Nov. 3, 1953 C. T. JENSEN 2,657,713

WOOD CULVERT HAVING LAMINATED WALL SECTIONS

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Fig. 1.

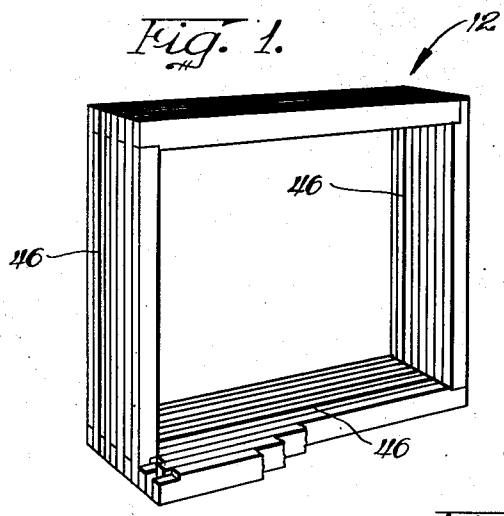


Fig. 2.

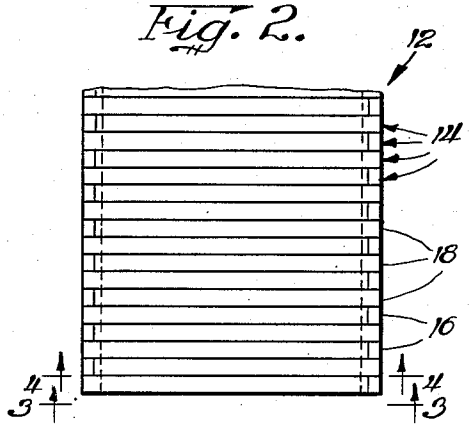


Fig. 3.

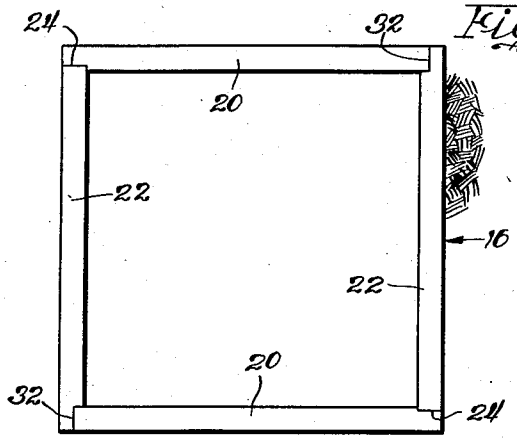


Fig. 5.

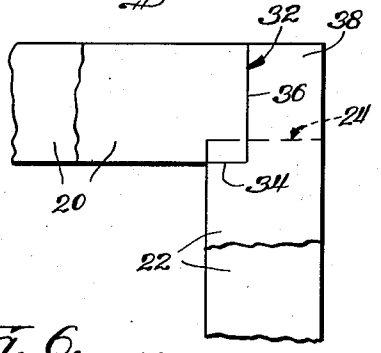


Fig. 4.

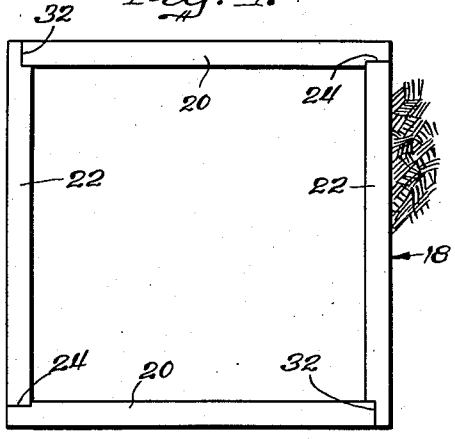
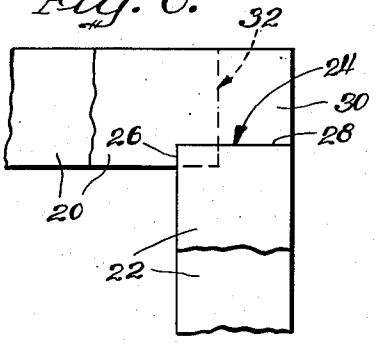


Fig. 6.



Inventor:
Carl T. Jensen.

By Bair & Freeman
attys

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WOOD CULVERT HAVING LAMINATED WALL SECTIONS

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Fig. 11.

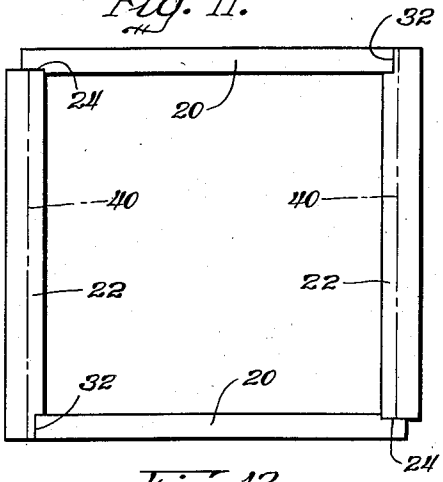


Fig. 12.

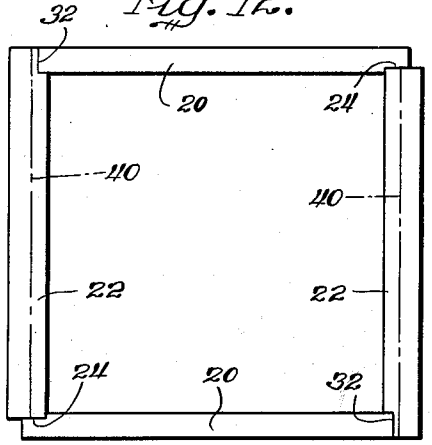


Fig. 13.

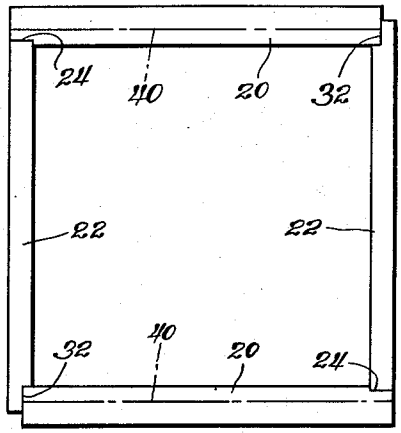


Fig. 14.

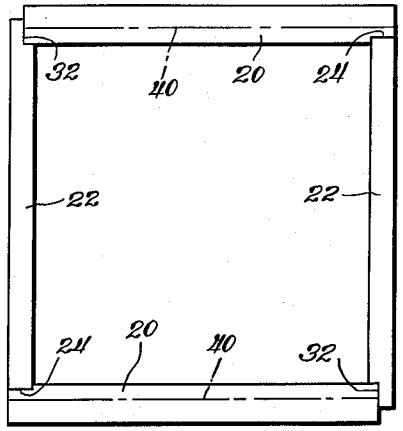


Fig. 8.

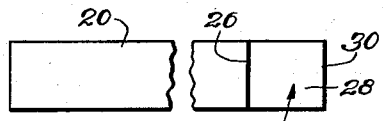


Fig. 7.

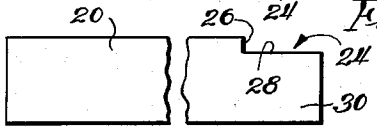
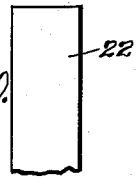
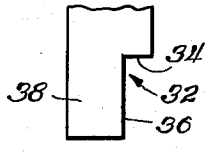


Fig. 9.



Fig. 10.





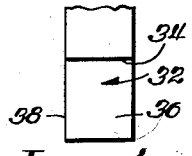
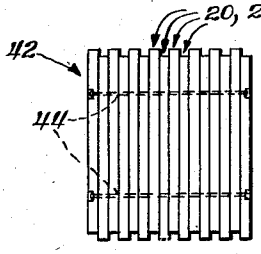


Fig. 15.



Inventor:
Carl T. Jensen.

By Baird & Freeman
attys

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WOOD CULVERT HAVING LAMINATED WALL SECTIONS

Carl T. Jensen, Minneapolis, Minn., assignor to Wheeler Lumber Bridge and Supply Co., Des Moines, Iowa, a corporation of Iowa

Application November 20, 1948, Serial No. 61,150

1 Claim. (Cl. 138—79)

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This invention relates to wood culverts having laminated top, bottom, and side walls, each of which is made up of pieces disposed side by side, and the culvert itself being thereby laminated.

An object of the present invention is the provision of novel joints between the pieces forming the respective walls.

Another object is the provision of novel joints between the pieces making up the culvert whereby certain pieces are mutually interchangeable.

A further object is the provision of novel joints whereby pieces of any size can be employed interchangeably with pieces of other sizes.

A still further object of the invention is the provision of a culvert made up of laminated wall sections in which pieces of selected sizes can be employed as desired in any of the walls of the culvert according to the different pressures to be exerted thereagainst in the completed and installed culvert.

With these and other objects in view, my invention consists in the construction, arrangement and combination of the various parts of my device whereby the objects contemplated are attained, as hereinafter more fully set forth, pointed out in the claim and illustrated in the accompanying drawings, in which:

Figure 1 is a perspective view of a culvert made according to the present invention;

Figure 2 is a plan view of a portion of the culvert;

Figure 3 is an end view taken on line 3—3 of Figure 2;

Figure 4 is a view taken on line 4—4 of Figure 2;

Figure 5 is an enlarged detailed view of the upper righthand corner of Figure 3;

Figure 6 is an enlarged detailed view of the upper righthand corner of Figure 4;

Figure 7 is an enlarged detailed view of one of the pieces making up the top and bottom walls of the culvert;

Figure 8 is a top view of Figure 7;

Figure 9 is an enlarged detailed view of one of the pieces making up the side walls of the culvert;

Figure 10 is a view of the right of Figure 9;

Figures 11 and 12 are views similar to Figures 3 and 4 showing the pieces making up the side walls of enlarged dimension;

Figures 13 and 14 are views similar to Figures 3 and 4 showing the pieces making up the top and bottom walls of enlarged dimension; and

Figure 15 illustrates the manner in which a

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group of pieces making up a wall are secured together to form a section.

Referring in detail to the drawings, the culvert is illustrated as a whole at 12 and shows portions of certain of the walls omitted for purposes of illustrating the manner in which the various walls are secured together. The culvert is made up of a large number of laminations or rings as indicated generally by the reference numeral 14. Each lamination 14 is in the shape of a rectangular ring so termed for convenience, the shape of which is illustrated in Figures 3 and 4. Certain of the laminations are indicated at 16 and others at 18. The laminations 16 and 18 are positioned alternatively along the length of the culvert and when so positioned side by side make up a continuous tubular formation.

One of the rings 16 is illustrated in Figure 3 and as there shown is made up of top and bottom pieces 20 and side pieces 22. The top and bottom pieces 20 are identical but are positioned oppositely with respect to each other and the same is true of the pieces 22. The latter pieces are identical but are positioned oppositely with respect to each other. One of the pieces 20 is illustrated in detail in Figures 7 and 8. The piece 20 includes an elongated main portion having a notch 24 cut in one end. The notch 24 is cut down from the surface of the piece 20 which is to form the inner surface of the culvert. A shoulder 26 is formed by the notch as well as a surface 28 disposed at right angles thereto. The notch 24 thus forms a reduced end portion 30. The shoulder 26 is disposed parallel with the end surface of the piece 20 and similarly the surface 28 is disposed parallel to the edge surfaces or in other words the notch 20 is rectangular in formation for the reception of a squared end piece. The notch 24 may also be referred to as a dap. It is significant to point out here that the depth of the notch 24, that is, the vertical dimension or the height of the shoulder 26, is shallow with respect to the thickness of the piece 20 or the vertical dimension as illustrated in Figure 7.

One of the pieces 22 is illustrated in Figures 9 and 10. The piece 22 includes an elongated main portion having a notch 32 cut out at one end. The notch 32 includes a shoulder 34 and another surface 36 disposed at right angles thereto. In this case also the notch 32 is rectangular in shape so that the shoulder 34 and surface 36 are disposed parallel to corresponding surfaces of the piece 22.

The depth of the notch 32 or the horizontal

dimension as viewed in Figure 9 is larger than the corresponding dimension in the notch 24. The purpose of the difference in dimensions of the notches will be pointed out later.

For purposes of describing the relation between the pieces reference will be made to Figures 3 and 4 although the practical way of constructing the culvert will be described later.

A bottom piece 20 is disposed in horizontal position as illustrated in Figure 3 with the notch 24 at the right and with the piece turned on edge. A piece 22 is disposed in the notch 24 with its squared end fitted in the notch. On the other side of the culvert a piece 22 is disposed with the notch 32 therein directed downwardly and fitted over the squared end of the bottom piece 20. The top piece 20 is then fitted on the side pieces with the squared end of the top piece fitted in the notch 32 in the side piece at the right and the notch 24 fitted over the squared end of the side piece 22 at the left.

The ring 18 shown in Figure 4 is made up of identical pieces as the ring 16, but in the ring 18 all of the pieces are respectively turned end for end. The bottom piece 20 is disposed with the notch 24 therein at the left and it will be seen that all of the other pieces in the ring are disposed in position opposite to those illustrated in Figure 3.

The culvert is made up of a succession of alternatively disposed rings 16 and 18. The two ringe are congruent in outline both on their outer surface and their inner surface and when they are disposed side by side the notches in the respective pieces are in no case superimposed one upon the other. Figure 5 illustrates one corner of the ring 16 with the ring 18 positioned behind it. The notch 32 has surfaces extending to the right and upwardly while the notch 24 has surfaces extending upwardly and then to the right so that the surfaces of the two notches are displaced with respect to one another. Figure 6 is an illustration of an extension of the same idea. If the ring 18 forms the end of the culvert the ring 16 therebehind is disposed so that the notches are displaced with respect to each other.

The various pieces making up the walls of the culvert are designed to withstand whatever loads are imposed by the pressure of the ground. The greatest force is of course exerted vertically and the effect thereof on the side walls thereof is mostly a crushing force. The side walls usually involve no difficulty in their design to withstand the crushing force. However, the top pieces or those pieces making up the top wall must withstand forces in a direction perpendicular to their length. To this end it is desirable that the least amount of material be cut away therefrom. Thus, the shallow depth of the notches 24 in the top pieces. With such shallow notches being a small fraction of the thickness of the piece the strength at the middle of the piece is not impaired. The bottom piece 20 is cut away to the same extent as the top piece so that the top and bottom pieces are readily interchangeable.

The notches 32 are cut deeper so as to form shoulders 34 of greater dimension. The shoulders 34 rest on the top and bottom pieces and since they are of greater dimension the top and bottom pieces are provided with greater bearing surface. Although the ends 38 are of lesser dimension than the corresponding ends 30 of the top and bottom pieces, these ends are of sufficient strength to withstand the lateral forces imposed on the side walls by the ground. The side pieces 22 as mentioned above are all identical so that they may be positioned on either side indiscriminately.

Figures 11 and 12 illustrate that feature whereby pieces 22 may be employed which are of greater dimension than the top and bottom pieces 20. In those cases where lateral pressures are relatively great pieces 22 of greater dimension are employed. In the illustration the dimension of the pieces 22 (in the direction of the thickness of the walls) are greater than the length of the notches 24. It will be observed that the pieces 22 extend laterally beyond the ends of the top and bottom pieces. The same condition holds true in both rings 16 and 18—Figure 11 illustrating a ring 16 and Figure 12 a ring 18. The pieces 22 of greater dimension in this illustration are of course employed throughout the length of the culvert.

In those cases where vertical pressures are relatively great the top and bottom pieces 20 are of greater dimension. Figure 13 illustrates pieces 20 which are of greater vertical dimension and as such extend vertically above the corresponding notches 32 in the side pieces. The same is true with respect to the ring 18 illustrated in Figure 14 from which it will be seen that regardless of which way the individual pieces are turned a perfect fit is accomplished in all cases.

The dot-dash lines 40 in Figures 11 to 14 represent that the respective pieces may be of lesser dimension than illustrated in the first part of the description. If it is found that the respective forces are relatively light the pieces may be of smaller dimension in any of the cases and although some pieces may be smaller than others they fit in the respective notches in the same manner.

The joints formed by the respective notches and inter-fitting ends are thus adapted to pieces of any size. It is not necessary that all of the pieces for any given culvert be predesigned. Any piece of any dimension will fit in a culvert with any other pieces of any other dimensions. All of the pieces making up any culvert are precut and placed in stock and none of them are designed so as to fit only with other pieces of a particular size. After the forces which will come into play on the culvert are calculated, pieces of the desired length and width are picked and fitted together with the other pieces and regardless of the dimensions of the other pieces they will all fit together perfectly.

The dimensions of the pieces illustrated in Figures 3, 4, and 7 to 10 may be considered as "standard." These dimensions are only a starting point for calculations and in no way limit the applicability of the invention. The width of the various pieces is the same as the length of the notches, that is, that dimension represented by the surfaces 28 and 36. In this instance, the culvert will be regular in outline on both the outer and inner surfaces. However, I wish to emphasize that this reference to "standard" pieces is in no way limiting, but is employed only as a criterion or norm for comparison of larger and smaller pieces. Thus, in Figures 11 to 14 it is clearly illustrated and pointed out that pieces of any dimensions whether larger or smaller than "standard" are equally applicable to all other pieces whether standard or otherwise.

The dimension of the various pieces in the di-

rection longitudinally of the culvert may be any desired dimension since this dimension in no way affects the construction of the culvert or the way in which the pieces are put together. When the laminations are positioned side by side in the culvert there is no one point which is relatively weak with respect to another point in the culvert. Take as an example the lower righthand corner. In the rings 16 the side piece 22 under the influence of the ground engages the shoulder 26 and as such the full cross sectional dimension of the side piece is supported by the shoulder. In the ring 18 right next to it the side piece 22 has the reduced end 38 engaging the righthand end of the bottom piece. Only that portion which is cut away by the notch 32 can in any way affect the strength of the side piece. However, this portion is small and the strength of the side piece at the central part thereof is not impaired. The same condition holds true at every corner of the culvert. Thus, alternate pieces are engaged fully by the pieces in the adjacent wall and the intermediate pieces are engaged by an amount which is only slightly less than the full amount.

The practical method of assembling the culvert involves making up a plurality of individual sections. Figure 15 illustrates a section 42 which is made up of alternate pieces 20 (or 22). The pieces are then bolted together by means of bolts 44 with the heads of the bolts flush with the surfaces of the outermost pieces. After sections 42 are made up they are assembled together to form the culvert. A plurality of sections for the bottom are laid down. Then sections forming the side walls are put in place in staggered relation with respect to the bottom so that the juncture between the sections in the side walls does not coincide with the juncture of the sections in the bottom wall. The same is true of the top wall in which the sections are also staggered with respect to the sections in the side walls and if preferred they can also be staggered with respect to the sections in the bottom walls. The heavy lines 46 indicate the juncture between the sections and it will be noted that these junctures are staggered around the culvert.

While I have herein shown and described a particular embodiment of my invention, it will be understood of course that I do not wish to be limited thereto, since many modifications may be made; and I therefore contemplate by the claim appended hereto to cover any such modification or substitution of mechanical equivalents as fall within the true spirit and scope of my invention.

I claim:

A culvert made up of top, bottom, and side wall sections, each of said sections being laminated and made up of pieces disposed side by side, each piece having an inner surface, an outer surface, opposed end surfaces, and disposed side surfaces, each piece in each section having a notch cut therein at only one end and in the inner surface thereof, each notch having two walls, one of which is parallel to the inner surface and the other wall being perpendicular to said one wall, and each notch opening out of the end of the piece, adjacent pieces in each wall section being arranged with said notches disposed at alternately opposite ends of said wall section, the end of each piece opposite the end with said notch therein being positioned in the notch of one of the pieces of a section of the adjoining wall, each piece overlapping the notch formed in the adjacent piece and engaging the side of the piece in the adjoining wall which enters the notch in said adjacent piece, and means extending through a plurality of said pieces clamping said pieces together to form one of said wall sections.

CARL T. JENSEN.

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