

No. 612,353.

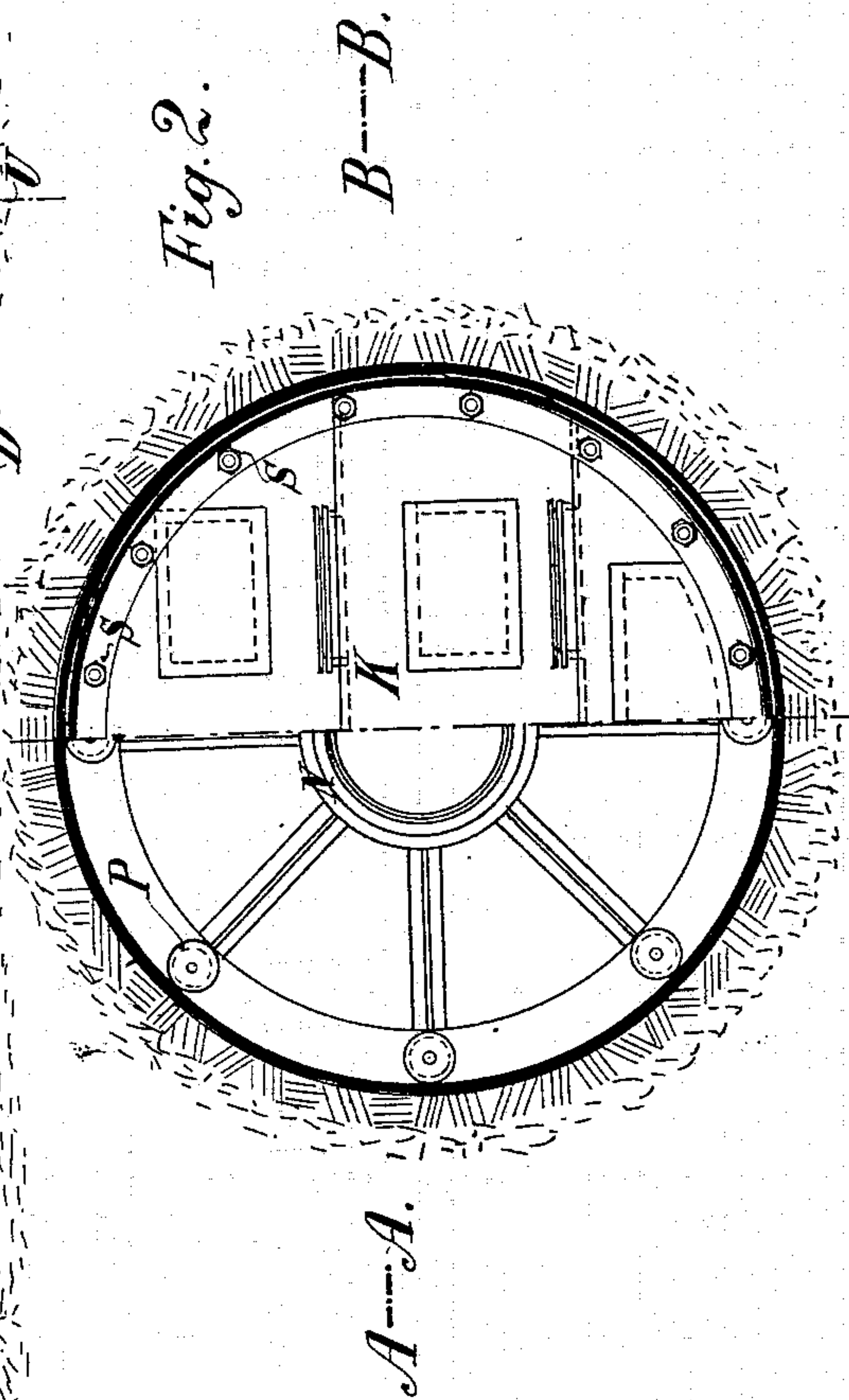
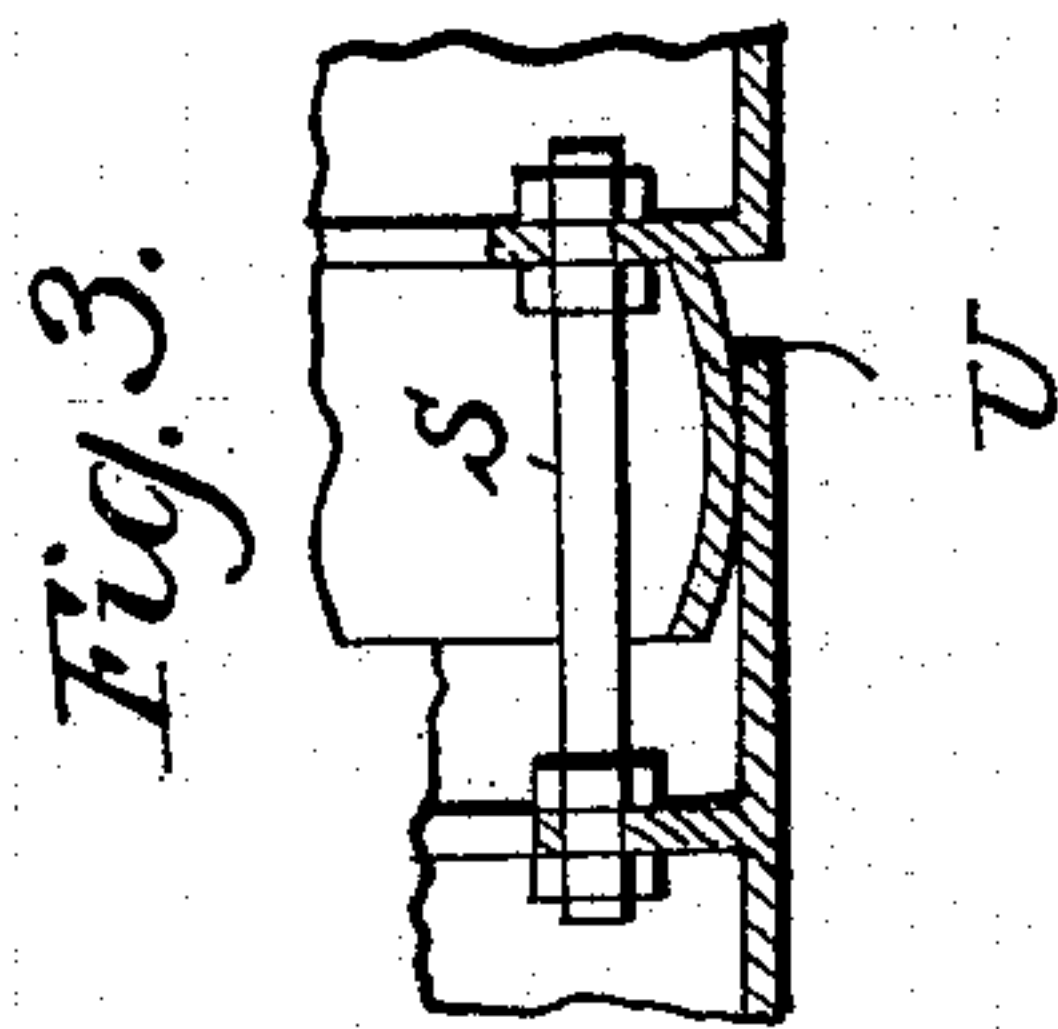
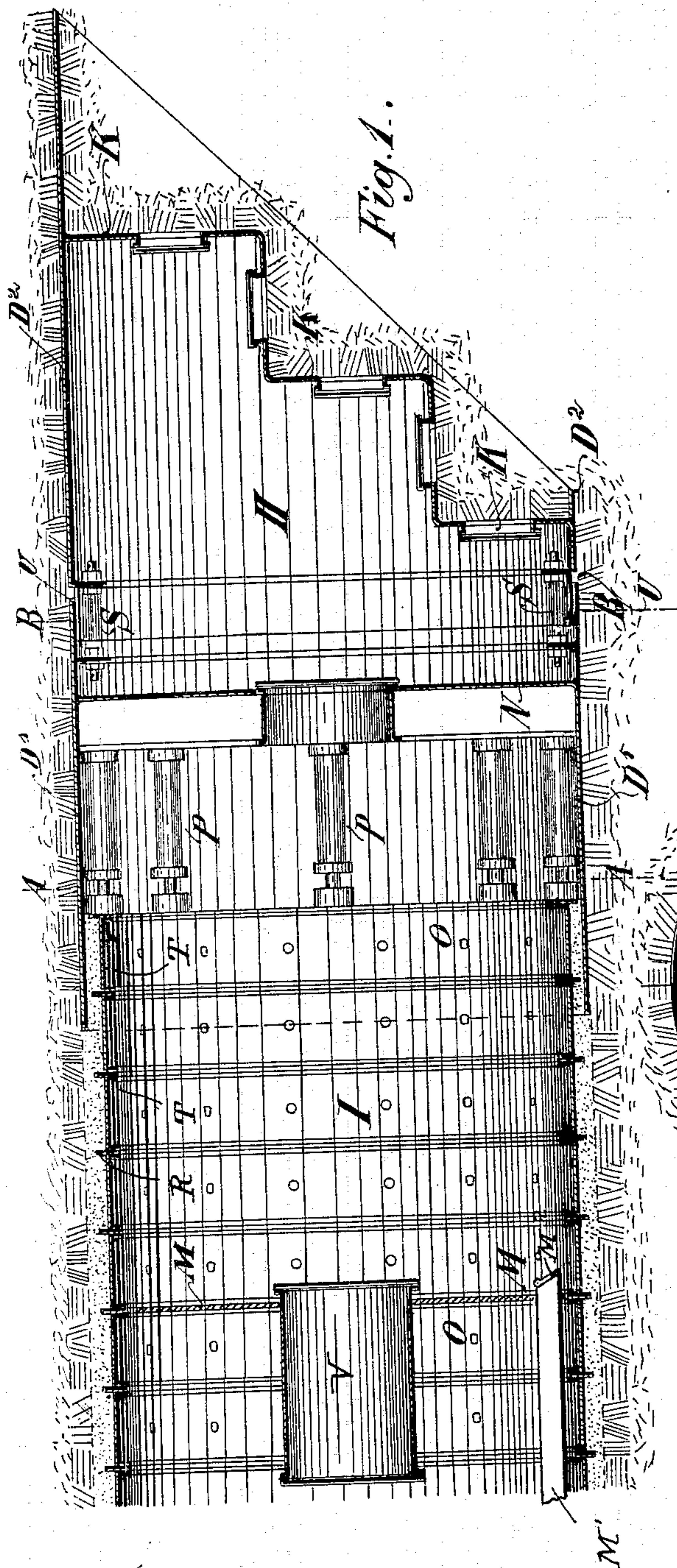
Patented Oct. 11, 1898.

W. LAUTER.

APPARATUS FOR DRIVING SUBTERRANEAN TUNNELS.

(Application filed Aug. 10, 1897.)

(No Model.)



Witnesses:  
Harry E. Hay  
A. E. Hansmann.

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# UNITED STATES PATENT OFFICE.

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## APPARATUS FOR DRIVING SUBTERRANEAN TUNNELS.

SPECIFICATION forming part of Letters Patent No. 612,353, dated October 11, 1898.

Application filed August 10, 1897. Serial No. 647,741. (No model.) Patented in Germany April 25, 1895, No. 87,157, and in England October 4, 1895, No. 18,565.

*To all whom it may concern:*

Be it known that I, WILHELM LAUTER, a subject of the King of Prussia, German Emperor, residing at Frankfort-on-the-Main, in the Kingdom of Prussia, Germany, have invented new and useful Improvements in Appliances or Apparatus for Driving Subterranean Tunnels or Galleries, (patented in Germany April 25, 1895, No. 87,157, and in England October 4, 1895, No. 18,565,) of which the following is a specification.

This invention relates to appliances or apparatus for driving tunnels or galleries, more particularly applicable for driving in quicksand and in soft or aqueous strata.

I will describe the same with reference to the accompanying drawings, in which—

Figure 1 shows a longitudinal section, and Fig. 2 cross-sections, on lines A A and B B. Fig. 3 is a detail sectional view of the connections between the shield-sections.

It consists of the tubular shield  $D' D^2$ , the rear end of which incloses a short length of the lining  $T$  of the finished tunnel or gallery, while the fore part, which is constructed with a slope, penetrates into the ground.

The iron lining of the tunnel or gallery consists of separate rings  $T$  and of outward-projecting ribs  $R$ , arranged between these rings. By means of the said ribs the stiffness of the tunnel-wall is increased and the rear part of the shield-casing is guided, leaving annular spaces between the lining  $T$  and the shield  $D'$ , which can be filled up with cement through the holes  $O$ , formed in the rings, so as to form by these means in a safe manner an outer lining of cement to the tunnel or gallery. The said openings  $O$  also enable the annular space to be filled up that is left by the tubular shield  $D' D^2$  as this is driven forward.

The shield is divided by the air-tight partition  $N$  into two chambers  $I$  and  $II$ , filled with compressed air, the outer chamber  $I$  being inclosed at the rear end by the wall  $M$ , fixed to the finished tunnel-lining and having an air-sluice  $V$ , while the other chamber  $II$  is closed at the front end by the step-shaped wall  $K$ , lying against the face of the working.

The driving forward of the shield, which is followed by the building in of the tunnel or gallery rings, is effected by the greater air-pressure existing in the chamber  $I$  and by the presses  $P$ , which bear on the one hand against the finished lining of the tunnel and on the other hand against the partition  $N$ . Compressed air is introduced into the chamber  $I$  from any suitable source of supply through a pipe  $M'$ , extending through the wall  $M$  and provided at its end with a flap-valve  $M^2$ , which opens inwardly to the chamber  $I$ . In order to facilitate the forcing forward of the shield in curves, the tubular sides thereof are made of two parts  $D'$  and  $D^2$ , which fit together, with overlapping spherically-shaped surfaces at  $U$ , and are adjusted relatively to each other by the extension or shortening of the screws  $S$ , connected to both parts, without materially narrowing the internal space of the shield or forming external projections which would interfere with the advance thereof.

The excavation of the face of the working is effected by the openings formed in the stepped face  $K$  of the shield, which are closed by covers, such excavation being effected solely through the horizontal holes so long as there is danger of the compressed air escaping; otherwise the excavation is also effected through the vertical openings, the air-pressure employed being such as to balance the counter-pressure exercised by the water or soil.

Having now particularly described and ascertained the nature of this invention and in what manner the same is to be performed, I declare that what I claim is—

1. A tunnel-wall comprising rings provided with openings extending through their sides and outwardly-extending ribs intermediate the rings, substantially as described.

2. In tunnel-driving apparatus, a tubular shield having a stepped end, the steps being provided with openings, and detachable covers for said openings, substantially as described.

3. The combination with a tunnel comprising a series of rings and formed with a transverse wall, a tubular shield embracing one

end of the tunnel and having a transverse  
wall, a series of presses intermediate said  
latter wall and the end of the tunnel, and  
means for introducing compressed air inter-  
5 mediate the walls of the tunnel and shield,  
substantially as described.

In testimony whereof I have signed my

name to this specification in the presence of  
two subscribing witnesses.

WILHELM LAUTER.

Witnesses:

KARL TRIEBER,

FRANK H. MASON.