Jan. 11, 1927. 1,614,247

S. MACOMBER

STRUCTURAL UNIT

Filed April 13, 1925 2 Sheets-Sheet 1

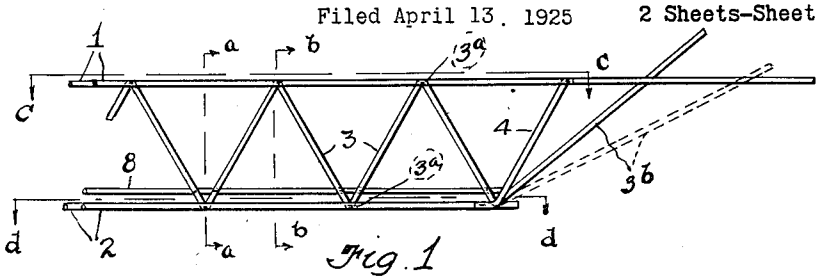


Fig. 1

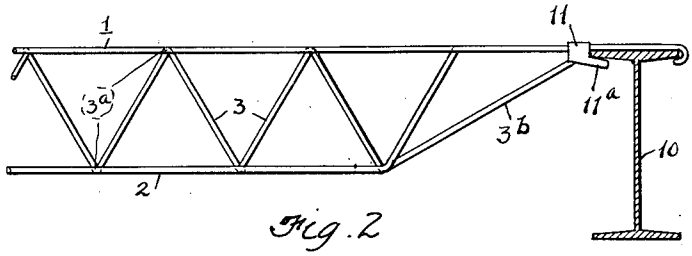


Fig. 2

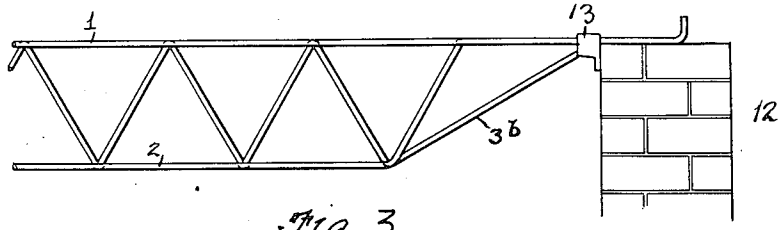


Fig. 3

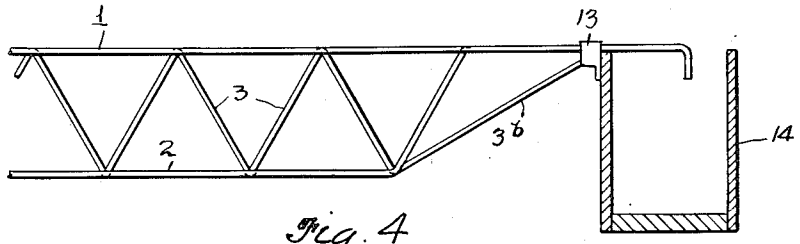


Fig. 4



Fig. 1c

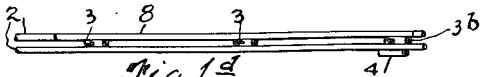


Fig. 1d

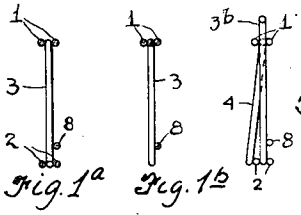


Fig. 1a Fig. 1b Fig. 1e

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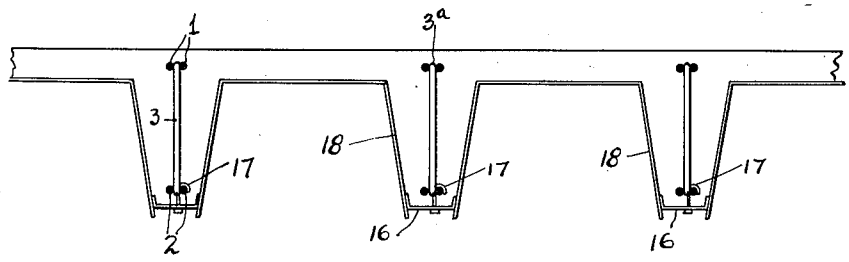


Fig. 5

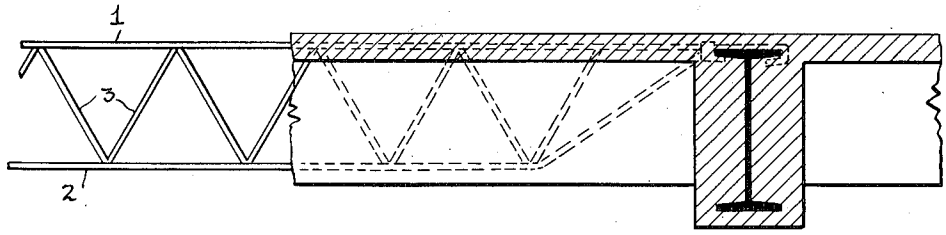


Fig. 6

Fig. 8

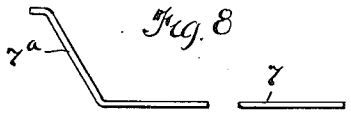


Fig. 7

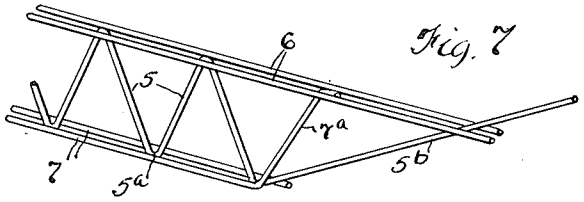
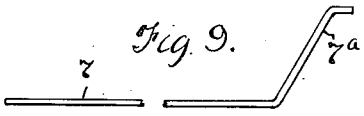


Fig. 9.



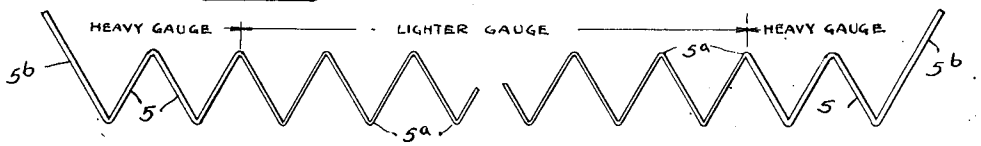


Fig. 10.

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UNITED STATES PATENT OFFICE.

STANLEY MACOMBER, OF MASSILLON, OHIO.

STRUCTURAL UNIT.

Application filed April 13, 1925. Serial No. 22,633.

The present invention relates more particularly to the construction of a truss section or other structural unit for buildings and the like where such unit is fabricated from a plurality of bar or rod-like elements or their equivalents.

One principal object of the invention is the provision of a structural unit of the type in question that may be readily adapted to various spans. Another object is to provide an improved method of fastening the ends of such unit to the I-beam, brick wall or other support, and by such fastening to complete the end connection so as to provide properly for the transfer of stresses. Included with the foregoing are special features of construction, all as will be hereinafter fully described and particularly pointed out in the claims, the annexed drawings and the following description setting forth in detail certain mechanism embodying the invention, such disclosed means constituting, however, but one of various mechanical forms in which the principle of the invention may be used.

In said annexed drawings:—

Fig. 1 is a side elevation of one end portion of a structural unit embodying the present improvements; Figs. 1^a and 1^b are transverse sections of such unit taken on the planes indicated by the lines *a*—*a* and *b*—*b*, Fig. 1; Fig. 1^c is a broken top plan view of such unit as indicated by the line *c*—*c*, Fig. 1; Fig. 1^d is a horizontal section thereof as indicated by the line *d*—*d*, Fig. 1; and Fig. 1^e an end elevation of the same; Fig. 2 is a side elevation of a structural unit similar to that shown in Fig. 1 but with its end secured to an I-beam support; Fig. 3 is a view similar to Fig. 2, but showing the end of a structural unit as secured in a brick wall; Fig. 4 similarly illustrates the manner of securing the end of such unit in a concrete wall; Fig. 5 is a transverse section of a series of such units with appropriate form-parts supported therefrom where such units are to be employed as reinforcing trusses in a reinforced concrete construction, specifically a floor; Fig. 6 is a broken vertical section of a completed floor wherein such units have been employed as reinforcing trusses, the plane of the section lying parallel with the plane of one such truss; Fig. 7 is a perspective view showing one end portion of a modified construction; and Figs. 8, 9 and 10 respectively illustrate the component parts of such modified construction.

Referring first of all to the form of structural unit illustrated in Figs. 1 to 1^e, inclusive, it will be noted that the truss there shown is made up of five principal elements or pieces, viz, two straight bars or rods 1 that compose the upper chord; two similar bars or rods 2 that compose the lower chord, both of said pairs of bars being substantially straight throughout their length and the lower pair being shorter than the upper pair; and another rod or bar 3 that constitutes the web member of the structure being bent reversely to form a succession of oppositely directed V's, the angles 3^a of which lie between the upper pair of bars 1 and the lower pair of bars 2.

The several bars just referred to are electrically welded or otherwise permanently and rigidly secured together at the points where the angles 3^a of the web member 3 thus lie between paired bars 1 and paired bars 2. However, because of the simplicity of the operation, it is preferred to "mash-weld" together the bars at the points in question, the middle bar being placed in position between the top and bottom bars, as shown in the sectional views, Figs. 1^a and 1^b, and the several welds being either successively or simultaneously produced.

Each end portion 3^b of the rod 3 that constitutes the web member is bent upwardly at a variable or adjustable angle, as will be presently explained, while a supplemental rod or equivalent member 4 is welded or otherwise permanently secured at its one end to the adjacent end of the bottom chord, i. e. at the point where said web member portion 3^b bends upwardly, the other extremity of such member being firmly secured in the manner previously indicated between the paired top chord members 1. The end portion 3^b of web member 3 is received between the ends of the top chord members 1 beyond the point where said member 4 is attached to the latter, and normally, i. e. before the structural unit is actually incorporated in a building, such end portion is free to assume any desired position within the limits indicated. Thus instead of occupying the position shown in full lines in Fig. 1, it may be bent up into substantially parallelism with member 3^a or it may be bent outwardly to assume the position shown

in dotted outline. As shown in Fig. 1[a], the lower end of member 4 is secured to the bottom chord alongside one of the component rods 3, but the exact point at which it is thus secured may be varied, as will be readily understood, or it may (in fact will preferably) be made continuous with one of the rods composing the bottom chord member.

It will be understood that considerable variation may be made in the arrangement of the terminal portions of the web and chord members and of the adjustable member 3[b]. Thus, in the construction shown in Figs. 7 to 10, inclusive, the web member 5, while formed from a rod just as before and in general resembling member 3, has its upwardly bent end portions 5[b] normally unattached to the upper chord members 6. The lower chord members 7 are respectively provided at opposite ends with upwardly bent portions 7[a] that are welded or otherwise permanently secured between the top chord members in the same fashion as the separate member 4 in the first described construction. It will be understood that the angles 5[a] of the web member 5 are welded or otherwise permanently attached to the top and bottom chord members just as before.

Said web member 5 presents a further distinction in that it varies in cross-section or, in other words, in strength at different points, being stronger adjacent the respective ends of the unit than in the intermediate portion thereof. Thus, where made of a rod bent to form a series of oppositely directed angles, as illustrated, the rod in the first couple angles adjacent each end is of heavier gauge than in the remaining intermediate angles composing the web member. In Fig. 10 this difference is somewhat exaggerated in order to bring out this feature of construction.

It will also be noted that in Figs. 1 and 5 an extra reinforcing rod or bar 8 is shown attached to one side of the web member. By means of this rod, provision may be made for greater live loads in a concrete dsign where this is found necessary or desirable. However, as indicated by the omission of this bar from the showing of the unit in the other figures of the drawing, its inclusion is optional.

The position of the outer end of member 3[b] (or equivalent web extension 5[b]) is adjusted to suit the span which the structural unit as a whole is required to bridge. As will be obvious from an inspection of Fig. 1, such span may vary within limits equal to twice the distance between the upper end of end portion 3[b] and the outermost position of the upper end of member 4, as shown in dotted outline. In actual practice the unit or section is designed for a maximum span condition, i. e. with member 4 in dotted position.

In installing the section between I-beam supports 10, the ends of the top chord are allowed to rest on such supports, the ends of the bottom chord being preferably spaced the same distance from each such support, i. e. the section as a whole being symmetrically disposed with respect to such supports. Member 3[b] is then swung outwardly until it contacts with the support and its extremity, if of sufficient length, may be bent over and around the top flange of the I-beam so as to anchor the section or unit to the latter. A clamp 11 is then applied to said member at the point where it intersects the top chord so as to tie the member and the rods composing such chord firmly together. This clamp may, if desired, be formed with a projecting lug 11[a] that is adapted to engage the opposite side of the top flange of I-beam 10 and thus still more firmly tie the section or unit thereto. The detail construction of clamp 11 forms no part of the invention and as a matter of fact, it will suffice simply to wire or weld the parts together at this point.

As soon as the foregoing connections have been completed, the bars comprising the upper chord being rigidly fastened by the clamp to member 3[b] are able to resist compressive strains, while said member 3[b] constituting as it does an extension of the bottom chord is in position to resist the tension stresses. The section or unit, accordingly, will now function as a structural unit exactly the same as if said member 3[b] had been permanently connected to the top chord in the shop.

Where the ends of the unit are supported on a brick wall 12 (see Fig. 3), the adjustment of member 3[b] will be had in the same manner as just described, except that its extremity if of sufficient length will here be bent to interlock with the brick composing such wall. A modified form of clamp 13, which is adapted to abut against the inner face of wall 12, is here shown instead of clamp 11. The arrangement will be substantially the same where the ends of the section are to rest on a concrete support or beam. As shown in Fig. 4, the end of the unit may be preliminarily supported on the box or mold 14 in which the concrete for such support is poured. After the concrete has set and the box removed, the unit or section will be left resting on such support or tied in the same in case it is continued to a higher level.

As previously indicated, the unit or section may be used independently as a steel joist. It is also well adapted for use as a reinforcing truss in reinforced concrete construction, as illustrated in Figs. 5 and 6. Where it is to be thus employed, a soffit 16 is supported from the bottom of each truss through the medium of hooks 17 that engage with one of the rods composing the bottom

chord, these soffits in turn supporting steel pans or domes 18, as will be readily understood from an inspection of Fig. 5. In this way no undershoring is necessary and the installation of the accessory parts required to mold the concrete about the trusses may all be done from the top of the latter.

It will thus be seen that special economies are effected by the use of this improved structural unit or section in reinforced concrete work in that false supports such as are ordinarily used may be entirely eliminated, the reinforcing material being provided in a form that is adapted to support the initial or construction load. The proper location of such reinforcing material in the finished concrete structure is at the same time insured so that the finished structure may carry the calculated ultimate load.

Irrespective of whether the unit be thus employed in reinforced concrete work or as a steel joist, either exposed of with merely a fireproofing coating, the flexibility of such unit whereby it may be accommodated to spans that vary considerably in length enables the unit to be economically manufactured since it is not necessary to make a great variety of different units to fit each particular span. When the adjustable end member is tied or clamped to the top chord of the unit, the latter becomes a truss with a calculable load carrying capacity which obviously may be made high enough to afford any desired margin of safety.

While the several members that enter into the construction of the unit have been shown as round rods, these members may of course be of any desired section, i. e. may consist of flats, angles, squares or any other shapes. Furthermore, the top and bottom chords may be made from one piece instead of two, as for instance from channels. By properly designing the strength of the component parts, the unit may be adapted to carry loads much larger than in ordinary floor construction so that, in other words, it can be used for the heavier or main members in buildings.

Other modes of applying the principle of my invention may be employed instead of the one explained, change being made as regards the mechanism herein disclosed, provided the means stated by any of the following claims or the equivalent of such stated means be employed.

I therefore particularly point out and distinctly claim as my invention:—

1. In a truss-like structural unit, the combination of top and bottom chord-members, a suitable web-member, and a member tied at its one end to said bottom chord-member and angularly adjustable with respect thereto whereby the other end of said member may be shifted with respect to said top chord-member.

2. In a truss-like structural unit, the combination of top and bottom chord-members, a suitable web-member, a member tied at its one end to said bottom chord-member and angularly adjustable with respect thereto whereby the other end of said member may be shifted with respect to said top chord-member, and means adapted to clamp such shiftable end of said member to said top chord-member at selected points.

3. In a truss-like structural unit, the combination of two parallel rods forming a top chord-member, two other rods spaced from but lying parallel with said first-named rods, said last-named rods forming a bottom chord-member, and a suitable web-member connecting said top and bottom chord-members, said bottom chord-member being provided at each end with an extension angularly adjustable with respect thereto, whereby the free end of such extension may be shifted with respect to said top chord-member.

4. In a truss-like structural unit, the combination of two parallel rods forming a top chord-member, two other rods spaced from but lying parallel with said first-named rods, said last-named rods forming a bottom chord-member, a suitable web-member connecting said top and bottom chord-members, said bottom chord-member being provided at each end with an extension angularly adjustable with respect thereto, whereby the free end of such extension may be shifted with respect to said top chord-member, and means adapted to clamp such shiftable end of each such extension to said top chord-member at selected points.

5. In a truss-like structural unit, the combination of two parallel rods forming a top chord-member, two other rods spaced from but lying parallel with said first-named rods, said last-named rods forming a bottom chord-member, and a suitable web-member connecting said top and bottom chord-members, said web-member being prolonged at both ends to provide angularly adjustable extensions, substantially as and for the purpose described.

6. In a truss-like structural unit, the combination of two parallel rods forming a top chord-member, two other rods spaced from but lying parallel with said first-named rods, said last-named rods forming a bottom chord-member, a suitable web-member connecting said top and bottom chord-members, said web-members being prolonged at both ends to provide angularly adjustable extensions, substantially as and for the purpose described, and means adapted to clamp such shiftable end of each such extension to said top chord-member at selected points.

7. In a truss-like structural unit, the combination of top and bottom chord-members, and a rod bent to form a series of oppositely

directed angles, the latter being secured to said top and bottom chord-members respectively and thereby constituting a web-member thereof, the intermediate portion of said web-member rod being of lighter gauge than the end portions thereof.

8. In a truss-like structural unit, the combination of two parallel rods forming a top chord-member, two other rods spaced from but lying parallel with said first-named rods, said last-named rods forming a bottom chord-member, and still another rod bent to form a series of oppositely directed angles, the latter being secured to said top and bottom chord-members, respectively, and thereby constituting a web-member thereof, the intermediate portion of said web-member rod being of lighter gauge than the end portions thereof.

9. In a truss-like structural unit, the combination of two parallel rods forming a top chord-member, two other rods spaced from but lying parallel with said first-named rods, said last-named rods forming a bottom chord-member, and still another rod bent to form a series of oppositely directed angles, the latter being secured to said top and bottom chord-members, respectively, and thereby constituting a web-member thereof, the intermediate portion of said web-member rod being of lighter gauge than the end portions thereof, and said bottom chord-member being provided at each end with an extension angularly adjustable with respect thereto, whereby the free end of such extension may be shifted with respect to said top chord-member.

10. In a truss-like structural unit, the combination of two parallel rods forming a top chord-member, two other rods spaced from but lying parallel with said first-named rods, said last-named rods forming a bottom chord-member, and still another rod bent to form a series of oppositely directed angles, the latter being secured to said top and bottom chord-members, respectively, and thereby constituting a web-member thereof, the intermediate portion of said web-member rod being of lighter gauge than the end portions thereof, and the rod composing said web-member being prolonged at both ends to provide angularly adjustable extensions, substantially as and for the purpose described.

11. In a truss-like structural unit, the combination of top and bottom chord-members, a suitable web-member, members secured at one end adjacent the respective ends of said bottom chord-member and secured at their other ends to said top chord-member, and members tied respectively at one end to said bottom chord member and angularly adjustable with respect thereto, whereby the other ends of said members may be shifted with respect to said top chord-member.

12. In a truss-like structural unit, the combination of top and bottom chord-members, the ends of the latter of which are extended upwardly and secured to the top chord-member, a suitable web-member, the ends of the latter being prolonged upwardly from the bottom chord-member, and angularly adjustable with respect thereto, whereby the extreme ends may be shifted with respect to the top chord-member.

Signed by me, this 10th day of April, 1925.

STANLEY MACOMBER.