

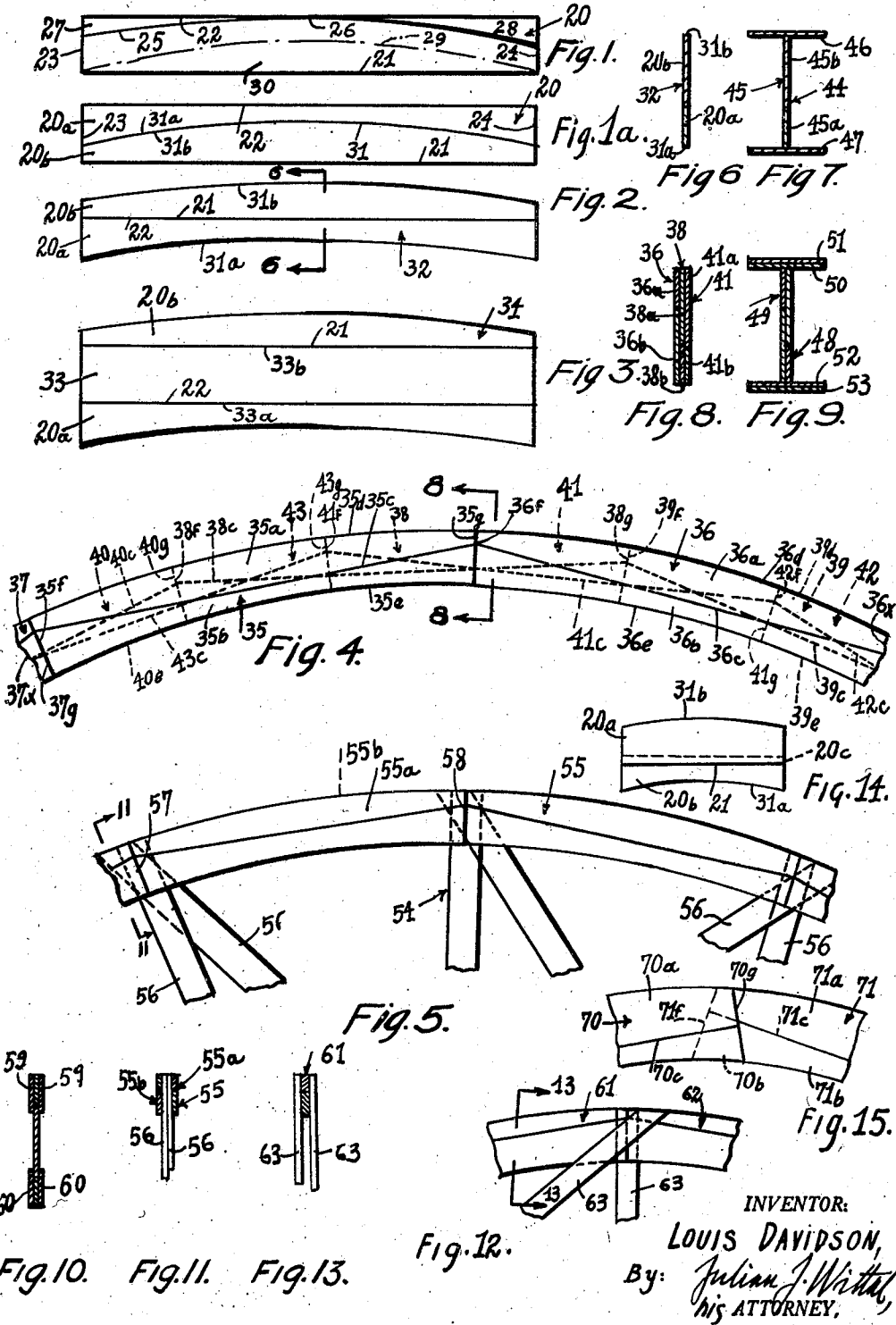
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L. DAVIDSON

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ARCH CONSTRUCTION

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ARCH CONSTRUCTION

Louis Davidson, Hewlett, N. Y.

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This invention relates to arch shaped constructions for the well known usual purpose of being supported with their planes in vertical position and carrying a load, and it particularly relates to such load carrying arches of building construction which are made of plate like elements of wood, metal or other appropriate material.

The main object of my invention is to provide novel methods and means for constructing arch shaped structures, particularly from plates, planks or strips of said materials, efficiently, expeditiously, comparatively inexpensively and without waste of material and labor.

Another object of my invention is to build trussed structures in a simple and reliable manner embodying my novel arches, as a portion thereof.

Still further objects of my invention will be apparent as the specification of the same proceeds, and, among others, I may mention: To provide structures, as characterized hereinbefore, which may use a great variety of materials and a great variety of appropriate securing means in an efficient manner, which will be adapted for simple arch members, and also for building more complicated arch constructions for large spans and stresses and which may be readily adapted and made appropriate for specific cases.

In the drawing, forming a part of this specification and accompanying the same:

Fig. 1 indicates the method now used for making arch shaped load carrying building construction members out of wooden planks, metal plates, and the like, and

Fig. 1a indicates the first step in my novel method;

Fig. 2 shows a plate arch member of the type indicated constructed according to my invention;

Fig. 3 shows a load carrying plate arch construction according to my invention in a case where a stronger structure is required;

Fig. 4 is a front elevational view of a multiple arch construction according to my invention and used for wider spans;

Fig. 5 indicates such a longer span arch built into a trussed structure;

Fig. 6 is a sectional elevational view of the construction of Fig. 2;

Fig. 7 is a similar section but showing added members;

Fig. 8 is a sectional elevational view, the section being taken on the line 8—8 of Fig. 4, and

Fig. 9 indicates a section of a two layer arch

construction built according to my invention and showing added transverse layers at the top and bottom, similarly to Fig. 7, to make my arch of an I beam cross section;

Fig. 10 is a cross sectional view of a modification of the construction shown in Fig. 3;

Fig. 11 is a sectional view, the section being taken on the line 11—11 of Fig. 5;

Fig. 12 is a fragmentary detail showing a modified form on the construction in Fig. 5;

Fig. 13 is a sectional elevational view, the section being taken on the line 13—13 of Fig. 12.

Figs. 14 and 15 show further modifications.

As has been mentioned hereinbefore, Fig. 1 indicates the method now used for forming plate like load carrying building arches from wooden planks, metal plates, and the like. The arch is formed from a rectangular plate like member, generally indicated by the numeral 20, having a lower edge 21 and upper edge 22, and side edges 23 and 24. To form an arch shaped member from the plate or plank 20, the curved cut 25 is made in its upper portion preferably touching the upper edge 22 at the center 26. This cut will remove the two upper side portions 27 and 28 and will make the curved line 25 a new upper edge for the plank 20 making the same of a generally arch shaped member but having the straight lower edge 21. If it is desired to make a true arch shaped member of the plate or plank 20, a similar second curved cut is made through its lower portion, as indicated in an imaginary manner by the dash and dot line 29, which then will be made the lower curved edge or lower cord of the arch member but a large lower portion 30 of the plate or plank 20 will be cut away with an appreciable loss of material and labor.

It will be seen that, aside of the difficult, slow and cumbersome operations, the parts 27 and 28, and in the latter case also the portion 30, will be wasted, and the remaining arch will not be as strong as the original plank.

As indicated in Fig. 1a, I take the same plank or plate 20 and cut a curved section line 31 across its length but spaced apart from both its upper edge 22 and lower edge 21, thereby separating the same into two elongated pieces or sections 20a and 20b, having the curved meeting or common edges 31a and 31b. I now take the upper piece 20a, move it downwardly and place its upper edge 22 to abut the lower edge 21 of the lower piece 20b, as indicated in Fig. 2. The two pieces 20a and 20b now will be secured together along their common edge 21, 22, by any appropriate means, like gluing, welding, soldering, or.

in suitable cases, by bolts, rivets, dowel pins, etc., using, if necessary, accessory structures, devices, and aids, usual in such cases, and well known to those versed in this art (not shown).

In this manner I form an arch member from a plank, plate, or the like, with one easy operation and without any waste. Fig. 2 shows this simple basic structure of my novel arches, generally indicated by the numeral 32, its upper chord being at 31b and lower chord 31a, and it being obvious that in use as a load carrying building element, the arch member is set up edgewise in the way of Fig. 2 with its plane in a vertical position, and it will be supported in such a position.

In Fig. 3 I indicate a form of my arch member adapted for cases where greater strength, and therefore greater depth is desired. In this case, I insert between the upper and lower sections 20a and 20b of an original plank or plate, a plank, plate or strip 33, the upper edge 22 of the section 20a abutting the lower edge 33a of the intermediate piece 33, and being secured thereto by any appropriate means, as has been indicated hereinbefore, and the lower edge 21 of the piece 20b abutting the upper edge 33b of said piece 33 and also being secured thereto.

The resulting plate arch of Fig. 3, generally indicated by the numeral 34, is composed of the three pieces 20a, 20b and 33, and has a much greater depth than the simple plate arch 32 formed of the original pieces 20a and 20b. This depth obviously depends on the width of the intermediate member 33, and it also is obvious that two or more such intermediate members may be used, each edgewise abutting the one below it, to build up any necessary width or depth in my arch member.

It is to be understood that my arches, in most cases, and particularly where greater spans and greater strength are involved and such built up members are desired, will be used as parts of combinations, as will be explained presently, or as parts of trusses, and they so will receive the necessary transverse or sideways reinforcements, or such reinforcements may be added to my members by any of the methods usual and well known in such cases.

In Fig. 4 I show an arch structure built up of a plurality of my basic individual arch members for a large span.

The building simply is executed in such a manner that the adjacent end edges of each two members will be made to follow the radials of the arch curve to be built, at the point in question, and they will be placed to abut and will be secured to one another, as will be more fully explained presently when describing the structure shown by Fig. 4. Since in such cases more strength is required in the body of the arch, and also to better secure the individual members edgewise to one another, several layers are used, and the arch members in the adjacent layers are staggered in an overlapping manner.

Referring now to Fig. 4, the same shows a central fragmentary portion of a built up arch structure constructed according to my invention and made of a plurality of individual basic arch members in this case arranged in three layers.

The left hand full front member is indicated generally by the numeral 35, having been built up of the upper section 35a and lower 35b secured together on the straight line 35c and having the curved upper edge 35d and lower edge 35e, and the two side edges 35f and 35g, which are radial

to the curve of the arch at those points, as has been mentioned hereinbefore.

Next to, and to the right of, the member 35 is placed a similar member 36, in the front layer of the arch structure of Fig. 4, having the similar elements thereof marked by the numerals 36a, 36b, 36c, 36d, 36e, 36f, its right hand end being broken away, as indicated at 36x. To the left of the member 35 in the front layer is placed the member 37, most of it being broken away, as indicated at 37x and abutting the side edge 35f by its right hand side edge 37g.

A second layer of such edgewise placed members is arranged back of the first front layer, and closely adhering thereto, in Fig. 4 one full member 38 and broken off right hand and left hand members 39 and 40 of it being indicated, their parts being appropriately numbered to aid in recognizing them.

Similarly a third layer of such members is built on and back of the second, or middle layer, Fig. 4 showing one full member 41 and parts of a right hand member 42 and left member 43 thereof.

It will be understood that the abutting edges of the two pieces in each member, and of the adjacent members will be secured to one another, as has been explained hereinbefore, by any appropriate means.

It is also obvious that the adjacent members in the individual layers will be secured to one another, as by gluing, riveting, bolting, etc.

It will be seen that in this manner I may build an arch structure of individual plate or strip like members expeditiously and to answer a great range of requirements as to shape, span and strength.

My individual arch members, as well as built up arch structures, may use any desired and suitable materials, like wood, metals, even plastic, etc.

In Fig. 7 I illustrate an individual arch member 44, having the web or arch proper 45, built up of the two plate sections 45a and 45b as has been explained hereinbefore, said arch member 44 being given an I cross section by securing the appropriately bent curved strips 46 and 47 to its upper and lower chord edges, respectively, as will be understood.

In Fig. 9 a similar arch member is shown, but built of two staggered layers 48 and 49 for a web and two bent strips 50 and 51 at the top and two strips 52 and 53 at the bottom, for added strength.

It also will be understood that in the structure shown in Fig. 4, or in any other of my arch structures several sections for an individual member, or several individual members may be set abutting each other with their longitudinal edges, to build up a greater width and greater strength in the arch, in the manner of Fig. 3, and that obviously if the arch structure is built of several layers as in Fig. 4, then not only the side edges may be staggered in the individual layers but said longitudinal edges too, so as to provide an overlapping of the elements in the individual layers in the direction of the depth or width of the arch also.

In Figs. 5 and 11 I show a portion of a truss into which is built one of my arches. The truss generally is indicated by the character 54 and my arch by the numeral 55, and my arch in this combination becomes a cord of the truss. The web members 56 of the truss are secured between two layers 55a and 55b of the arch by any appropriate means, like bolts, rivets, welding, gluing, etc., and preferably at the meeting of the individual members in the layers, as at 57 and 58.

Appropriate devices well known in the art (not shown) may be placed between the spaced apart arch layers intermediate of the web members to reinforce them and prevent their buckling.

Fig. 10 shows a cross sectional view of an individual member built as indicated in Fig. 3, which however has been reinforced by upper and lower strips 59 and 60 at both sides of it.

In Fig. 12 I show a fragmentary portion of a truss in which two members 61 and 62 of my arch are set edgewise and the web members 63 are secured to the outside of the arch as indicated in the section of Fig. 13.

With reference to the modifications of my invention shown in Figs. 7 and 9, I want to remark, that it is very hard to make an arch shaped structure of an I cross section with the methods and means heretofore available for such purpose. A steel I beam is hard to bend and after such bending one section of it will be stressed over the normal while the opposite region will be compressed. Wood in such structures cannot be made by bending at all, as will be obvious. My invention makes it possible to construct arch structures of any metal, wood or other material and give it the I shape cross section with simple and easy means.

The strength of such a cross section also can be easily adjusted to the requirements of the case, if necessary several web layers may be provided, as indicated in the section of Fig. 8, and similarly the top and bottom transverse strips 50 to 53 in Fig. 9 may be increased.

I also want to remark that the curved section line 31a, 31b in Fig. 1a obviously may be placed anywhere between the two outer longitudinal edges 21 and 22, so that it may start from the corner or intersection of the left hand side edge 23, with the lower longitudinal edge 21 and end at the opposite corner formed by the right hand side edge 24 with the edge 21.

In Fig. 14 I indicate one other method of forming the basic individual or single arch member of Fig. 2. In the modification of Fig. 14:

Edges 21 and 22 are placed into overlapping relation, as will be obvious, leaving a portion 20c in each of the sections 20a and 20b overlapping each other, whereupon the two sections may be secured in such position.

In this case, of course, the sections 20a and 20b will not be in the same plane, however, in many cases of such constructions this is acceptable depending on thickness and kind of materials to be used, and the method of Fig. 14 may be more easy to apply than the one indicated in Fig. 2.

Fig. 15 indicates a similar construction to that of Fig. 14, but applied to the combination arches of the type of Figs. 4 and 5. In the fragmentary showing of Fig. 15 two basic or single arch members of my invention are shown, designated by the characters 70 and 71, respectively, the side or transverse edges 70g and 71f of which are placed into overlapping relation, the two members having a portion, indicated by 70b, overlapping, whereupon the same may be secured in such a position by any of the means mentioned hereinbefore, or by any other manner, as parts of a construction.

In general, I want to remark that my arch constructions are intended as parts of larger structures, particularly roofs and concrete form work, and the various overlappingly, abuttingly, or otherwise set portions thereof may be secured in such a position also by the balance of said outside structures, and not only by direct connections and the spaces possibly left between not co-planar sections thereof may either be left vacant, or filled out, as necessary or convenient.

In the foregoing, I have illustrated and described preferred and satisfactory embodiments and applications of my invention, but it is obvious that changes may be made therein within the spirit and scope thereof as defined in the appended claims.

What I claim as new is:

1. An arch construction for buildings, comprising several vertical layers, each layer consisting of several elongated wooden boards, each piece composed of two sections of the same thickness, each section having one straight and one curved longitudinal edge and each two sections being placed with their straight edges abutting, said pieces being placed in an end to end relation in a chain, and so forming a single layer first arch, additional similar layers placed flat against said first arch, secured to one another, with the ends of the pieces in the several layers in staggered relation to form an arch of several layers with the transverse and the abutting straight edges being staggered with reference to the individual layers.

2. In an arch construction of claim 1, a flat member of the thickness of the respective layer interposed between the straight edges of each pair of sections, the straight edges of each pair of sections abutting the respective straight edges in the flat member therebetween.

LOUIS DAVIDSON.