Oct. 16, 1928. 1,687,850

J. G. SHODRON

FRAME FOR BUILDINGS

Filed Feb. 1, 1926 3 Sheets-Sheet 1

Fig. 1.

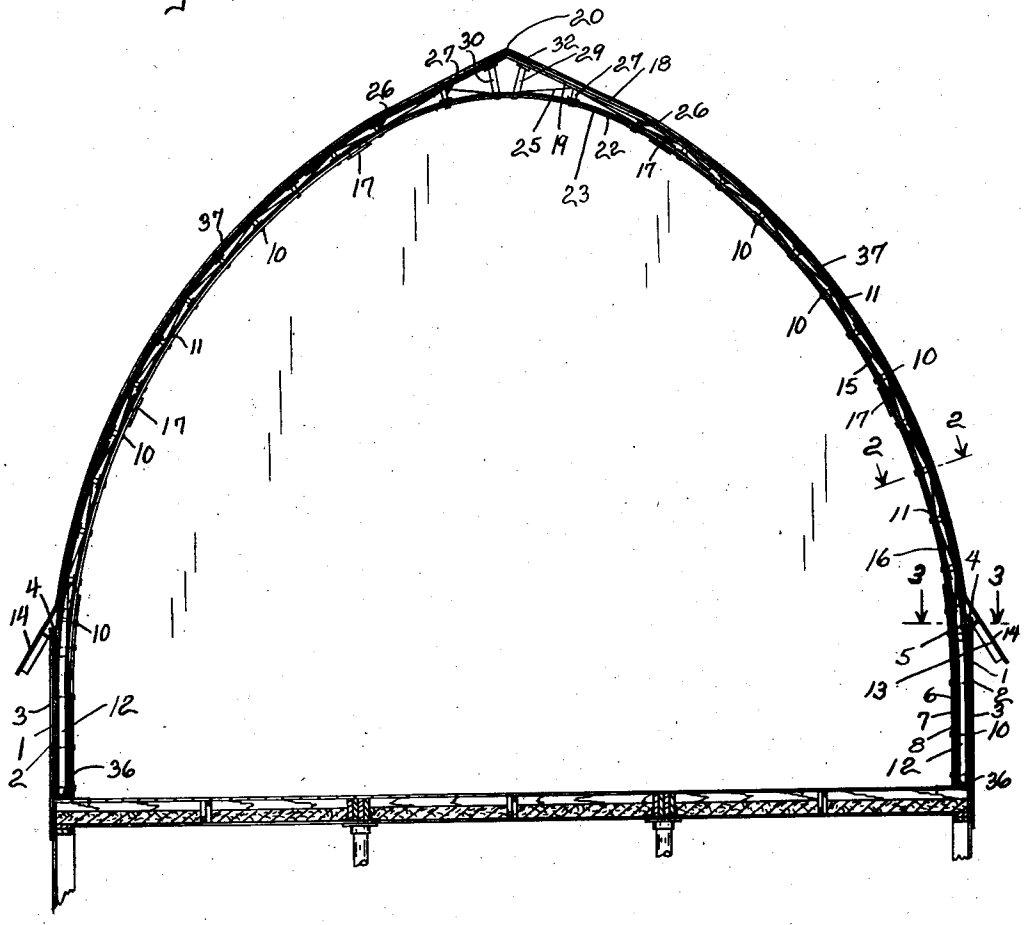


Fig. 2.

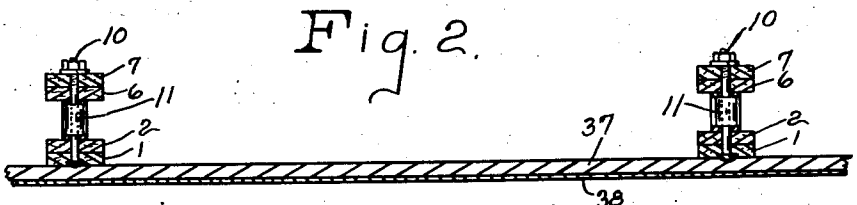
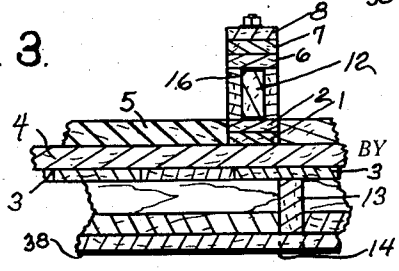


Fig. 3.



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Filed Feb. 1, 1926 3 Sheets-Sheet 2

Fig. 4.

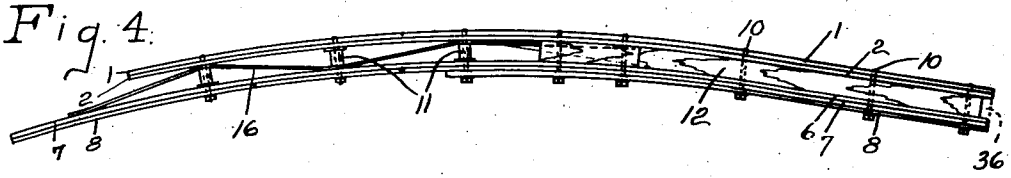


Fig. 5.

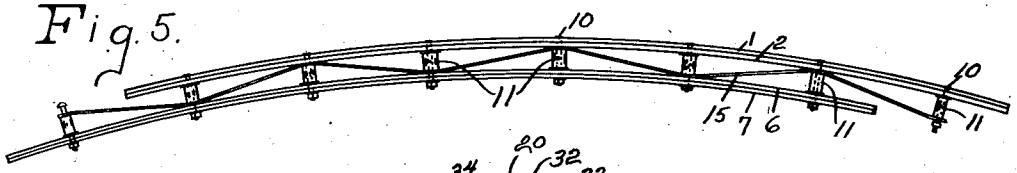


Fig. 6.

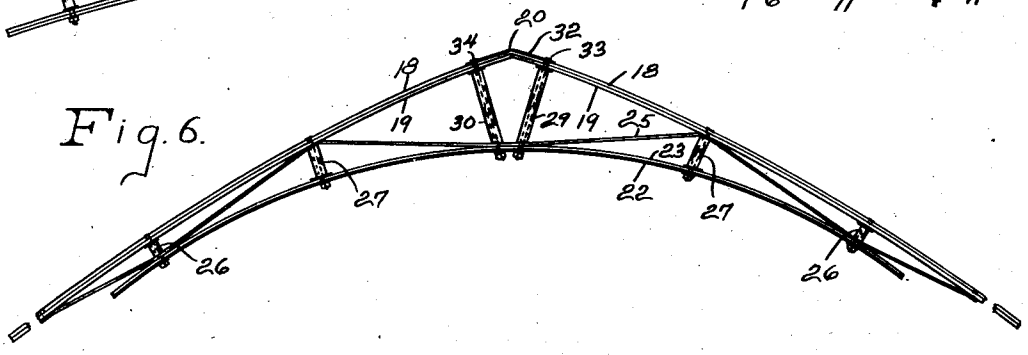
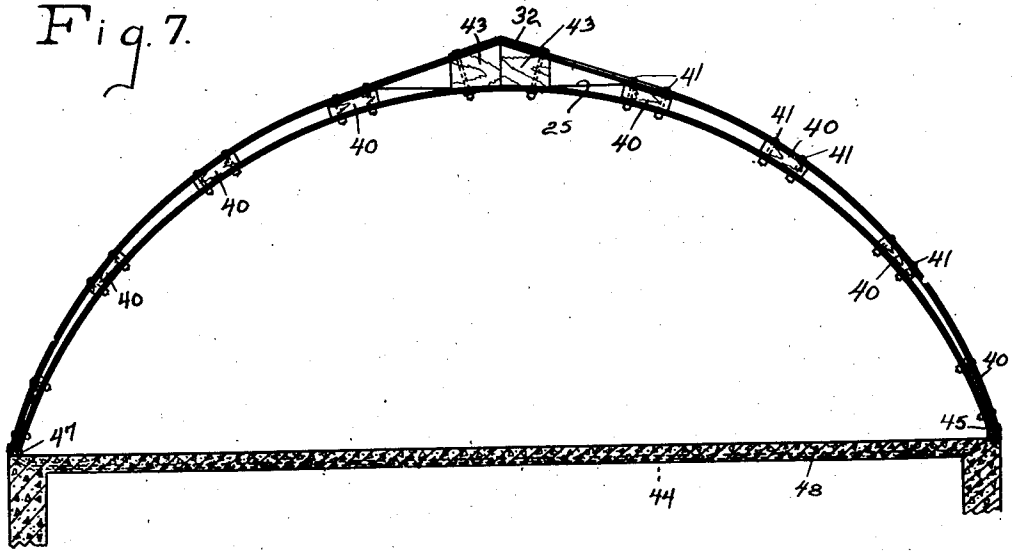


Fig. 7.



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Filed Feb. 1, 1926 3 Sheets-Sheet 3

Fig. 8.

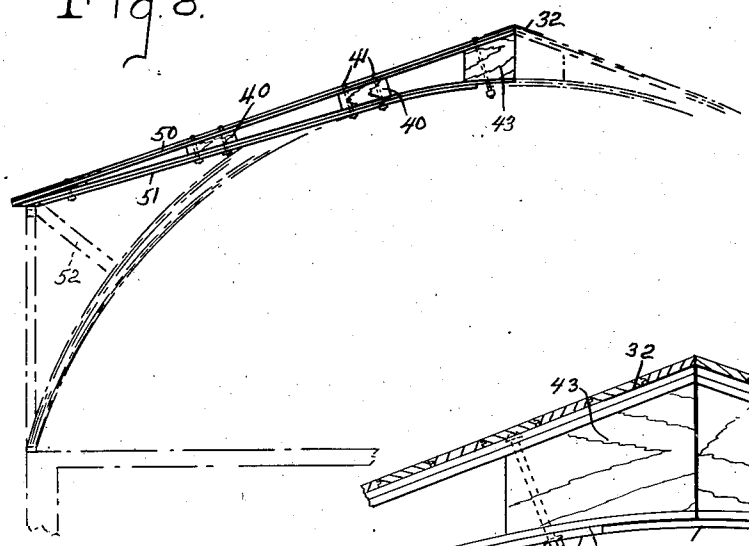


Fig. 11.

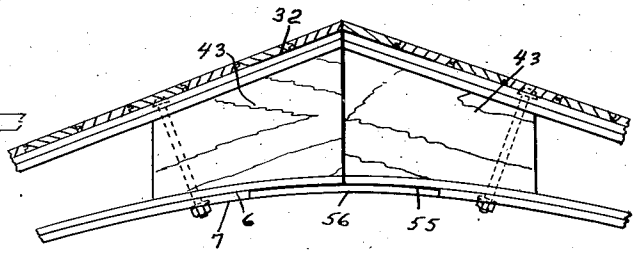
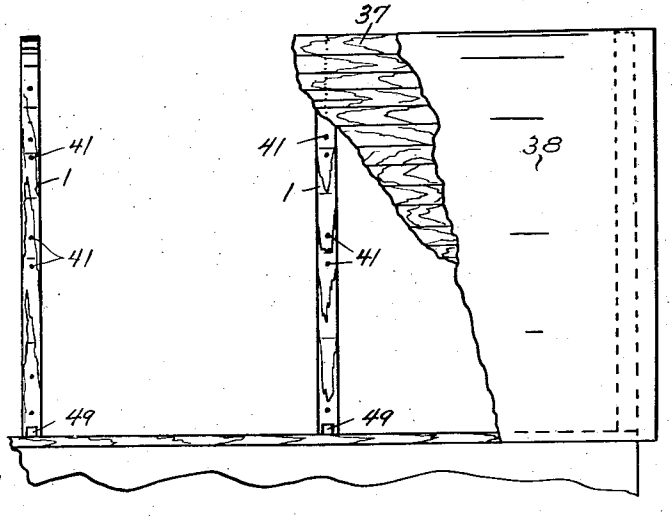


Fig. 9.



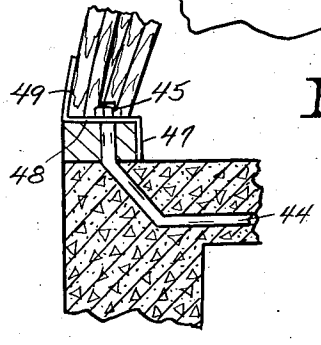


Fig. 10.

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UNITED STATES PATENT OFFICE.

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FRAME FOR BUILDINGS.

Application filed February 1, 1926. Serial No. 85,164.

My invention relates to improvements in building frames, with particular reference to the frames of barns and other buildings of the type commonly known as farm buildings, although the invention is applicable to any building in which the general requirements for frame construction are similar.

Objects of this invention are to provide a frame of maximum strength in proportion to material used, to provide a frame in which small or short pieces of material may be assembled to form trussed frame members of great strength proportioned to quantity and cost of material used; to provide a frame which combines the principle of the arch with that of a truss having a central ridge; to provide a frame adapted to support a wall in a manner to provide maximum housing space with minimum obstruction by supporting members such as posts, beams or braces within the area enclosed; to provide a frame which can be factory made and shipped to the place of erection in units of such size as to enable them to be conveniently handled but which can be raised and connected with each other by persons having no previous experience with structural work, and which, when so connected, will form the framework of an architecturally attractive building of standard size and proportions exactly suited to the requirements of the owner and of maximum serviceability; to provide a frame composed of units having laminated and trussed wooden bodies reinforced by shear members in a manner to prevent buckling and twisting of the frame members; and to provide such frame members or arches with postlike legs or base portions which may be cut by the erector to vary the height of the structure without varying the characteristics of the upper or arched portions.

A further object of this invention has reference to the rapidly diminishing supplies of timber and the consequent increasing cost of construction in the building of barns and other farm buildings where the initial costs, transportation costs and erection costs for all metal or timber framing are prohibitive. This invention is designed to enable a factory to utilize short pieces of material and even quantities of scrap material in connection with sheet metal strips for the construction of frame units which are stronger, lighter and, in general, better adapted for the desired purposes than the heavily braced beams, and posts heretofore used; also, to enable such manufacturers to provide metal or wood reinforcing tension and shear members at small cost and with minimum expenditure, which can be easily installed during the erecting operation at the points where strains are likely to develop under wind pressures which otherwise might prove destructive of the structure.

In the drawings:

Figure 1 is an end elevation of a building having a frame embodying the invention herein described, the end wall being removed.

Figure 2 is a sectional view through two arched frame members, drawn on line 2—2 of Figure 1.

Figure 3 is a fragmentary, sectional view on line 3—3 of Figure 1.

Figures 4, 5 and 6 are detail views showing respectively a lower frame unit, an intermediate frame unit, and a connecting top unit, of the three standard types from which the frame arches are constructed.

Figure 7 is a view, similar to Figure 1, showing a modified form of construction.

Figure 8 is a detail side view of a portion of one of the frame arches used in the building shown in Figure 7 and showing a lateral roof extension thereof.

Figure 9 is a side elevation of a portion of the structure shown in Figure 7.

Figure 10 is a fragmentary, sectional view showing the tie bolt connection with the base of the arch.

Figure 11 is a detail of one of the ridge trusses, enlarged.

Like parts are identified by the same reference characters throughout the several views.

In place of the studs, rafters, plates, posts and tie beams ordinarily employed for the construction of barn frames, this invention contemplates the use of a series of arched frame members, each composed of factory made units which curve inwardly from each side of the building and are connected end to end when setting up the frame. The upper unit of each arch has outer walls which extend tangentially to the curve of the arch to form a central ridge, but the inner wall con-

forms throughout to the curvature of the arch,—i. e., to the curvature of the inner surfaces of the arch. The arch thus formed describes one half of an ellipse the longer or major axis of which extends vertically. The curvature of the successive units differs in such a manner that the arch conforms generally to an elliptical curve in all portions of the inner wall and also in those portions of the outer wall other than the upper ridge forming tangential extensions thereof. The ridge or peak of the building frame is disposed in a plane substantially coinciding with the major axis of the ellipse.

Each of the units has spaced inner and outer walls built up from a set of comparatively thin overlapping strips or boards arranged lineally so as to break joints, and securely nailed or otherwise fastened together to form a laminated wall. In the construction shown, the outer wall of the lower unit of each arch comprises a set of two overlapping boards 1 and 2 arranged in the manner above described. The inner wall is similarly constructed of boards or sets of boards 6, 7 and 8 similarly secured together and connected at suitable intervals with those of the outer wall by bolts 10, said bolts being passed through spacing sleeves 11 in the upper portion of this unit, whereby the inner and outer walls are kept apart by the sleeves, while clampingly connected by the bolts.

In the construction shown in Figure 1, the lower portions of the lower units or base members of the arch are substantially straight and the walls are spaced apart by a wooden bar 12. These units may therefore be readily shortened, for they may be cut to the desired length by merely sawing them in two, thereby varying the height of the building without affecting the structure or curvature of the arch or the width of the building. The upper portions conform to the curvature of the arch and the upper end portions of the strips 7 and 8 of the inner wall are extended beyond the strips 1, 2 and 6, and form a means for connecting these lower frame units with the next succeeding frame units of the series which composes the arch, as hereinafter explained. The curvature of the various portions of the arch will, of course, depend upon the design.

Vertically disposed sheathing boards 3 may be employed for this portion of the building, and their upper end portions extend in a straight line and are secured to a horizontally extending girth 4 which is interposed between them and the upper end portions of the boards 2. Between the arches this girth is nailed to blocking pieces 5. These girths support the eaves bars 13 which are nailed to the arches and carry the roof boards which provide the water shed or eaves 14.

For the purposes of this description the next unit of the series is herein termed "an intermediate unit". Its walls are similarly constructed but preferably from a less number of strips or boards,—i. e., from boards 1 and 2 in the outer wall and 6 and 7 in the inner wall. This unit, however, conforms to the curve of the arch throughout its length, and a strip 15 of metal is employed as a reinforcing or tension and shear member. This tension and shear member is passed across the outer end of one spacing sleeve and across the inner end of the next and is provided with holes through which the bolts 10 pass, thereby connecting the bolts and the inner and outer walls along lines which lie obliquely to the wall surfaces. A similar tension and shear member 16 may be used in the upper portion of the lower unit.

The number of these intermediate units to be connected lineally in the respective sides of the arch will of course depend upon the size of the building, the units being preferably of a standard length. Some of the inner wall boards of the lower unit,—(i. e.,—the strips 7 and 8, in the construction shown), are butted with the boards 7 and 8 of the associated intermediate unit, and the inner wall boards 7 and 8 of this intermediate unit are correspondingly extended at the other end for connection with the succeeding unit, whereby all the units in the arch may be assembled in break joint relation. The abutting ends of the inner walls of successive units are preferably tied together, when the units are assembled, by splicing strips 17.

The upper intermediate units on the respective sides of the arch are connected with each other by the top unit (herein termed the ridge unit). The upper or outer wall boards or strips 18 and 19 of the ridge unit are substantially straight, and extend tangentially from the intermediate units with which they are overlappingly connected to the central peak or ridge 20. The inner wall boards or strips 22 and 23 are curved and form the top of the arch formed by the inner walls of the assembled units.

A metallic tension strip 25 extends about the inner ends of the end spacing sleeves 26 of these top or ridge units and over the spacing sleeves 27 in the central portions of each slope of the ridge unit and under the two divergent central struts 29 and 30 which are located adjacent to and on opposite sides of the peak. It will be observed that the portions of this metal tension strip or strap 25 which cross the top of the arch are substantially horizontal between the sleeves 27.

An angular cap piece 32, also of metal, is applied to the meeting end portions of the outer walls of the ridge unit, and secured in position by the ridge bolts 33 and 34. This cap piece 32 co-operates with the tension strip 25 and the spacing sleeves and bolts in providing a metallic reinforcement for the ridge unit which prevents it from drawing apart.

The wooden portions of the unit are equally effective in providing resistance to buckling strains.

To provide against a spreading of the arch at the base, a sill plate 36 is securely fastened to the floor and sills at each side of the building. This sill plate is of a proper width to fit the spaces between the inner and outer walls of the lower frame units and affords a secure anchorage. The walls are nailed or bolted thereto.

The frame members or studs of the end walls are preferably similar in construction to the arched stud-rafter frame members, above described, except that they will of course be straight where a vertical end wall is desired and their upper ends will be secured to the end members of the series of stud-rafters. They will be of differing lengths, but may, if desired, be so spaced and constructed from standardized units of such length that cutting and fitting will not be required when setting up the frame. After the frame has been set up it may be covered with sheathing boards 37 and roofing 38 in the ordinary manner. No intermediate posts or bracing will be required for a barn structure of any ordinary size and the enclosed space is therefore peculiarly adapted for the storage of hay, grain straw, etc. The structure will also have a maximum capacity in proportion to its width and height.

In Figures 7 to 10 a modification is illustrated which is more particularly adapted for the erection of small buildings. The frame units are similarly constructed except as follows:

In place of the spacing sleeves 11 above described, tapered spacing blocks 40 are employed which are of progressively increasing thickness from the lower ends to the top of the arch on each side, and disposed with their smaller ends extending downwardly in the space between the walls, these spacing blocks being adapted to provide a substantially uniform divergence of the inner and outer walls from their lower ends to the ridge. The tie bolts 41 are used in pairs,—one pair for each spacing block. The ridge unit may be formed in two parts divided at the peak. The central portion of the ridge unit is preferably filled with a pair of strut blocks 43, each formed with an angular upper surface to conform to the ridge contour.

In the construction shown in Figures 7 to 10, metal tie plates 32 and 55 (see Figure 11) are employed to connect the two parts of this ridge unit as well as to reinforce it. The substantially vertical units shown at the lower end of the arch in Figure 1 are omitted in Figure 7. Such units may be used, if desired, to increase the elevation, but for chicken coops, hog pens, etc., such elevation is not required. The pitch or curvature of the arch may of course be varied, particularly with reference to the width of the building and the requirements for head room, but such work will be done at the factory, where the stresses can be calculated and materials selected to provide the requisite strength.

Where the improved frame is to be applied to a concrete base the anchoring sill plates may be secured to anchor bolts embedded in the concrete wall or floor. In Figure 7 an embedded tie bolt 44 extends entirely across the enclosed space and has upturned threaded ends passed through the sill plates and secured by nuts 45. This feature of construction may be applied to the Figure 1 structure where the foundation walls or floors are of concrete. But in the construction shown in Figure 7, the inner and outer wall boards converge into contact at their lower ends, and are anchored to the sill plates by metal tie plates having inner vertical sill engaging portions 47 horizontal portions 48 and outer upwardly extending portions 49 engaging the lower end of the frame unit to anchor it to the sill plate.

Where lateral extensions are desired, substantially straight units having converging outer and inner walls 50 and 51 may be employed, and their outer ends supported by vertical units similar to the base or lower units shown in Figure 1. The converging walls 50 and 51 with their shear blocks form an adequate support for the low flat roof of such an extension. At each end, the vertical unit posts are braced from one of the arches by an obliquely disposed tension member 52.

Where the ridge unit is made in two parts as in Figure 7, the tie plate or bar 25 will of course be divided at or near the central joint. Therefore, I preferably make the inner wall boards 8 short at the abutting ends of the unit and insert the metal spanner plate 55 which is nailed or otherwise secured in place at the time of installation and covered by a spanner board 56 also nailed in position as best shown in Figure 11 and providing a wooden member to which sheathing may be nailed.

By having the lower units reinforced and spaced by wooden members, the lower ends of the frame arch may be cut away whenever a building of the same space but of less height is to be erected. In general, the various features shown in Figures 1 and 7 may be used in either structure, as desired. Also the lower units of arches such as are shown in Figure 1 may be cut to the desired length and used as base or post portions for the arches shown in any of the other views to increase the height of the structure.

I claim:

1. A building stud-rafter frame member comprising a set of opposed inwardly curving units, a trussed connecting unit having outer portions substantially tangential to the curving outer surfaces of the first mentioned units and leading to an intermediate peak,

said connecting unit having an inner surface constituting a continuation of the inner surfaces of the first mentioned units, each of said units having spaced outer and inner walls with intervening spacing and reinforcing members, and the tension member of the connecting unit being arranged tangential to the inner portion and to extend across the space underneath the peak along the inner wall to junction points in the outer portion at each side of the peak.

2. In a building frame, a frame member having a substantially continuously arched inner wall and arched outer walls extended tangentially at their upper portions to a meeting point above the top of the arch of the inner wall, and web connections between the inner and outer walls of said members, including a metal tension member extending tangentially of the top of the inner wall arch and connected to the outer walls at opposite sides of the peak.

3. In a building frame, a frame member having a substantially continuously arched inner wall and arched outer walls extended tangentially at their upper portions to a meeting point above the top of the arch of the inner wall, and web connections between the inner and outer walls of said members, including a metal tension member extending tangentially of the top of the inner wall arch and connected to the outer walls at opposite sides of the peak, said peak being also reinforced by an angularly bent bar secured to the outer wall at the respective sides of the peak.

4. A unit for building frames having divergent inner and outer walls, spacing members between said walls of increasing dimensions in the direction of the point of widest wall divergence, and connecting devices cooperative with the spacing members to hold the walls in fixed relation to each other, together with tension members extending longitudinally from one connecting device to the next and beyond one of them to an appropriate distance for connection with another unit in end to end relation thereto.

5. A building frame unit comprising a set of spaced inner and outer walls, tubular spacing members, a continuous metal band extending longitudinally between said walls and across the outer and inner ends of successive spacing members in alternation, said band having apertures registering with the ends of said tubular spacing members, and bolts extending through said apertures and tubular spacing members and connecting the inner and outer walls.

6. A building stud-rafter frame member comprising a set of opposed inwardly curved units having spaced inner and outer walls, a trussed connecting unit having an outer wall constituting a continuation of the outer walls of the first mentioned units and having also an inner wall constituting a continuation of the arch formed by the inner walls of the first mentioned units, a continuous interposed tension and shear member connecting the outer and inner walls, and intervening spacing and reinforcing members, the tension member of the connecting unit being arranged substantially tangential to the top of the inner wall and extending across the space underneath the central portion of the outer wall to junction points in the outer wall at each side of said central portion thereof.

7. A building frame arch including a plurality of arch forming units, each having inner and outer walls curved in conformity with the arch, intervening spacing members and wall connections including means for maintaining the conformation of the walls, one wall of one unit being extended beyond the other, and the opposing wall of the next unit having a complementary extension in the opposite direction, and an intervening spacing member and a wall connection securing such extensions to each other in overlapping and spaced relation.

8. A building frame arch including a plurality of arch forming units, each having inner and outer walls curved in conformity with the arch, intervening spacing members and wall connections, one wall of one unit being extended beyond the other, and the opposing wall of the next unit having a complementary extension in the opposite direction and arranged with an intervening spacing member and a wall connection securing such extensions to each other in overlapping and spaced relation, and a truss connected to both walls and to the other spacing members.

9. A building frame arch including a plurality of arch forming units, each having inner and outer walls curved in conformity with the arch, intervening spacing members, wall connections, one wall of one unit being extended beyond the other, and the opposing wall of the next unit having a complementary extension in the opposite direction and arranged with an intervening spacing member and a wall connection securing such extensions to each other in overlapping and spaced relation, and a continuous metal band cooperative with the connecting members, securing the successive spacing members to each other and alternately to the opposing walls and to the extension of the next unit.

10. A building frame arch having an outer wall of changing degrees of curvature conforming generally to that of an elliptical curve having a vertical major axis, except in its top portion, said top portion extending tangentially from the connected arch portions to a central ridge peak disposed in a plane substantially coinciding with the major axis of said curve, an inner wall extending in spaced relation to said outer wall in sub-

stantial conformity to the line of the latter, and intervening spacing members and wall connections including means for maintaining the conformation of the walls.

11. A building frame arch having an outer wall of changing degrees of curvature conforming generally to that of an elliptical curve having a vertical major axis, except in its top portion, said top portion extending tangentially from connected arch portions to a central ridge peak, an inner wall spaced from and connected to said outer wall and substantially conforming in all portions to said elliptical curve, and intervening spacing members and wall connections including means for maintaining the conformation of the walls.

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