

1,018,578.

Fig. 1

Fig. 2

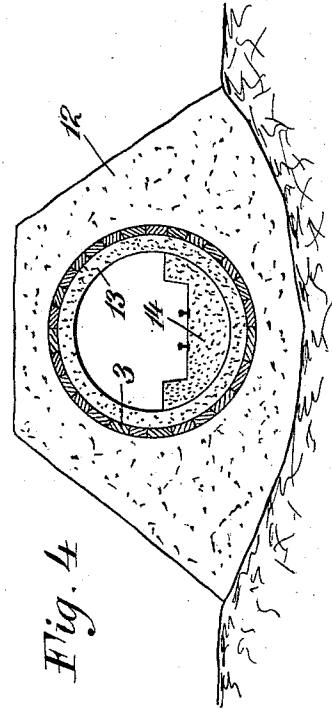


Fig. 4

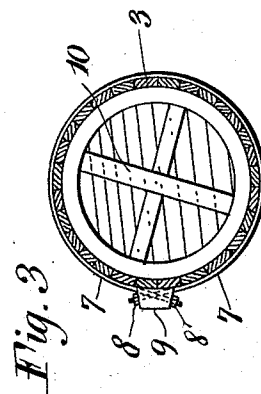


Fig. 3.

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UNITED STATES PATENT OFFICE.

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METHOD OF TUNNEL CONSTRUCTION.

1,018,578.

Specification of Letters Patent.

Patented Feb. 27, 1912.

Application filed August 30, 1911. Serial No. 646,885.

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
5 of New York, have invented certain new and useful Improvements in Methods of Tunnel Construction, of which the following is a full, clear, and exact specification.

This invention relates to method of tunnel construction, and more particular for
10 conduits, tunnels, subways, or the like, under a river or water course, where it is not practicable to interrupt navigation, or desirable to use present known methods of
15 construction.

According to this invention, I propose to build the land portions of the tunnel in any well known manner, extending the same from the bank outward as far as is practicable and then to connect these ends by the
20 portion under water, this invention being more particularly concerned with the method of constructing and laying this connecting portion. In carrying out the method, I propose to erect a continuous tubular tunnel body on a floating support or barge, and then to sink this tubular body progressively by moving the support, I having discovered that such method is practicable for long lengths of tunnel by reason
25 of the flexibility thereof. The tubular tunnel body as built is gradually sunk into a prepared bed or channel, and where necessary is weighted to cause it to sink and remain stationary, and when finally finished is buried or covered with earth, stone, concrete, or the like, so that the original riverbed is restored after the tunnel body has been laid. In constructing the tube, it is
30 desirable to insert bulkheads at various places, and also interior reinforcements to withstand bending and compression strains, which are removed when the interior is finished by reinforced concrete, brick-work or
35 such other suitable construction as may be desired.

The preferred way of constructing the tubular body on the floating support, is to provide the support with tracks inclining
40 downward at one end on which run small trucks, and to build a continuous wooden stave tubular body on these trucks similarly to a barrel, and to bind these staves together exteriorly by hoops. Such a body
45 when in long lengths will have sufficient

flexibility to allow it to be gradually sunk on the bottom in the previously prepared channel by withdrawing the support. It will also have sufficient strength to resist the pressure of the water, and its buoyancy
60 will be naturalized by loading it, either interiorly or exteriorly, as may be easily understood.

In the accompanying drawings, Figure 1 is a diagram showing the commencement of
65 the method; Fig. 2 is a similar diagram showing it in a further stage; Fig. 3 is a cross section of the tubular body when ready for submersion; and Fig. 4 is a cross section of the completed tunnel.

1 represents one end of the land tunnel, which is to be constructed in any desired manner and as far out in the river as can cheaply be done and then provided with a
70 temporary bulkhead 2 to keep back the water, this bulkhead being preferably a few feet behind the outer end of the land tunnel and the end diameter of the tunnel is such as to preferably receive the end of the
75 continuous flexible tunnel body 3 which is constructed on a float 4 and sunk as shown in Fig. 2 in a previously prepared channel 5. As the tunnel body is sunk and fastened
80 to the land, the float is moored to the tunnel body, or to the land by moorings 6, and by gradually slackening these moorings, the float will move away, owing to the inclination of the tracks. Thus the tunnel body
85 will be gradually sunk on the bottom in the previously prepared bed. When starting, of course the end of the tubular body will be guided and pulled if necessary into relation with the previously built land end, or the land end can be left open at the top so
90 that the end of the tubular body can be dropped into proper position.

The tubular body is preferably made up of wooden staves of proper size and shape arranged with breaking joints and held together by hoops 7 which are provided with
100 nuts 8 bearing on blocks 9 and which are screwed up to the desired tension.

10 represents cross bracing or a bulkhead which is built inside the tubular body while on the float, thus dividing the continuous
105 tubular body into sections from which the water may be removed as the tunnel is completed after submersion. The float 4, as has been stated, is preferably provided with inclined tracks which carry small trucks 11, 110

and these trucks may be allowed to drop overboard as the float is moved, to be recovered later. By gradually sinking one end of the float the load can be taken off the trucks before the float is moved lengthwise of the tubular tunnel body, if desired. When the opposite shore end is reached the joint with the tunnel at that end may be made in any desired manner, and in case the float cannot be manipulated so close to the land, temporary staging could be built to carry the tunnel body during erection without the float, and then the tunnel body dropped by tackle to register with the already completed end of the land tunnel. The flexible tunnel body being provided with bulkheads and being naturally quite or nearly quite water-proof, can readily be finished from the land end, it being sufficiently strong to withstand the water pressure and preferably being loaded by means of stone, concrete, clay, or the like, as soon as it is laid on the bottom.

In Fig. 4, 12 represents the loading material dumped on the tubular body to hold it in place, as concrete, or clay, and 13 represents reinforced concrete or brick-work forming the finished lining inside, and 14 a track or roadbed. The wood tunnel body being under water and surrounded by clay, earth or concrete, is practically indestructible, and the tunnel is made tight against leakage in any of the well known ways.

By means of the foregoing method, it is possible in many locations to effect a very decided saving in the cost of construction of sub-aqueous tunnels, over the present known methods of shield construction, and the method of this invention is applicable to tunnels or conduits for various purposes.

A further and important advantage of this method is that the tunnel is not required to be as far below the surface, as where the shield method, for instance, is used. Thus the gradients of the land approaches can be lower and shallower, enabling quicker construction, and lower cost of operation.

Having thus described my invention, I declare that what I claim as new and desire to secure by Letters Patent, is:—

1. The method of constructing sub-aqueous tunnel, which consist in erecting from segmental longitudinal staves a continuous tunnel body above water and gradually sinking the same as erected.

2. The method of constructing sub-aqueous tunnel, which consists in erecting from segmental longitudinal staves a continuous tunnel body above water, said tunnel body being flexible in considerable lengths, and progressively sinking completed portions of said tunnel body by loading and immersing such portions.

3. The method of constructing a sub-aqueous tunnel, which consists in erecting from segmental longitudinal staves a continuous

tunnel body above water on a floating support, binding said staves together by hoops and progressively sinking the tunnel body by moving the support.

4. The method of constructing a sub-aqueous tunnel, which consists in erecting above water on a floating support, a continuous tunnel body of segmental longitudinal staves with breaking joints moving the support relatively to the tunnel body to sink the tunnel body, loading the tunnel body when submerged to hold it stationary, and joining the ends of such tunnel body to other sections of tunnel.

5. The method of constructing a sub-aqueous tunnel which consists in erecting a continuous tubular tunnel body of wood on a floating support, moving the support lengthwise of the tubular body to submerge one end, loading the body as submerged, joining said tubular body at each end to other sections of tunnel, and finally completing a continuous tunnel.

6. The method of constructing a sub-aqueous tunnel which consists in dredging a tunnel bed, erecting from segmental longitudinal staves a continuous tubular tunnel body on a floating support above said bed, moving the support from under said tunnel body to submerge one end in the bed, and progressively moving the support as the body is built to complete the submer-sion.

7. The method of constructing a sub-aqueous tunnel which consists in constructing a continuous tubular tunnel body of segmental longitudinal staves, on a floating support, reinforcing the tunnel body at intervals, inserting bulkheads therein, and moving the support lengthwise of the tunnel body to sink it progressively from one end to the other.

8. The method of constructing sub-aqueous tunnel which consists in constructing a continuous tubular tunnel body of longitudinal staves on a floating support, inserting reinforcing bulkheads therein, moving the support lengthwise of the tubular body to progressively sink it, and weighting and covering the submerged body to hold it stationary.

9. The method of laying a sub-aqueous tube which consists in constructing a continuous tubular body on an inclined floating support, and moving the support lengthwise of the tubular body to progressively submerge it.

10. The method of laying a sub-aqueous tube which consists in constructing a continuous tubular body in an inclined position on a floating support and sinking the tubular body by movement of the support lengthwise of the tubular body upon slackening the mooring of the support.

11. The method of laying a sub-aqueous

5 tube which consists in constructing on a
floating support a continuous tubular body
composed of segmental longitudinal staves
having flexibility and strength such as to
10 be self sustaining with one end on the
ground and the other on the support, and
sinking the tubular body progressively
from one end by moving the support length-
wise of the tubular body.
12. The method of constructing sub-
aqueous tunnel which consists in erecting
above water on a support, a homogeneous
longitudinally continuous tunnel body, and
15 sinking the completed portion progres-
sively from one end, as erection proceeds
at the other.

13. A tubular sub-aqueous tunnel body

comprising longitudinal segmental wooden
staves bound together by hoops to be self
sustaining and flexible in considerable con- 20
tinuous lengths, and internal transverse
bulkheads at intervals.

14. A sub-aqueous tunnel body compris-
ing longitudinal segmental wooden staves
bound together by hoops, and lined inside 25
with masonry to form the completed tunnel
body.

In testimony whereof I affix my signa-
ture, in presence of two witnesses.

JAMES C. MEEM.

Witnesses:

J. S. WOOSTER,
GEO. N. KERR.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents,
Washington, D. C."
