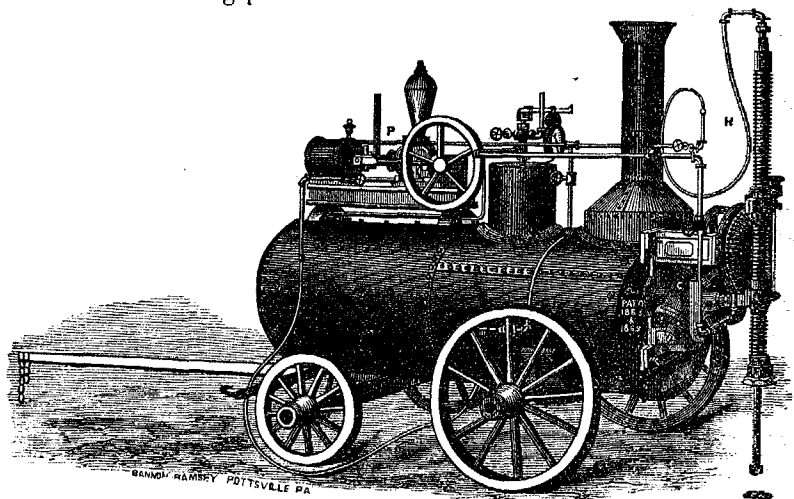


**THE DIAMOND ROCK DRILL.**

BY JOHN WARNER, A. M.

Engineers and mechanics are acquainted with the process of boring metals with rotating drills made of hardened steel, but boring the hardest rocks with rotating drills set with diamonds for cutters is a recent invention which, although in use several years, will, I think, have the interest of novelty for most of the readers of the Journal. The invention is due to Prof. Leschot, a French engineer. It was used in completing the Mont Cenis Tunnel, and was favorably reported on by a commission at the Paris Exposition of 1867. The Pennsylvania Diamond Drill Company is now engaged in manufacturing and operating the Diamond Drill. By the kindness of M. H. Smith, Esq., of Pottsville, the Company's Resident Superintendent, I am enabled to present the following particulars :



The cut represents a Portable Steam Rock Drilling Machine, suitable for boring artesian wells, or test-holes in prospecting for coal or minerals ; it weighs about 6000 lbs. Other machines, constructed on the same general principles with this, are made of various forms and sizes, for various kinds of work, as for quarrying, sinking shafts, mining and tunneling : these machines may be operated by steam or by compressed air.

Returning to the cut, the boiler is immediately recognized, and the machinery which operates the vertical drill is bolted against the end of the boiler.

This machinery consists of two oscillating steam cylinders, C, of six inches diameter and six inches stroke, working the same crank shaft; other details of the steam engines need not be noticed here. By a series of mitre wheels and other gearing, the revolution of the crank shaft produces the rotary motion and downward feeding of the vertical drill rod, or its speedy withdrawal, when desired, from the bore hole.

The drill rod is made of iron tubing, especially prepared, screwed together, from time to time, in sections, as the drill descends into the rock.

The drill rod passes through a larger tube, about ten feet long, having a screw thread upon the outside. This tube produces the so-called automatic differential and frictional screw feed, by means of which the feed motion and the pressure of the drill upon the rock are made independent of the weight of the drill rod, whatever may be the depth of the bore hole, so that the drill is rendered perfectly sensitive and, to a certain extent, self-adapting to the character of the rock, even when this varies extremely and suddenly in hardness.

The drill proper is screwed fast to the lower end of the drill rod. It is a metallic thimble, about four inches long, having a number of diamonds, either of the so-called black diamonds or of those translucent or partially crystallized, or of both, in their natural or rough state, firmly imbedded in the annular face of one end of the thimble; a female screw in the other end suffices to attach the drill to the drill rod. As the drill descends, a cylinder or core of stone is left standing inside of the hollow drill rod: a self-adjusting wedge is placed in a groove inside of the hollow drill; this wedge allows the core to pass freely up into the drill rod, but seizes the core and breaks it off and brings it to the surface when the drill is withdrawn. If the core is very large, it may be necessary to break it off at the bottom by an ingenious system, of which we shall not give details; frequently the core is broken by natural cleavages of the rock. The cores thus taken out, from time to time, give a perfect record of the lithological formations through which the drill has passed. It is also possible to use drills which make no core, cutting the hole in its whole diameter; but we continue to speak of the hollow drill.

An indispensable appendage is yet to be mentioned: this is a steam force-pump, P, here seen on top of the boiler. This pump draws a supply of water from any convenient reservoir, by means of a rubber hose, and in a similar manner forces the stream, through a swivel joint,

in at the upper end of the hollow drill rod, and thus to the bottom of the bore hole, where it moistens the rock, keeps the drill cool, and then ascends on the outside of the drill rod, carrying upwards the fine material or cuttings into which the rock is reduced by the diamonds set in the drill.

The principal parts of the machine above mentioned are, then, 1st, the boiler; 2d, the steam driving machinery and feed gear, with the drill-rod and drill; 3d, the force pump and stream of water. These parts may be connected with a vertical boiler, or they may be separated and placed at a distance each from the others, according to the nature of the work. It should be observed that the drill rod and feed gear can be so arranged as to permit boring in any desired direction, with convenient modes of shifting the direction at pleasure; and the same freedom of application may be obtained with compressed air for a motive power.

The speed of boring depends much upon the nature of the rock, varying, for a two-inch hole, which is suitable for test-holes, from four feet per hour, in hard rock, to ten feet per hour in sandstone and slate, with a rotary speed of three hundred revolutions per minute.

In the Pottsville region holes have been bored, in hard rock, as large as nine inches in diameter.

These machines are recommended by General H. Pleasants, Engineer of Mines of the Philadelphia and Reading Railroad Company, under whose direction they are now in use, near Pottsville, in sinking deep shafts upon coal lands belonging to that Company.

The speed with which the work of shafting and tunneling may be prosecuted, and the regularly cylindrical shape of the holes—an important matter in blasting—give these machines advantages over all others yet known for the same purposes.

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## MERRILL ON IRON TRUSS BRIDGES,

By CHARLES F. JOHNSON, JR.,

(Engineer for the Kellogg Bridge Company.)

Although Colonel Merrill's work has been before the profession for some time, a few words on various subjects suggested by it may not be unseasonable. The subject of Iron Bridge Building is becoming so important, that any contribution to our knowledge of the economical distribution of material in an iron truss is valuable. A thorough and analytical work, like that of Colonel Merrill's, must therefore be