

(No Model.)

J. E. ROBINSON.

WATER TIGHT BULK HEAD FOR UNDERGROUND RAILWAYS, &c.

No. 354,348.

Patented Dec. 14, 1886.

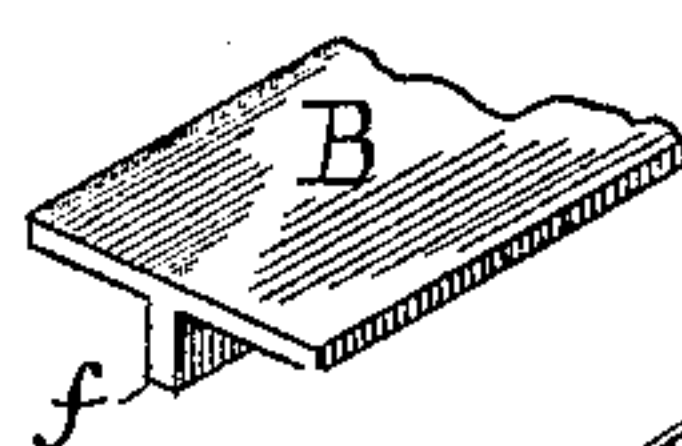
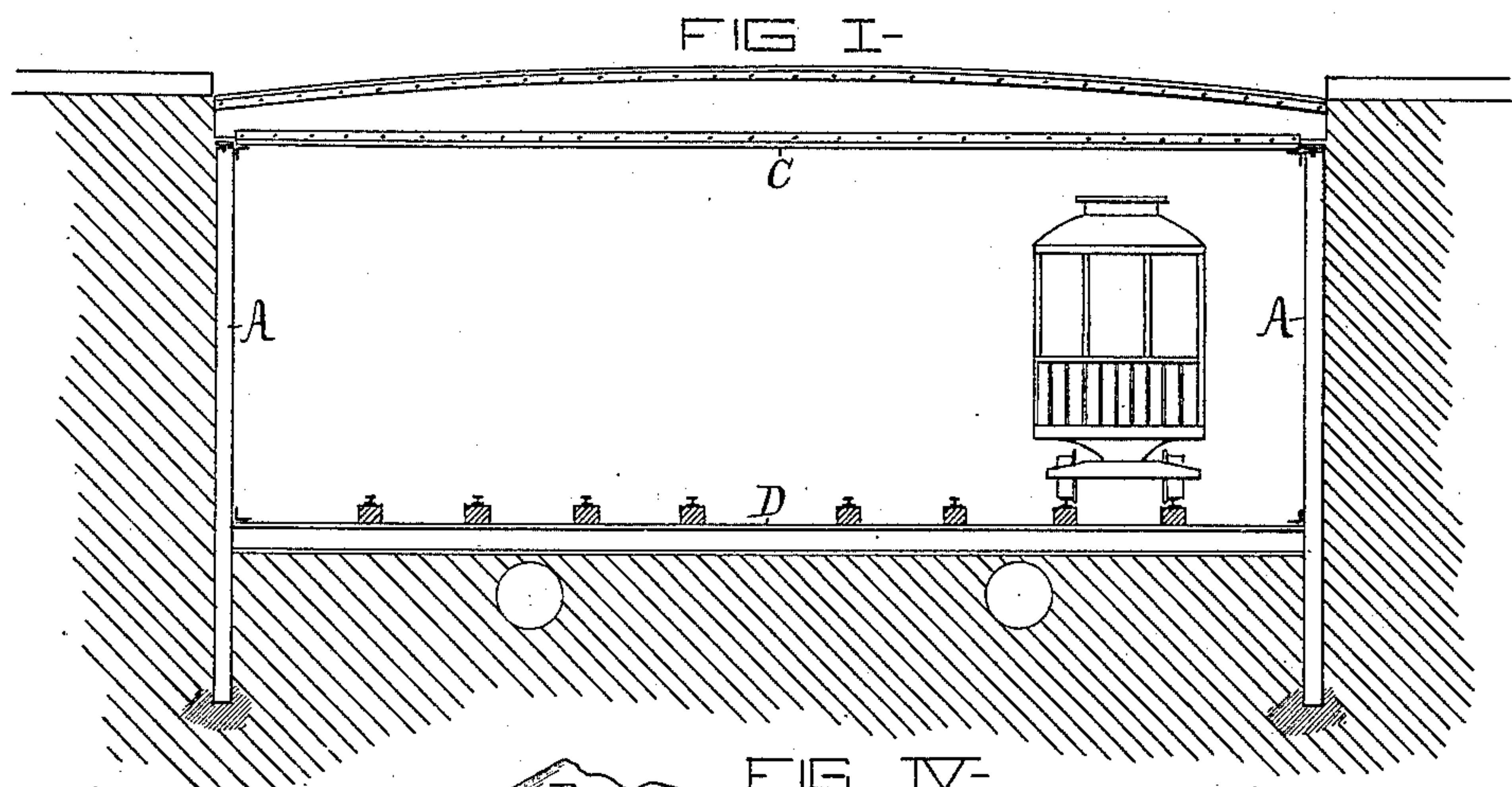


FIG II-

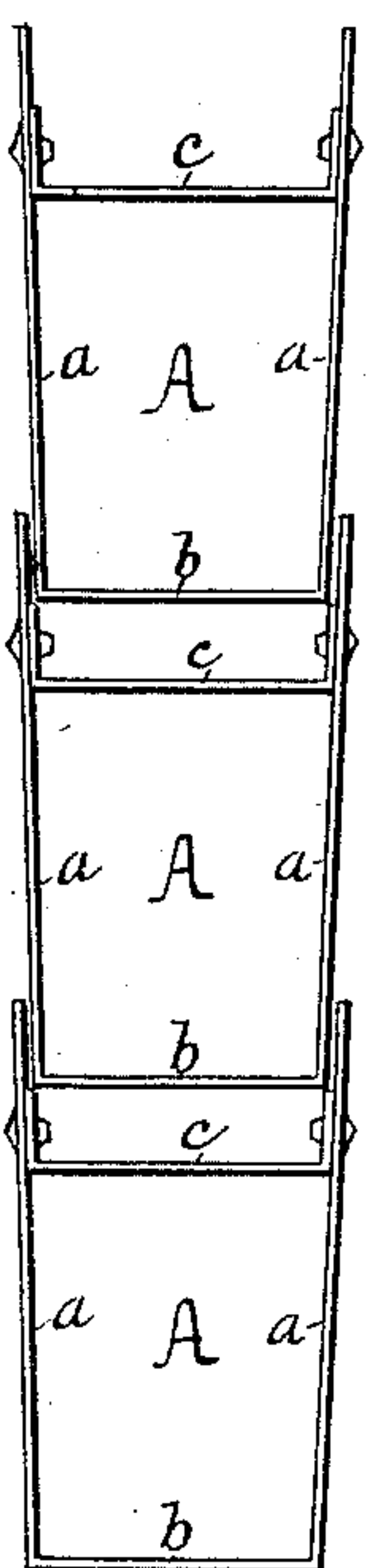


FIG III-

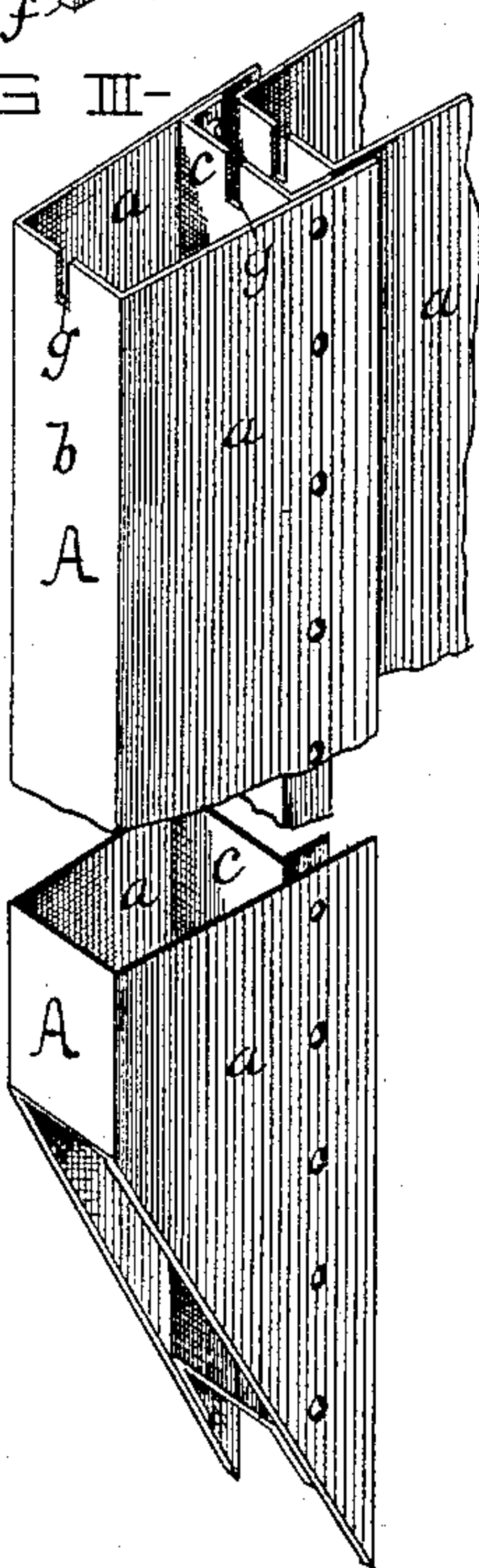
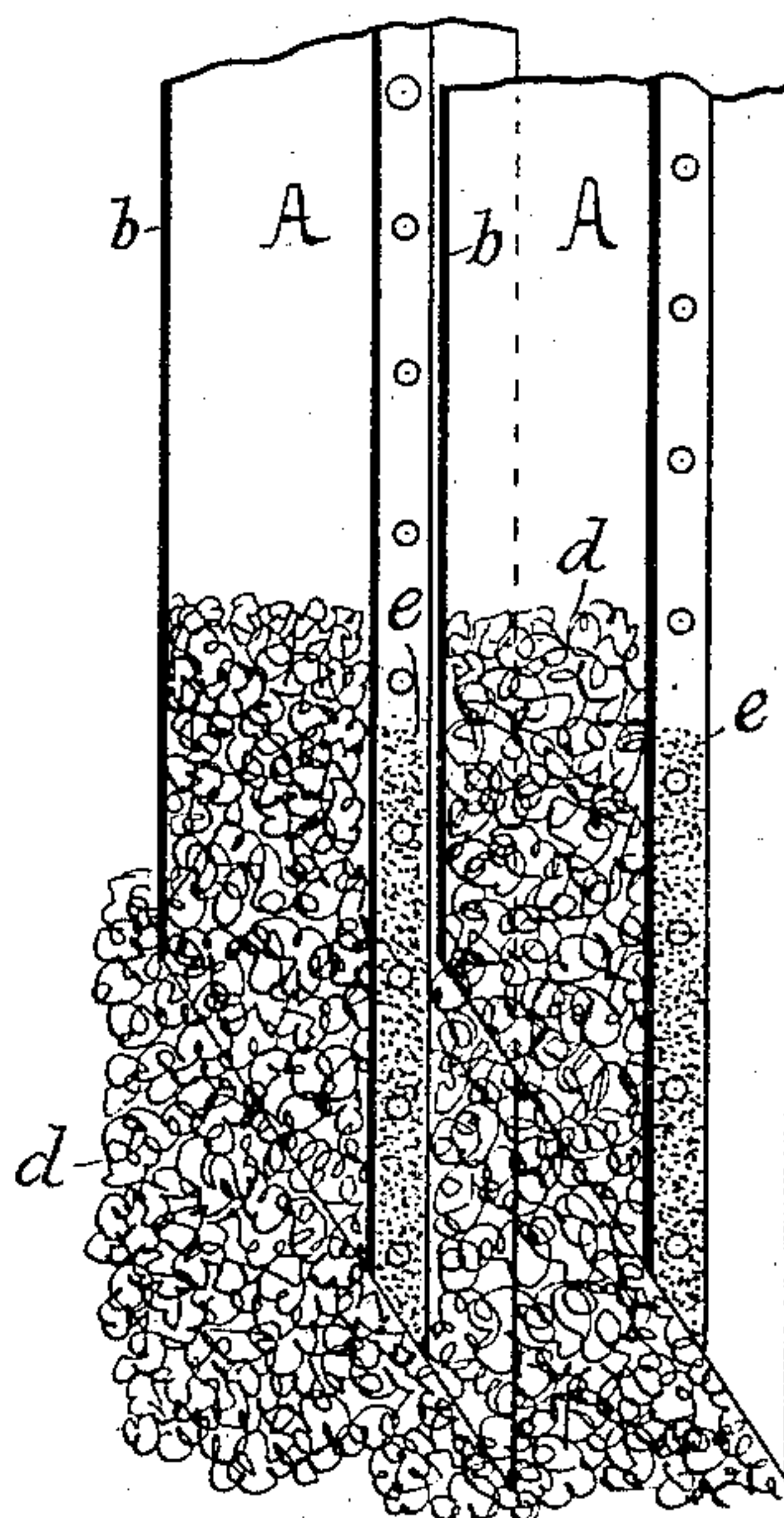


FIG V-



-WITNESSES-

*Dan'l Fisher*

*Warren Ross*

-INVENTOR-

*John E. Robinson,*  
*by G. H. Howard*



# UNITED STATES PATENT OFFICE.

JOHN E. ROBINSON, OF BALTIMORE, MARYLAND.

## WATER-TIGHT BULK-HEAD FOR UNDERGROUND RAILWAYS, &c.

SPECIFICATION forming part of Letters Patent No. 354,348, dated December 14, 1886.

Application filed August 2, 1886. Serial No. 209,772. (No model.)

*To all whom it may concern:*

Be it known that I, JOHN E. ROBINSON, of the city of Baltimore and State of Maryland, have invented certain Improvements in the Construction of Water-Tight Bulk-Heads for Underground Railways and Tunnels, &c., of which the following is a specification.

This invention relates to certain improvements in the construction of water-tight bulk-heads to be employed in underground railways, tunnels, and sewers at such places where the ground is wet by reason of its being below tide-water, or the presence of springs, as will hereinafter fully appear.

In the drawings forming a part hereof, Figure I is a transverse section of an underground railway provided with the improved water-tight bulk-heads. Figs. II, III, IV, and V are details of the invention, as will hereinafter fully appear.

A A are piles formed of plates or sheets of iron, bent longitudinally so as to form the sides *a a* and the crown *b*. The open side of each pile is closed by means of a plate, *c*, and for these plates I preferably use what are termed "channel" plates or irons, the flanges of which are riveted to the sides *a a*, as shown particularly in Figs. II and III. The channel-plate is set some distance back of the open end of the pile, in order that another pile similarly formed and constructed may be connected thereto, as shown in Figs. II, III, and V.

It will be seen by reference to Fig. II that the sides *a a* of the pile are not parallel with each other, but are flared outwardly, so as to admit of the entrance thereto of the adjoining pile. The lower end of the pile is pointed, to facilitate its driving, and the point thus formed being at the open side, the pile as it is driven is forced against the one previously driven. The piles when driven form nearly a water-tight bulk-head; but to make it absolutely water-tight the space between the crown of one pile and the channel-plate of the adjoining one is thoroughly cleansed of all the contained earth and the space thus formed filled with hydraulic cement. The cement also serves to strengthen the piles. The earth is removed from the interior of the pile when the same is in place, and also around the foot of the pile, and concrete substituted for the earth removed. By this means a broad foundation of concrete is obtained for the piles and

the same protected against collapse. The concrete inclosed within the piles is denoted by *d* and the hydraulic cement by *e*. (See Fig. V.) After the piles are all driven a cap-plate, *B*, is laid on their upper ends, and to retain the cap-plate in position it is provided with a rib, *f*, which fits into slots *g* in the heads of the piles. (See Figs. III and IV.) The earth is next removed from between the two bulk-heads to such a depth as will allow of the roof-trusses *C C* being placed in position, and secured to the bulk-heads to hold them in place.

I do not claim any invention in the construction of the roof-trusses.

The earth between the bulk heads is now dug out to the required depth, a proper proportion of the whole length of the piles being of course left embedded in the earth below the excavation, to prevent their being forced in by the external pressure of earth and water. As the excavation is completed from the ends of the tunnel, floor-beams *D* are placed on the earth, to retain the lower ends of the bulk-heads apart.

Should there be a serious influx of water from under the floor, pumps and suitable pipes can be employed to carry it off.

I claim as my invention—

1. A bulk-head for the purpose described, which consists of a series of hollow metallic piles open at one side and arranged with the closed side of one pile within the open side of the next adjoining one, substantially as and for the purpose specified.

2. A bulk head for the purpose described, which consists of a series of interlocking hollow metallic piles having dividing heads or channel-plates secured therein, substantially as specified.

3. A bulk-head for the purpose described, which consists of a series of interlocking hollow piles filled with concrete and having water-tight joints formed of metallic heads and hydraulic cement, substantially as and for the purpose specified.

4. Two bulk-heads formed of hollow interlocking piles, combined with a connecting roof-truss and floor-beams, substantially as and for the purpose specified.

JOHN E. ROBINSON.

Witnesses:

WM. T. HOWARD,  
DANL. FISHER.