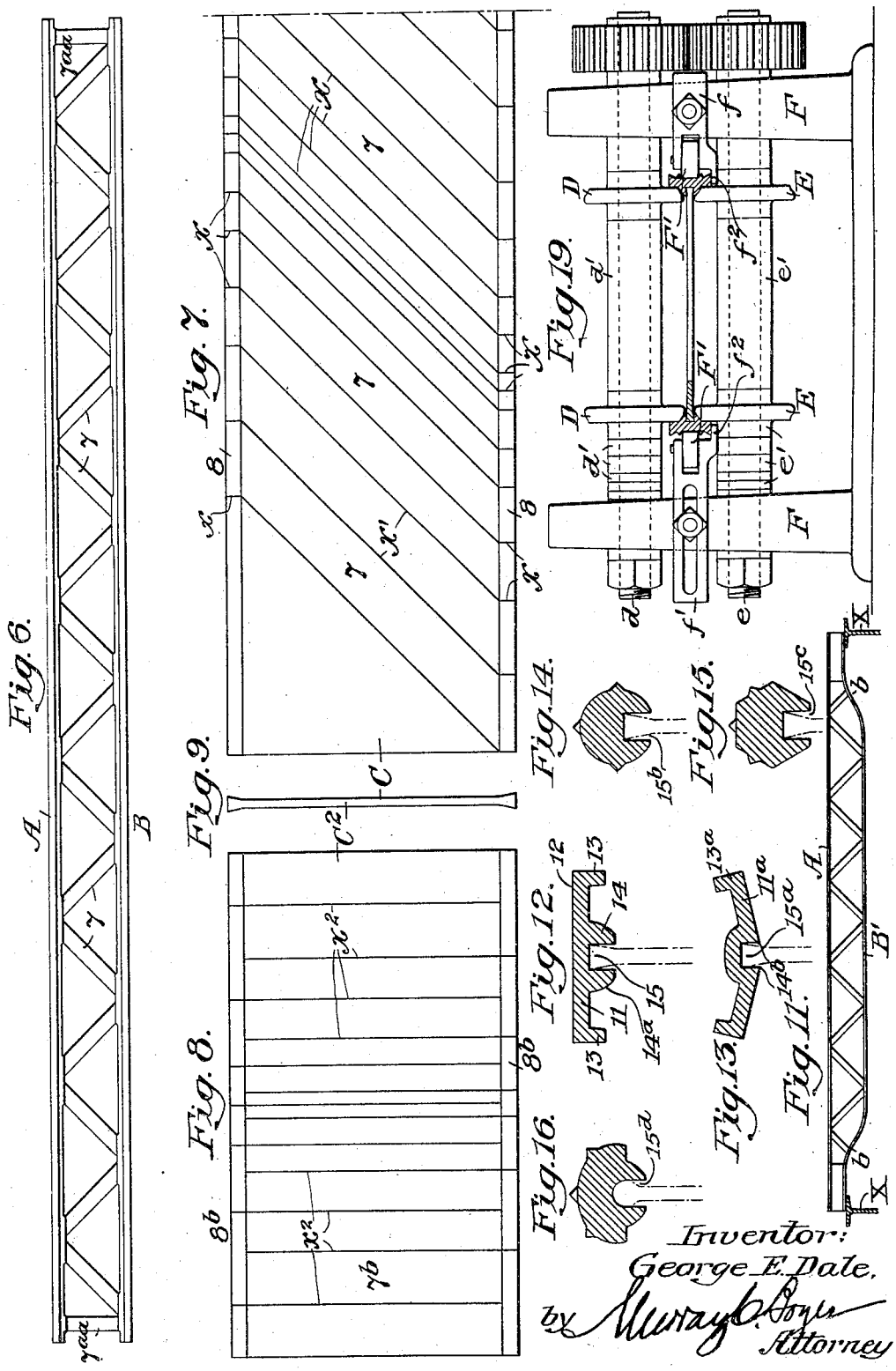
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STRUCTURAL REENFORCING AND BUILDING MEMBER

Original Filed May 6, 1924 2 Sheets-Sheet 2



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UNITED STATES PATENT OFFICE

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STRUCTURAL REENFORCING AND BUILDING MEMBER

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My invention relates to that type of metal beam or joist which is built up of metal sections, and one object of my present invention is to provide metal lumber in the form of a structural beam or joist for use in floor and ceiling construction; such structural member being particularly valuable for use as a reenforcing element in concrete structures and also as the main supporting member in floor construction involving the use of cinder fill or other fire-proof material.

A further object of my invention is to provide a structure having maximum efficiency in resisting tension and compression strains and stresses and one in which the metal sections are employed to the greatest advantage.

A further object of my invention is to provide a reenforcing structural element comprising upper and lower chords, with a series of independent members suitably spaced and disposed between the same, preferably in a diagonal direction, and having their ends permanently secured to the upper and lower chords.

A further object of my invention is to provide the diagonal connecting web members disposed between the upper and lower chords with enlarged end portions to fit in the channels of said chords and be anchored thereto; said end portions having terminals at right angles to their major axis and in parallel relation.

And a still further object of my invention is to employ rolled metal sections for the upper and lower chords; said sections being longitudinally grooved to provide laterally disposed walls or ribs definitely spaced apart throughout the length of said chords and forming channels receiving the ends of the members disposed between the same. These laterally disposed walls or ribs may be compressed into engagement with the ends of the members arranged between the chords and by providing the latter with suitably shaped ends, dovetail in cross section for instance, said members disposed between the chords may be permanently held thereto upon compressing said laterally disposed walls or ribs into engagement with said shaped ends.

These and other features of my invention are more fully described hereinafter; reference being had to the accompanying drawings, in which:

Figure 1 is a view in elevation of one form of structural reenforcing or building element within the scope of my invention.

Fig. 2 is a side elevation, on a larger scale and partly in section, of a portion of the structure shown in Fig. 1.

Fig. 3 is a plan view of a portion of the upper chord shown in Fig. 2.

Fig. 4 is a cross sectional view taken on the line IV—IV, Figs. 1 and 2.

Fig. 5 is a cross sectional view of the metal section from which the upper and lower chords of the structure shown in Figs. 1, 2, 3 and 4, are formed.

Fig. 6 is a view similar to Fig. 1, illustrating another form of structural reenforcing or building element within the scope of my invention.

Fig. 7 is a view in elevation of a plate having shaped edges, in the present instance dovetail in cross section, from which the members disposed between the upper and lower chords of my improved structural reenforcing or building element may be cut.

Fig. 8 is a similar view of a plate illustrating the manner in which it may be slit and subsequently stretched to form the members for engagement with the upper and lower chords.

Fig. 9 is an edge view of the plates shown in Figs. 7 and 8.

Fig. 10 is a view on a smaller scale showing the slit plate illustrated in Fig. 8 in the stretched condition.

Fig. 11 is a view illustrating a modified form of built-up beam, within the scope of my invention.

Figs. 12, 13, 14, 15 and 16 are cross sectional views illustrating modified forms of rolled metal sections which may be employed as the upper and lower chords of my improved structural reenforcing or building element.

Figs. 17 and 18 are edge views of modified forms of plates which may be employed in preparing the members disposed between the upper and lower chords of the structure forming the subject of my invention, and

Fig. 19 is a view of a set of rolls and supporting means therefor, which may be employed in the assembly of the members forming the improved structural reenforcing or building elements forming the subject of my invention.

The upper and lower chords of my improved structural reenforcing or building element constituting the compression and tension members respectively may be made from rolled metal sections or standard structural material, the cross section of which may vary as indicated in the several views of the drawings and is preferably, though not necessarily, of a contour having one surface approximating a single plane so that when such reenforcing or building element is disposed in an upright position, the lower surface of the lower chords will approximate a horizontal plane at or be substantially at a right angle to the vertical axis of said element.

I have shown in Figs. 4 and 5 cross sectional views of one form of rolled metal member which I may employ for the upper and lower chords of the structures shown in Figs. 1, and 6, which chord member may comprise a body 1, having its upper surface 2 concaved or dished; the sides 3 of such body extending higher than the central portion of the upper surface of the same. Referring more particularly to Fig. 5, the underside of the body 1 is provided with a pair of ribs 4, substantially centrally disposed and extending longitudinally of the same; such ribs having preferably curved outer surfaces as indicated at 4^a, and being spaced apart to form a substantially rectangular groove or channel 5.

When employed as a reenforcing element in concrete construction, the upper surface of the upper chord and the lower surface of the lower chord may have projections for interlocking engagement with the enclosing mass of concrete, such projections being illustrated at 6, and lying within the approximate plane of the raised edges of such surfaces.

In forming structural reenforcing elements in accordance with my present invention, such as the beam shown in Fig. 1, I employ upper and lower chords A and B, each of which may have a cross section of the character shown in Fig. 5, and positioned as illustrated in Fig. 4, and between these chords the members 7 may be arranged diagonally, preferably with the terminals of their end portions in contact at the points of engagement with the respective chords. In such arrangement, therefore, the width of the element, that is to say, the distance between the chords determines the spacing of the diagonal members. The ends of the diagonally arranged members 7 are placed in the grooves or channels 5 and are so shaped that they may be permanently held to the chords by displacing or compressing the ribs 4 into engagement with the same, and such ends may have a dovetail shape in cross section.

The diagonally arranged members may be cut from a rolled plate C, Fig. 7, having dovetail edge portions 8; such members being cut from the plate on the lines indicated, which lines include short cuts x at right angles to the edge of the plate, to the extent of the dovetail portion, with diagonal cuts x in the web of such plate. The diagonal members may vary in size (width) and weight from the centre toward the ends of the reenforcing element, as illustrated in Fig. 1, or they may all be of the same width, as illustrated in Fig. 6.

The diagonal members may be assembled as indicated in Figs. 1 and 6, and in addition and by preference I employ vertically disposed members at the ends of the beam; plates 7^a of material length, as shown in Fig. 1, or the vertical members 7^{aa} of the same width as the diagonal members employed, as shown in Fig. 6. In each instance the plates and vertical members will have suitably shaped edges with lateral projections, preferably dovetail in cross-sectional contour, for disposal in the grooves or channels 5 of the upper and lower chords, to which they will be secured in the same manner as the diagonal members are secured thereto.

In assembling the members of my improved reenforcing or building element, the plates 7^a (or the members 7^{aa}), and the diagonal members 7, are set in the proper relative position with their dovetail or other shaped ends fitting within the rectangular channel or groove 5, of the upper and lower chords and abutting each other. If desired, suitable tying means may be employed to hold them temporarily in such relation. By applying suitable pressure; preferably by means of pairs of suitably spaced driven rolls, D and E, as indicated in Fig. 19, the ribs 4 may be compressed against the lateral projection of the edge portions of the end plates 7^a (or the members 7^{aa}) and the ends of the diagonal members 7, thereby securely and permanently locking such portions in proper relative position with respect to the upper and lower chords to complete the structural reenforcing or building element, as illustrated in Figs. 1 and 6, or that shown in Fig. 11.

In Fig. 11 I have shown a slightly modified form of beam, in which the lower chord B′ is bent or arched adjacent to the ends of the same, as indicated at b. A beam of this type is particularly available for use in building construction where the thickness of the floor is such as to permit such ends to rest upon cross beams or girders indicated at X.

In Fig. 12 I have shown a metal section which may be employed for the upper and lower chords, comprising a web 11, with an upper surface 12, which will lie approxi-

forcing or building element is in the position of use; such web having side flanges 13, which may depend from the same; Fig. 11 illustrating the position of the section when employed as the upper chord. The under side of this member 11 is provided with ribs 14 substantially like those shown in the section illustrated in Fig. 5, with a rectangular space or channels 15 between said ribs to receive the ends of the diagonal members, or the vertically disposed end members; the outer surface of the ribs being preferably curved as indicated at 14^a. These ribs may be compressed into engagement with the lateral projections at the ends of the members 7, 7^a or 7^{aa}, placed between the upper and lower chords, in the same manner as the structure illustrated in Fig. 4.

In lieu of providing the member to form the upper and lower chords with its web initially flat, it may be shaped as illustrated at 11^a in Fig. 13, that is to say, with the central portion depressed and the flanged edge portions 13^a raised, and with a groove or channel 15^a on the underside; such arrangement enabling the lateral portions 14^b of the web to be brought into locking engagement with the lateral projections at the ends of the members 7, indicated by broken lines, upon flattening the chord member; that is to say, bringing the web 11^a of the same into a horizontal position.

In Figs. 14, 15 and 16 I have shown other forms of metal sections available for use as the upper and lower chords of the beam structure. These may be made of variously shaped, so-called, deformed bars, grooved or channeled as indicated at 15^b, 15^c and 15^d, respectively, to provide the laterally disposed portions or walls 14^b, 14^c and 14^d, flanking said grooves or channels and the equivalent of the ribs 4 or 14, shown in Figs. 5 and 12. By squeezing these lateral portions together, they will be caused to engage and permanently hold the ends of the web members fitted within the grooves or channels and disposed between the upper and lower chords.

The diagonal members illustrated in Figs. 1, 2, 3, et seq., are cut from a solid plate having dovetail edges, the thickness of such edges being equal to the width of the root of the grooves or channels formed in the upper and lower chord members and tapering toward the web of the plate, so that when the ribs or equivalent portions of the upper and lower chord members are squeezed together, the lateral projections at the end portions of the members 7, 7^a, or 7^{aa}, will be securely and permanently held to said chords. In lieu of a plate having an edge of this type, such edge may be rounded as indicated at 8^d in Fig. 17, and arranged to fit in a correspondingly shaped groove or channel 15^d formed in chord members of the type illustrated in Fig. 16; such shaped edge being readily and permanently confined in place by compressing the ribs or other portions of the chord members flanking the groove or channel receiving said rounded edges.

Instead of cutting the members to fit between the upper and lower chords from a solid plate having dovetail shaped edges, they may be cut from a thinner plate C', which may have its edges turned over to form the dovetail portions, as clearly illustrated in Fig. 18.

In lieu of using independent diagonal members indicated at 7, in Figs. 1 and 6, which members may be cut from a plate with suitable shaped edges as indicated in Fig. 7, or otherwise prepared, I may take a plate C^2 of a character similar to that illustrated in Fig. 7, or with rounded edges, or with edges of any suitable shape that will permit portions of the chord members to be compressed into gripping engagement with the same and slit such plate at w^2, at right angles to the edges as indicated in Fig. 8; such slits extending from one edge to the portion to be embraced by the ribs at the opposite edge alternately, and then the plate so prepared may be stretched to form a continuous member, illustrated in Fig. 10, having the desired diagonal web portions 7^b, which may be applied to the upper and lower chords in the same manner as the individual diagonal members are applied, and held in place in the same manner.

Instead of employing end plates 7^a with vertical edges at each end, as shown in Fig. 1, the diagonal members at the ends may be omitted and plates with diagonal edges, from which the other diagonal members have been cut, may be employed. In this way there will be no waste in the cutting of the plate C to form said diagonal members.

While the continuous element having the diagonal members only, as shown in Fig. 10, may be cut from a plate of the type indicated at C^2, Fig. 8, it will be understood that end portions performing the function of the plates 7^a, or the vertical members 7^{aa} may be formed integral therewith.

For the purpose of compressing the ribs or other engaging portions of the chord members into permanent securing position with respect to the lateral projections at the ends of the web members disposed in said grooves or channels and arranged between said upper and lower chords, I may use a structure such as indicated in Fig. 19, comprising the pairs of upper and lower rolls D and E, and supporting and driving means therefor. These rolls may be carried by shafts d and e, and collars d' and e' of varying dimensions lengthwise of the shafts may be provided so that the rolls may be spaced at the proper widths to properly engage the compressible portions of the upper and lower chords depending upon the dimensions of the particular structure undergoing preparation. To

support the chord members while the compressing action is taking place, I may provide the roll housings F with brackets f and f'; the latter being adjustable lengthwise of the rolls for changes in the dimensions of the structure being assembled, and each of said brackets carrying a positioning roll F'. Additionally, these brackets may be provided with ledges f^2 upon which the upper and lower chord members may rest in proper relative position while the compressing action is taking place. Modification of this structure is entirely within the scope of my invention to accommodate chord members of different shape, since the essential point is to provide means that will insure compression of the ribs or equivalent portions of the chord members to permanently anchor thereto the laterally projecting portions at the ends of the members 7, 7^a, or 7^{aa}, disposed between the same and forming with said chord members the structural reenforcing or building element forming the subject of my invention.

In compressing the ribs or equivalent lateral portions of the members forming the upper and lower chords, there will be a slight tendency of the same to spread at the points of engagement with the members, diagonal or otherwise, interposed between said upper and lower chords and secured to the same.

I claim:

1. A metallic building structure element comprising a channel compression member, a channel tension member, and a web composed of a plurality of similar bars each having lateral projections formed on their ends and secured in said channels laterally of the channel; said bars being arranged diagonally and in zigzag fashion and so that one end of each bar abuts an end of an adjacent bar.

2. A metallic building structure element comprising a channel compression member, a channel tension member, and a web composed of a plurality of similar bars each having lateral projections formed on their ends; said lateral projections being secured in said channels laterally of the channel and said bars being arranged diagonally and in zigzag fashion and so that one end of each bar abuts an end of an adjacent bar.

3. A metallic building structure element comprising a channel compression member, a channel tension member, and a web composed of a plurality of similar bars each having lateral projections formed on their ends and secured in said channels laterally of the channel by turning in the edges of the channels over the said projections, said bars being arranged diagonally and in zigzag fashion and so that one end of each bar abuts an end of an adjacent bar.

4. A metallic building structure element comprising a channel compression member, a channel tension member, and a web composed of a plurality of similar bars each having lateral projections formed on their ends; said lateral projections being secured in said channels laterally of the channel by turning in the edges of the channels over the said projections and said bars being arranged diagonally and in zigzag fashion and so that one end of each bar abuts an end of an adjacent bar.

5. A metallic building structure element comprising a channel compression member, a channel tension member, and a web composed of a plurality of similar bars each having enlarged ends secured in said channels laterally thereof by turning in the edges of the channels over said enlarged ends; said bars being arranged diagonally and in zigzag fashion and so that one end of each bar abuts an end of an adjacent bar.

6. A metallic building structure element comprising a channel compression member, a channel tension member, and a web composed of a plurality of similar bars each having enlarged ends; said enlarged ends being secured in said channels laterally of the channel by turning in the edges of the channels over said enlarged ends and said bars being arranged diagonally and in zigzag fashion and so that one end of each bar abuts an end of an adjacent bar.

7. A truss web member, comprising a plate sheared at its side edges and of parallelogram configuration between its ends; said ends being uniformly enlarged throughout their extent where they unite with the chord members of a truss, and having terminals disposed diagonally with respect to the side edges of said plate and in parallel relation with respect to each other.

8. A truss member, comprising a plate sheared at its side edges and of parallelogram configuration between its ends; said ends being dovetail in cross section, being disposed diagonally with respect to the side edges of said plate, being uniformly enlarged throughout the extent of said dovetail portions wihch unite with the chord members of a truss and having terminals at right angles to their major axis and to the longitudinal axis of said chord members.

9. A built-up reenforcing beam having upper and lower chords comprising rolled metal sections having side flanges with longitudinal ribs in pairs disposed midway between said flanges; the ribs of the respective chords being disposed toward each other and arranged in separated relation to form substantially rectangular spaces between the same, and spacing members comprising plates disposed diagonally between said chords and having dovetail ends of uniform dimensions disposed between said ribs and secured to the chords; said dovetail ends having their terminals at right angles to the longitudinal axis of the truss and abutting the terminals of the dovetail ends of adjacent spacing members.

10. As a new article of manufacture, a truss member for use as a reenforcing building element, having upper and lower chords with grooves extending longitudinally of the same and disposed toward each other, and connecting members consisting of plates extending diagonally between said chord members; said connecting members being of parallelogram configuration between their ends with sheared side edges and having uniformly enlarged end portions fitting the grooves of said chord members and anchored therein; said enlarged ends terminating at right angles to the longitudinal axis of the truss member and diagonally with respect to the parallel sides of said connecting members and abutting the ends of adjacent connecting members.

11. As a new article of manufacture, a truss member for use as a reenforcing building element, having upper and lower chords with grooves extending longitudinally of the same and disposed toward each other, and connecting members consisting of plates extending diagonally between said chord members; said connecting members being of parallelogram configuration between their ends with sheared side edges and having dovetail end portions of uniform dimensions fitting the grooves of said chord members and anchored therein; said dovetail ends terminating diagonally with respect to the parallel sides of said web members and abutting the terminals of the dovetail ends of adjacent web members.

12. As a new article of manufacture, a truss member for use as a reenforcing building element; having upper and lower chords with grooves extending longitudinally of the same and disposed toward each other, and spacing members extending diagonally between said chord members; said spacing members being of parallelogram configuration between their ends with sheared side edges and having uniformly enlarged end portions fitting the grooves of said chord members and anchored therein; said enlarged end portions terminating at right angles to the longitudinal axis of the truss member and abutting the terminals of adjacent web spacing members.

13. As a new article of manufacture, a diagonal spacing and connecting element for truss members comprising a plate of parallelogram configuration having uniformly enlarged ends disposed in parallel relation; the terminals of said enlarged ends lying at right angles to their major axis and diagonally with respect to the major axis of said spacing and connecting element.

14. As a new article of manufacture, a diagonal spacing and connecting element for truss members, comprising a plate of parallelogram configuration having enlarged ends dovetail in cross section disposed in parallel relation; the terminals of said enlarged dovetail ends lying at right angles to their major axis and diagonally with respect to the major axis of said spacing and connecting element.

In witness whereof I have signed this specification.

GEORGE E. DALE.