No. 734,265. PATENTED JULY 21, 1903.

D. L. HOUGH.

TUNNEL CONSTRUCTION.

APPLICATION FILED FEB. 7, 1903.

NO MODEL. 2 SHEETS—SHEET 1.

Fig. 1.

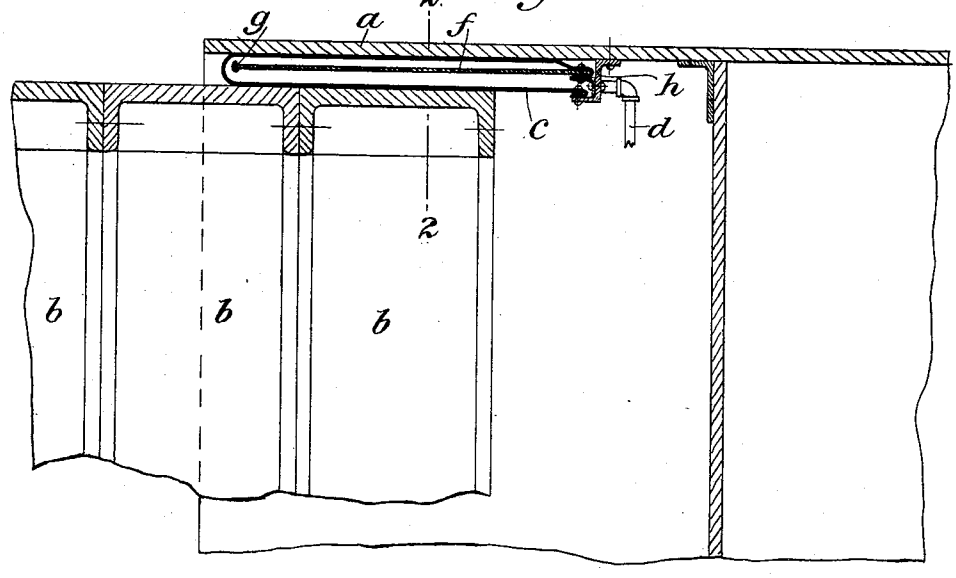
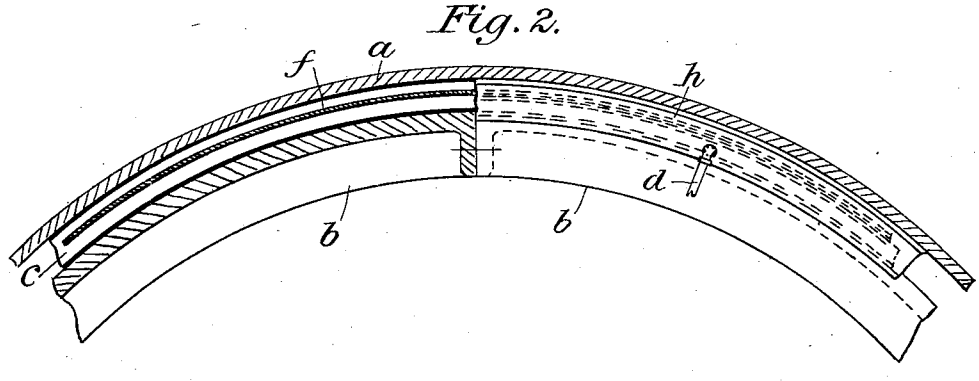


Fig. 2.



WITNESSES:

J. A. Dunstan Jr.

Fredk A. Gruenther

INVENTOR

D. L. Hough

BY

Redding, Kiddle & Greeley

ATTORNEYS

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

No. 734,265. PATENTED JULY 21, 1903.

D. L. HOUGH.

TUNNEL CONSTRUCTION.

APPLICATION FILED FEB. 7, 1903.

NO MODEL. 2 SHEETS—SHEET 2.

Fig. 3.

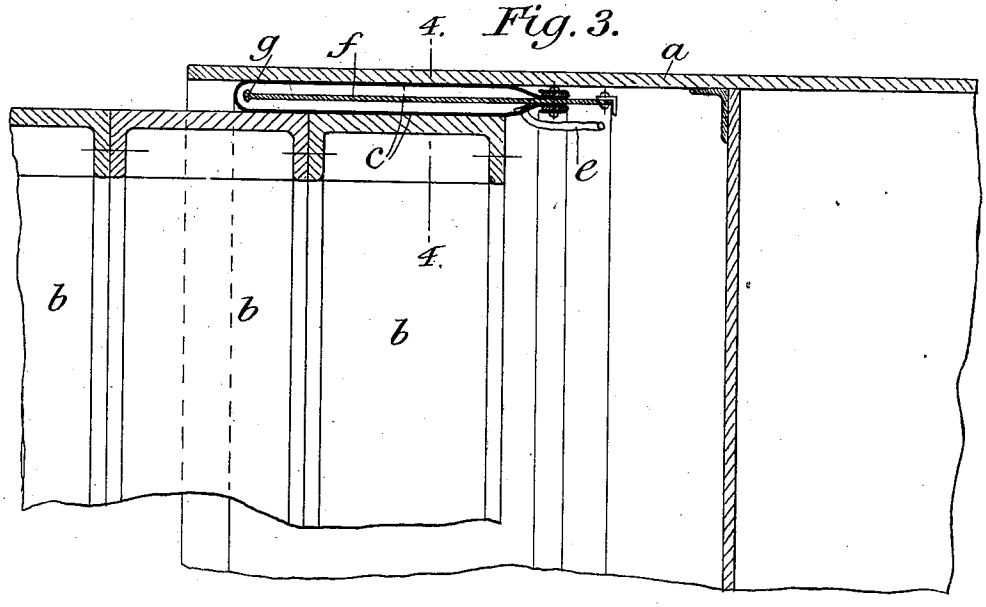
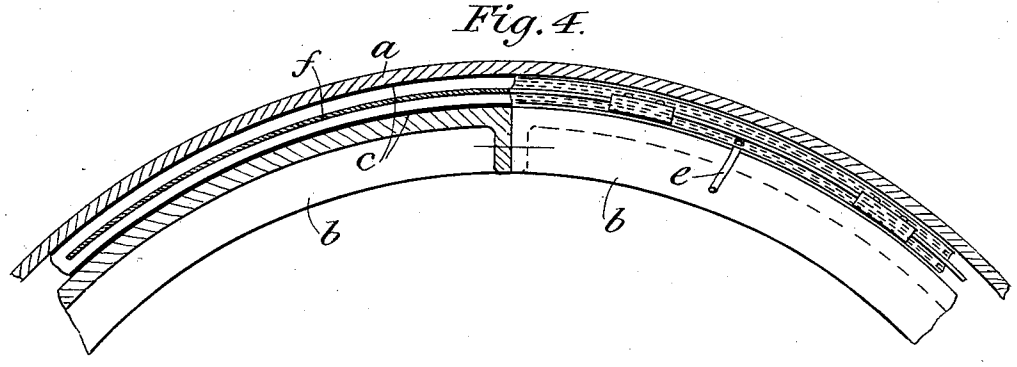


Fig. 4.



WITNESSES:

J. B. Dunstan Jr.

Fredk A. Guenther

INVENTOR

D. L. Hough

BY

Redding, Kiddle & Peeler

ATTORNEYS

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

No. 734,265. Patented July 21, 1903.

UNITED STATES PATENT OFFICE.

DAVID L. HOUGH, OF NEW YORK, N. Y., ASSIGNOR TO THE UNITED ENGINEERING & CONTRACTING COMPANY, OF NEW YORK, N. Y., A CORPORATION OF NEW YORK.

TUNNEL CONSTRUCTION.

SPECIFICATION forming part of Letters Patent No. 734,265, dated July 21, 1903.

Application filed February 7, 1903. Serial No. 142,287. (No model.)

To all whom it may concern:

Be it known that I, DAVID L. HOUGH, a citizen of the United States, residing in the borough of Manhattan, city of New York, in the State of New York, have invented certain new and useful Improvements in Tunnel Construction, of which the following is a specification, reference being had to the accompanying drawings, forming a part hereof.

In the construction of tunnels by the shield method, in which the placing of the lining goes on with the advance of the shield, much difficulty is usually experienced in maintaining a reasonably tight joint between the shield and the tunnel-lining for the effectual exclusion of water.

It is the object of this invention to provide simple and effective means for making the joint between the lining and the shield tight enough to exclude water without interfering with the advance of the shield or with the placing of successive sections of the lining.

In accordance with the invention a pneumatic packing is placed between the lining and the shield and provisions are made for holding the packing in place, for effecting its advance from time to time as the shield is advanced and successive sections of the lining are added, and for inflation.

Figure 1 is a view in longitudinal section showing portions of a shield and tunnel-lining with the packing interposed. Fig. 2 is a view partly in transverse section on the plane indicated by the line 2 2 of Fig. 1 and partly in elevation. Figs. 3 and 4 are views similar to Figs. 1 and 2, respectively, but showing a slightly-different embodiment of the invention, particularly with respect to the means for holding the packing in place and for advancing it.

In the several embodiments of the invention illustrated in the several figures of the drawings the tunnel-shield, which may be of any preferred construction, is represented at *a* and successive sections of the tunnel-lining, which may also be of any suitable construction, are represented at *b*.

In the embodiment of the invention represented in the drawings the packing *c* consists of a substantially air-tight annular bag, or it might be of several bags placed side by side, so placed as to encircle the tunnel-lining *b* and to fill the space between the lining *b* and the shield *a* when inflated, the means for inflating the bag being sufficiently represented by the pipe *d* in Figs. 1 and 2 or the flexible pipe *e* in Figs. 3 and 4. Within the bag is a plate *f*, which substantially conforms to the curvature of the lining *b* and has a width substantially equal to the width of the bag *c*, the purpose of this plate, which preferably has a thickened edge *g* and is made in separate sections for convenience in handling, being adapted to hold the bag out to substantially its full width when inflated and to prevent the excessive bulging of the bag which would otherwise take place where the bag is unsupported by the tunnel-lining, as represented in Fig. 1. The bag may be secured by means of a suitable angle-iron or angle-irons *h* directly to the shield *a*, as represented in Figs. 1 and 2, so that the bag shall advance as the shield advances, or the plate *f* may be extended beyond the bag, as shown in Fig. 3, or the packing otherwise arranged so that it can be advanced independently of the movement of the shield. In either case the plate *f* or the angle-irons *h* or the equivalents thereof constitute a rigid support and attachment for the packing to hold the packing in place and by means of which the packing may be advanced from time to time as required. The packing in any form is preferably prepared exteriorly, as by dressing with black-lead or other suitable material, so that it may be moved along as required without excessive friction and without requiring the pressure within the bag to be reduced to such a degree as to permit leakage. In the use of the packing it will be obvious that the pressure within the bag-like packing need be but slightly in excess of the external pressure of the tunnel-lining in order to provide an effective obstruction to the entrance of water between the lining and the shield, the work within the shield being carried on as usual under air-pressure, which may be somewhat greater or less than the external pressure, or at atmospheric pressure, as may be preferred, so far as the efficiency of the packing is concerned.

I claim as my invention—

The combination with a tunnel-shield and a tunnel-lining, of a pneumatic bag packing interposed between the shield and the lining, and a stiffening-plate within the bag to hold it in shape when inflated, substantially as shown and described.

This specification signed and witnessed this 5th day of February, A. D. 1903.

DAVID L. HOUGH.

In presence of—
J. H. DUNSTAN, Jr.,
FREDK. A. GUENTHER.