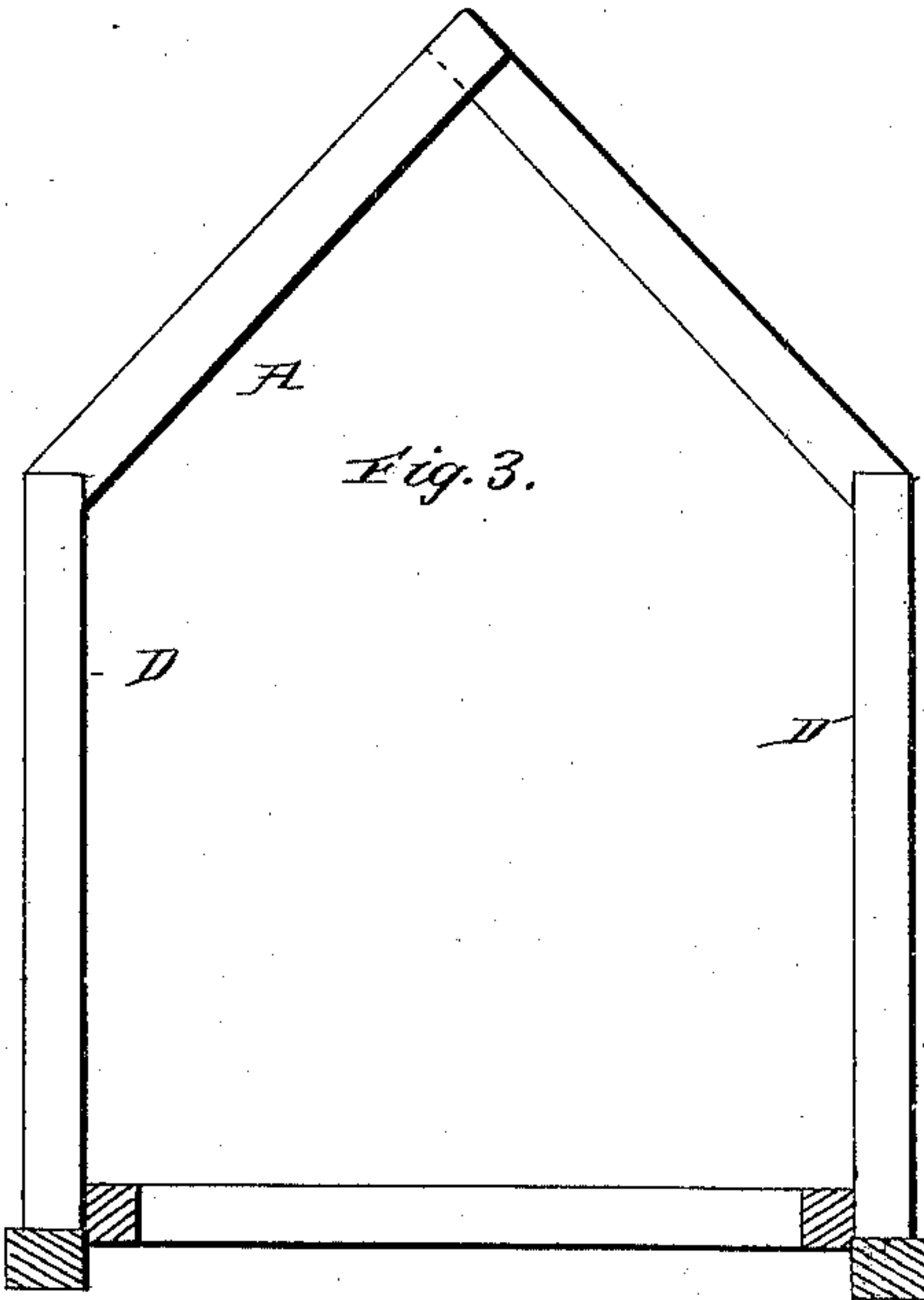
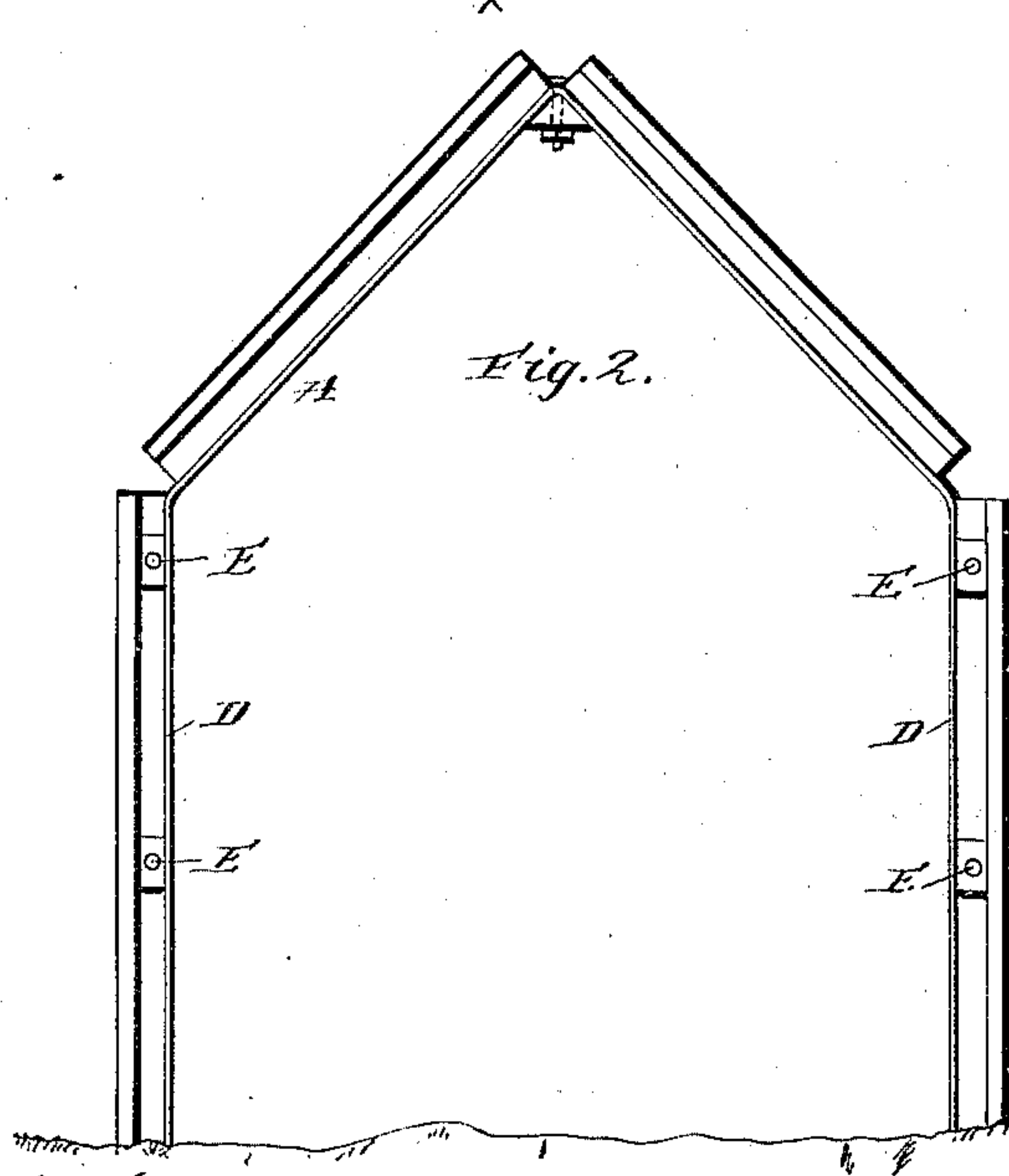
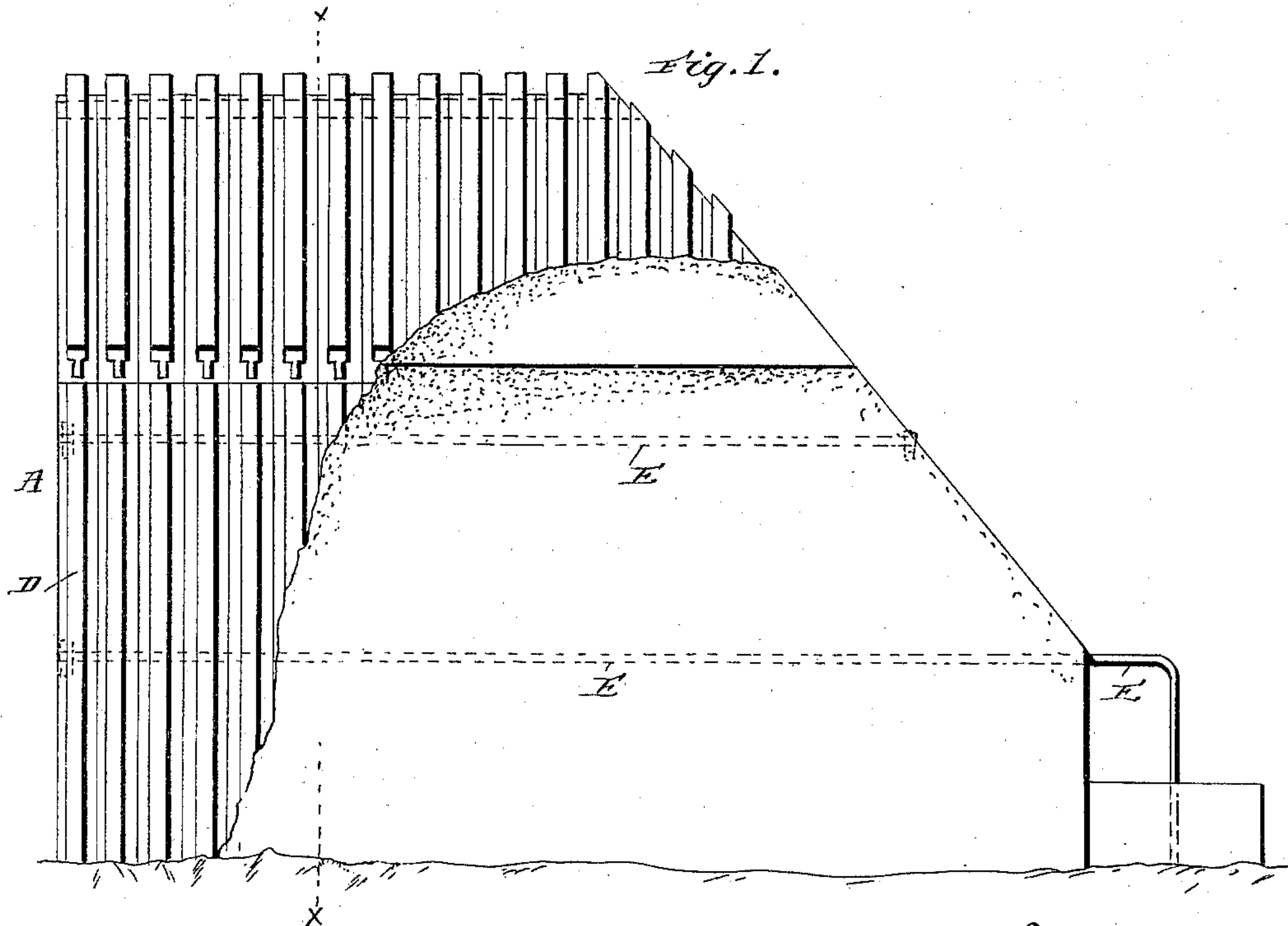


(No Model.)

W. D. HARRIS.  
ROOFED CULVERT.

No. 445,994.

Patented Feb. 10, 1891.



Witnesses.  
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# UNITED STATES PATENT OFFICE.

WILLIAM DALE HARRIS, OF OTTAWA, ONTARIO, CANADA.

## ROOFED CULVERT.

SPECIFICATION forming part of Letters Patent No. 445,994, dated February 10, 1891.

Application filed November 18, 1890. Serial No. 371,802. (No model.) Patented in Canada December 2, 1889, No. 32,981.

*To all whom it may concern:*

Be it known that I, WILLIAM DALE HARRIS, a citizen of the Dominion of Canada, residing at Ottawa, in the Province of Ontario, have  
5 invented certain new and useful Improvements in Roofed Culverts for Railroad and other Embankments, (for which I have obtained Letters Patent in Canada, dated December 2, 1889, No. 32,981;) and I do declare  
10 the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to roofed culverts designed to be constructed through railroad and  
15 other embankments for the passage of water; and it has for its object, among other things, to provide a construction entailing but a comparatively small expense and embodying the essential elements of strength and durability,  
20 whereby danger to passing trains arising from a collapse of the culvert is obviated.

Heretofore in the construction of culverts, whether of wood or stone, the work is begun  
25 at the bottom and built up in horizontal courses or sections toward the top. The collapse of such a construction arising from heavy freshets of water invariably begins with the bottom or foundation courses or sections.  
30 The fracture is communicated to the succeeding upper course, which in turn giving away communicates it to those above, and the courses fall and block the channel of the water, causing the water to rise and  
35 wash out the wrecked culvert and superincumbent embankment and create a chasm in the path of passing trains.

A culvert constructed in horizontal courses, as described, is adapted to resist stresses of  
40 compression alone, leaving those of tension and torsion unprovided for, and it will therefore be seen that when such a structure is suddenly subjected to the latter forces by the washing out of a portion of its foundation it  
45 immediately collapses. My improved construction renders such accidents impossible, inasmuch as it consists in the employment of vertical courses or sections instead of horizontal, whereby the culvert is begun at one  
50 end and built toward the other end, each vertical course or section constituting a complete culvert or arch in itself, capable of resisting

stresses of tension and torsion, as well as of compression, and together forming a culvert as one of one piece, flexible throughout its  
55 entire course in the three directions of length, breadth, and depth, and capable of resisting strain from below, above, and from either side.

My improvements will be fully understood from the following description and claims  
60 when taken in connection with the accompanying drawings, in which—

Figure 1 is a side elevation of a portion of my improved culvert, illustrating one end of the same. Fig. 2 is a vertical transverse sectional view taken on line *x x* of Fig. 1, illustrating one of the vertical sections of courses  
65 composing the culvert. Fig. 3 is a front elevation of a vertical section or course composed of wood.

In carrying out my invention I do not desire to confine myself to any specific form of foundation for my improved culvert nor to any particular devices for bracing and anchoring the same, as such will be varied to  
75 suit the situation and character of the embankment in which the culvert is constructed.

In the construction of my improvements the main portion A of the culvert is formed with vertical side walls and a gable roof. The respective ends of the culvert are preferably  
80 constructed as illustrated in Fig. 1, being formed of side sections of gradually-increasing height, the higher of which are provided with a portion of roof which gradually increases in length and merges into the complete side walls and roof of the culvert, and  
85 by this construction it will be seen that the ends of the culvert are made flush with the inclined sides of the embankment; but I do not desire to confine myself to this construction of the ends, as the culvert may be built  
90 out entire, if desired, and may be continued any desired distance outside the embankment.

The vertical courses or sections D, as illustrated in Figs. 2 and 3, may be constructed of wood or metal, and they consist of the vertical side walls and the gable roof, which, as is obvious, is best adapted to withstand the  
95 weight of earth upon the culvert.

Where metal is employed in the construction of the vertical courses or sections, I prefer to employ railway-rails, old or new, as



their use is desirable, as will presently appear.

In forming a section, as illustrated in Fig. 2, the rail is bent into the form shown, with the T portion thereof on the outside, and it will be seen that when the sections or courses are fastened together, as will be presently described, the T portions of the rail will form a key between which to lock the concrete, with which the outer side walls and top of the culvert is covered.

In forming the sections of wood the vertical and top walls thereof are scarfed together, as better illustrated in Fig. 3, and by reason of the peculiar construction of the culvert and the placement of the timbers of the sections the said timbers are kept permanently and uniformly damp.

In building the culvert, after the necessary excavation and foundation have been made, the metal, railway-rail, or wood sections are placed in their proper positions and are fastened together in such positions by longitudinal bars E, which, taking through their side walls adjacent to the bottom and top thereof, are bolted together by nuts and screws, and these longitudinal bars E have their ends suitably finished with threaded ends by which the vertical sections may be drawn tight together and preserved from displacement. The side walls are suitably anchored back by iron stays or buttressed by crib or stone buttresses, as the case may be.

When the ends of the culvert are formed to come flush with the inclined sides of the embankment, the lower longitudinal fastening-bars are continued through the short side walls, and are suitably fastened to prevent movement. In certain cases a longitudinal iron tie-bar runs the entire length of the culvert just under the apex, suspended from the roof and tying the whole structure together at the gable.

When railway-rails are employed in the construction of the sections or courses, I prefer to make the apertures for the passage of the longitudinal bars through the web of the T portion of said rails. After the vertical sections have been placed in position and se-

curely bolted together and suitably braced and anchored, the outside thereof is covered with a suitable concrete and the inside tarred or otherwise protected to prevent corrosion of the material.

By constructing the culvert of aggregate courses or sections suitably bound together it will be seen that I provide a flexible metallic or timber passage which, when placed upon a suitable foundation and properly braced and anchored, constitutes a culvert capable of resisting stress of compression, tension, and torsion.

Having described my invention, what I claim is—

1. A course or section of a culvert composed of a railway-rail iron, bent, as described, so as to form vertical sides and a gable top, substantially as specified.

2. A culvert composed of vertical sections, each formed of a single piece of material having parallel vertical sides and a gable or slanting top, substantially as specified.

3. A culvert composed of a series of vertical courses or sections bolted together and having an external covering of concrete and an interior coating of tar, substantially as specified.

4. A culvert composed of a series of vertical courses or sections formed so as to provide external key-seats and having vertical sides and a gable top and a covering of concrete, substantially as specified.

5. In a culvert, the combination, with a series of courses or sections having side walls and a gable roof, of longitudinal bars taking through the side walls of said sections and underneath the apex of said roof and adapted to fasten them together, and anchor-bars or buttresses taking through or built behind the side walls and serving to anchor or stay said side walls, substantially as and for the purpose specified.

In testimony whereof I affix my signature in presence of two witnesses.

WILLIAM DALE HARRIS.

Witnesses:

J. A. GEMMILL,

A. F. MAY.