(No Model.)

J. H. GREATHEAD.

TUNNELING APPARATUS.

No. 458,048. Patented Aug. 18, 1891.

Fig. 4.

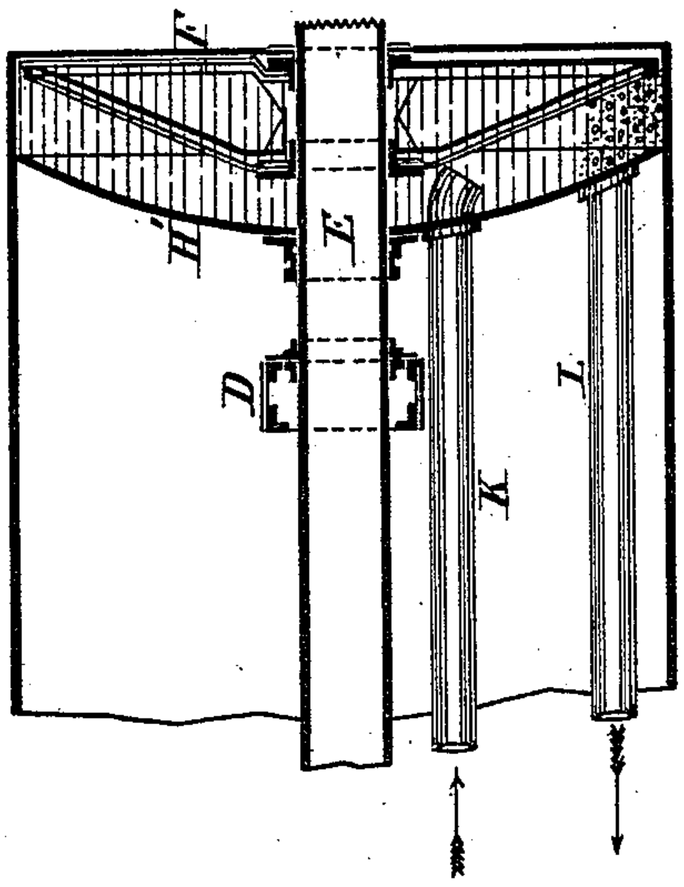


Fig. 2.

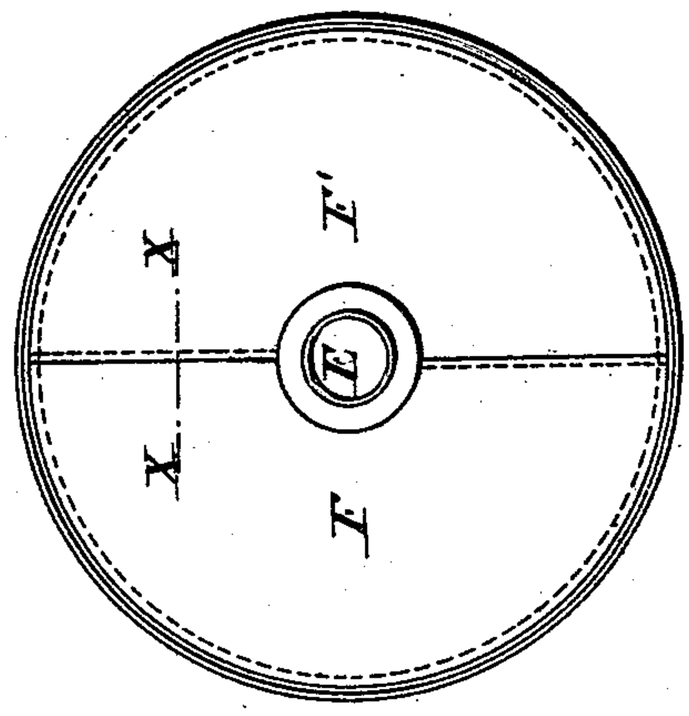


Fig. 3.

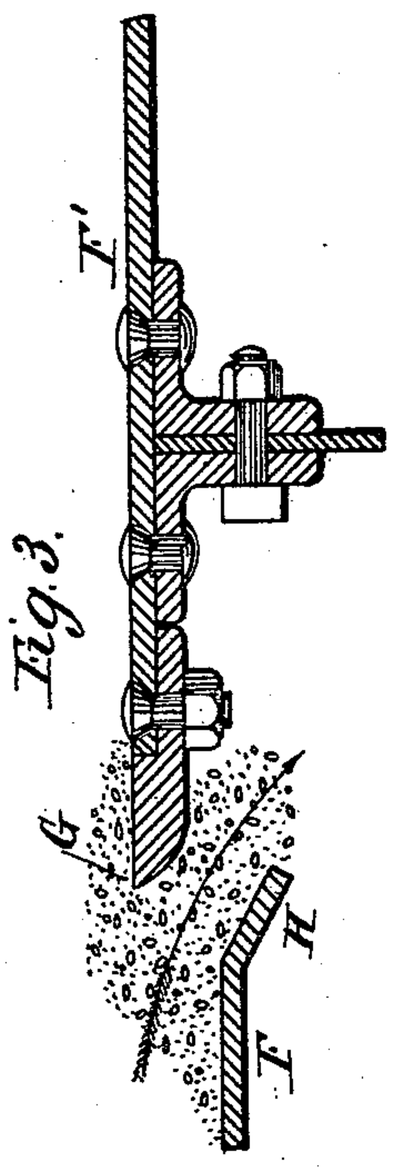
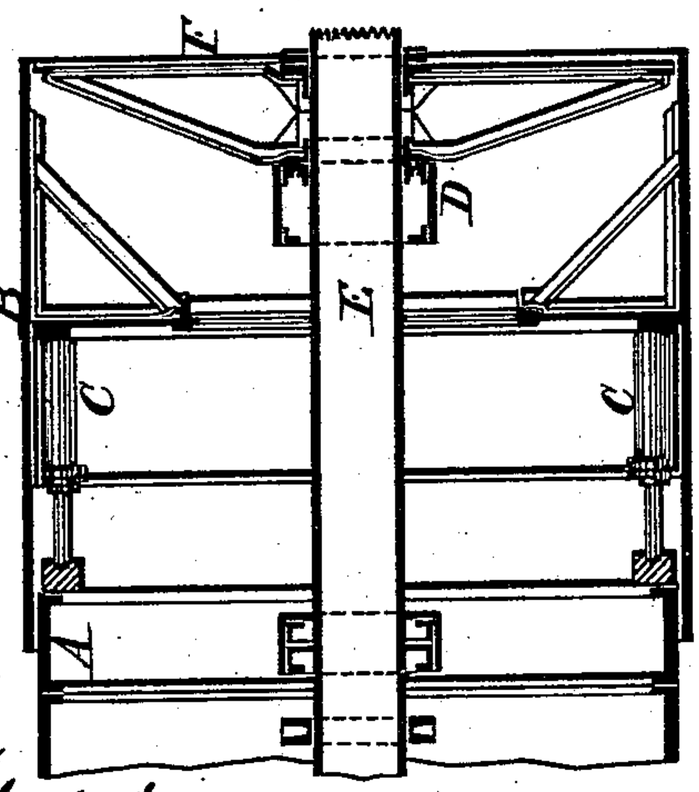


Fig. 1.



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UNITED STATES PATENT OFFICE.

JAMES HENRY GREATHEAD, OF WESTMINSTER, ENGLAND.

TUNNELING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 458,048, dated August 18, 1891.

Application filed February 10, 1890. Serial No. 339,860. (No model.) Patented in England January 4, 1889, No. 195.

To all whom it may concern:

Be it known that I, JAMES HENRY GREATHEAD, a citizen of England, residing at Victoria Chambers, Westminster, county of Middlesex, England, have invented a new and useful Improvement in Tunneling Apparatus, (for which I have obtained a patent in Great Britain dated January 4, 1889, No. 195,) of which the following is a specification.

In driving a cylindrical or nearly cylindrical tunnel provided with a shield which is advanced from time to time as the boring proceeds, it is of advantage in sand, gravel, silt, or similar soils, especially if they are water-bearing, to displace the material in front of the shield in a gradual and regular manner, so as to prevent the falling in of loose material in such a way as to form cavities and disturb the superincumbent material; also, in such cases it is generally necessary to have within the shield an air-lock supplied with compressed air, so as to prevent inflow of water from the material outside, and it is of advantage to present as little space as possible in front of the shield for escape of air.

According to my present invention I mount in bearings in the shield a revolving shaft, which carries in front of it blades inclined to the plane of rotation, each blade overlapping the next blade in order, so that there is only a narrow space between each pair of blades for the passage of excavated material inward or for passage of air outward. By causing these blades to revolve slowly as the shield advances, proportioning their speed to the advance of the shield, the material in front, instead of being dislodged in irregular masses leaving cavities, is gradually scooped out, the place of the detached material being always filled by the advancing blades.

Figure 1 of the accompanying drawings is a longitudinal section showing the front part of a tunnel with a revolving head, according to my invention. Fig. 2 is a front view of such a head, having two semicircular blades, and Fig. 3 is a section to an enlarged scale on the line X X of Fig. 2 Fig. 4 is a section showing the boring-head in a water-chamber.

A is part of the metallic lining of the tunnel, over the front part of which the shield B loosely fits, so that as material is excavated in front of the shield it is from time to time pressed forward by hydraulic presses C. So far the construction and operation of the apparatus are well understood and are practiced. In the front part of the shield I mount in bearings in a cross-girder D a shaft E, which may be tubular, and on this I fix two or more blades F F′, which are inclined so that the edge of the one is a little in advance of the edge of the other, as shown in Fig. 3, and that these edges somewhat overlap each other, leaving only a narrow space between them. One of these segments—namely, that in front—is provided with a cutting-edge G, which, as the head is made to revolve, cuts the material in front of it, the material thus excavated finding its way through the narrow space between the edges of the blades into the interior of the shield, whence it is removed through the completed part of the tunnel. The rear segmental blade F is provided with an inward and rearward inclined lip H to direct the excavated material inward or back of the segmental cutting-blade F′. The shield, with cutting-head, as above described, may be used in combination with the known means of removing the excavated material by water, as shown by Fig. 4. In this case the head revolves in a space in front of the shield, which is parted off from the hinder part of the shield by a partition H′. Through this partition pass two pipes K and L, the one K admitting water under pressure to the front compartment of the shield and the other L conveying away the water along with the excavated material.

Although I have shown the cutting-head as being made with two semicircular blades F F′, there might be only one such blade, extending quite round the circle of the head, or there might be a greater number of blades, each a sector of the circle, the width of the blades being in all cases such that the front edge of each somewhat overlaps the hinder edge of the next. The cutting-head may in some cases be of less diameter than the shield, the annular space left round it being covered by a coned mouth.

It will be observed that with this apparatus the whole of the excavated surface is at all points in the revolution of the cutter covered

by the face of the segmental blades, except the narrow slit, where one blade overlaps the other. The material acted on by the cutting-blades is thus excavated gradually and evenly across the entire face of the said blades and is not permitted to fall in irregular masses against the cutters to obstruct their action and leave uneven cavities in advance of the cutter mechanism.

Having thus described the nature of my invention and the best means I know of for carrying the same into practical effect, I claim—

1. In a tunneling apparatus, the combination, with the shield B, having cross-girder D, of the rotary shaft E, having bearings in said girder, and the overlapping segmental cutting-blades F F′, mounted on said shaft and inclined to the plane of rotation, one of said blades being slightly in advance of the other and provided with a removable cutting-edge G, overlapping the space between said blades, substantially as described.

2. In a tunneling apparatus, the combination, with the shield B, the rotary shaft E, and the overlapping segmental cutting-blades F F′, mounted on said shaft in the forward end of said shield and inclined to the plane of rotation, of the partition H′ in rear of the cutting-blades, the pipe K for admitting water under pressure to the front compartment of the shield, and the pipe L for conveying water and excavated material from said compartment, substantially as shown and described.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, this 29th day of January, A. D. 1890.

JAMES HENRY GREATHEAD.

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