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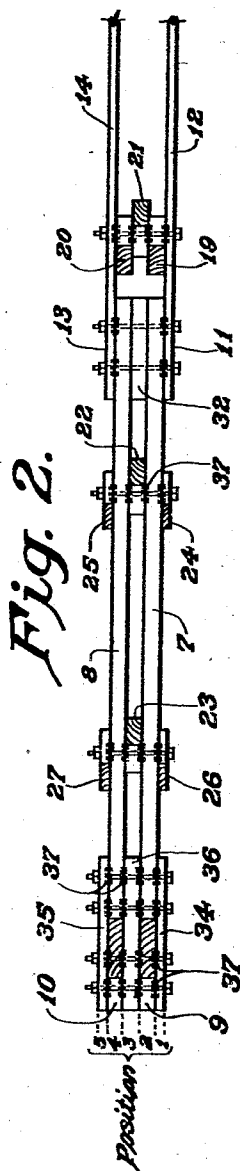
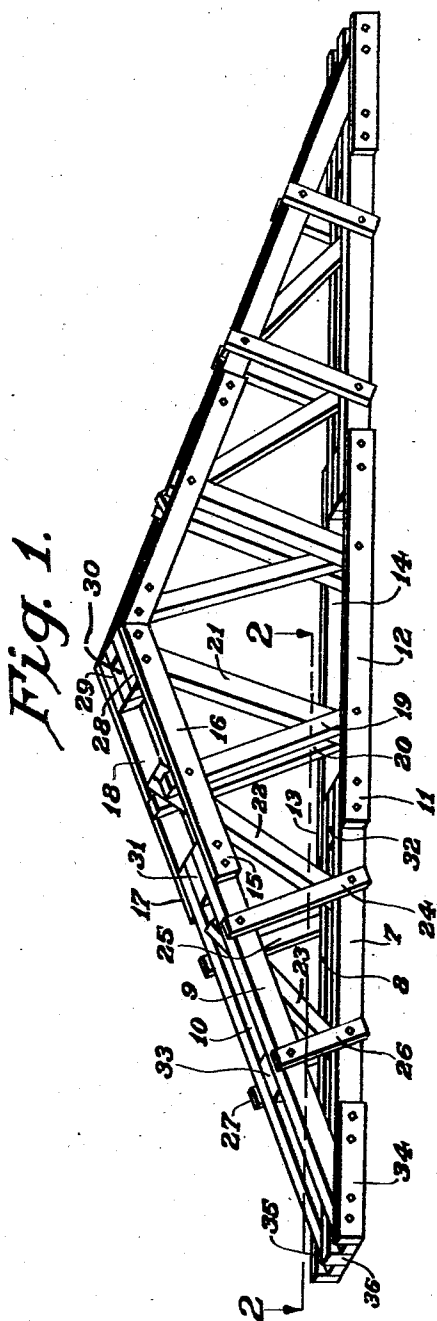
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2,385,142

TIMBER TRUSS AND THE LIKE

Filed Dec. 14, 1943

3 Sheets-Sheet 1



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Sept. 18, 1945.

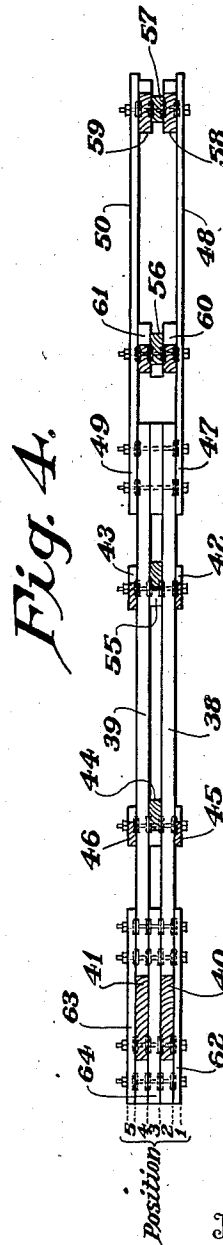
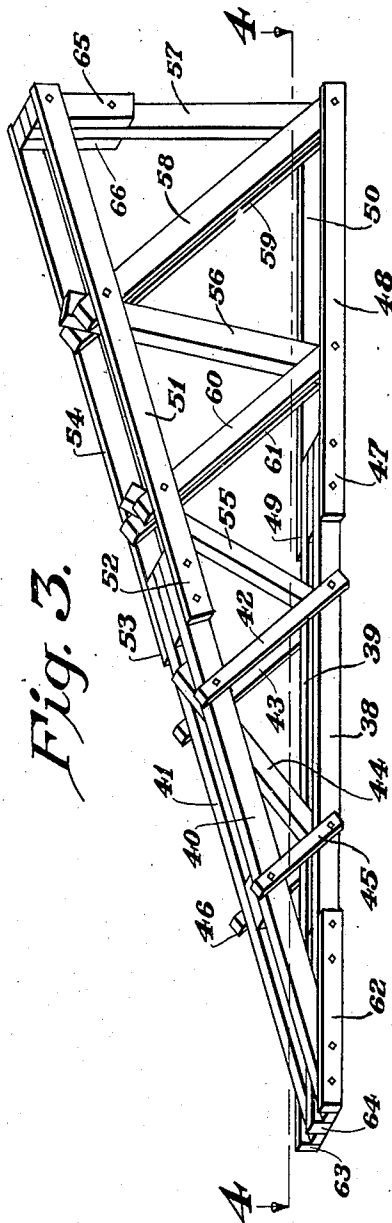
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3 Sheets-Sheet 2



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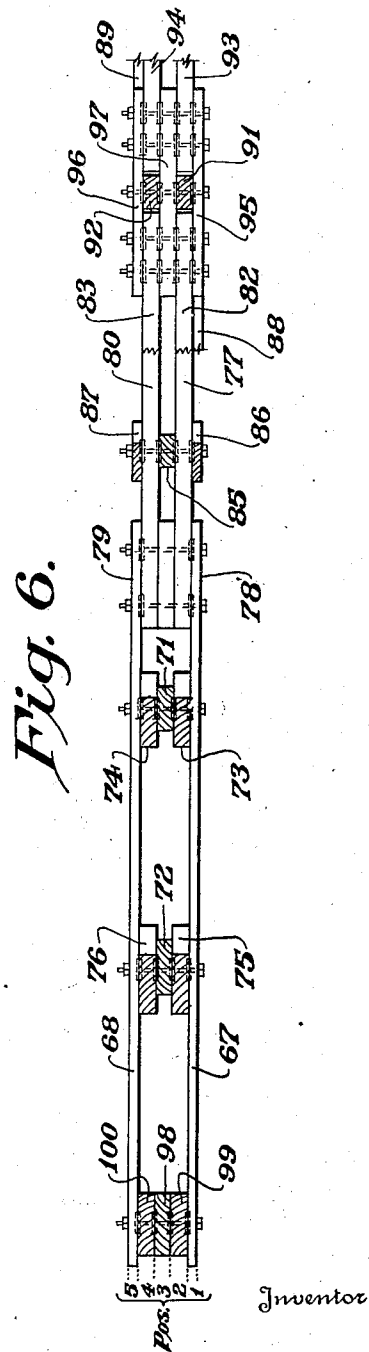
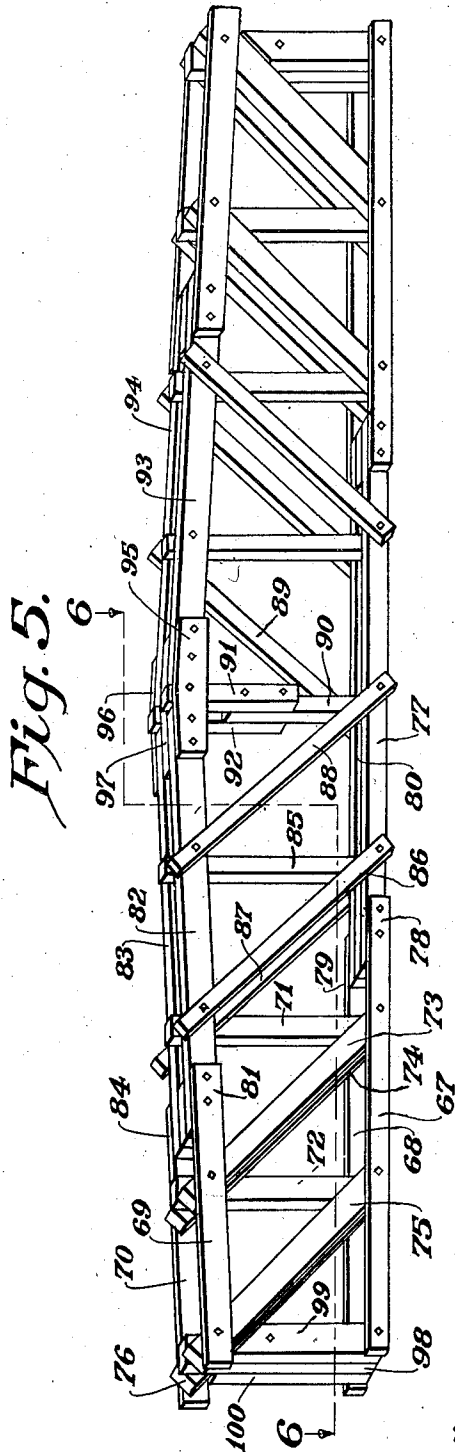
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TIMBER TRUSS AND THE LIKE

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3 Sheets-Sheet 3



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UNITED STATES PATENT OFFICE

2,385,142

TIMBER TRUSS AND THE LIKE

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Application December 14, 1943, Serial No. 514,240

4 Claims. (Cl. 20-0.5)

This invention relates to timber trusses and the like, such as roof trusses, floor trusses, bridge trusses, crane runway supports, conveyor-supporting structure, and similar structures designed to support either live or dead loads. Throughout this specification and in the claims all such structures will, for convenience, be referred to as "trusses," it being understood that the term is intended to be generic to all structures of the general types mentioned above.

With few exceptions, wood trusses are conventionally made as "five member" trusses. A "five member" truss is a truss in which double members are provided for each of the chords, a single member is provided for certain of the web members, and double members are provided to make up the remaining web members. The positions occupied by these five members in the truss are conveniently designated by numbering the positions consecutively across the width of the truss from one side to the other. Since there are five positions, the extreme outside members will occupy the positions designated by the numerals 1 and 5, the central member will occupy the position designated by the numeral 3, and the two members next adjacent the central member on the two sides thereof will occupy the positions designated by the numerals 2 and 4. This convenient scheme of designating the positions of the members is used in this specification and in the claims.

As above indicated, in a five member truss each chord is made up of two chord members. It has long been conventional in the building of wood trusses to provide splices in these chord members. The positions or locations of these splices have been dictated by the lengths of lumber which have been available for use in the structure involved. These splices have conventionally been butt splices, that is adjacent ends of the chord members have been positioned in abutting relationship and splice plates have been placed on one or both sides of the chord members. The chord members and the splice plate or plates have then been bolted or otherwise secured together to form the conventional butt splice. In the past, it has been considered necessary and desirable to maintain the chord members of each chord in the same positions throughout the length of the truss so that the web members could be arranged in a repeating pattern along the length of the truss. This requirement has probably been responsible for the continued use of the conventional butt splice. The conventional butt splice is rather inefficient or undesir-

able because of the stresses which the short splice plates are required to carry, because of the relatively large amount of inelastic slip which such a splice permits and because of the large number of bolts and split ring connectors which are required to make the splice. A further disadvantage of the conventional butt splice is that when the chord members are so spliced the distance between the chord members is constant along the length of the truss and it is, therefore, necessary to use web members of sufficient total thickness to fill the space between the chord members, even though in portions of the truss web members of lesser dimensions would be entirely adequate to carry the stresses involved.

I have found that the above enumerated disadvantages of the use of conventional butt splices in trusses can be eliminated and that several important advantages can be obtained by varying the relative positions of the chord members and the web members in the truss, the positions of these members in any given portion of the length of the truss being governed by the relative distribution of stresses among the chord members and the web members. The positions of the chord members are varied by using lapped splices at the adjoining ends of the wood pieces which make up the chord members. The use of lapped splices eliminates approximately one-half of the inelastic slip per splice which is inherently present in butt splices.

In all conventional trusses there are portions of the length of the truss in which the chords are subjected to relatively high stresses, while the webs along the same portions of the length of the truss are subjected to relatively low stresses. Along other portions of the same truss, the chords are subjected to relatively low stresses, while the webs along these portions are subjected to relatively high stresses. Along those portions of the length of the truss in which the chords are subjected to high stresses, it is advantageous to use chord members of greater thickness than is necessary along those portions of the truss in which the chords are subjected to relatively low stresses. If the chord members which are subjected to relatively high stresses are placed in the 2 and 4 positions, their transverse dimensions may be made large. A single web member may be placed in the 3 position between the chord members and double web members of reduced transverse dimensions may be placed in the 1 and 5 positions, since along this portion of the length of the truss the web members are subjected to relatively low stresses. In other portions of the length of the

truss, the chord members carry relatively low stresses, while the stresses in the web members are relatively high. In this portion of the length of the truss, I have found it highly advantageous to place the single web member in the 3 position and double web members in the 2 and 4 positions. This arrangement permits direct transmission of web stresses from one web member to another, without those stresses being transmitted through the chord members. In this portion of the length of the truss, the stresses in the chord members are relatively light, and since those chord members are located in the 1 and 5 positions, their transverse dimensions may be reduced to effect savings in lumber and in the weight of the truss.

Among the objects of the invention are: to provide a truss in which the web members in the portions of the length of the truss in which the web members are subjected to high stresses are so arranged that stresses may be transmitted directly from web member to web member without transmission through the chord members; to provide a truss in which the chord members are placed outside all the web members in those portions of the length of the truss in which the chords are subjected to low stresses so that the cross-sectional dimensions of the chord members in such portion of the truss may be reduced; to provide a truss in which the double web members are positioned outside the chord members in the regions of low web stresses so that the cross-sectional dimensions of the double web members in such regions may be reduced; to provide a truss in which the chord members are constructed of wooden pieces joined together by lapped splices whereby there is a reduction in the inelastic slip at each splice over that which is inherently present in conventional butt splices; to provide trusses having load-carrying characteristics which compare favorably with prior art trusses requiring substantially greater amounts of lumber in their construction; to greatly reduce the number of bolts and ring connectors which are required to assemble the truss and to give it the desired load-bearing characteristics; and to eliminate the use of splice plates carrying high chord stresses.

Other objects and advantages of my invention will be made apparent from the following detailed description, taken in connection with the accompanying drawings, in which:

Figure 1 is a perspective view of a triangular truss embodying my invention;

Figure 2 is a slightly enlarged fragmentary sectional view, looking in the direction of the arrows along the line 2—2 of Figure 1, and illustrating, at the left end thereof, the order of numbering the positions in the width of the truss;

Figure 3 is a perspective view of a saw-tooth truss embodying my invention;

Figure 4 is a sectional view taken in the direction of the arrows along the line 4—4 of Figure 3;

Figure 5 is a perspective view of a flat truss embodying my invention; and

Figure 6 is a slightly enlarged fragmentary sectional view taken along the line 6—6 of Figure 5, and looking in the direction of the arrows.

In all of the illustrated forms of the invention the chord members contain lapped splices, the chord members being placed in the 1 and 5 positions in the regions of low chord stresses and high web stresses, and the chord members being placed in the 2 and 4 positions in the regions of high chord stresses and low web stresses.

Referring first to the triangular truss shown in Figures 1 and 2, it will be noted that the lower

chord members 7 and 8, at one end of the truss, are positioned in the 2 and 4 positions, and that the upper chord members, 9 and 10, at the same end of the truss, are likewise positioned in the 2 and 4 positions. The lower chord member 7 is connected by a lapped splice 11 to a lower chord member 12, which is placed in the 1 position. The lower chord member 8 is similarly connected by a lapped splice 13 to a lower chord member 14, which occupies the 5 position. The upper chord member 9 is connected by a lapped splice 15 to a chord member 16, in the 1 position, and the upper chord member 10 is connected by a lapped splice 17 to a chord member 18 in the 5 position.

In all triangular or pitched trusses, the web members in the central region of the length of the truss are subjected to relatively high stresses, while the chord members are relatively lightly stressed. However, near the end portion of the truss, this situation is reversed, and the chord members are subjected to high stresses, while the web members are relatively lightly stressed. The web members 19 and 20 are placed respectively in the 2 and 4 positions inside the upper and lower chord members 12, 14, 16 and 18, all of which are in either the 1 or 5 positions. The web member 21 occupies the 3 position, and it will be evident that stresses are transmitted directly from the web member 21 to the web members 19 and 20 without transmission of those stresses through the chord members 12 and 14. The web member 22 is also in the 3 position, this web member being connected at its upper end directly to the web members 19 and 20, and being connected at its lower end directly to the chord members 7 and 8, which, it will be recalled, occupy the 2 and 4 positions respectively. The web members 19, 20, 21 and 22 are in the region of the truss in which the web members are subjected to relatively high stresses, and it is, therefore, highly advantageous to have these members in the 2, 3 and 4 positions, so that the high stresses may be transmitted directly from web member to web member without the necessity of transmission through the chord members.

At the end portion of the truss, the chord members 7, 8, 9 and 10 are subjected to relatively high stresses, while the stresses in the web members are relatively low. The web member 23 occupies the 3 position and its lateral dimension is such that it serves to properly space the chord members 7 and 8 and 9 and 10. The web members 24 and 25 are respectively in the 1 and 5 positions, and since these web members are subjected to relatively light stresses, their transverse dimensions may be substantially reduced without adversely affecting their ability to withstand the stresses to which they are subjected. The reduction in the transverse dimensions of the web members 24 and 25 is possible because of their positions in the 1 and 5 positions of the truss. In the conventional truss in which the chord members are continued throughout the length of the truss in the same relative position, it is not possible to reduce the transverse dimensions of web members in regions of low web stress, without resort to the use of filler blocks or similar arrangements. The web members 26 and 27 are also in the 1 and 5 positions respectively, and their transverse dimensions may likewise be reduced as discussed above in connection with the web members 24 and 25.

At the apex of the triangular truss, the chord members 16 and 18 are spliced to their complementary chord members on the other half of the

truss by means of splice plates or blocks 28 and 29, and a filler block 30 is provided on each side of the apex to enable the members to be securely bolted together. A filler block 31 lies between the ends of the chord members 9 and 10 by which they are lap spliced to the chord members 16 and 18. A similar filler block 32 is positioned between the chord members 7 and 8 at the ends by which they are lap spliced to the chord members 12 and 14. The numeral 33 designates a filler block positioned between the chord members 9 and 10 adjacent the upper ends of the web members 26 and 27.

At the heel joint of the truss, splice plates 34 and 35 are placed in the 1 and 5 positions respectively and a splice plate 36 is placed in the 3 position between the chord members 7 and 8 and the chord members 9 and 10. All joints are preferably bolted and provided with split ring timber connectors of the type well known in the art. Such split ring connectors are diagrammatically illustrated in Figure 2 of the drawings and are designated by the reference numeral 37. Attention is called to the fact that only one-half as many bolts and split ring connectors are required to make the lapped joints as are required to make conventional butt splices. It is also important to note that the lapped splice avoids one-half of the inelastic slip which is inherently present in the conventional butt splice.

In the truss shown in Figures 1 and 2, it will be recalled that the region of highest chord stress is at the end of the truss. It is necessary to use the splice plates 34, 35 and 36 in this region, but it will be noted that in joining the chord members 7 and 9 the splice plates 34 and 36 are both effective, and thus there are provided four contacting faces for the placement of split ring connectors. Similarly, in connecting the chord member 8 with the chord member 10, the splice plates 35 and 36 are both effective and here, also, there are provided four contacting faces between the splice plates and the chord members for the placement of split ring connectors. An important advantage of the present invention is that these several contacting faces with the provision of facilities for the use of a large number of split ring connectors in the regions of high chord stresses are obtained with a total truss thickness of only five members.

I have not specifically described the right half of the truss shown in Figure 1, but since it is similar to the portion already described, no useful purpose could be served by a repetition of the previous description.

The same general principles have been followed in the saw-tooth truss shown in Figures 3 and 4. The lower chord members 38 and 39 and the upper chord members 40 and 41 are subjected to relatively high stresses in this truss, while the web members 42, 43, 44, 45 and 46 are subjected to relatively low stresses. The chord members 38 and 40 are, therefore, placed in the 2 position and the chord members 39 and 41 are placed in the 4 position. The web member 44 occupies the 3 position and its thickness is such that it properly spaces the chord members 38 and 39 and the chord members 40 and 41. The web members 42 and 45 are in the 1 position, while the web members 43 and 46 are placed in the 5 position. Since these four web members are on the outside of the truss and carry relatively low stresses, their cross-sectional dimensions may be substantially reduced.

The chord member 38 is connected by a lapped

splice 47 to a chord member 48, while the chord member 39 is connected by a lapped splice 49 to the chord member 50. Similarly, the chord member 40 is secured to the chord member 51 by a lapped splice 52, and the chord member 41 is lap spliced at 53 to the chord member 54. The chord members 48, 50, 51 and 54 are subjected to relatively low stresses in this type of truss and, for that reason, it is advantageous to place these members in the 1 and 5 positions. Single web members 55, 56 and 57 are located in the 3 position. Web members 58 and 59 are placed in the 2 and 4 positions respectively, these two members together forming a double web member. Web members 60 and 61 are also placed in the 2 and 4 positions respectively, and serve to make up a double web member.

The web members designated by the reference numerals 55 to 61, inclusive, are subjected to high stresses in a truss of this type and by arranging these members in the 2, 3 and 4 positions, it will be noted that the stresses are transmitted directly from web member to web member, without transmission through the chord members.

At the heel joint of the truss, splice plates 62, 63 and 64 are provided. Here again splice plates are used in a region of high chord stresses, but it will be noted that the splice plates 62 and 64 are both effective in splicing the chord member 38 to the chord member 40. It will also be noted that splice plates 63 and 64 are both effective in splicing the chord member 39 to the chord member 41. As is the case in the truss shown in Figures 1 and 2, there are thus provided four contacting faces for the placement of split ring connectors in the splice between each pair of upper and lower chord members, and this advantage is secured with a total truss thickness of only five members.

The upper end of the single web member 57 is provided with filler blocks 65 and 66 in the 2 and 4 positions, respectively. These blocks afford a convenient means of joining the web member 57 in the 3 position to the chord members 51 and 54 in the 1 and 5 position.

In a flat truss of the type shown in Figure 5, the chords in the central portion of the truss are highly stressed while the web members in the central portion are subjected to relatively low stresses. However, at each end portion of the truss, the chord members are subjected to relatively low stresses, while the web members are highly stressed. It will be recognized that this situation is the reverse of that which exists in the trusses shown in Figures 1 and 3, but my invention is equally adaptable to trusses of the flat type. Lower chord members 67 and 68 are placed in the 1 and 5 positions respectively, while upper chord members 69 and 70 are similarly positioned respectively in the 1 and 5 positions. The chord members 67 to 70, inclusive, are subjected to relatively low stresses and since they occupy the outside positions in the truss, their cross sectional dimensions may be small. Single web members 71 and 72 are provided in the 3 position. Web members 73 and 74 occupy the 2 and 4 positions, respectively, and double web members 75 and 76 are likewise placed respectively in the 2 and 4 positions. The web members 71 to 76 are subjected to relatively high stresses, and it will be noted that these stresses are transmitted directly from web member to web member without transmission through the chord members.

Chord member 67 is spliced to chord member 77 by a lapped splice 78 and chord member 68 is lap

spliced at 79 to chord member 80. Similarly, chord member 69 is lap spliced at 81 to chord member 82, and chord member 70 is connected to chord member 83 by a lapped splice 84. By means of these lap splices, the chord members 77 and 82 are placed in the 2 position, and the chord members 80 and 83 are placed in the 4 position. A single web member 85 occupies the 3 position and web members 86 and 87 are placed in the 1 and 5 positions respectively. As shown, a single web member 88 is placed in the 1 position, the corresponding web member in the 5 position, designated by the reference numeral 89, leading to that portion of the truss to the right of its midpoint. A single web member 90 occupies the 3 position and is provided at its upper end with blocks 91 and 92 in the 2 and 4 positions respectively. These blocks 91 and 92 extend respectively between the inner ends of the chord member 82 and 93 and the chord members 93 and 94.

Splice plates 95, 96 and 97 are provided for connecting the chord members 82, 93, 83 and 94, and the blocks 91 and 92. In splicing the chord member 82 to the chord member 93, it will be noted that the splice plates 95 and 97 are both effective and that four contacting faces are provided for the placement of split ring connectors. Also, in splicing the chord member 83 to the chord member 94, the splice plates 96 and 97 are both effective and four contacting faces are provided for split ring connectors. It will be noted that this advantageous splicing arrangement is obtained without increasing the width of the truss to greater than five members.

At the end of the truss, a single web member 98 occupies the 3 position, and blocks 99 and 100 are placed on either side of the web member 98 in the 2 and 4 positions respectively.

I have specifically described only so much of the truss shown in Figure 5 as is necessary to an understanding of the invention. It will be obvious from an inspection of Figure 5 that the right half of the truss is similar to the portion which I have described.

It will be noted that in all forms of the invention the lapped splices in the upper chords are positioned across a single web member from the lapped splices in the lower chords. Such an arrangement is advantageous in that it enables the web members to act as spacing members for the chord members, in spite of the alteration in the relative positions of the chord members.

The foregoing detailed description of several forms of the invention will enable those skilled in the art to understand the principles involved in securing the advantages of my invention. It will be obvious that various modifications may be resorted to without departing from the scope of my invention as defined by the following claims.

Having thus described my invention, I claim:

1. A truss comprising longitudinally extending pairs of members forming chords, transversely extending pairs of members forming double webs

and single transversely extending members forming single webs, said single webs lying in the central longitudinal plane of the truss and the positions of said chords and double webs alternating with the double webs intermediate the chords in those portions of the length of the truss in which web stresses predominate over chord stresses and with the chords intermediate the double webs in those portions of the length of the truss in which chord stresses predominate over web stresses, the changes of positions of said chords being effected through lapped splice joints in said chords.

2. A triangular truss comprising longitudinally extending pairs of members forming chords, transversely extending pairs of members forming double webs and single transversely extending members forming single webs, said single webs lying in the central longitudinal plane of the truss and the positions of said chords and double webs alternating with the double webs intermediate the chords in the mid-portion of the length of the truss in which web stresses predominate over chord stresses and with the chords intermediate the double webs at each end portion of the length of the truss in which chord stresses predominate over web stresses, the changes of positions of said chords being effected through lapped splice joints in said chords.

3. A saw-tooth truss comprising longitudinally extending pairs of members forming chords, transversely extending pairs of members forming double webs and single transversely extending members forming single webs, said single webs lying in the central longitudinal plane of the truss and the positions of said chords and double webs alternating with the chords intermediate the double webs along that portion of the length of the truss from its heel toward its apex in which chord stresses predominate over web stresses and with the double webs intermediate the chords along the remaining portion of the length of the truss in which web stresses predominate over chord stresses, the changes of positions of said chords being effected through lapped splice joints in the chords.

4. A flat truss comprising longitudinally extending pairs of members forming chords, transversely extending pairs of members forming double webs and single transversely extending members forming single webs, said single webs lying in the central longitudinal plane of the truss and the positions of said chords and double webs alternating with the chords intermediate the double webs in the mid-portion of the length of the truss in which chord stresses predominate over web stresses and with the double webs intermediate the chords at each end portion of the truss in which web stresses predominate over chord stresses, the changes of positions of said chords being effected through lapped splice joints in said chords.

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