

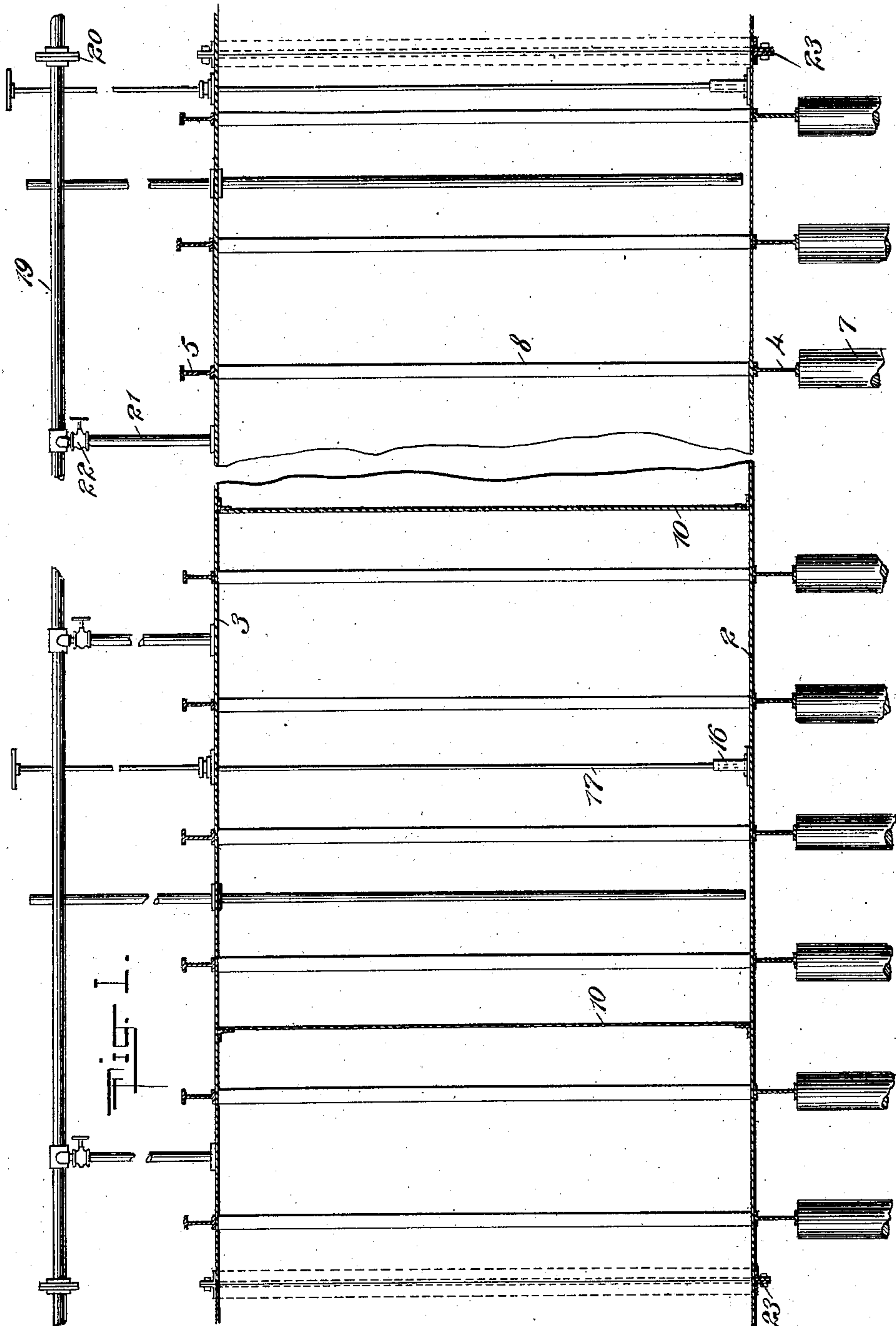
No. 751,287.

PATENTED FEB. 2, 1904.

J. L. HOLMES.  
TUNNEL CONSTRUCTION.  
APPLICATION FILED AUG. 11, 1903.

NO MODEL.

3 SHEETS—SHEET 1.



WITNESSES:

*Charles L. Ligon*  
*C. R. Ferguson*

INVENTOR

*Jesse L. Holmes*

BY

*Wm. M. M. M.*

ATTORNEYS

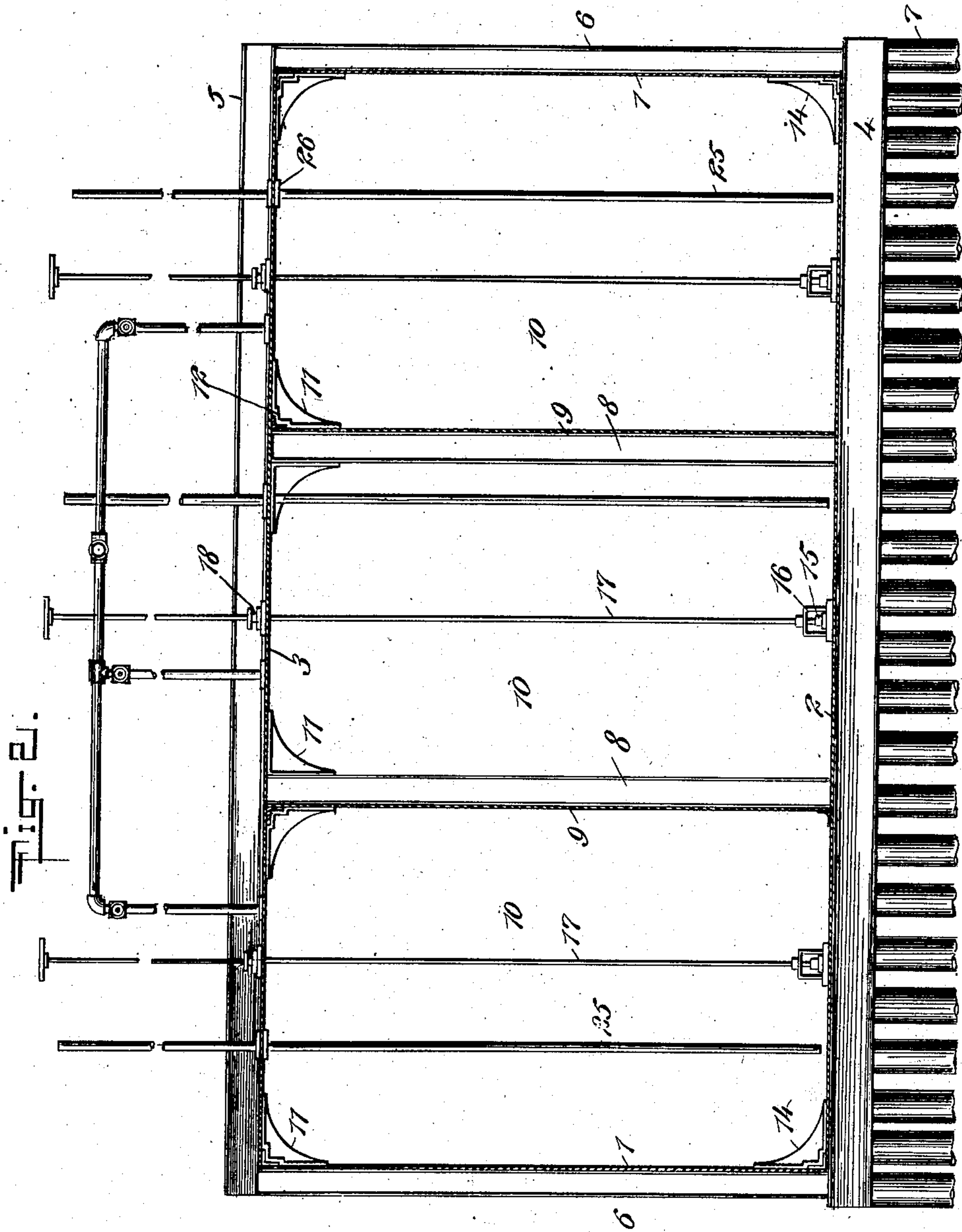
No. 751,287.

PATENTED FEB. 2, 1904.

J. L. HOLMES.  
TUNNEL CONSTRUCTION.  
APPLICATION FILED AUG. 11, 1903.

NO MODEL.

3 SHEETS—SHEET 2.



WITNESSES:  
*Charles Figaro*  
*C. R. Ferguson*

INVENTOR  
*Jesse L. Holmes*  
BY *Mumuk*  
ATTORNEYS



No. 751,287.

PATENTED FEB. 2, 1904.

J. L. HOLMES.  
TUNNEL CONSTRUCTION.  
APPLICATION FILED AUG. 11, 1903.

NO MODEL.

3 SHEETS—SHEET 3.

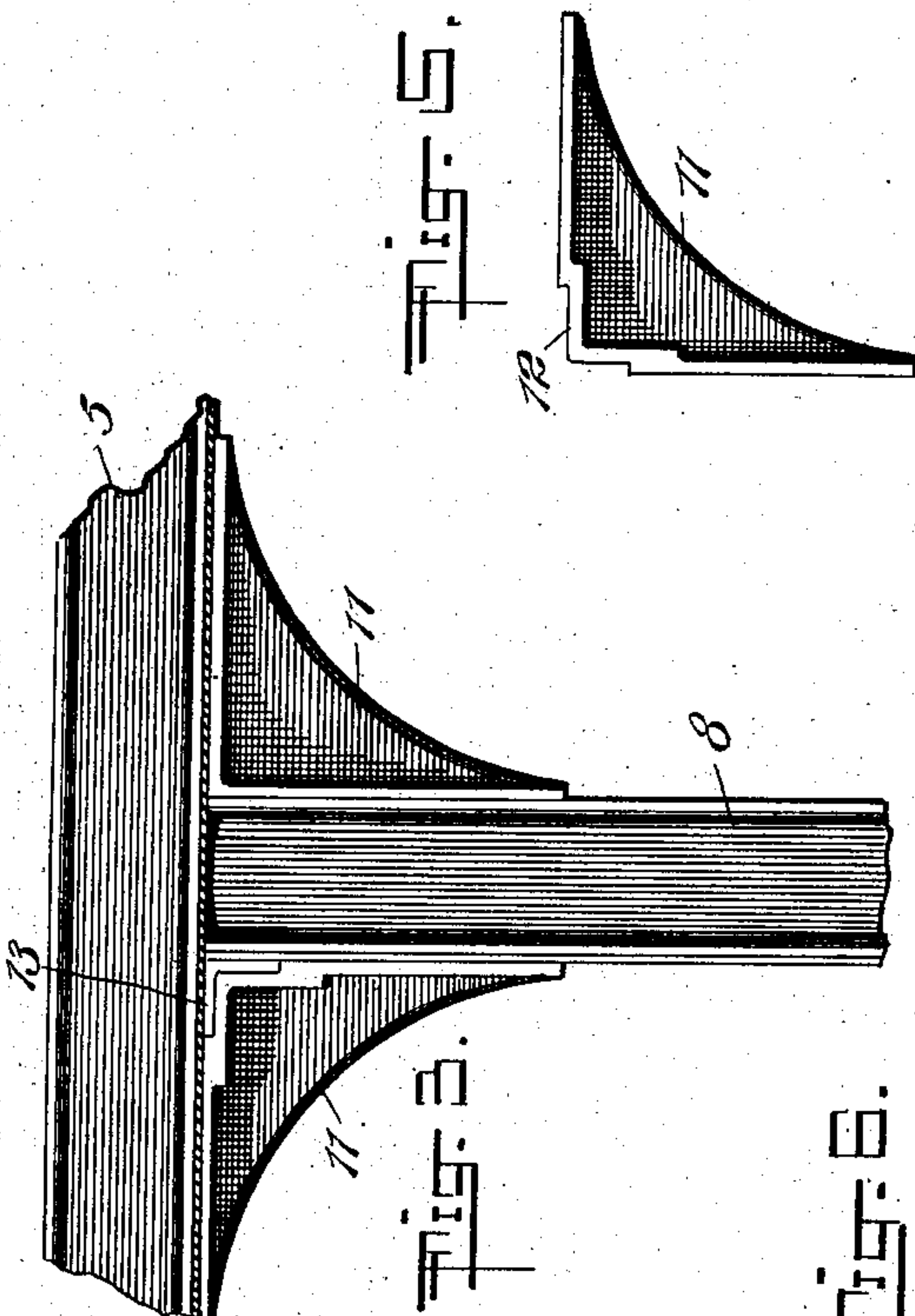
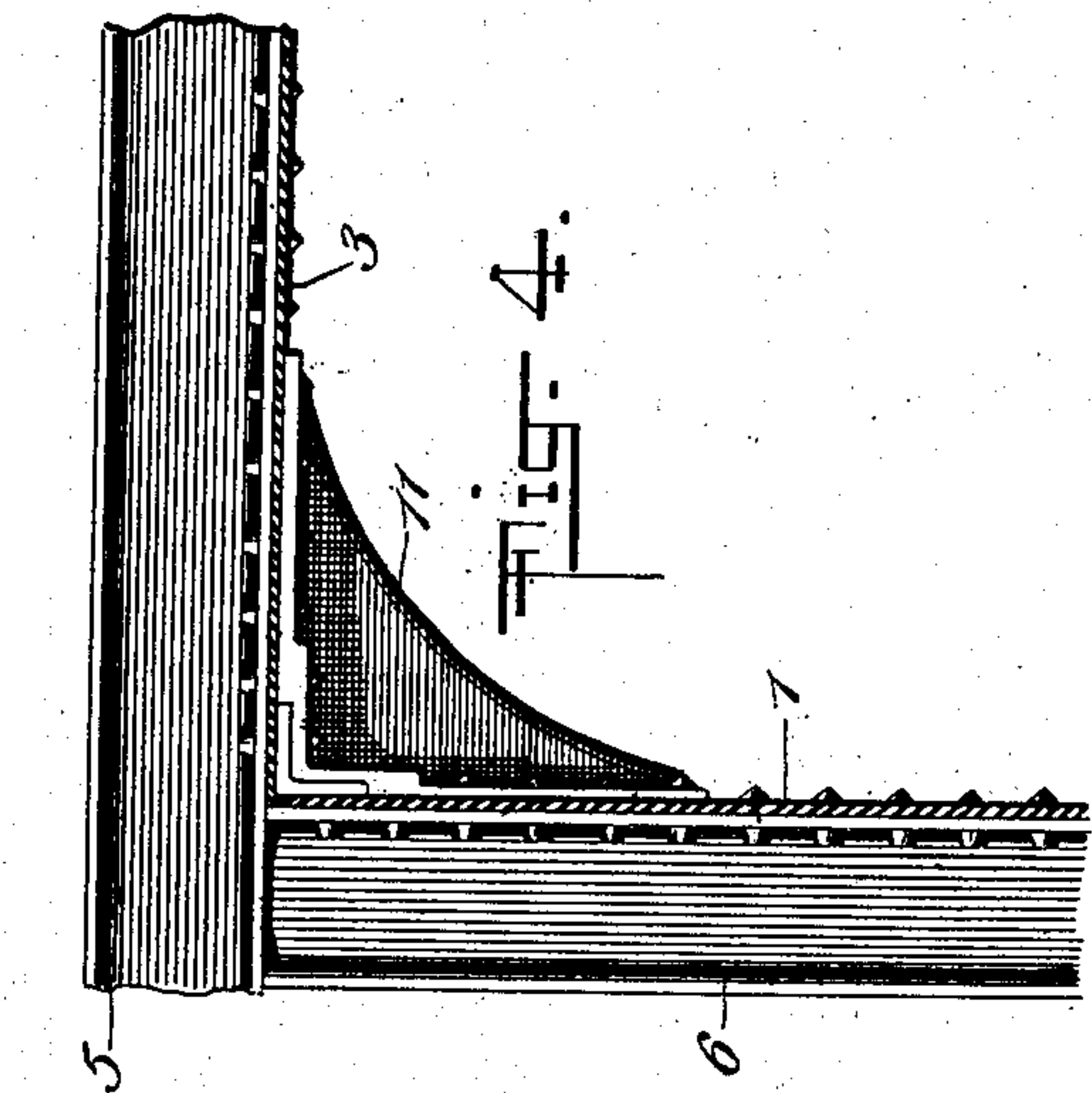
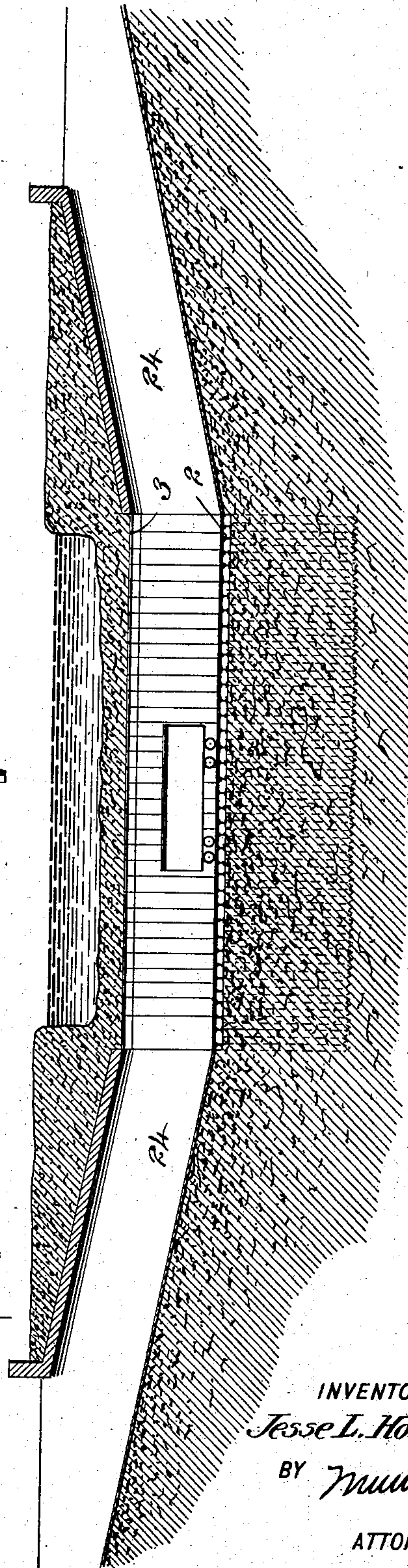


Fig. 6.



WITNESSES:  
*Charles Figaro,*  
*C. R. Ferguson*

INVENTOR  
*Jesse L. Holmes*  
BY *Mumford*  
ATTORNEYS



## UNITED STATES PATENT OFFICE.

JESSE LINCOLN HOLMES, OF BUTTE, MONTANA.

## TUNNEL CONSTRUCTION.

SPECIFICATION forming part of Letters Patent No. 751,287, dated February 2, 1904.

Application filed August 11, 1903. Serial No. 169,130. (No model.)

*To all whom it may concern:*

Be it known that I, JESSE LINCOLN HOLMES, a citizen of the United States, and a resident of Butte, in the county of Silverbow and State of Montana, have invented a new and Improved Tunnel Construction, of which the following is a full, clear, and exact description.

This invention relates to improvements in the construction of tunnels across rivers or the like, an object being to provide a novel tunnel construction by means of which the work of laying a submarine tunnel may be rapidly carried on to completion.

I will describe a tunnel construction embodying my invention and then point out the novel features in the appended claims.

Reference is to be had to the accompanying drawings, forming a part of this specification, in which similar characters of reference indicate corresponding parts in all the figures.

Figure 1 is a sectional elevation of a tunnel construction embodying my invention. Fig. 2 is a cross-section thereof. Figs. 3, 4, and 5 are details showing means for securing and bracing certain parts, and Fig. 6 is a section showing the tunnel in position.

The tunnel comprises side walls 1, a bottom wall 2, and a top wall 3, these several walls being of metal—such, for instance, as sheet-steel. Extended across the under side of the bottom wall are I-beams 4, which are connected to I-beams 5, arranged transversely on the top by uprights 6. As shown in the drawings, the bottom beams 4 rest upon spiles 7. It is to be understood, however, that when the bed of the watercourse consists of clay or other hard material the tunnel may rest directly thereon. Therefore I do not limit the invention to employing spiles.

The tunnel is made in sections, and at suitable intervals posts 8 are erected therein, and connected to these posts and extending longitudinally of the section are sheet-metal partitions 9. Extended between the two partitions and between the partitions and the outer walls 1 are bulkheads for partitions 10, and thus the section is divided into a plurality of water-tight compartments. The several uprights are firmly connected to the upper wall by

means of brackets 11. Certain of these brackets have cut-away portions 12 for receiving or extending around angle-beams 13, and preferably the said uprights or posts 6 will be connected to the bottom wall of the tunnel by brackets 14. The bottom wall in each compartment is provided with an opening normally closed by a valve 15, which has a bearing in a yoke 16, attached to the valve seat or casing. From each valve an operating-rod 17 extends upward through a stuffing-box 18 in the top wall, and this rod projects sufficiently above the water-level to be readily reached and manipulated.

Extended along and lengthwise of the tunnel is a main air-pipe 19, the sections being connected together as the tunnel-sections are connected by means of couplings 20. From this main pipe 19 branches 21 provide communication with the interior of the compartments, each branch being provided with a valve 22. The several sections of the tunnel are connected together by bolts passing through angle-beams 23, attached to the outer sides of the sections at the ends.

In placing the tunnel the water-bed is to be dredged, and then the section of the tunnel, provided the tunnel is a long one, is floated to the desired spot over the channel, and the valve 15 is opened, so as to admit water to sink the structure. After placing one section in position another section is to be lowered and attached to the first section, and this is continued until the tunnel is completed to the approaches 24. The dirt originally removed to form the trench or tunnel is to be returned or placed on top of the structure, as clearly indicated in Fig. 6. After sinking a section or the several sections the valve 15 is to be closed and air forced into the several compartments, which will cause the discharge of water through the pipes 25, which extend through the top wall and nearly to the bottom of the compartments, the outlets being above the water-level. These pipes 25 are made in sections—that is, one section extends upward from the top of the tunnel structure, while the lower section is screwed into a boxing 26. Therefore these pipe-sections may be readily



removed and the openings closed by screw-plugs upon the completion of the tunnel. Of course the cross-partitions or bulkheads are to be removed, and the longitudinal partitions  
 5 may also be removed, or they may remain, forming three chambers in the tunnel, and, in fact, a greater number of longitudinal partitions may be employed, if desired. Upon the completion of the tunnel the valves are  
 10 to be removed and the openings plugged, and the air-pipe is also to be removed.

The object of the several compartments in the sections of the tunnel is to prevent the water ballast from shifting during the sinking process. By this means the sections can  
 15 be lowered without danger of their tipping up, and thus sinking edgewise. The main purpose of the air-pipes is to lighten the sections, if necessary, in order that they may be  
 20 easily handled, and put in place before the water-bed is restored; but, as hereinbefore stated, they can be used after the earth has been replaced to expel the water from the compartments of the sections of the tunnel.

25 Having thus described my invention, I claim as new and desire to secure by Letters Patent—

1. A structure for forming tunnels comprising side, top and bottom walls of metal formed in sections, partitions extended lengthwise of  
 30 the sections, partitions extended transversely of the sections thus forming water-tight compartments, means for controlling the admission of water to the compartments, and means for discharging water therefrom.

35 2. A structure for forming tunnels comprising metal side walls, a metal top wall and a metal bottom wall, angle beams or irons extended around the outer sides of said walls, partitions dividing the tunnel-sections into  
 40 compartments, the bottom wall having an opening leading into each compartment, valves for the openings, valve-rods extended from said valves through the top wall of the tunnel-sections, water-discharge pipes, and an air-

pressure pipe communicating with the compartments. 45

3. A structure for forming tunnels comprising top and bottom walls and side walls of sheet metal, uprights or posts arranged in the tunnel, **I**-beams on which the bottom wall  
 50 rests, **I**-beams extended across the top of the structure, posts connecting the lower and upper **I**-beams, bracket connections between the uprights and upper wall of the tunnel, longitudinal partitions in the tunnel, transverse  
 55 partitions in the tunnel thus forming water-tight compartments, each compartment having an inlet for water, valves for the inlets, an outlet-pipe leading from each compartment, a main air-pipe, and valved branches leading  
 60 from said main pipe into the several compartments.

4. A structure for forming tunnels comprising top and bottom walls and side walls of sheet metal, **I**-beams on which the tunnel rests,  
 65 spiles on which the said **I**-beams rest, partitions in the tunnel dividing the same into a plurality of water-tight compartments, each compartment having an inlet for water, valves for controlling the inlets, discharge-pipes leading  
 70 from a point near the bottom of each compartment and through the top wall, and means for conducting air into the compartments.

5. A structure for forming tunnels comprising sheet-metal sections joined together, means  
 75 for admitting water to the sections for sinking the same, water-discharge pipes leading upward from the lower portions of the sections and air-pressure pipes leading into the tops of the sections. 80

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

JESSE LINCOLN HOLMES.

Witnesses:

EDWIN M. LAMB,

W. Y. PEMBERTON.