(No Model.)

DE WITT C. HASKIN.

ART OF CONSTRUCTING TUNNELS.

No. 300,469. Patented June 17, 1884.

Fig. 1.

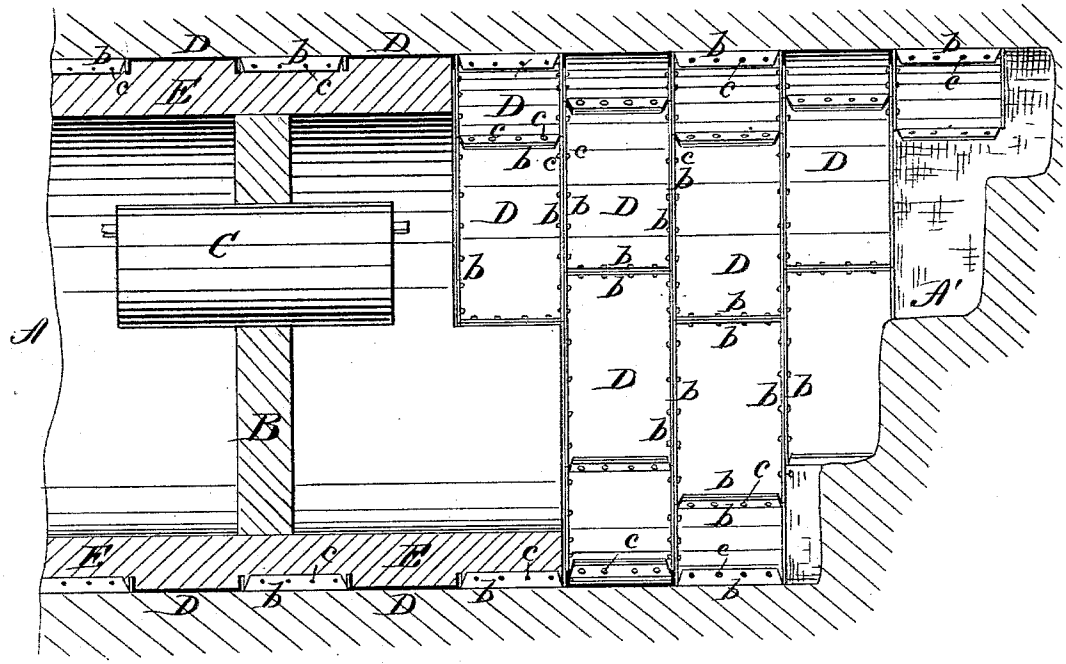
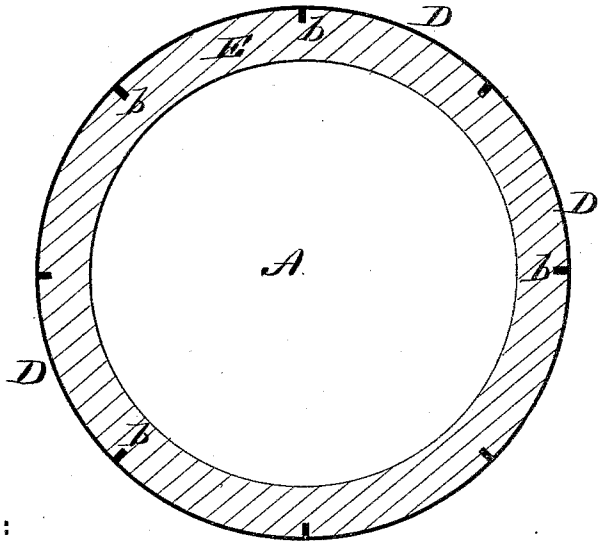


Fig. 2.



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UNITED STATES PATENT OFFICE.

DE WITT C. HASKIN, OF NEW YORK, N. Y.

ART OF CONSTRUCTING TUNNELS.

SPECIFICATION forming part of Letters Patent No. 300,469, dated June 17, 1884.

Application filed January 31, 1883. (No model.)

To all whom it may concern:

Be it known that I, DE WITT C. HASKIN, of the city, county, and State of New York, have invented certain new and useful Improvements in the Art of Constructing Tunnels, of which the following is a full, clear, and exact description.

This invention relates to the construction of underground tunnels and other excavations, including tunnels under the beds of rivers and other waters, both when the work is done under ordinary atmospheric pressure and under a forced pressure of air in the section being worked.

The invention consists in excavating a small portion of earth in the crown of the heading and inserting therein one or more iron plates and securing the same to the upper part of a completed section of the tunnel, thereby forming a partial hood projecting in front of said section, then excavating the heading in advance of said hood and inserting another plate or plates and attaching the same to the partial hood, afterward excavating the earth under the first-named partial hood sufficiently for the insertion of one or more plates at the sides thereof, and attaching said side plates to the completed section of tunnel and to said hood-plates, and continuing the operation till each circle of plates in succession is completed, and the whole earth is excavated in a step-like manner from within them; and it also consists in forming in the excavation a tube or shell composed of plates having facial flanges, the said plates being supported by compressed air while being bolted together, all as hereinafter fully described.

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

Figure 1 represents a longitudinal sectional elevation of an underground tunnel in part, such as may be used under the bed of a river, and which may be made in sections divided by bulk-heads, with an air-lock connecting the sections for working with compressed air to keep out the water and to partially hold up the earth, said view representing such tunnel as in the course of being constructed in accordance with my invention; and Fig. 2 represents a transverse section of a finished portion of the tunnel.

A in the drawings indicates a finished portion or section of the tunnel, divided by a bulk-head, B, from an unfinished section, A′, thereof, and with an air-lock, C, in between them, for making the excavation subject to a compressed condition of the atmosphere within the section of the tunnel in the course of being excavated. The tunnel, when completed, is formed with an exterior tube or shell, of iron or other suitable material, lined with brick, concrete, stone, or other material. Thus the exterior shell is made of a series of plates, D, of boiler-iron, and of curvilinear contour in direction of their length corresponding with the transverse shape of the tunnel to be made. These plates are rapidly put into their places, commencing at the roof or upper portion of the excavation, so that workmen at the heading will always be protected by an iron ceiling, and the earth above the tunnel furnished with a support almost as soon as an excavation is made. To thus put in the plates D the men at the heading first dig or spade forward a thin partially-circular opening, leaving the core or main portion untouched, and only excavating sufficiently to allow the top plates to be placed in position, where they are bolted and braced to each other before the earth beneath is removed, the most advanced plates being extended out like a hood, well braced up until all the earth in the core beneath is removed, and the plates are put in position on all sides around the excavation. This method of proceeding is clearly shown at the right hand of Fig. 1 of the drawings. These plates D, which form the shell of the tunnel, have inner facial flanges, *b*, on each of their sides or margins, which admit of each plate being bolted, as at *c*, all around it to the next one. Said plates are so arranged in relation with each other that they break joints, as clearly shown in Fig. 1. After the section of a tunnel has been thus fitted with an exterior shell, as described, or as portions of said shell in direction of its length are completed, a brick, concrete, stone, or other mason-work lining, E, of considerably greater thickness than the plates D, is built up within or applied to said plates, and,

being formed as an arch on all sides, resists all outside pressure both vertically and laterally. The flanges or projections *b* on the plates D also serve to anchor this lining E to its place, and when arranged on or along each margin of the several plates form a most effectual anchor. Said lining may be constructed of good hard-burned brick laid in hydraulic cement.

Although the tunnel is here shown as of circular form in its transverse section, it may deviate more or less from such shape. Thus it may be of greater height than width, or otherwise. When the excavation is made subject to a compressed condition of the atmosphere within the section of the tunnel in the course of being excavated, the plates used to form the exterior shell will be quickly forced to their positions and partly held to their places, as if by suction applied to their exterior, by the atmospheric compression from within, so soon as said plates come in contact with the earthen exterior of the tunnel-section, and thus said plates will assist in retaining the air, and serve to better uphold the roof and sides from caving in.

The above-described method permits the ready change of shape and form of the plates while putting them in to suit the variable nature of the soil that may be encountered.

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

1. The herein-described method of constructing tunnels, which consists in excavating a small portion of the earth in the crown of the heading and inserting therein one or more iron plates and securing the same to the upper part of a completed section of the tunnel, thereby forming a partial hood projecting in front of said section, then excavating the heading in advance of said hood and inserting another plate or plates and attaching the same to the partial hood, afterward excavating the earth under the first-named partial hood sufficiently for the insertion of one or more plates at the sides thereof, and attaching said side plates to the completed section of tunnel and to said hood-plates, and continuing the operation till each circle of plates in succession is completed and the whole earth is excavated in a step-like manner from within them, as shown and set forth.

2. The herein-described method of constructing tunnels, consisting in forming in the excavation a tube or shell composed of plates having facial flanges, the said plates being supported in position while being bolted together by compressed air, as set forth.

DE WITT C. HASKIN.

Witnesses:
EDGAR TATE,
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