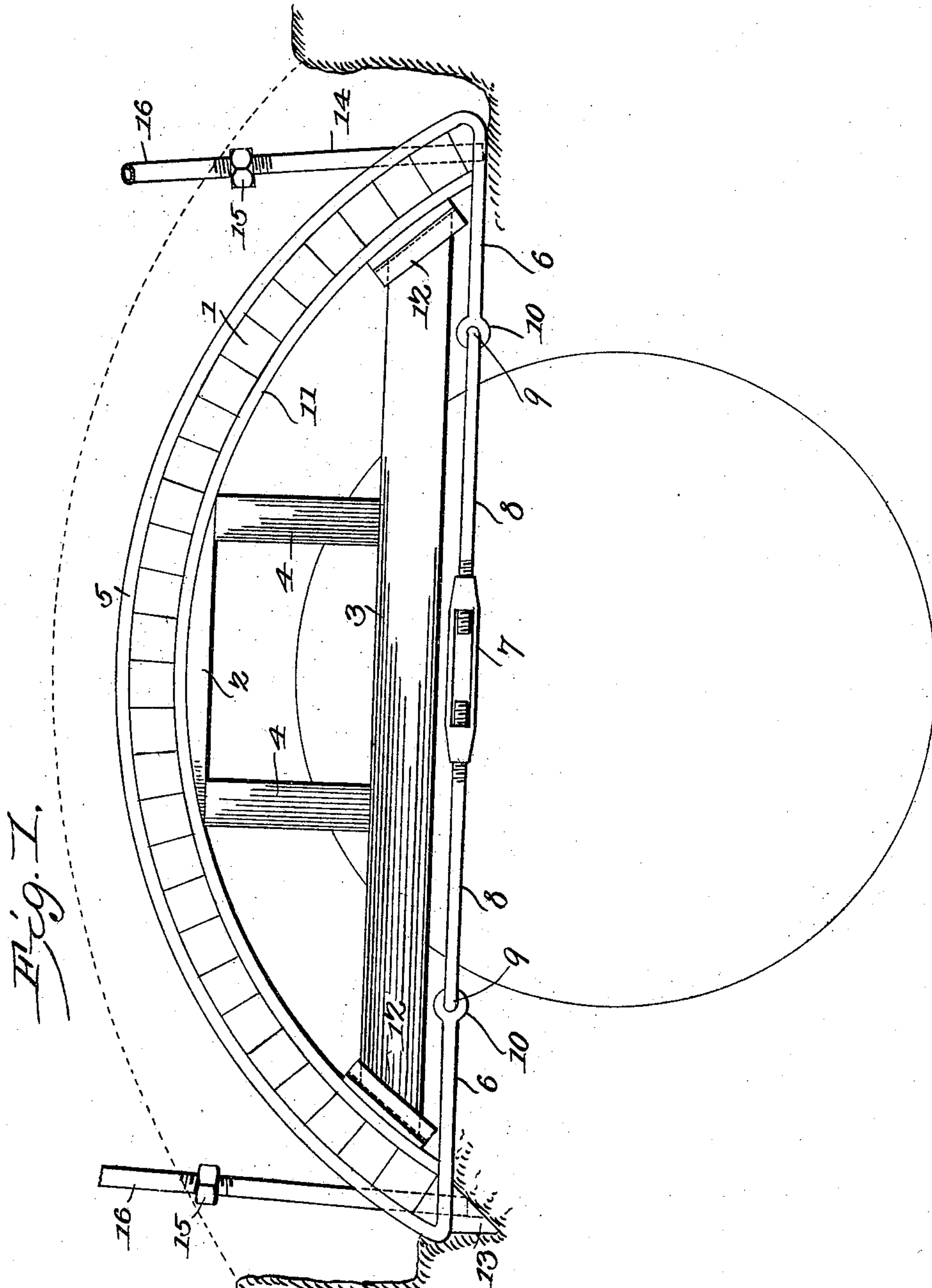


No. 819,361.

PATENTED MAY 1, 1906.

J. C. MEEM.  
TUNNEL ROOF SHIELD.  
APPLICATION FILED OCT. 11, 1905.

2 SHEETS—SHEET 1.



Witnesses:

*E. J. Stewart*  
*R. M. Elliott*

*James C. Meem,* Inventor,  
by *C. A. Snow & Co.* Attorneys.

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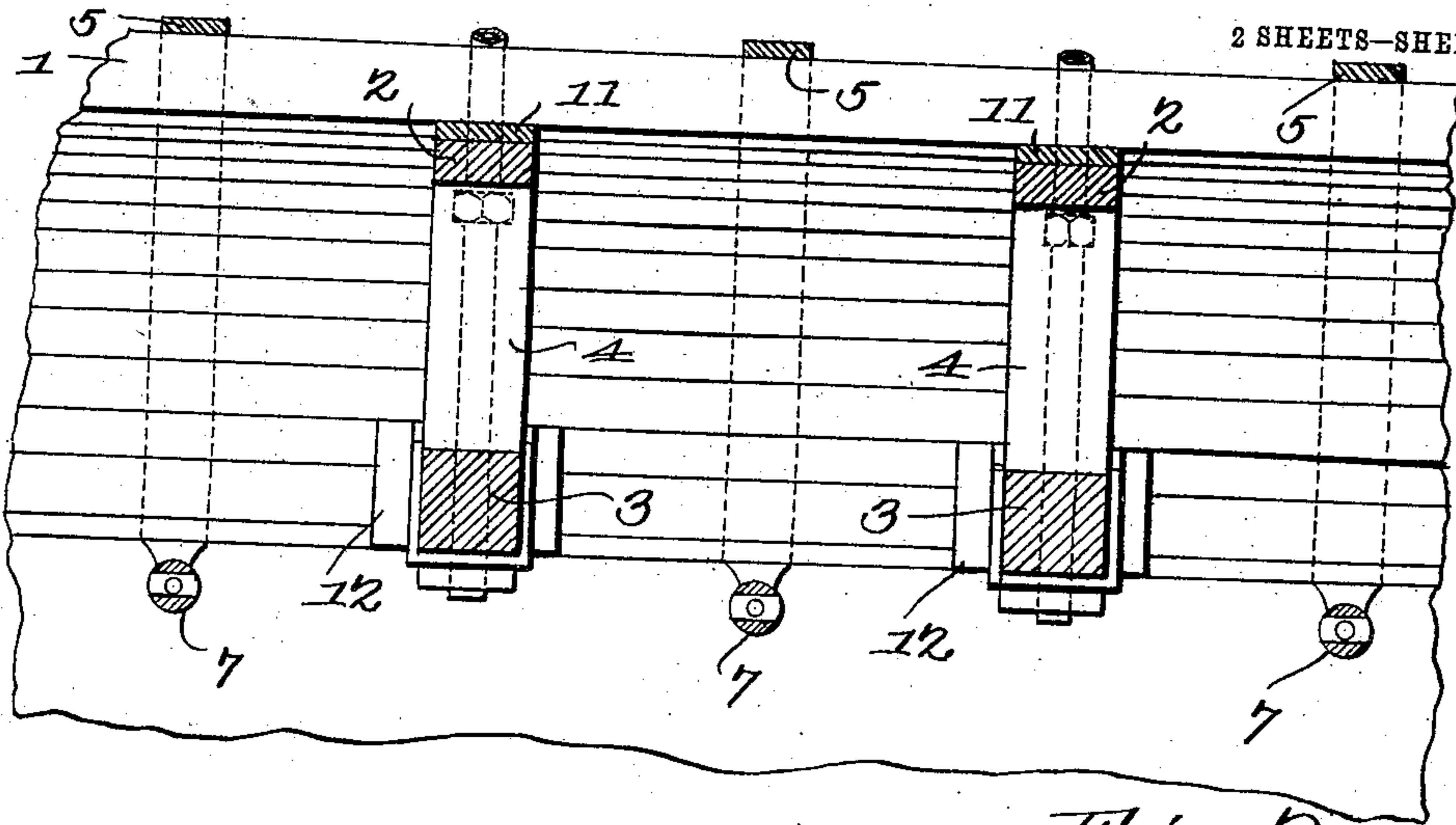


Fig. 2.

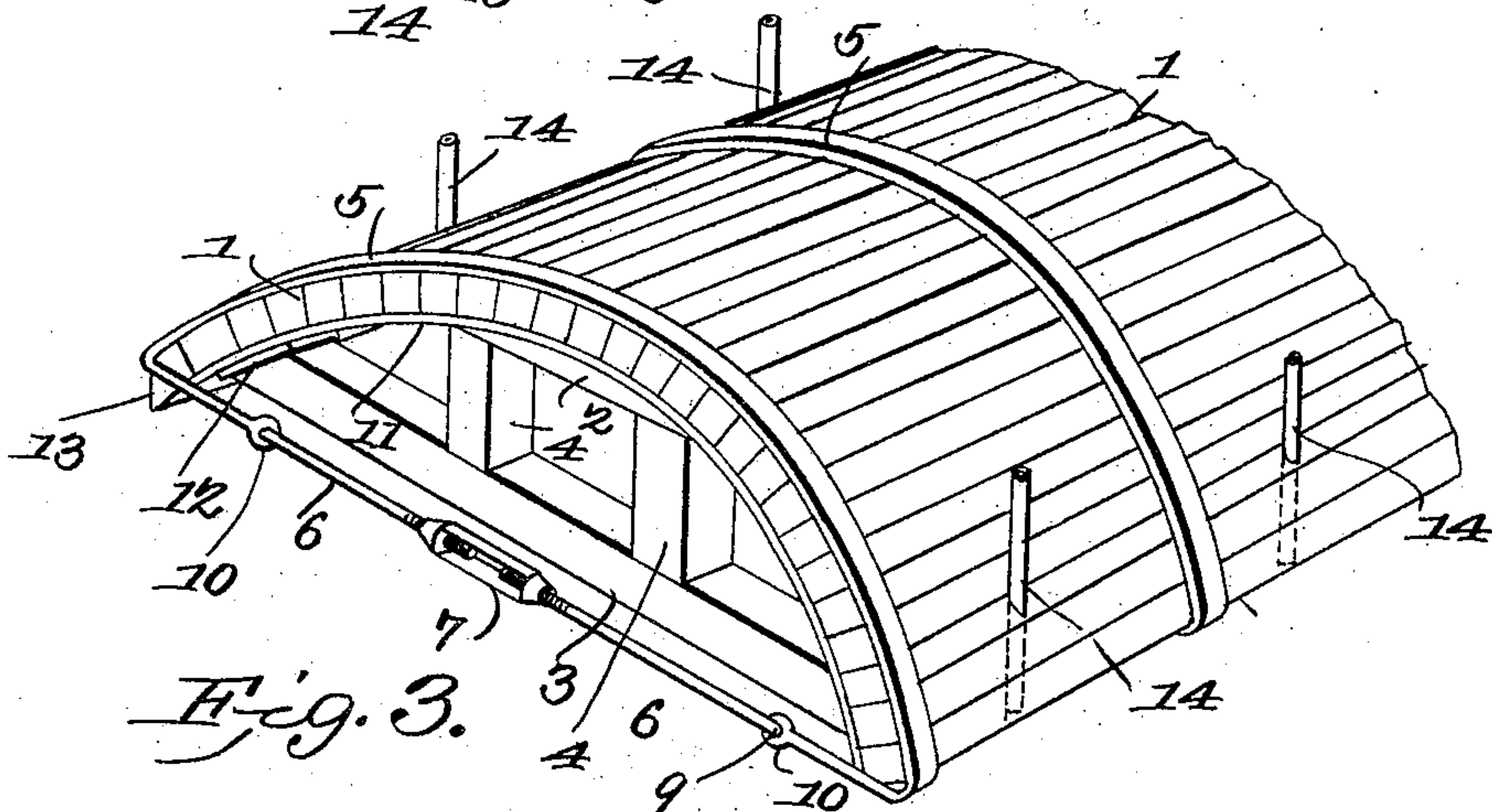
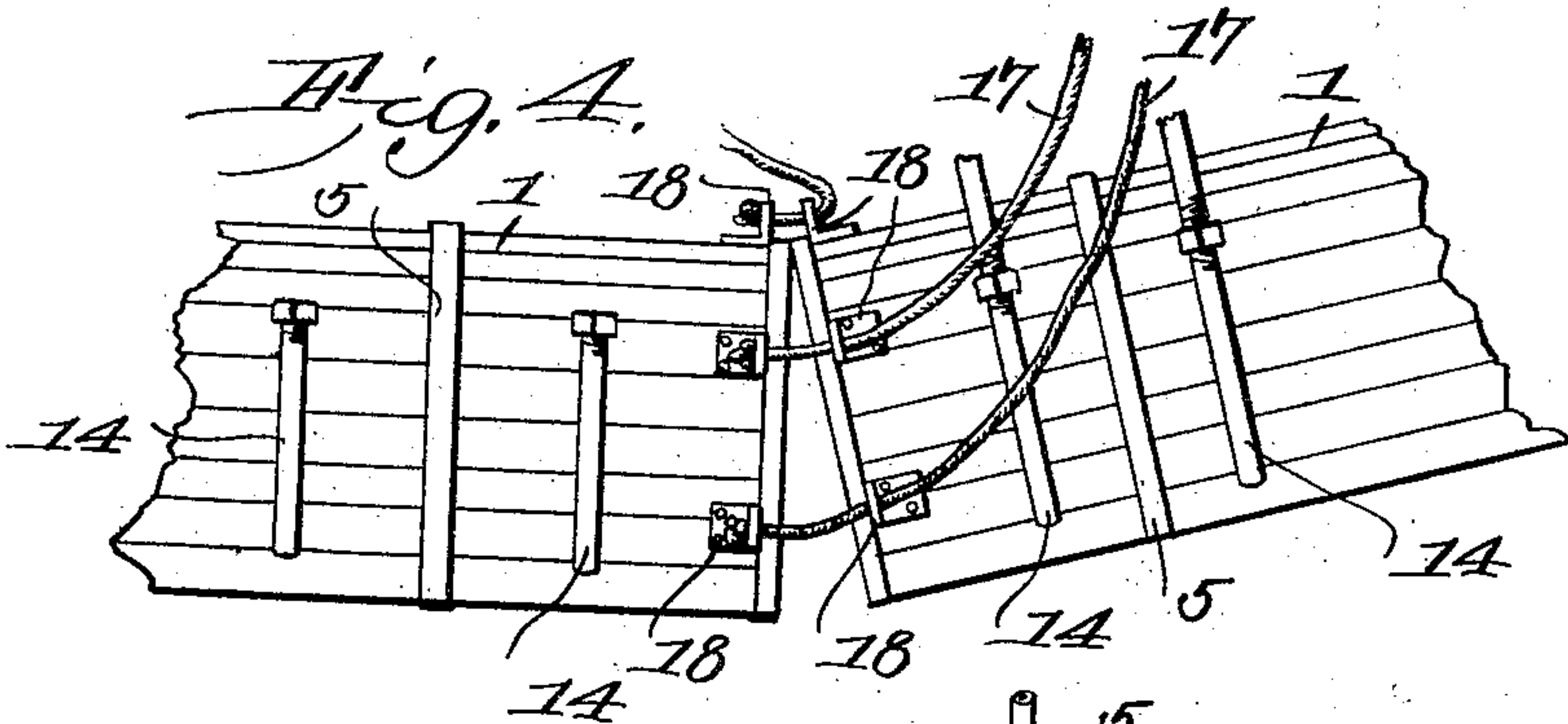


Fig. 3.

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# UNITED STATES PATENT OFFICE.

JAMES C. MEEM, OF BROOKLYN, NEW YORK, ASSIGNOR OF ONE-HALF TO  
BOROUGH CONSTRUCTION COMPANY, OF BROOKLYN, NEW YORK, A  
CORPORATION.

## TUNNEL-ROOF SHIELD.

No. 819,361.

Specification of Letters Patent.

Patented May 1, 1906.

Application filed October 11, 1905. Serial No. 282,299.

*To all whom it may concern:*

Be it known that I, JAMES C. MEEM, a citizen of the United States, residing at Brooklyn, in the county of Kings and State of New York, have invented a new and useful Tunnel-Roof Shield, of which the following is a specification.

This invention relates to tunnel-roof shields, and constitutes an improvement upon one of similar character for which I obtained Letters Patent of the United States December 9, 1902, No. 715,406.

The objects of the invention are to obviate unnecessary dredging, to accelerate the procedure of settling or positioning the shield, and to improve its construction.

With the above and other objects in view, as will appear as the nature of the invention is better understood, the same consists in the novel construction and combination of parts of a tunnel-roof shield, as will be hereinafter fully described and claimed.

In the accompanying drawings, forming a part of this specification, and in which like characters of reference indicate corresponding parts, Figure 1 is a view in end elevation exhibiting the shield of the present invention positioned relatively to a tunnel. Fig. 2 is a vertical longitudinal sectional view through the shield and tunnel. Fig. 3 is a perspective detail view of a portion of one of the shields. Fig. 4 is a view in elevation showing the manner in which a shield that is to be positioned is connected with one that is already in position.

The shield, which may be made of any desired length and on any desired arc either of a circle or of a conic section, comprises arch members 1, which will preferably be of wood and spiked or otherwise suitably secured together, upper and lower chord-stiffeners 2 and 3, and uprights 4, that bear at their respective ends against the opposed faces of the chord-stiffeners. The parts above named are held assembled and bound firmly together by rods or eye-bars 5, that pass over the arch as bands and underneath as tension-chord members 6 and are retained under suitable tension by turnbuckles 7, or there may be bands passed over the shield as short detached straps spiked or bolted to the arch, or there may be chord tension members attached to the lower edges of the shield by bolts or rivets or in any other preferred manner, where they are retained under tension by turnbuckles, as in the illustration. These

may be carried by draft-bars 8, the terminals of which are formed into eyes 9 to engage similar eyes 10 on the terminals of the tension-chord members. In addition to the parts named, and as usual, there may be employed segmental ribs or compression members 11, constructed, preferably, of steel beams spaced apart at suitable intervals and interposed between the arch members 1 and upper chord-stiffeners 2. Against the inner faces of the terminals of the compression members bear socket-plates 12, in which the ends of the chord-stiffeners 3 are seated. If preferred, the lower edges of the shield may terminate in the same plane as the tension-chord members 6, as shown at the right of Fig. 1, or the shield may be extended below the tension-chord members to form cutting edges 13, as shown at the left of Fig. 1.

As stated, it is one of the objects of the invention to obviate unnecessary dredging and to facilitate the settling or positioning of the shield. This is effected by combining with the shield at spaced intervals and adjacent to its edges a series of pipes 14, provided at their upper ends with couplings 15, with which may connect pipes 16, leading to a source of water under pressure or to a suitable force-pump, the object being to drive water under high pressure through the pipes 14 adjacent to the edges of the shield, thus to effect washing away of the river-bottom and to facilitate the settling of the shield.

These shields are intended to be submerged on the bottom of a river or harbor and the excavation to be carried on underneath, the roof of the shield serving to hold any compressed air or keep out the water. It is contemplated that the shield shall be sunk onto a natural bottom or to a bottom which at first has been dredged to a sufficient depth to allow it to be fully or partially covered by the natural bottom when the latter has been restored to its original level. Any projection of the roof which may be above this level it is intended to cover by a mixture of clay to render the roof as far as possible air and water tight. A heavy canvas or other cover may be placed over the joints, if desired, and over this in turn may be placed a blanket of clay as described elsewhere.

To illustrate a procedure under which the shield of this invention is employed, one method is herein outlined. A portion of the bottom of the river or harbor may be first



dredged to a suitable depth, after which the roof or shield which has been constructed and floated to position over the dredged bottom is sunk, it being first properly weighted to  
 5 cause it to be submerged by its own weight. As soon as it has come to a position on the bottom which is reasonably near its intended permanent location the pipes 14 are connected with powerful pumps on a float in the  
 10 vicinity, and water is then forced down these pipes under such heavy pressure that the ground under the edges of the shield is forced away allowing it to sink into the mud. As the shield sinks to its position a covering of  
 15 earth is thrown over it to settle it in position and to render it impervious to the compressed air which may be used in the subsequent tunneling operations. As soon as the rear end of one section of a shield is in place  
 20 another is brought out and sunk to position and attached to the forward end of the last section by ropes 17, of which there may be any preferred number employed. These ropes are passed through orifices in angle-  
 25 plates or cleats 18, secured near the terminals of the shields, the terminals of the ropes being held against movement relatively to the cleats or angle-plates on the shield that is positioned. As the forward end of the shield  
 30 is jolted down to position the ropes may be pulled taut by divers or from above, and as soon as the abutting sections are in place a cover or mattress of canvas will be thrown over the joint and a cover of clay may be  
 35 dumped over the whole. The rear end of the last section and the forward end of the preceding section may then be washed down by water through the pipes, it being understood that the top fastening may act as a hinge and  
 40 the lower fastenings may contain pulleys or wheels, by means of which the lower jaws of the abutting ends may be pulled tight as the forward end is washed down. This procedure, however, may be varied by sinking  
 45 the entire length of the shield at one time by providing a sufficient number of pumps, so that the entire length may be washed to position at one operation, or it may still be further varied, so that one section at a time may  
 50 be washed down to position before a subsequent section is attached. It is also intended that one pump shall operate several of the pipes at one time, or valves may be so arranged that one or more of the pipes may be

operated to the exclusion of all the rest. In  
 the event that a boulder be in the vicinity of  
 one of the pipes and the ground adjacent  
 thereto be soft it will be more necessary to  
 bring the heaviest water-pressure to bear  
 upon that one in the vicinity of the boulder  
 to cause it to slip to one side or the other, and  
 thus permit the tunnel-shields to settle into  
 place. With the roof-shield in position and  
 a covering of impervious material over it it  
 will then be an easy matter to sink a shaft at  
 either end of the shields and introduce compressed air and laborers for the excavation  
 and operation of the tunnel, which may then  
 be built by ordinary methods.

Having thus described the invention, what  
 is claimed is—

1. A tunnel-roof shield having means combined therewith for introducing water under pressure beneath its edges, and means for assembling it with an adjacent shield.

2. A tunnel-roof shield having a water-conveying pipe disposed at intervals along two of its edges and provided with means for attachment to a water-supply, and means for assembling it with an adjacent shield.

3. A tunnel-roof shield having arch members, upper and lower chord-stiffeners, uprights that bear at their respective ends against the opposed ends of the chord-stiffeners, means for holding the parts assembled,  
 means for introducing water beneath the edges of the shield, and means for combining it with an adjacent shield.

4. A tunnel-shield having cutting edges, water-conveying pipes projecting through the edges, and means for assembling a shield that is being submerged with one that is already submerged.

5. A tunnel-shield having cutting edges, water-conveying pipes projecting through the edges, and orificed cleats arranged adjacent to the ends of the shield and adapted to be engaged by ropes or chains to assemble a shield that is being submerged with one that is already submerged.

In testimony that I claim the foregoing as my own I have hereto affixed my signature in the presence of two witnesses.

JAMES C. MEEM.

Witnesses:

C. F. FEARINGTON,  
 C. S. FAIRGRIEVE.