Dec. 25, 1934. V. K. CATES ET AL 1,985,599

ROOF CONSTRUCTION

Filed Nov. 19, 1931 2 Sheets-Sheet 1

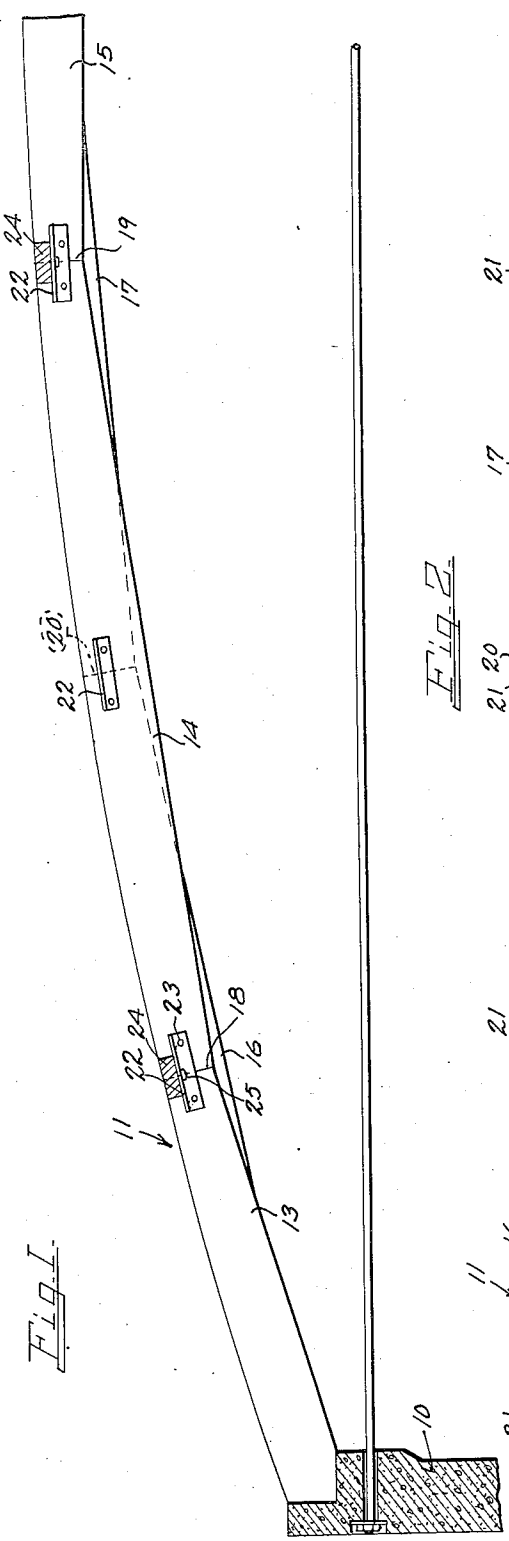


Fig. 1.

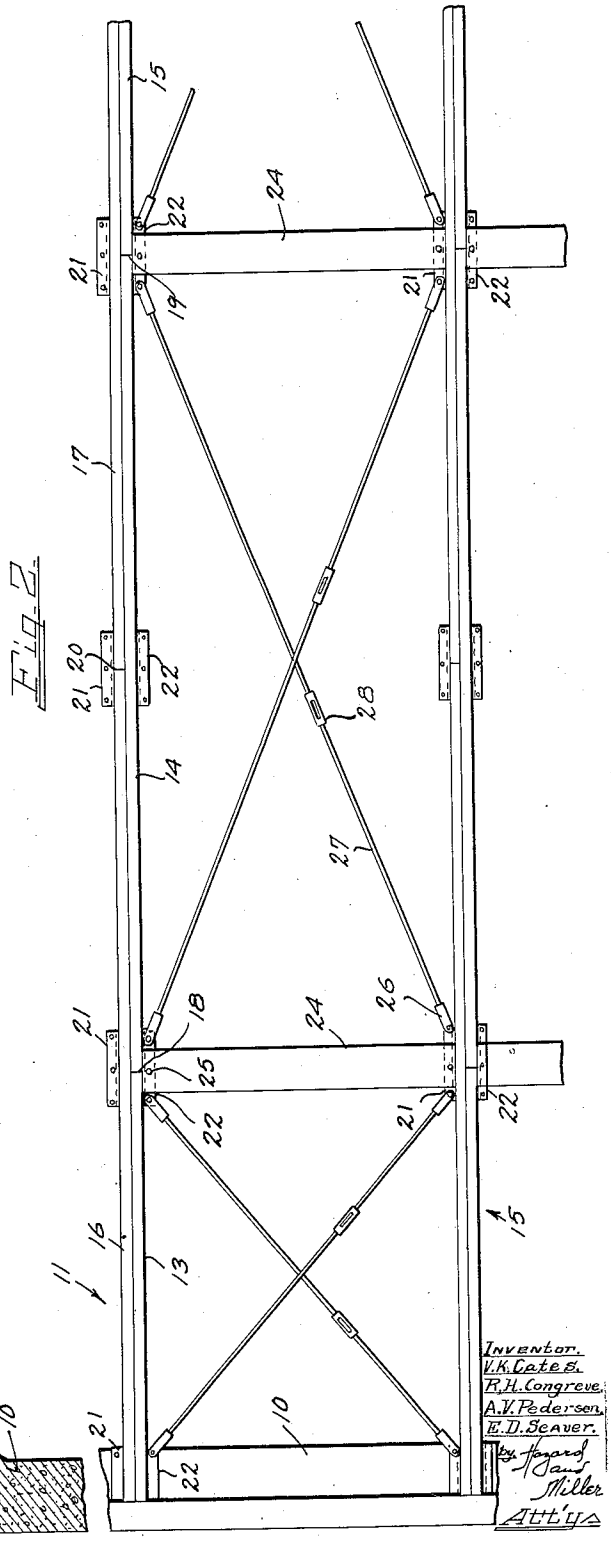


Fig. 2.

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Fig. 3.

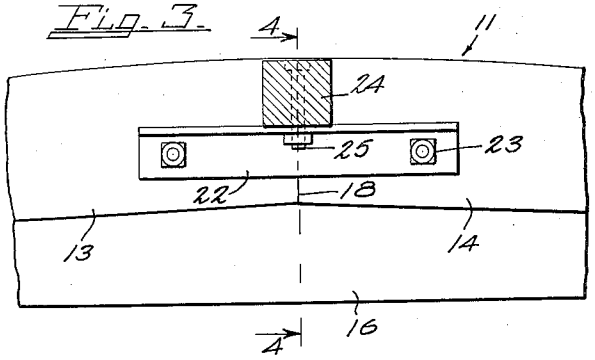


Fig. 4.

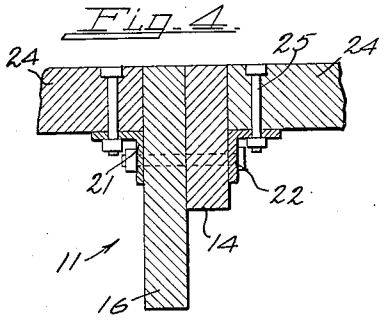


Fig. 5.

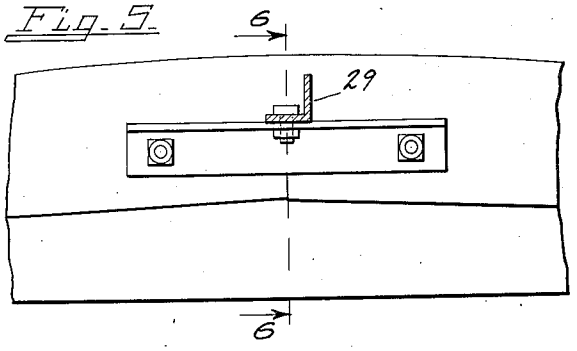


Fig. 6.

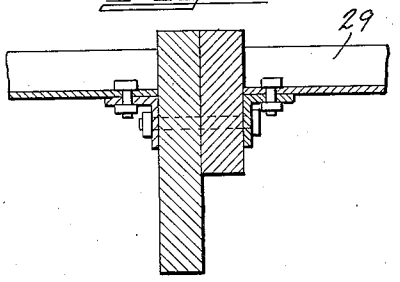


Fig. 7.

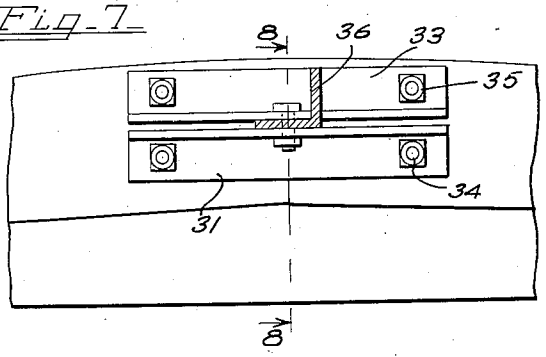


Fig. 8.

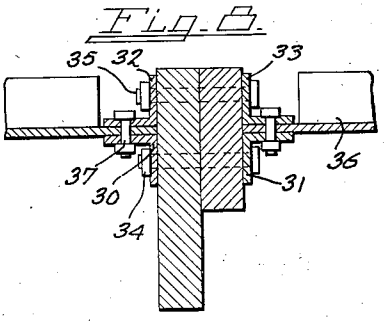


Fig. 10.

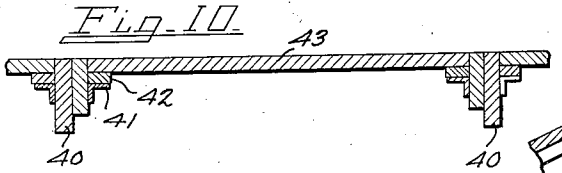
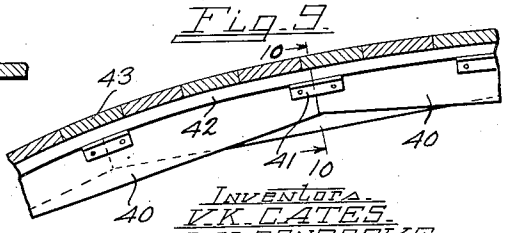


Fig. 9.



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UNITED STATES PATENT OFFICE

1,985,599

ROOF CONSTRUCTION

Vincent K. Cates, Ralph H. Congreve, Axel V. Pedersen, Los Angeles, and Edward D. Seaver, Alhambra, Calif., assignors to Summerbell Truss Co., Los Angeles, Calif., a partnership composed of Fred H. Hodgins and Charles C. Calvert

Application November 19, 1931, Serial No. 576,114

19 Claims. (Cl. 108—23)

This invention relates to improvements in roof constructions and more particularly to arch constructions employed in the construction of the roof.

An object of the invention is to provide an improved arch construction consisting of a plurality of arches arranged side by side, each arch being made up of arch segments. The arch segments are preferably though not necessarily of uniform size and shape and may be previously cut prior to the installation or erection of the arch. They are assembled in end to end relation with the joints between adjacent arch segments in one arch arranged in staggered relation with respect to the joints between adjacent segments in the other arch.

An object of the invention is to provide an improved construction for fastening the arch segments of an arch together and for fastening the arches forming an arch construction together. The improved fastening means reinforces the arches or the arch construction at the joints thereof and effectively stiffens the arch construction at its joints.

Another object of the invention is to provide an arch construction having the above mentioned characteristics in which the fastening devices not only fasten and stiffen but also provide seats or supports for struts between adjacent arch constructions forming the roof.

Another object of the invention is to provide an arch construction of a laminated character having bolts or equivalent fasteners extending through the laminations or arches of the arch construction, the bolts being connected by angular pieces which also form anchors or means for attaching tension members, such as tension rods or cables, used to connect adjacent arch constructions.

Another object of the invention is to provide a relatively simple, durable arch construction in which stresses can be easily calculated and which can be easily and quickly constructed and assembled.

With the foregoing and other objects in view, which will be made manifest in the following detailed description, and specifically pointed out in the appended claims, reference is had to the accompanying drawings for an illustrative embodiment of the invention, wherein:

Fig. 1 is a partial view in side elevation illustrating a portion of an arch construction embodying the invention.

Fig. 2 is a plan view of two arch constructions illustrating the manner in which they are connected by struts and tension members.

Fig. 3 is a view on an enlarged scale of a joint in the arch construction.

Fig. 4 is a vertical section taken upon the line 4—4 upon Figure 3.

Fig. 5 is a view similar to Figure 3 illustrating a slightly modified form of construction at the joint.

Fig. 6 is a vertical section taken substantially upon the line 6—6 upon Figure 5.

Fig. 7 is a view similar to Figure 3 illustrating a further modification.

Fig. 8 is a sectional view taken upon the line 8—8 upon Figure 7.

Fig. 9 is a partial sectional view illustrating a further form of construction embodying the invention.

Fig. 10 is a sectional view taken upon the line 10—10 upon Figure 9.

Referring to the accompanying drawings, wherein similar reference characters designate similar parts throughout, the roof construction is supported upon suitable walls, one of which is indicated at 10. It consists of a plurality of spaced arch constructions, two of which are designated at 11 and 12 respectively. Each arch construction is of a laminated character and may be considered as being made up of two or more arches arranged side by side. For example in Figure 2 the arch construction 11 may be considered as being made up of an arch composed of arch segments 13, 14 and 15. The adjacent arch is made up of arch segments 16 and 17. The arch segments are arranged in end to end relation and are of substantially uniform size and shape. Their upper edges, as clearly shown in Figure 1, are preferably shaped to conform to the curvature of the arch but this refinement may be dispensed with under certain circumstances. It will be noted that the joints 18 and 19 in one arch of the arch construction 11 are in staggered relation with respect to the joints 20 in the other arch so as to preserve as uniform a strength and stiffness factor as possible. On the sides of the arch construction at each joint there are positioned small sections of angle iron 21 and 22, the vertical webs of which lie flat against the sides of the arch construction 11 and the flanges of which project outwardly. These sections of angle iron are positioned so that their flanges are disposed a short distance beneath the upper edge of the arch construction. Bolts 23, or equivalent fastening devices, extend through the ends of the angle irons 21 and 22 and through the ends of the

arch segments forming the joint. They also extend through the center of the arch segment of the adjacent arch. When these bolts are tightened, the arch segments are effectively connected together and the outstanding flanges on the angle irons effectively stiffen the arch construction at the joint. By having the flanges of the angle irons 21 and 22 beneath the top edge of the arch, these flanges may form seats or supports for the ends of struts 24 which are disposed between adjacent arch constructions such as those indicated at 11 and 12. In some instances bolts 25 may be passed through the ends of the struts and through the flanges of the angle irons. Where the struts are of wood they may be so formed as to be flush with the top of the arch as shown in Figures 3 and 4. The ends of the angle irons 21 and 22 preferably have apertures formed therein providing for the attachment of the ends 26 of tension members 27 which may be tension rods or cables provided with turnbuckles 28. These tension members are preferably arranged in the diagonal manner shown and serve to effectively tie the arch constructions 11 and 12 together to form a rigid structure.

In Figures 5 and 6 there is a modified form of construction wherein steel angle iron struts indicated at 29 are employed instead of the wood struts 24. These angle iron struts likewise rest on the outwardly extending flanges of the angle irons and are bolted thereto. The tension members 27 may be used with these angle iron struts in the same manner as with the wooden struts.

In Figures 7 and 8 a further modification is illustrated wherein each joint has a pair of lower angle irons 30 and 31 and a pair of upper angle irons 32 and 33. Bolts 34 arranged on both sides of the joint extend through the arches and through the vertical webs of the lower angle irons. A similar pair of bolts 35 arranged on both sides of the joint extend through the vertical webs of the upper angle irons and through the arches. The flanges of the upper angle irons are positioned lowermost so as to be close to the flanges of the lower angle irons. In this construction if angle iron struts 36 are employed, the ends of the webs of the struts are cut away so that the ends of the flanges may be received between the flanges of the angle irons on the arch construction and bolted thereto as by bolts 37.

In Figures 9 and 10 there is a further construction embodying the invention. In this construction each arch construction is made up of arch segments 40 as before with angle irons 41 applied to the sides of the arch construction at the joint. The flanges of the angle irons which project outwardly from both sides of the arch construction form ledges which support a curved wooden member 42. This wooden member conforms to the curvature of the arch and in turn forms a continuous ledge along the sides of the arch construction for supporting sheeting or rafters 43 which may span the space between adjacent arch constructions.

It will be seen from the above described construction that the improved arch construction is very simple. The various parts may be previously cut at a wood shop or planing mill and easily and quickly assembled at the location of the structure. The arch segments are not only effectively tied together by the bolts but the joints of the arch constructions are effectively reinforced by the angle irons applied to the sides thereof at the joints. These angle irons serve not only the purpose of stiffening and strengthening the arch construction at its joints but they form seats for the reception of struts and also provide an attaching means for the attachment of tension members.

The angle irons may have substituted therefor any equivalent angular structure, such as for example channel irons, T irons, or any other structural shape. Preferably, however, they have some form of outstanding flange to stiffen the arch construction against lateral bending. While it is customary in a structure of this character to calculate the bending moments as of only the full unbroken section nevertheless the angle irons or equivalent devices applied to the arch construction are capable of transmitting some bending moments across the joint. While this factor does not enter into the calculation of stresses nevertheless it is operative and serves to increase the effective safety factor.

In most roof constructions the tension members 27 forming the diagonal bracing are used only at the end bays, that is the space between two endmost arch constructions. While this has been illustrated upon Figure 2 it is contemplated under various circumstances to use the diagonal tension members at intermediate points or between intermediate arch constructions. The struts are usually employed between all arch constructions but if under certain circumstances it should be found to be desirable to omit the struts such an alteration is contemplated within the scope of the invention. It is not necessary to have the struts bolted or otherwise secured to the angle irons. In certain forms of construction they are merely lagged or toenailed into the arches.

Various changes may be made in the details of construction without departing from the spirit or scope of the invention as defined by the appended claims.

We claim:

1. An arch construction comprising a plurality of arches positioned side by side, said arches being formed of arch segments, the joints between adjacent segments in one arch being staggered with relation to the joints in the other, fastening devices extending through both arches adjacent the joints therein, and means positioned against the outer sides of the arch connecting the fastening devices across the joints, said means providing ledges beneath the top of the arch serving as bases for supporting struts between adjacent arch constructions.

2. An arch construction comprising a plurality of arches positioned side by side, said arches being formed of arch segments, the joints between adjacent segments in one arch being staggered with relation to the joints in the other, fastening devices extending through both arches adjacent the joints therein, and means positioned against the outer sides of the arch connecting the fastening devices across the joints, said means having provision made for the attachment of tension members on opposite sides of the arch to extend between adjacent arch constructions.

3. An arch construction comprising a plurality of arches positioned side by side, said arches being formed of arch segments, the joints between adjacent segments in one arch being staggered with relation to the joints in the other, bolts extending through the arch segments adjacent each end thereof, and angle irons connecting the bolts across each joint, the outwardly extending portions of the angle irons being disposed beneath the top of the arch providing ledges to support struts between adjacent arch constructions.

4. An arch construction comprising a plurality of arches positioned side by side, said arches being formed of arch segments, the joints between adjacent segments in one arch being staggered with relation to the joints in the other, bolts extending through the arch segments adjacent each end thereof, and angle irons connecting the bolts across each joint, said angle irons having apertures formed therein providing for attachment of tension members between adjacent arch constructions.

5. A roof construction comprising a series of arch constructions, each arch construction comprising a pair of arches made up of arch segments arranged in end to end relation, bolts extending through the arches adjacent the joints between adjacent arch segments, means connecting the bolts adjacent the sides of the arch construction across the joints, and struts between adjacent arch constructions supported upon said connecting means.

6. A roof construction comprising a series of arch constructions, each arch construction comprising a pair of arches made up of arch segments arranged in end to end relation, bolts extending through the arches adjacent the joints between adjacent arch segments, means connecting the bolts adjacent the sides of the arch construction across the joints on both sides of each arch construction at the joints, and tension members between adjacent arch constructions secured to said connecting means.

7. A roof construction comprising a series of arch constructions, each arch construction comprising a pair of arches made up of arch segments arranged in end to end relation, the joints between adjacent arch segments in one arch of any arch construction being staggered with respect to those in the other arch, bolts extending through the arches adjacent the joints between adjacent arch segments, means connecting the bolts adjacent the sides of the arch construction across the joints, and struts between adjacent arch constructions supported upon said connecting means.

8. A roof construction comprising a series of arch constructions, each arch construction comprising a pair of arches made up of arch segments arranged in end to end relation, the joints between adjacent arch segments in one arch of any arch construction being staggered with respect to those in the other arch, bolts extending through the arches adjacent the joints between adjacent arch segments, means connecting the bolts adjacent the sides of the arch construction across the joints, and tension members between adjacent arch constructions secured to said connecting means on both sides of each joint therein.

9. A roof construction comprising a series of arch constructions, each arch construction comprising a pair of arches made up of arch segments arranged in end to end relation, the joints between adjacent arch segments in one arch of any arch construction being staggered with respect to those in the other arch, bolts extending through the arches adjacent the joints between adjacent arch segments, means connecting the bolts adjacent the sides of the arch construction across the joints, struts between adjacent arch constructions supported upon said connecting means intermediate the ends thereof, and tension members between adjacent arch constructions secured to said connecting means.

10. A roof construction comprising a series of arches, each arch being made up of arch segments arranged in end to end relation, angle irons positioned against the sides of the arch across the joints between arch segments, bolts extending through the angle irons and through the arch segments, and struts between arches supported upon said angle irons.

11. A roof construction comprising a series of arches, each arch being made up of arch segments arranged in end to end relation, angle irons positioned against the sides of the arch across the joints between arch segments, bolts extending through the angle irons and through the arch segments, and tension members between arches secured to said angle irons.

12. A roof construction comprising a series of arches, each arch being made up of arch segments arranged in end to end relation, angle irons positioned against the sides of the arch across the joints between arch segments, bolts extending through the angle irons and through the arch segments, struts between arches supported upon said angle irons, and diagonal tension members between arches secured to said angle irons.

13. An arch construction comprising a plurality of arches positioned side by side, said arches being formed of arch segments, the joints between adjacent arch segments in each arch being staggered with relation to the joints in the adjacent arch, and means secured to the arch construction and extending across the joints in the arches providing seats for struts between adjacent arch constructions.

14. An arch construction comprising a plurality of arches positioned side by side, said arches being formed of arch segments, the joints between adjacent arch segments in each arch being staggered with relation to the joints in the adjacent arch, and means secured to the arch construction and extending across the joints in the arches providing for attachment of tension members between adjacent arch constructions.

15. An arch construction comprising a plurality of arches positioned side by side, said arches being formed of arch segments, the joints between adjacent arch segments in each arch being staggered with relation to the joints in the adjacent arch, means secured to the arch construction and extending across the joints in the arches providing for attachment of tension members between adjacent arch constructions, and seats for struts between adjacent arch constructions.

16. An arch construction comprising a plurality of arches positioned side by side, said arches being formed of arch segments, the joints between adjacent arch segments in each arch being staggered with relation to the joints in the adjacent arch, and angle irons secured to the arch constructions adjacent the joints in the arches so as to cross the joints in the arches, said angle irons having outwardly extending flanges providing seats for struts between adjacent arch constructions.

17. An arch construction comprising a plurality of arches positioned side by side, said arches being formed of arch segments, the joints between adjacent arch segments in each arch being staggered with relation to the joints in the adjacent arch, and angle irons secured to the arch constructions adjacent the joints in the arches so as to cross the joints in the arches, said angle irons having outwardly extending flanges providing for attachment of tension members between adjacent arch constructions.

18. In an arch construction, a pair of arches arranged adjacent each other, each arch being formed of arch segments arranged end to end

with joints in one arch staggered with relation to joints in the adjacent arch, bolts extending through the segments on both sides of the joints therein, flanged members positioned on both outer sides of the arch construction at each of the mentioned joints, and struts having their ends supported upon the flanges.

19. In an arch construction, a pair of arches arranged adjacent each other, each arch being formed of arch segments arranged end to end with joints in one arch staggered with relation to joints in the adjacent arch, bolts extending through the segments on both sides of the joints therein, flanged members positioned on both outer sides of the arch construction at each of the mentioned joints and connecting the bolts across the joints, and tension members secured to the flanges adapted to be extended therefrom to an adjacent arch construction without passing through the arches.

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