(No Model.)

G. McC. DERBY.

ROCK DRILLING APPARATUS.

No. 278,517. Patented May 29, 1883.

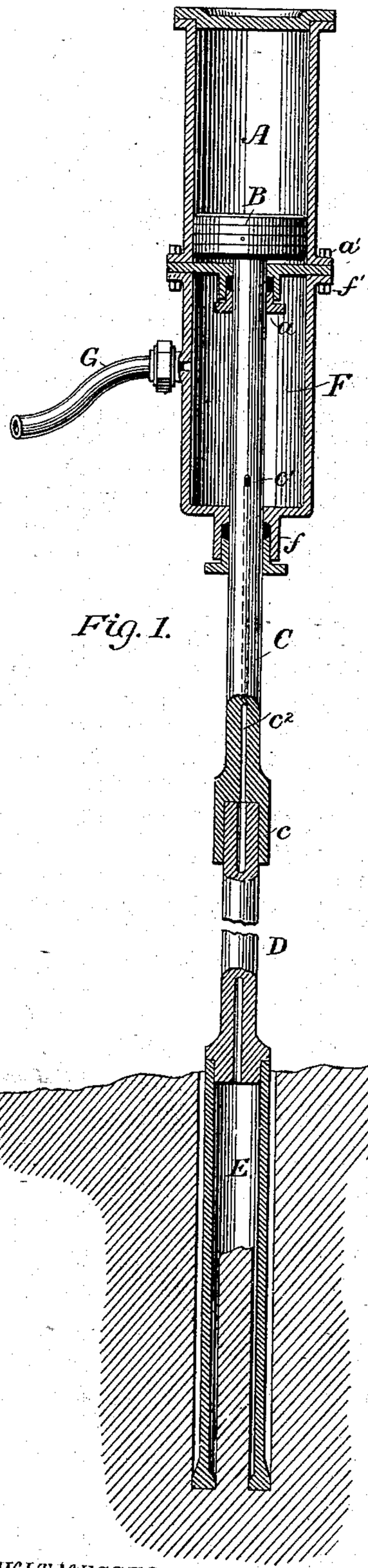


Fig. 1.

Fig. 2.

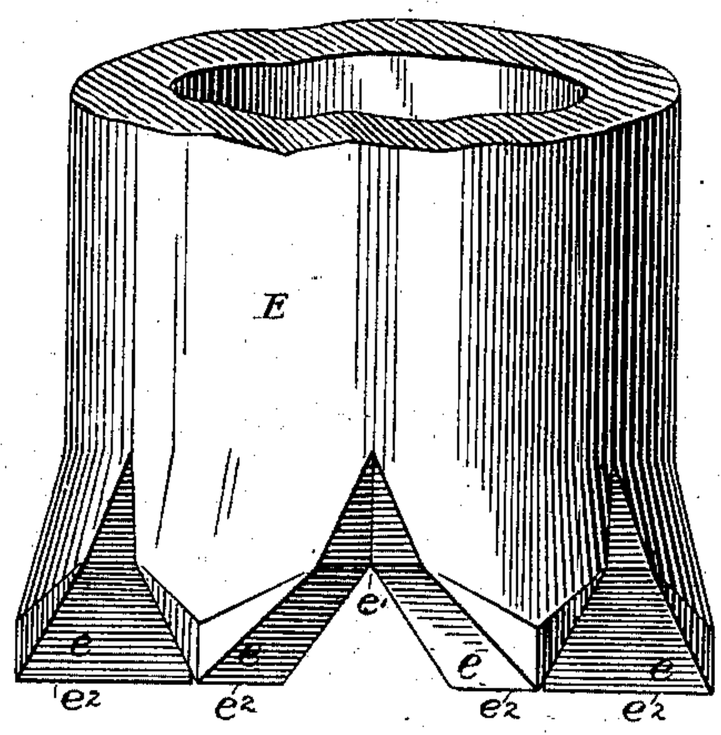


Fig. 3.

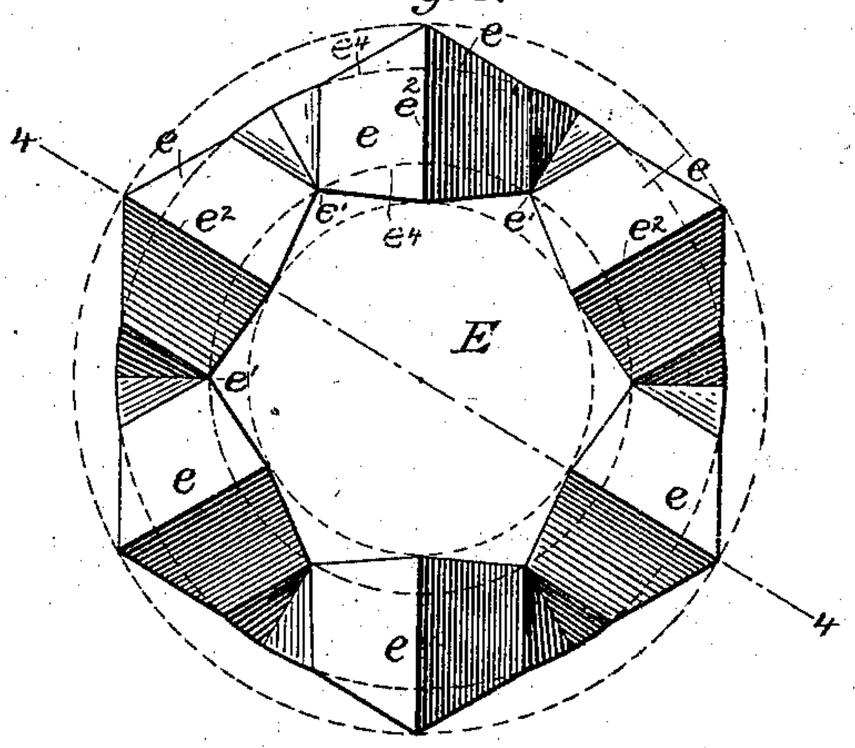
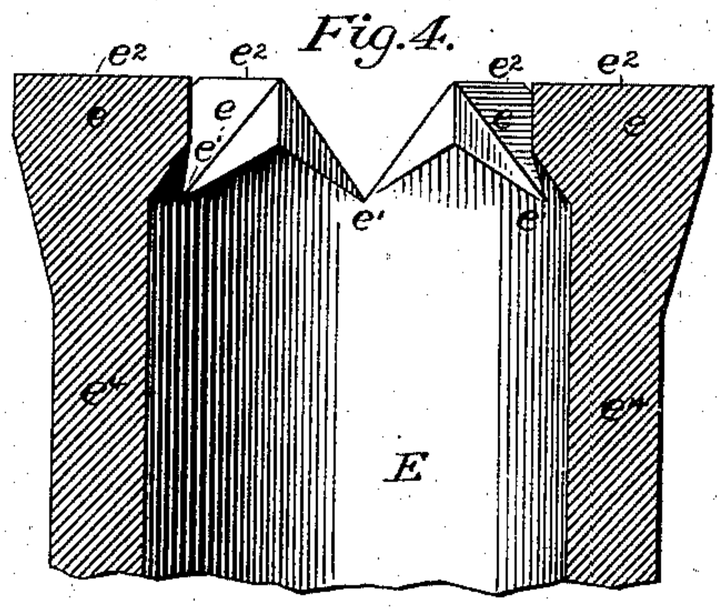


Fig. 4.



WITNESSES

Wm A Skinkle

Geo N. Breck.

INVENTOR

George McC. Derby,

By his Attorneys

Pope Edgecomb & Butler

UNITED STATES PATENT OFFICE.

GEORGE McC. DERBY, OF NEW YORK, N. Y.

ROCK-DRILLING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 278,517, dated May 29, 1883.

Application filed November 14, 1882. (No model.)

To all whom it may concern:

Be it known that I, GEORGE McC. DERBY, a citizen of the United States, and residing in the city, county, and State of New York, have invented certain new and useful Improvements in Rock-Drilling Apparatus, of which the following is a specification.

My invention belongs to that class of drills denominated "tubular," in which the bit or cutting-edge of the drill is formed upon or attached to the end of a tubular steel, and by the action of which an annular section of the rock operated upon is cut away. The advantage of this class is that the labor that would be expended in pulverizing the interior is saved. It belongs also to the class known as "reciprocating," which are operated upon the principle of the steam-hammer. These have their shank connected to a piston working in a cylinder. Steam or compressed air, being admitted alternately before and behind the piston, forces it rapidly to and fro, causing the drill to strike the rock with great rapidity and force. The advantage of the reciprocating drill, besides the rapidity of its operation, is that it can be used to drill a hole at any angle to the vertical. Heretofore, so far as my knowledge extends, it has not been found practicable to operate a tubular drill with this class of machine, but only drills having a solid steel and bit have been so worked. The diamond drill is tubular, but is worked only by a constant revolution about the axis of the tube and scratches away the rock without striking.

The practical difficulties to be overcome in using a tubular bit on the class of machine-drills above described are, first, to dispose of the core formed; and, second, to prevent the clogging of the drill by the accumulation of débris in the hole. These difficulties are largely increased by the very high rate of speed at which these machines are run and the small diameter of the holes that it is customary to drill with them.

The object of my invention is to overcome these difficulties and to provide means by which a tube may be employed for drilling holes under the influence of a rapid to-and-fro motion, imparted by such machinery as has heretofore been used for thus driving solid steels, thus uniting the advantages of both classes.

My invention consists in pitching up the end or bit of the drill and shaping the cutting-edges in such a manner as to rapidly break the rock, and to prevent clogging either on the outside or inside of the tubular shank-steel. It consists, also, in applying a stream of water, air, or steam to remove the broken material from the bit, soften the rock, and preserve the temper of the drill.

In the accompanying drawings, Figure 1 is a vertical section of a tubular drill embodying my invention, together with a device for communicating reciprocating motion thereto and supplying water or other fluid to the bit of the drill. Figs. 2, 3, and 4 are respectively an elevation, an end view, and a vertical section of the bit of the drill.

Referring to the drawings, A represents a steam-cylinder, of any suitable construction, and B a piston, arranged to be driven alternately forward and back within the cylinder in a manner well understood.

Affixed to the piston B, and moving therewith, is a tubular piston-rod, C. At its outer extremity a suitable clamp, *c*, is formed for receiving the extremity of the drill-shank D, and to the other extremity of the shank D is secured, in any suitable manner, the tubular drill E, hereinafter described. The shank D is also tubular, its perforation communicating at one extremity directly with that of the rod C, and at the other extremity with the interior of the tubular drill E.

Surrounding the rod C at its upper extremity is a cylindrical air or fluid chamber, F, with which communicates an inlet-tube, G, for supplying air, steam, or water from any suitable reservoir and under any desired amount of pressure.

Suitable packing-boxes, *a* and *f*, surround the piston-rod C at the points where it passes through the heads of the cylinders A and F. Suitable packing is provided, and the two cylinders are firmly united by means of suitable pressure-screws, *a'* and *f'*. A transverse aperture, *c'*, leads from the exterior of the piston-rod C, at a point within the air or fluid chamber F, into the center of the same, and

communicates with the longitudinal perforation c^2. The aperture c' is at all times within the cylinder F, and through it the fluid is forced continuously into the interior of the drill E. The continual flow of air or solvents therethrough serves both to force the powdered rock away from the bit of the drill, and thus from the hole, as it is being formed, thereby obviating the difficulties arising from the clogging of the drill, and to prevent the drill from becoming overheated and its temper thereby destroyed.

To provide clearance and keep the drill from being clogged by the accumulation of débris about its extremity near the bit, either upon the inside or outside, it becomes necessary that the cutting-edge of the drill should be wider than the steel immediately above it, and I therefore construct the same in substantially the manner shown in Figs. 2, 3, and 4. This construction consists in forming the face of the bit transversely serrate, as shown in Fig. 2, and at the same time swelling or expanding it upon its inner and outer edges. By rendering the cutting-edge serrate it will rapidly pulverize the rock against which it is driven, and by constructing the cutting-edges wider than the steel of the drill the dimensions of the hole formed will be sufficient to permit the drill to be reciprocated without undue friction, and the size of the core of rock cut by the inner edge of the drill will be such as to extend within the same without in any manner interfering with the motion of the drill.

For the purpose of conveniently obtaining the required expansion of the face of the drill, I prefer to form any convenient number of transverse wedge-shaped teeth, *e*, around the extremity of the drill. The inner edges of the adjacent teeth meet each other at their respective bases, as shown at e', and the surplus metal, obtained by forming the triangular openings between the same, is thrown out upon each lateral surface of the teeth, thus causing the face e^2 of each tooth to be of greater width than its base. The result of this method of forming the cutting-edge or bit is that it presents to the rock a polygonal figure, as seen in Fig. 3, the lines joining the outer ends of the cutting-edges of the teeth forming a regular figure, the number of sides depending upon the number of teeth.

The form given to the face of the drill in carrying out my invention will depend both upon the size of the hole to be made and the material to be operated upon. If a large hole is to be made, it is important to have the core remain unbroken, so that it can be removed in as large pieces or sections as possible, thereby saving the power that would be necessary to pulverize it; or if the rock operated upon is very hard, then it again becomes important to leave the core unbroken. To do this it is necessary that the teeth of the drill be pitched up both on the inside and outside, as represented in Fig. 3—that is, the face of the teeth should extend beyond the surface of the tubular steel both on the inside and on the outside. In such cases the tubular steel must be nearly as long as the distance the machine feeds. On the other hand, if the hole to be drilled is small, or if the rock is soft and easily pulverized, it is not always necessary to pitch up the inside of the teeth in this manner, the pitching up of the outside being sufficient. The drill, then, by its action breaks off the core in small sections and soon pulverizes it, the débris of which is carried away with the rest.

It will be apparent from an inspection of the drawings that the triangular spaces formed between the teeth and extending above their basis provide abundant clearance for the escape of the débris. The expansion of the steel commences as near the base of the teeth as is expedient for combining the requisite enlargement and strength.

I do not herein broadly claim a tubular rock-drill attached to a tubular shank, in combination with mechanism for communicating a positive to-and-fro motion thereto, and for forcing a stream of air or water therethrough, as I contemplate embodying the same in an application to be hereafter filed by me.

I claim as my invention—

1. A tubular rock-drill having its bit or cutting-edge composed of wedge-shaped teeth the cutting-edges of which are wider than their bases, so arranged that lines joining their outer edges shall form a polygon, and having triangular recesses between said teeth and extending above their bases for the escape of débris.

2. The combination, substantially as hereinbefore set forth, of a tubular rock-drill, a tubular shank rigidly secured to said drill, mechanism for giving a positive to-and-fro motion to said drill, means, substantially such as described, for supplying air, steam, or water through the interior of said shank and drill to the bit of the drill, and a bit or cutting-edge to said drill, composed of wedge-shaped teeth the cutting-edges of which are wider than their bases, so arranged that lines joining their outer edges shall form a polygon, and having triangular recesses between said teeth and extending above their bases for the escape of débris.

In testimony whereof I have hereunto subscribed my name this 11th day of November, A. D. 1882.

GEO. McC. DERBY.

Witnesses:

DANIEL W. EDGECOMB,

CHARLES A. TERRY.