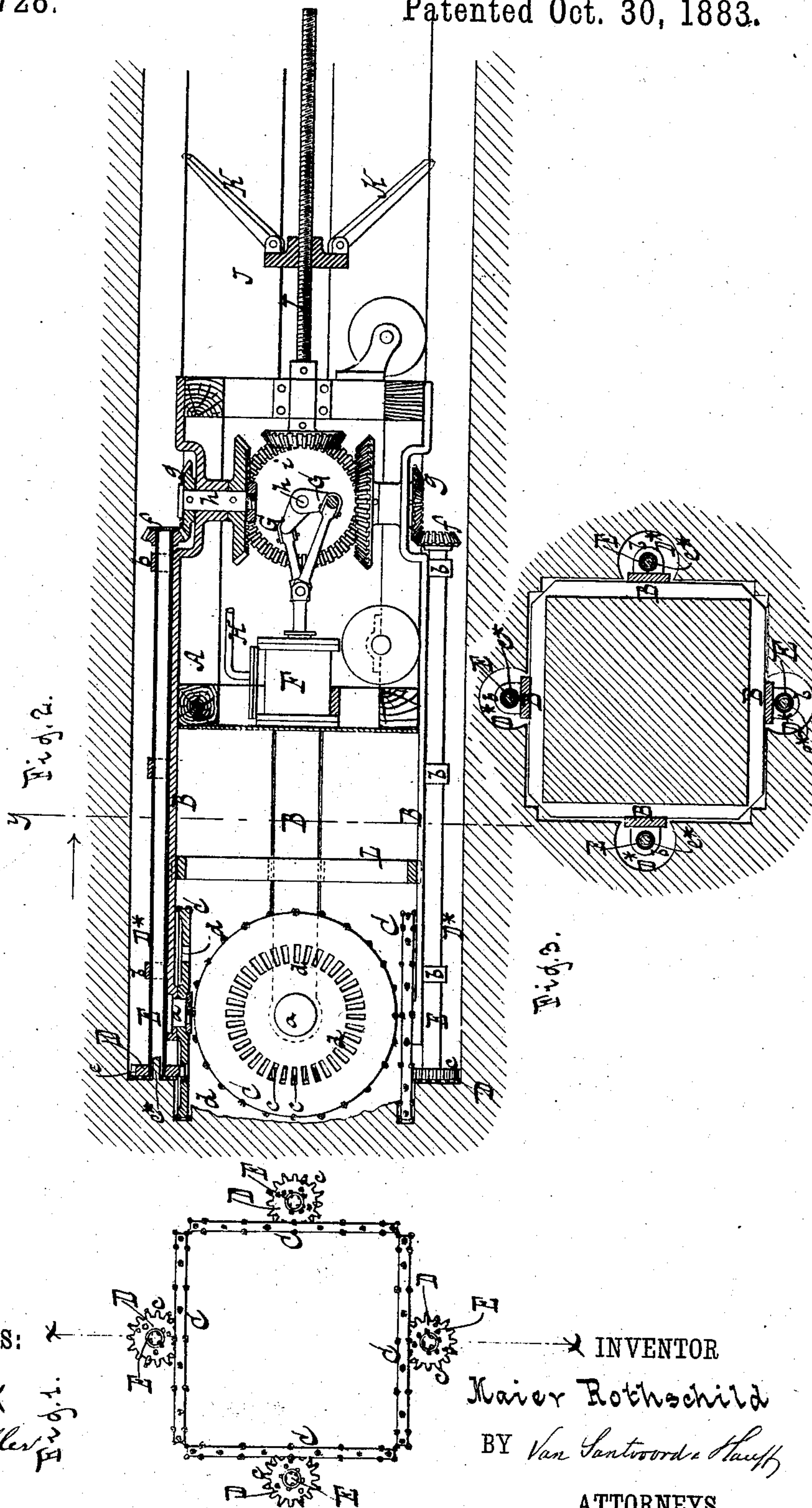


(No Model.)

M. ROTHSCILD.  
TUNNELING MACHINE.

No. 287,728.

Patented Oct. 30, 1883.



WITNESSES:

Otto Hufeland  
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# UNITED STATES PATENT OFFICE.

MAIER ROTHSCHILD, OF SHAMOKIN, PENNSYLVANIA.

## TUNNELING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 287,728, dated October 30, 1883.

Application filed January 11, 1883. (No model.)

*To all whom it may concern:*

Be it known that I, MAIER ROTHSCHILD, a citizen of the United States, residing at Shamokin, in the county of Northumberland and State of Pennsylvania, have invented new and useful Improvements in Tunneling-Machines, of which the following is a specification.

This invention relates to a tunneling-machine which consists of a carriage, an open frame extending from said carriage, a number of diamond cutters mounted on said frame, and placed in such relation to each other that a solid piece of rock is cut out as the carriage advances.

The peculiar construction of my machine and the relation of the several working parts toward each other are pointed out in the following specification and illustrated in the accompanying drawings, in which—

Figure 1 represents a front view of the machine, showing the various diamond cutters and their relative position toward each other. Fig. 2 is a longitudinal vertical section in the plane  $x x$ , Fig. 1. Fig. 3 is a transverse vertical section in the plane  $y y$ , Fig. 2.

Similar letters indicate corresponding parts.

In the drawings, the letter A designates a carriage, the body of which is constructed of strong timbers, and which is supported by four or more wheels, so that it can be moved forward or backward either on the bare ground or on a suitable track. From the front portion of this carriage extend, in a horizontal direction, four bars, B, and the outer ends of these bars form the bearings for axles  $a$ , Fig. 2, on which are mounted the diamond cutters C in such a position in relation to each other (see Fig. 1) that the same, when brought to act upon a rock, will cut out a prismatical block with a square cross-section. (See Fig. 3.) As the carriage advances, this prismatical block enters between the bars B, and when the carriage is drawn back it carries the prismatical block with it, and a clear cavity is left in the rock.

In order to make room for the bars B, so that they can enter the rock, additional cutters, D, are applied, one to each of the bars B. These cutters are firmly mounted on tubular shafts E, which have their bearings in boxes  $b$ , secured to the bars B, and these cutters are provided

on their peripheries with cogs  $c$ , which engage with radial openings  $d$  in the cutters C, so that by turning the tubular shafts E motion is imparted to all the cutters. By means of the openings  $d$  open gears are produced, in order to allow the dust or dirt to pass through, and to prevent clogging.

The cutters D are provided with diamond cutters on their faces and on their peripheries, so that they cut out circular cavities  $D^*$ , Fig. 3, with cores  $e^*$ , which pass into and through the tubular shafts E. The openings or cavities  $D^*$  merge into the openings produced by the cutters C, so as to allow the bars B to advance without obstruction. On the inner end of each of these tubular shafts E is mounted a bevel-wheel,  $f$ , Fig. 1, which gears into a bevel-wheel,  $g$ , mounted on the outer end of a shaft,  $h$ , which has its bearing in the frame or body of the carriage A. On the inner ends of the shafts  $h$  are mounted bevel-wheels  $i$ , which mesh into each other, so that by imparting motion to one of them the required motion is transmitted to all the cutters C and D.

An open frame, L, may be secured between the bars B, so as to keep the same steady, said frame being situated close behind the cutters C.

In the body of the carriage are firmly secured two steam-cylinders, F, (one only being shown in the drawings,) the piston of each of which connects with a crank, G, firmly secured to one pair of the bevel-wheels  $i$ , the two cranks being situated at a suitable angle toward each other, so that a dead-center is avoided. Steam is admitted to the cylinders by a flexible pipe, H, from a steam-generator situated outside of the tunnel and not shown in the drawings.

One of the bevel-wheels  $i$  is geared with a screw-spindle, I, which passes into a stationary nut, J, so that by revolving said screw-spindle the carriage A is slowly advanced against the rock to be acted upon. The nut J is provided with four hinged braces, K, which can be brought to bear upon the sides of the tunnel, so as to retain the nut firmly in position, while the carriage is caused to advance. At the beginning of the operation the carriage A may be advanced by any suitable means until the tunnel has been cut out to such a depth that the braces K of the nut J will obtain the required hold.



With the steam-cylinder F may be combined a pump, for the purpose of throwing water upon the cutters whenever such may be requisite.

In the drawings my machine is represented 5 in a horizontal position; but it will be readily seen that said machine can be used in a vertical position for sinking shafts, and in that case a balance-weight must be applied to counter-balance partially or fully the weight of the machine. 10

A tunneling-machine has heretofore been composed of a wheeled carriage, on which is built a vertical frame-work, carrying horizontal and vertical shafts, to the ends of which 15 are secured disks for cutting at the top, bottom, and sides simultaneously, and such, therefore, I do not claim.

What I claim as new, and desire to secure by Letters Patent, is—

20 1. The combination, substantially as herein described, of the carriage A, the bars B, projecting from the front of the carriage, the cutters C, mounted on the ends of the bars at right angles toward each other, the additional cut- 25 ters arranged to operate in advance of the bars to form channels for the passage of the same, and means for advancing the carriage and operating all the cutters.

30 2. The combination, substantially as described, of the carriage A, the bars B, projecting from the front of the carriage, the cutters C, mounted on the ends of the bars, the additional cutters mounted on shaft running parallel to the bars B, arranged to operate in ad- 35 vance of the bars to form channels for the passage of the same, and means for advancing the carriage and operating all the cutters.

3. The combination, substantially as herein

described, of the carriage A, the bars B, projecting from the front of the carriage, the cut- 40 ters C, mounted on the ends of the bars at right angles toward each other, the additional cutters mounted on shaft running parallel to the bars B, arranged to operate in advance of the bars to form channels for the passage of the 45 same, and means for advancing the carriage and operating all the cutters.

4. The combination, substantially as herein- before described, of the carriage A, the bars B, extending from said carriage, the cutters C, 50 mounted on the inner sides of the bars, the tubular shafts E, mounted on the outside of said bars, the cutters D, mounted on the tubular shafts E, and geared together with the cutters C, and mechanism for imparting a revolving 55 motion to the tubular shafts for advancing the carriage.

5. The combination, substantially as herein- before described, of the carriage A, the bars B, extending from said carriage, the disks C, car- 60 ried by said bars, the shafts E, mounted on said bars, the cutters D, mounted on the shafts E, and geared with the cutters C by an open gearing, the steam-cylinder (one or more) mount- 65 ed in the carriage A, the screw-spindle I, and the bevel-wheels *i f g*, which transmit motion from the steam-cylinder to the shafts E, and to the screw-spindle I.

In testimony whereof I have hereunto set my hand and seal in the presence of two subscrib- 70 ing witnesses.

MAIER ROTHSCCHILD. [L. S.]

Witnesses:

W. HAUFF,

E. F. KASTENHUBER.