

Dec. 24, 1946.

E. J. KUMP, JR

2,413,145

LAMINATED PLYWOOD ARCH

Filed July 20, 1943

Fig. 1.



Fig. 2.

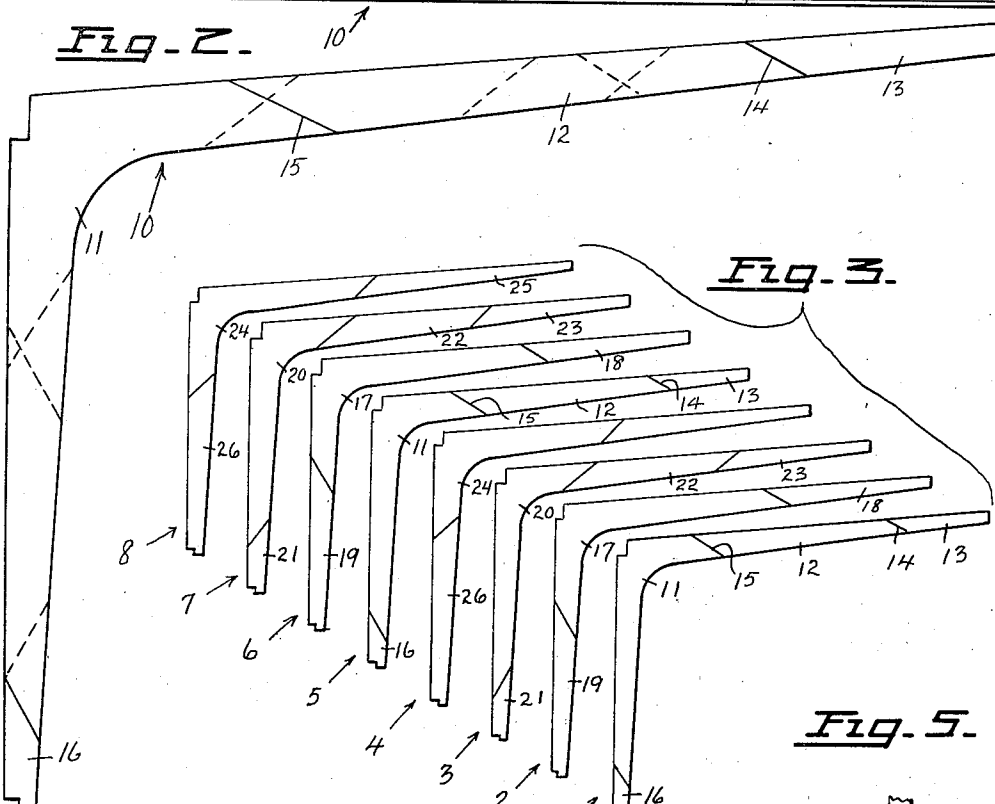


Fig. 3.

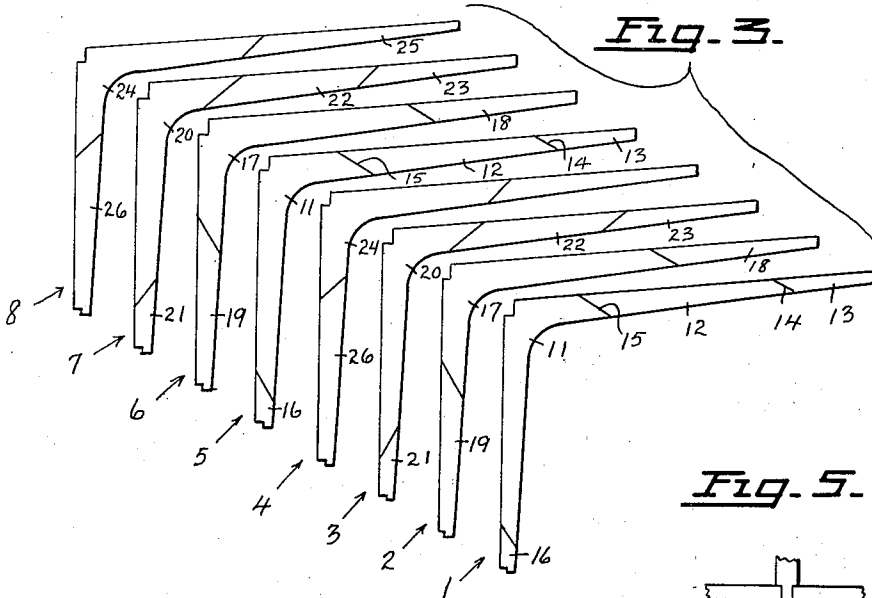


Fig. 5.

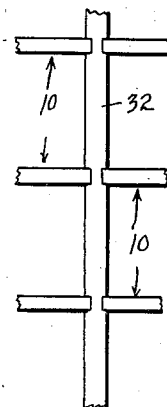
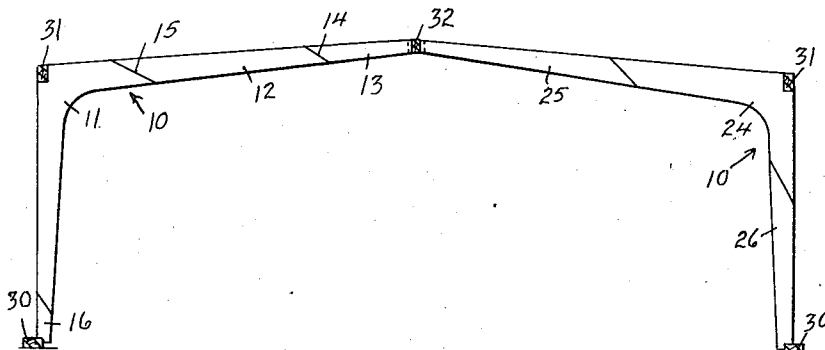


Fig. 4.



INVENTOR.

BY ERNEST J. KUMP, JR

Bozkin, Mohler & Beckley
ATTORNEYS.

UNITED STATES PATENT OFFICE

2,413,145

LAMINATED PLYWOOD ARCH

Ernest J. Kump, Jr., Millbrae, Calif.

Application July 20, 1943, Serial No. 495,425

3 Claims. (Cl. 20—2)

1

This invention relates to building construction generally, and specifically to arch construction in a building.

One of the objects of this invention is the provision of an improved arch structure made from plywood that is strong, economical to make, and that is produced without the necessity for steaming and bending the wood, and is adapted to be made from standard plywood panels free from objectionable waste.

Another object of the invention is the provision of the half arches that are adapted to be connected for forming the framework for walls and a ceiling or roof, and which half arches are adapted to be quickly modified to produce the framework for a smaller room, or a lower roof or ceiling, as desired.

Manufacturers of plywood have fairly well standardized its manufacture to rectangular, flat sheets. The number of plies in the sheets may vary from three up, and as is well known, the grain in the plies of adjacent pairs ordinarily extends at right angles to each other. Plywood is being quite extensively used at the present time in buildings. Panels are used for walls, ceilings and roofs. However, the studding and the rafters or ceiling beams and trusses are still of substantially the conventional type with all their weaknesses and limitations. By the present invention hereinafter described, I produce half arches from standard, rectangular, flat, plywood sheets without steaming or bending, and these half arches when joined at the center of the full arch which they produce, are extremely strong and the curve at the juncture between the column and the beam of each half arch can be relatively flat or very sharp, as desired, which is practically impossible to produce by steaming and bending of plywood.

In the drawing,

Fig. 1 is a plan view of a half arch.

Fig. 2 is an elevational view of a half arch.

Fig. 3 is an elevational view of a number of layers of plywood strips ready for gluing their flat sides together to form the half arch of Figs. 1, 2.

Fig. 4 is a sectional view illustrating a pair of half arches, such as shown in Fig. 2, joined to provide a full arch.

Fig. 5 is a fragmentary plan view of the ridge piece at the adjacent ends of the half arches of Fig. 4.

In detail, each half arch is made from strips of plywood cut from standard rectangular sheets of the latter. For example, in Fig. 3 is shown eight half arches, each of which is a single layer

2

of plywood, and which are generally numbered 1 to 8, each layer forming a half arch of exactly the same shape and contour, so that the layers can be laid one on the other in a pile with glue between their adjacent flat sides to produce the full half arch of Figs. 1, 2, generally designated 10.

Referring to Fig. 3 again, and to the layer 1 thereof, it will be seen that this layer 1 comprises a corner piece 11 that joins the generally horizontally extending beam strip with the vertically extending column of the layer. In using the term "beam," I refer to that portion that forms the upper portion of an arch and that is adapted to constitute the roof or ceiling framework, such as would correspond to beams or rafters, while the term "column" refers to that portion that is adapted to form the framework for the walls and generally corresponding to studding.

The beam portion of layer 1 is made of longitudinally aligned strips 12, 13 that are cut diagonally relative to their longitudinal axes and at their adjoining ends to form a joint 14, while strip 12 and the corner piece 11 are also joined along diagonal line 15.

The column of the layer 1 is mostly integral with the corner piece, but the lower end comprises strip 16 in longitudinal alignment therewith, and this strip 16 also is cut off diagonally at its end adjacent the downward extension of the corner piece for joining to a correspondingly cut end edge of said extension. This joining of the strips of each layer with each other or with the corner piece along diagonal lines relative to the longitudinal axes of the strips being joined, is very important.

Layer 2 has a cornerpiece 17, and a strip 18 for the beam portion and a strip 19 for the column.

Layer 3 has a corner piece 20, column strip 12, beam strips 22, 23, in which the diagonally cut ends of the beam strips follow lines that extend oppositely to lines 14, 15 of arch 1.

Layer 4 has a corner piece 24, beam strip 25, and column strip 26.

While these four half arches, or two or three of them could be glued together to form a single half arch, I preferably duplicate the half arches where as here, eight are used. Hence, half arches 5, 6, 7, 8 are identical with half arches 1, 2, 3, 4 and are arranged so that half arches 1, 8 are outermost, and half arches 4, 5 are together at the center of the half arch.

When the layers of plywood strips are glued together, the strips in adjacent pairs of layers are of unequal lengths so that the strips in one

3

layer will substantially extend across the adjoining ends of the strips in the layer adjacent thereto. This is very important to providing strength in the half arch.

The strips of layers 5 to 8 being the same as the strips of layers 1 to 4, respectively, the same numbers will be used in layers 5 to 8 as are used for identifying the strips of layers 1 to 4.

After the layers 1 to 8, or any desired number thereof, are glued together to provide half arch 10, the lower ends of the column portion may be notched for fitting over a floor plate 30 (Fig. 4) and also the corner piece may be notched for a stringer or plate 31. A ridge piece 32 may be notched (Fig. 5) for the adjacent ends of the half arches, and when the half arches are so secured together they will provide full arches as seen in Fig. 4.

The following specifications are purely illustrative, but constitute satisfactory structure. A laminated half arch made up of eight layers of $\frac{3}{8}$ inch plywood strips provides arches that are extremely strong, in which each beam portion is about twelve feet long and each column is between eight and nine feet long with the curve of the arch coincident with a line inscribed about substantially a one foot radius. The width of the column portion in the plane of the half arch may be about 5 inches at the foot end thereof, and the free end of the beam portion may be about four and one-half inches in vertical thickness. The thickness of the half arch in the other dimension may be about two and five-eighths inches. The span of the full arch is about twenty-four feet, and any number of arches, say about four feet apart, can be used for making the framework of as long a room as is desired.

In the event smaller rooms are desired, it is obvious that the beam portion of each half arch 10 can be equally cut off at the outer end to shorten the beam portions to the desired length, and the columns can also be cut off at their lower ends if a lower ceiling or roof is desired.

The forming of each half arch from strips of plywood as above described, enables cutting the strips forming each layer from rectangular plywood sheets without appreciable waste, and the resultant half arches are as strong, if not stronger, than they would be were they each completely cut from a single sheet of plywood, were it possible to do so.

Also, this construction enables the making of as sharp a curve as may be desired at the juncture between the arch ribs and legs. Attempts to bend plywood transversely of the planes of the plies thereof to form half or full arches is not only too costly to be practical, but it is impossible to make an arch having a curve developed about a relatively short radius, such as shown herein, and at the same time produce an arch or half arch of the desired strength.

The arch illustrated in Fig. 4 is generally called a two-hinge arch, as the ridge piece 32 provides a fixed joint between the halves of the arch, but these adjacent ends of the beam portions of the half arches may be pinned together to provide three-hinge arches, without departing from the invention.

In some instances only a single row of half arches are used in a building to form the beams and columns of a porch, or the like, along one side of the main building.

4

Having described the invention, I claim:

1. An arch frame in a building comprising a row of spaced arch members, each of said members being a pair of half arches respectively having a vertically extending leg and an arch rib integral therewith extending generally horizontally from the upper end of such leg, the juncture between the leg and rib of each half arch providing a shoulder and the said shoulders of the half arches being notched on their outer sides relative to the inside of the arch formed by each pair to provide an upwardly and laterally opening recess in each half arch for receiving a stringer, a pair of parallel elongated stringers fitted in the said notches along opposite sides of the frame formed by the said half arches, said stringers being substantially flush along their upper sides with the upper surfaces of said arch ribs and the sides of the stringers facing laterally outwardly of said half arches being substantially flush with the laterally outwardly facing surfaces of said legs whereby said upper and laterally outwardly facing sides of said stringers will coact with the said surfaces of said arch ribs and legs for engaging flat roof and side walls to be carried on said surfaces.

2. A structural half arch comprising a vertically extending leg portion, an inclined arch rib portion, and a shoulder portion integrally joining said leg and arch rib portions, said half being made up of a plurality of pairs of plywood strips of uniform thickness glued together and positioned with their flat sides parallel with the plane of said half arch, the strips of each pair being alternately disposed relative to strips of others of the pairs, the width of the respective strips in said shoulder portion being the full thickness of said shoulder portion in the plane of the arch and the ends of the adjacent pairs of said strips in said shoulder portion terminating at different distances within said leg and arch rib portions in end edges that extend diagonally relative to the longitudinal axes of said leg and arch portions respectively.

3. A structural half arch comprising a vertically extending leg portion, an inclined arch rib portion, and a shoulder portion integrally joining said leg and arch rib portions, said half being made up of a plurality of pairs of plywood strips of uniform thickness glued together and positioned with their flat sides parallel with the plane of said half arch, the strips of each pair being alternately disposed relative to strips of others of the pairs, the width of the respective strips in said shoulder portion being the full thickness of said shoulder portion in the plane of the arch and the ends of the adjacent pairs of said strips in said shoulder portion terminating at different distances within said leg and arch rib portions in end edges that extend diagonally relative to the longitudinal axes of said leg and arch portions respectively, the inner edges of the strips in said shoulder portion that define the inside of the arch half at said latter portion being uniformly curved and the opposite outer edges being coincident with straight lines intersecting at an obtuse angle, a notch in said shoulder portion extending transversely of said strips adjacent such intersecting lines for receiving a stringer.

ERNEST J. KUMP, Jr.