

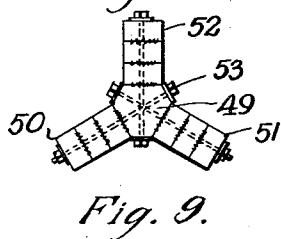
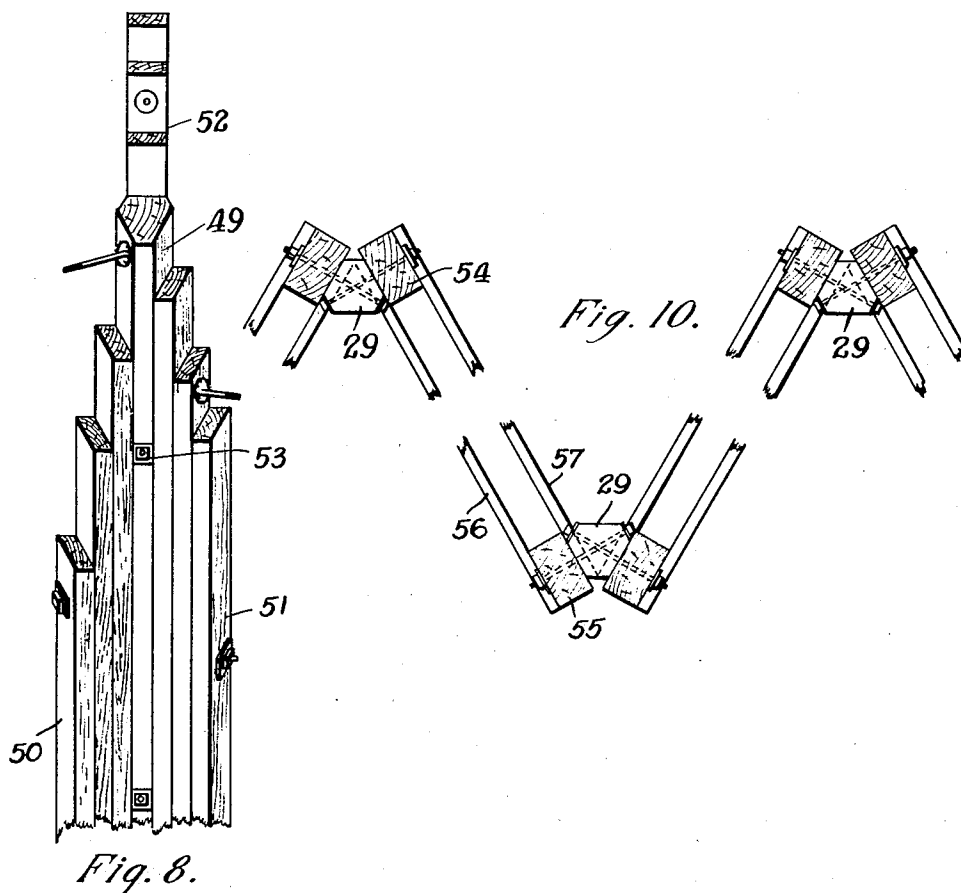
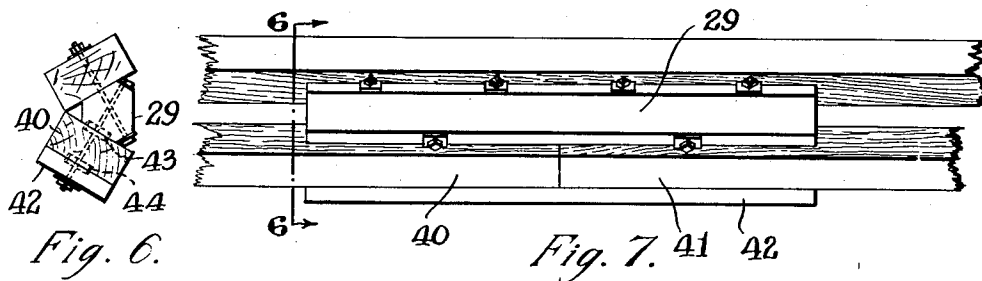
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FABRICATED STRUCTURE AND ELEMENTS THEREOF

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FABRICATED STRUCTURE AND ELEMENTS
THEREOF

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17 Claims. (Cl. 20—99)

The present invention relates to fabricated structures and to elongated structural elements or formations embodied in such structures, the principal object of the invention being to provide
5 structures and elements thereof of maximum strength with a minimum of material. While the invention has a wide range of application, I have shown it in the accompanying drawings as embodied in tower, mast and truss construction
10 and shall particularly describe it with reference to these typical examples.

In the drawings,

Figure 1 shows an elevation of a spacer piece involved in the new construction;

15 Figure 1a is a plan view of the spacer piece of Figure 1;

Figure 2 is an elevation of a spacer piece similar to that of Figure 1 but formed of different material;

20 Figure 2a is a section substantially on line 2a—2a of Figure 2;

Figure 3 is a partial horizontal sectional view of a tower or the like embodying the present invention;

25 Figure 4 is a partial elevation of the tower of Figure 3;

Figure 4a is a horizontal sectional view of a structural element involving the spacer block of Figure 1;

30 Figure 5 is an elevation of a portion of a structural element of the nature of that of Figure 4a but involving a spacer piece of different form;

Figure 5a is a section substantially on line 5a—5a of Figure 5;

35 Figure 6 is a section substantially on line 6—6 of Figure 7;

Figure 7 is an elevation of a structural element such as that of Figure 4a but involving a spliced joint;

40 Figure 8 is a partial elevation of a structural element or unit in the form of a mast involving a spacer piece of similar section to that of Figure 1;

Figure 9 is a plan view of the mast of Figure 8; and

45 Figure 10 is a vertical section of a truss arrangement embodying the present invention.

To refer to the drawings and first to Figures 1, 3, 4 and 4a, reference numerals 15 and 16 designate spars here shown as constituting the legs of a tower face portion, the face portion also including the diagonal web pieces 17 and 18 and the horizontal web pieces 19 and 20. The web pieces 17 and 18 are parallel to each other and are bolted respectively to the parallel outer and
55 inner faces of the legs 15 and 16 by means of

bolts 21 and 22. The horizontal web pieces 19 and 20 are similarly respectively bolted to the outer and inner parallel faces of the legs. Below the horizontal web pieces, other diagonals 23 and 24 connect the legs in truss formation and the web pieces are repeated at suitable intervals throughout the length of the associated legs.

As here shown, the tower is of equilateral triangular plan or cross section and hence comprises three face portions of the construction just described, the legs of the other face portions being shown at 25, 26, 27 and 28, respectively, the web pieces connecting the face members 27 and 28 being omitted in order not to confuse the showing.

Reference numeral 29 designates a wooden spacer piece of hexagonal section and having the relatively broad alternate faces 30, 31 and 32 and the intervening relatively narrow faces or flattened portions 33, 34 and 35, each of the latter being substantially parallel to the opposite face 30, 31 or 32 and the latter faces being at sixty degrees angles to each other.

With the tower faces brought into proper relation to each other, the adjacent legs of each pair of adjacent faces have their adjacent faces brought into contact with adjacent broad or alternate faces such as 30 and 31 of a spacer piece or pieces. Each spacer piece is provided with through holes as at 36 and 37, Figure 1, these holes being perpendicular to those faces which are in contact with the faces of the associated legs and the latter being provided with aligned holes. Bolts 38 and 39 are passed through the aligned holes of the associated legs and spacer piece to unite the three into a structural element wherein the associated spars or legs act in unison as a column. The bolts 38 and 39 have abutment means engaging the flattened portions, as 33, 34 or 35 of the spacer piece.

The adjacent legs of all the faces are united through spacer pieces in the manner just described so that an extremely rigid structure is provided.

The spacer pieces are preferably so disposed relative to the associated legs as to hold the latter a distance apart. It is a feature of the invention that the tower faces may have identical web arrangement. Thus, it will be noted from Figure 4 that the web pieces of the adjacent faces converge in the same horizontal zone and that clearance for the extremities of the inner web pieces of the two faces is provided by means of the spacing between legs 16
55

and 25 which is afforded by the associated spacer pieces.

In tower construction, the faces may be initially constructed of identical pattern and assembled together either in horizontal or vertical position. A spacer piece is preferably located at the joint between two spar sections as particularly shown in Figure 7, the spar sections being designated as 40 and 41, the spacer piece functioning also as a splice member. Additionally, a splice plate 42 may be secured against the outer faces of the sections 40 and 41 over the adjacent section ends and secured thereto by the same bolts which connect the section ends and the spacer piece. For the resistance of shear effects, dowels or the like may desirably be positioned between the contacting faces of the spacer pieces and legs. For example, bores 36 may be provided with the outer enlargements 36' and the contacting faces of the legs may be provided with complementary enlargements to receive dowels as at 43, Figure 6. Dowels as at 44 may also be provided between the spars and the splicer plate as also indicated in Figure 6.

The tower or similar framework structure shown in Figures 3 and 4 thus comprises a suitable number of face portions, the adjacent legs of which are connected by spacer pieces of shorter length than the spars, these pieces being preferably of restricted length as shown and spaced longitudinally of the associated legs so as not to interfere with the web members, the inner web members of adjacent face portions being in turn maintained out of interference with each other by means of spacer pieces. Again, each corner of the tower is constituted by a columnar structural element comprising the adjacent legs as 16 and 25 and the associated interconnected spacer pieces.

The angularly related faces such as 31 and 32 of the spacer piece may be considered as determining the angular relation of the associated face portions. Since, in the embodiment just described, the faces 31 and 32 are at sixty degree angles to each other, it follows that the tower must be of equilateral triangular arrangement. In Figures 5 and 5a, I have shown a spacer piece 46, still of convex polygonal cross section, but here rectangular instead of hexagonal. Reference numerals 47 and 48 designate spars or legs bolted against angularly related faces of the spacer piece 46, it following that the face portions of which legs 47 and 48 are parts are at right angles to each other. The spacer pieces 46 are preferably disposed inwardly of the final structure in the same manner as the spacer pieces 29.

It will be evident that in the construction of a tower of any given polygonal cross section it is only necessary that the faces of the spacer pieces be correspondingly angularly related to each other, the adjacent faces of the tower immediately taking their proper angular relation upon being secured against the faces of the spacer pieces.

The various pieces described have been shown as being of wood but they may, of course, be of metal. In Figures 2 and 2a, I have shown a spacer piece 45 identical in external form to the spacer piece 29, but here in the form of a hollow metal body.

In Figures 8 and 9, I have shown a mast or pillar construction or the like embodying a spacer piece or core 49 of the same cross section as the

spacer piece 29, Figure 1. The spars 50, 51 and 52 are here shown as being of laminated construction but may also be solid sections, and are secured against the three main faces of the spacer piece, the abutment means on the bolts being adapted to lie against the alternate flattened portions of the spacer pieces without interfering with the spars, this being shown, for example, at 53, Figures 8 and 9. Thus, while the structural element described with reference to Figures 3, 4 and 4a includes spars secured against two faces of the spacer pieces, the construction shown in Figures 8 and 9 shows spars secured in symmetrical relation against all three main faces of the spacer piece. Desirably, dowels are provided not only between the spars and spacer piece, but also between the laminations of each spar.

Figure 10 shows an arrangement comprising a number of trusses disposed horizontally to form a roof frame or the like, the arrangement being particularly desirable where a considerable span must be bridged as in hangars, factories, or the like. Each truss comprises parallel spars 54 and 55 connected together by web pieces 56 and 57 whose arrangement may be exactly the same as that described with reference to Figure 4. In fact, the truss of Figure 10 may be identical with the face portions, Figure 4, with the exception that in the arrangement shown in Figure 10 the spars are preferably always parallel, whereas in the tower or like construction, the spars may be somewhat converged, in case of a tall structure, so as to provide an upward taper.

In the arrangement according to Figure 10, each truss is laterally inclined to bring its lower spar adjacent to the lower spar of the truss on one side and its upper spar adjacent the upper spar of the truss on the other side, the adjacent spars of adjacent trusses being secured together through spacers 29 in exactly the same manner as described with reference to Figures 3 and 4.

While I have shown specific embodiments of the invention, it will be understood that the disclosure herein is merely illustrative, since various changes in details, arrangement, and material may be resorted to without departure from the scope of the invention as defined in the following claims.

I claim:

1. A tower of polygonal cross-section having face sections each comprising a pair of legs joined by web pieces, and spacer pieces between the adjacent legs of adjacent face portions to which said adjacent legs are secured.

2. A tower of polygonal cross-section having face portions each comprising a pair of legs joined by web pieces, the legs of each face portion having surfaces in substantially the same plane, and spacer pieces between the adjacent legs of adjacent face portions having angularly related faces against which said leg surfaces are secured.

3. A tower of polygonal cross-section having face portions each comprising a pair of legs joined by web pieces, the legs of each face portion having surfaces in substantially the same plane, spacer pieces between the adjacent legs of adjacent face portions having angularly related faces against which said leg surfaces lie and flattened portions substantially parallel to said angularly related faces respectively, and bolts passed through said adjacent legs and the associated spacer piece in perpendicular relation to said angularly related faces respectively and

having abutment means engaging the latter.

4. A tower of polygonal cross-section having face portions each comprising a pair of legs joined by web pieces, and spacer pieces in vertically spaced relation between each pair of adjacent legs of adjacent face portions to which said adjacent legs are secured.

5. A tower of polygonal cross-section having face portions each comprising a pair of legs joined by web pieces, the legs of each face portion having surfaces in substantially the same plane, and spacer pieces in vertically spaced relation between each pair of adjacent legs of adjacent face portions having angularly related faces against which said leg surfaces are secured.

6. A tower of polygonal cross-section having face portions each comprising a pair of legs joined by web pieces, the legs of each face portion having surfaces in substantially the same plane, spacer pieces in vertically spaced relation between each pair of adjacent legs of adjacent face portions, said spacer pieces having angularly related faces against which said leg surfaces lie and flattened portions substantially parallel to said angularly related faces respectively, and bolts passed through said adjacent legs and the associated spacer piece in perpendicular relation to said angularly related faces respectively and having abutment means engaging said flattened portions.

7. A tower of polygonal cross-section having substantially identical face portions each comprising a pair of legs joined by web pieces on their inner sides, and spacer pieces in vertically spaced relation between each pair of adjacent legs of adjacent face portions to which said adjacent legs are secured, the web members of adjacent face portions having their ends disposed in substantially the same horizontal planes and between the spacer pieces and the latter spacing the legs associated therewith so as to prevent interference of adjacent ends of said web members.

8. A tower of polygonal cross-section having substantially identical face portions each comprising a pair of legs joined by web pieces on their inner sides, and spacer pieces in vertically spaced relation between each pair of adjacent legs of adjacent face portions to which said adjacent legs are secured, the web members of adjacent face portions having their ends disposed in substantially the same horizontal planes and between the spacer pieces and the latter spacing the legs associated therewith so as to prevent interference of adjacent ends of said web members, said spacer members having angularly related faces determining the angle between adjacent face portions.

9. A tower of triangular cross-section having face portions each comprising a pair of legs joined by web pieces, and spacer pieces between the adjacent legs of adjacent face portions, said spacer pieces being hexagonal in cross-section and having alternate surfaces at an angle to each other against which the associated legs lie to determine the angle between the faces, the spacer pieces having other surfaces substantially parallel to said alternate surfaces, and bolts securing said legs to said spacer pieces and extending through the latter in perpendicular relation to said alternate surfaces, said bolts having abutment means thereon engaging said other surfaces.

10. A tower of triangular cross-section having substantially identical face portions each comprising a pair of legs joined by web pieces on

their inner sides, and spacer pieces in vertically spaced relation between each pair of adjacent legs of adjacent face portions, said spacer pieces being hexagonal in cross-section and having alternate surfaces at an angle to each other against which the associated legs lie to determine the angle between the faces, the spacer pieces having other surfaces substantially parallel to said alternate surfaces, and bolts securing said legs to said spacer pieces and extending through the latter in perpendicular relation to said alternate surfaces, said bolts having abutment means thereon engaging said other surfaces, the web members of adjacent face portions having their ends disposed in substantially the same horizontal plane and between the spacer pieces and the latter spacing the legs associated therewith so as to prevent interference of adjacent ends of said web members.

11. In combination, a pair of trusses each comprising a pair of substantially parallel chord members joined by web members, and a plurality of spacer pieces having angularly related surfaces against which a chord member of each truss is respectively secured whereby the trusses are held in an angular relation determined by the angular relation of said surfaces, said web members being on the adjacent sides of said trusses and those of each truss having their inner ends opposite each other, said spacer pieces being spaced longitudinally of the trusses to avoid said inner ends and spacing said trusses so as to prevent interference of said inner ends.

12. A structural element comprising a spacer piece of hexagonal cross-section and having alternate surfaces at a sixty degree angle to each other and other surfaces substantially parallel to said alternate surfaces respectively, spars extending side by side and lying against at least two of said alternate surfaces respectively in substantially non-obstructing relation to said other surfaces, and bolts passed through said spars respectively and said spacer piece in perpendicular relation to said alternate surfaces respectively and having abutment means engaging said other surfaces which are opposite said alternate surfaces.

13. A mast comprising a spacer piece of symmetrical hexagonal cross-section, spars secured to alternate ones of the surfaces of said spacer piece in longitudinally extending relation thereto, and bolts passed through said spacer pieces and spars respectively and having abutment means thereon engaging the spacer piece surfaces which are between said alternating surfaces.

14. A mast comprising a spacer piece of symmetrical hexagonal cross-section, spars secured to alternate ones of the surfaces of said spacer piece in longitudinally extending relation thereto, and bolts passed through said spacer pieces and spars respectively and having abutment means thereon engaging the spacer piece surfaces which are between said alternating surfaces, said alternating surfaces being of substantially greater width than the surfaces therebetween.

15. A structural element comprising a spacer piece of hexagonal cross-section and having alternate surfaces at a sixty degree angle to each other and other surfaces substantially parallel to said alternate surfaces respectively, spars lying against at least two of said alternate surfaces respectively in substantially non-obstructing relation to said other surfaces, and bolts passed through said spars respectively and said spacer

piece in perpendicular relation to said alternate surfaces respectively and having abutment means engaging said other surfaces which are opposite said alternate surfaces, at least one of said legs comprising pieces spliced by one of said spacer pieces, and a splice member cooperating with said one of said spacer pieces to connect such leg pieces and securable against any aligned adjacent faces of such leg pieces other than the ones engaged by the spacer piece without interference with the adjacent leg.

16. A structural element comprising a spacer piece of hexagonal cross-section and having alternate surfaces at a sixty degree angle to each other and other surfaces substantially parallel to said alternate surfaces respectively, spars lying against at least two of said alternate surfaces respectively in substantially non-obstructing relation to said other surfaces, bolts passed through said spars respectively and said spacer piece in perpendicular relation to said alternate surfaces respectively and having abutment means engaging said other surfaces which are opposite said

alternate surfaces, at least one of said spars comprising a pair of sections in end to end relation and one of said spacer pieces functioning as splicer means therefor, and interlocking means between said sections and said one of said spacer pieces whereby the splicing function of the latter is enhanced.

17. A structural element comprising a spacer piece of hexagonal cross-section and having alternate surfaces at a sixty degree angle to each other and other surfaces substantially parallel to said alternate surfaces respectively, spars lying against at least two of said alternate surfaces respectively in substantially non-obstructing relation to said other surfaces, bolts passed through said spars respectively and said spacer piece in perpendicular relation to said alternate surfaces respectively and having abutment means engaging said other surfaces which are opposite said alternate surfaces, and interlocking means between said spars and spacer pieces whereby additional shear resistance is developed.

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