(No Model.)

C. HOFFMANN.

APPARATUS FOR ROCK BORING.

No. 474,297. Patented May 3, 1892.

Fig. 3.[a]

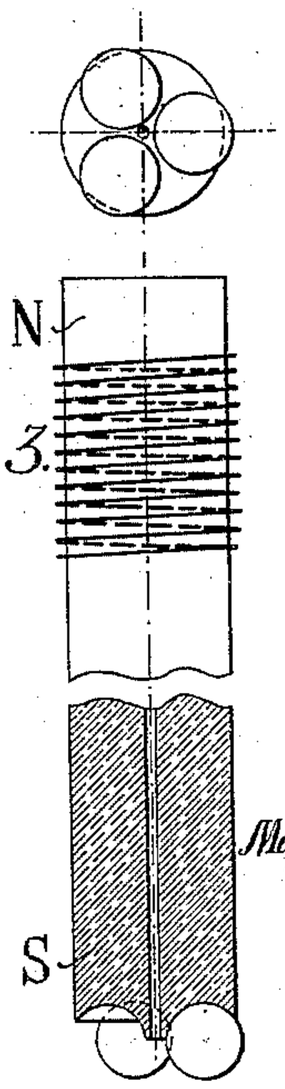


Fig. 3.

Fig. 1.[a]

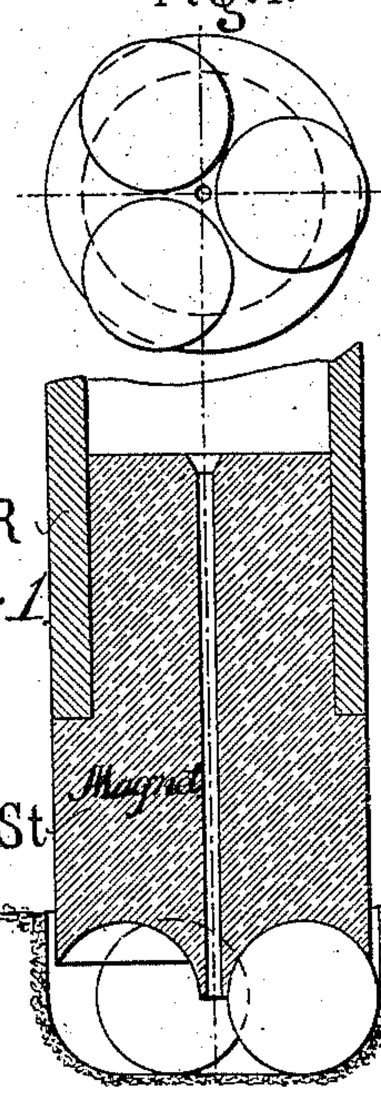


Fig. 1.

Fig. 2.[a]

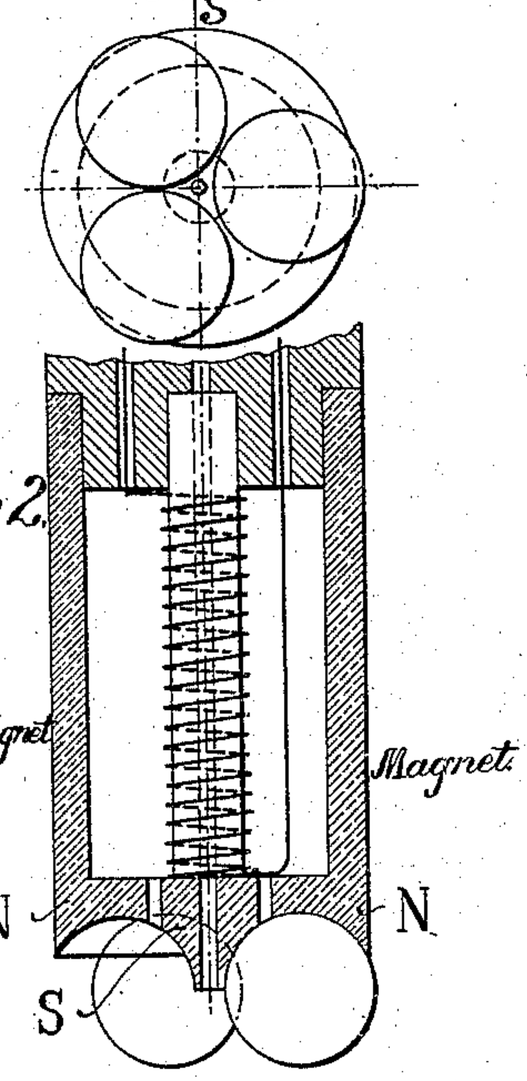


Fig. 2.

Fig. 4.[a]

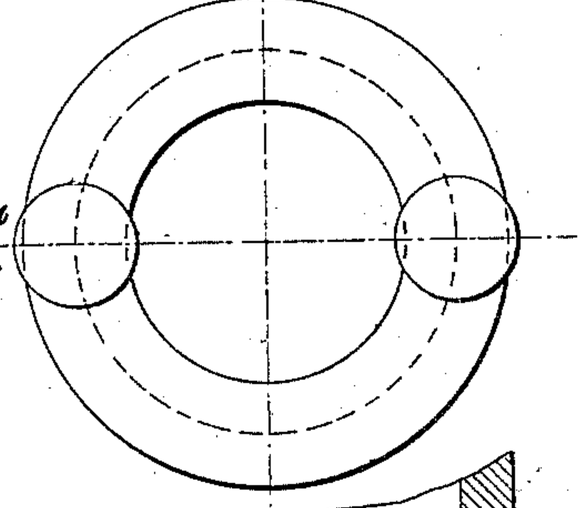


Fig. 4.

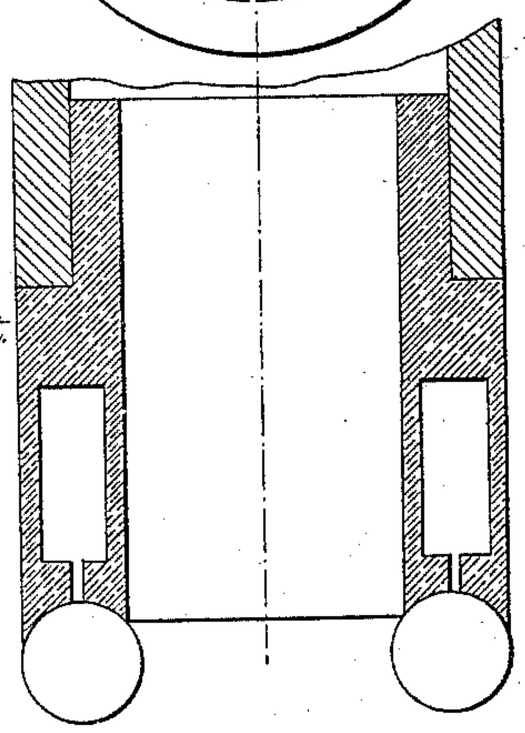


Fig. 5.[a]

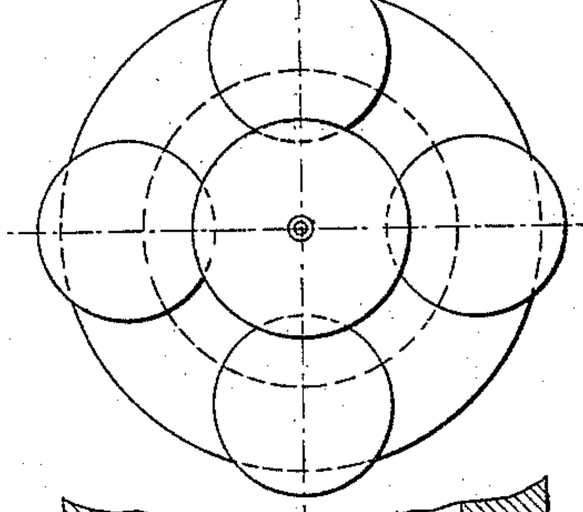
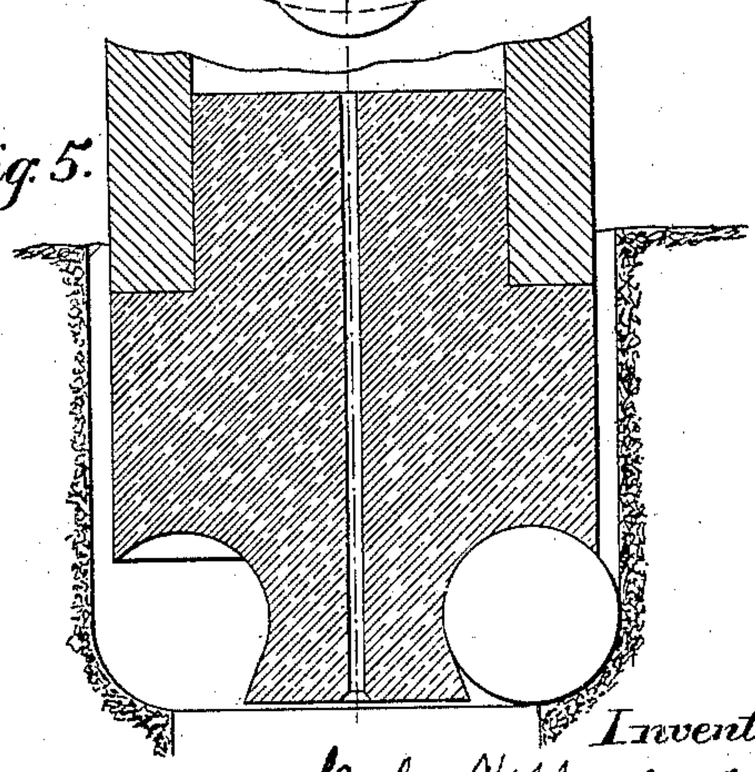


Fig. 5.



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UNITED STATES PATENT OFFICE.

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APPARATUS FOR ROCK-BORING.

SPECIFICATION forming part of Letters Patent No. 474,297, dated May 3, 1892.

Application filed November 25, 1891. Serial No. 413,119. (No model.)

To all whom it may concern:

Be it known that I, CARL HOFFMANN, a subject of the King of Prussia, residing at Charlottenburg, Prussia, have invented certain new and useful Improvements in Rock-Drills; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to rock-drills; and it consists of certain novel features hereinafter described and claimed.

In the accompanying drawings, in which similar letters refer to similar parts throughout the views, Figure 1 represents a vertical section of one form of drill-head constructed according to my invention, and Fig. 1^a represents a view of the lower end of the same looking upward. Figs. 2, 3, 4, and 5 represent modifications of the device shown in Fig. 1; and Figs. 2^a, 3^a, 4^a, and 5^a represent views of the bottom of the said modifications, respectively, looking upward.

In Figs. 1 to 5 illustrations are given of various methods of manufacturing drill-heads to carry out the process above described.

In the device shown in Fig. 1, R represents any long iron or steel tube, which at its upper end is attached to a drilling machine or mandrel. The steel piece S*t*, Fig. 1, attached to the bottom part of the tube R, is provided at the bottom with a semicircular groove intended for the reception of one or more chilled-steel, cast-iron, or other solid-metal balls, preferably magnetic, which, when the bore-rod is turned, are rolled under pressure over the bottom of the bore-hole. At the center of the steel piece S*t* there is a hole *h*, through which water flows between the boring-balls. In order to prevent the boring-balls from falling down from the bore-rod when the borer is withdrawn or when the same should happen to meet cavities in the rock, both parts are kept together in a permanent connection by magnetic attraction. This is shown in Figs. 1 to 4.

In Fig. 1, S*t* represent a permanent magnet.

In Fig. 2 the bottom surface of the bore-rod consists of the two concentric poles N and S of a pot-shaped electro-magnet. The annular interval *v* between N and S must be conceived as filled out by a non-magnetic material.

In Fig. 3 a magnetizing-spiral is on the bore-rod, and its upper end becomes one pole of a magnet and its lower end, which holds the balls, an opposite pole.

Figs. 4 and 5 show two special constructions. Fig. 4 represents a ball-drill, which at the center of the bore-hole leaves a core standing. Fig. 5 shows an enlarging-drill as used, for instance, in bore-holes which, owing to the unevenness of the rock, were not run straight.

The boring itself is done in the following manner: The bore-rod is firmly pressed upon the globes or balls and made to turn. The balls, rolling around in the groove, follow the rotary motion of the axis, and, as they always touch the rock at but few points, upon such points a strong pressure is exerted and the rock at such points is crushed without the occurrence of a sliding friction between it and the balls, which might subject the balls to considerable wear and tear. The finely-pulverized rock is removed by the jet of water introduced through the hole *h*. The rock at the center of the bore-hole not directly struck by the balls comes off in small pieces, owing to the lateral pressure exerted by the balls, which particles fall below the balls and are here likewise crushed by them. It is, however, not necessary to make the boring-balls and the boring-heads of magnetic or, as the case may be, of magnetizable material. One may just as well make use of bronze or any other alloys or metals sufficiently capable of resistance and of any special stopping or catching apparatus which would prevent the balls from falling out of the end of the drill-head when the latter is withdrawn from the bore-hole or the pressure on the balls is removed.

In the mode of arrangement, as illustrated by Fig. 5, for instance, the middle shoulder enlarged toward the bottom of the bore-head fully suffices to hold the balls and to draw them out by means of the boring-rod without additionally using the magnetic attractive force. In a similar manner one could proceed in case of the remaining forms of construction.

Having thus described my invention, what I claim, and desire to secure by Letters Patent of the United States, is—

1. In a rock-drill, the combination, with a rotary drill-head having an annular groove in the front end thereof, of a plurality of hard-metal balls suitably held in but protruding from and free to roll in said annular groove, substantially as described.

2. In a rock-drill, the combination, with a rotating drill-head having a conduit for water therein and having an annular groove in the front end thereof, of a plurality of hard-metal balls free to roll in said groove, but suitably held therein and protruding therefrom, substantially as described.

3. In a rock-drill, the combination, with a magnetized rotating drill-head having an annular groove in the front end thereof, of a plurality of hard-iron or steel balls held by magnetism in said groove, but rolling freely therein and protruding therefrom, substantially as and for the purposes described.

4. In a rock-drill, the combination, with a magnetized rotating drill-head having a conduit for water therein and having an annular groove in the front end thereof, of a plurality of hard-iron or steel balls held by magnetism in said groove, but rolling freely therein and protruding therefrom, substantially as and for the purposes described.

In testimony whereof I have affixed my signature in presence of two witnesses.

CARL HOFFMANN.

Witnesses:
B. ROI,
E. KOLLINER.