“The Manufacture of Power Drills for Mining, Excavating, Etc.”

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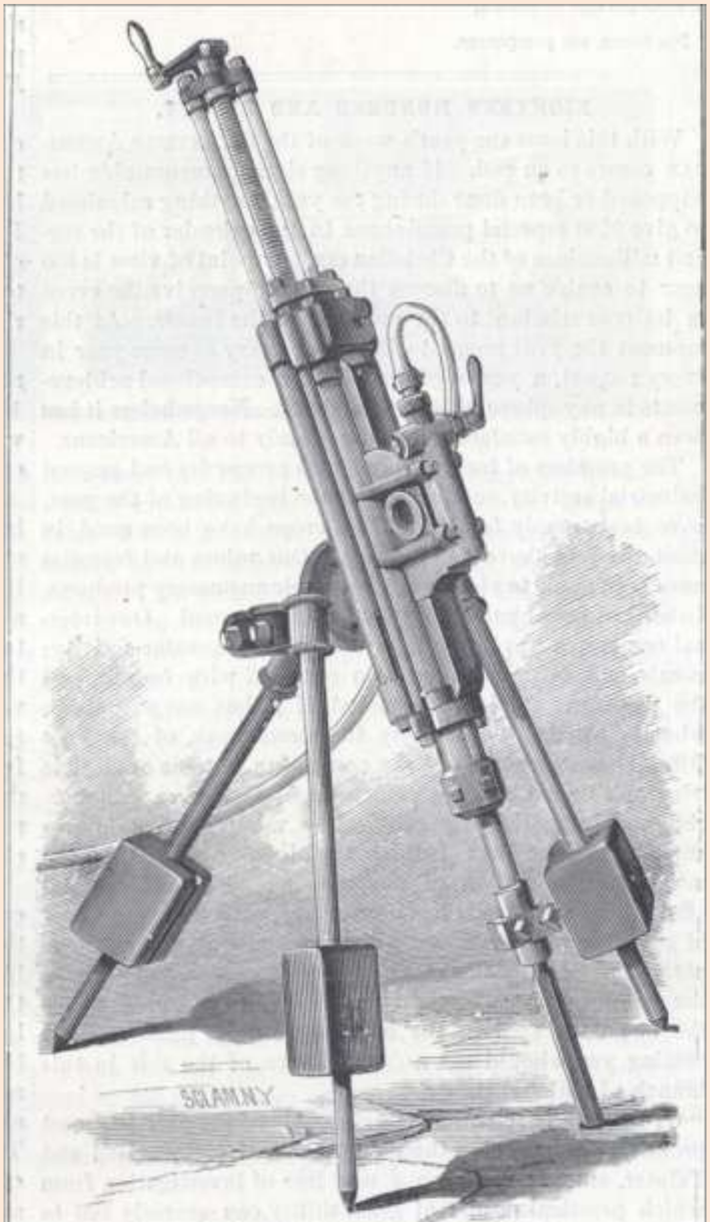
"Although mining, tunneling, etc., have been of more or less importance, as calling for the labor of large numbers of men, in all ages and in nearly every quarter of the globe, it is only within a few years that the tools and appliances with which such work can be prosecuted have shown any great improvement over those employed in early times. After the use of gunpowder for blasting purposes had been commenced, it seemed for a long period as though there was a complete cessation of all idea (sic) of improvement in this direction, until the comparatively recent introduction of the power drill in connection with more powerful explosives. It is not too much to say, however that from these two causes, but more particularly from the introduction of the power drill, the past twenty years has shown greater improvement in the means and appliances for the rapid and economical prosecution of this class of work than all the years that had gone before. Besides this, also, many projects which were heretofore entirely impracticable have been brought well within the scope of modern engineering ability and mines which could never have been made to pay under the old system of hand drilling are now contributing to the substantial wealth of the world.

"The power drill may be worked with either compressed air or steam, but in many cases, from the location where the drill is operated and the inconvenience attending the getting rid of the exhaust steam, it would be only at a great disadvantage that steam could be employed, while the circulation of pure fresh air provided by the working of the drill with compressed air affords a most valuable result in the way of ventilation for the shafts of mines, in tunnels, and all kinds of ordinary underground work. The manufacturers of the Rand Little Giant rock drill, of the practical working of which we present illustrations on this page of the paper, are also manufacturers of an improved air compressor for use in connection therewith. They have recently furnished the most powerful air compressing plant employed in mining in the world, and it is now in successful operation at the Calumet and Hecla mines on Lake Superior. These compressors furnish cool and perfectly dry air, the last particular being absolutely essential in cold climates or at great elevations.

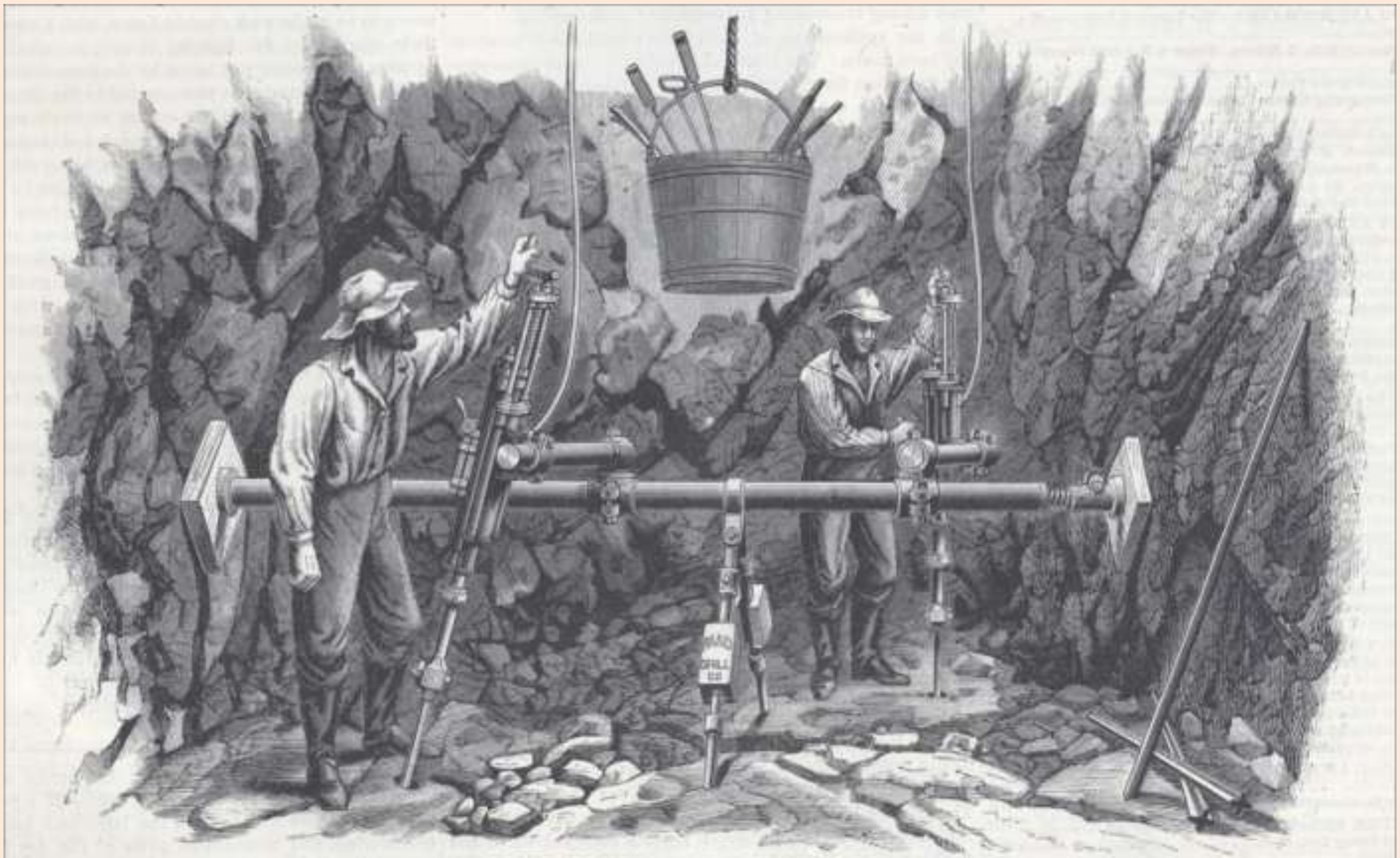
"The requirements for a perfect rock drill are numerous, but it should first of all be simple in construction and strong in every part, the parts, as far as possible, being so arranged that any broken or worn portion may be easily removed and a new part substituted without causing delay in the work. It should occupy but little space, with the striking part relatively of great weight, and to give the blow directly, so that only the piston should feel the shock of connection. Of course the piston must be so arranged as to make a variable stroke, so that no damage will result from the sudden removal of resistance, which often occurs in boring through rocks of different density, or where flaws or breaks occur. Such a machine, if disconnected from frame or carriage, should be as light as possible, and so arranged that it may be readily put up and taken to pieces.



THE RAND ROCK DRILL

"The Rand Little Giant rock drill is the result of many years of experiment for the attainment of these ends, and from the testimonials of some of our largest mining companies who are using the drills and compressors of this company with the utmost satisfaction, it is believed that success has been practically attained. The first point to notice in the construction of this machine is its simplicity, there being no connecting rod or other device outside the steam chest and cylinder to get out of order, the valve being thrown in the same direction the piston is moving, and the port remaining open until the full stroke has been made. The lever for operating the valve is placed in a recess between the ends of a double-headed piston, and is struck at the ends as the piston reciprocates, the arm of the lever driving the valve. The valve is of steel, and the whole mechanism is so simple and direct that there is never any difficulty in running at any desired speed, as high as 600 to 700 double strokes per minute having been made, the double stroke meaning the forward and backward motion of the piston.

"In the working of this drill the full force of the compressed air or steam is brought to bear directly at the point where the stroke is delivered. The piston rod enters the piston on a taper, and the rotation bar, which is nearly triangular in cross section, is made very strong; the ratchet wheel for rotating is proportionately large, and the teeth strong. This piston is hardened and then ground to a perfect fit on an emery wheel.



ROCK DRILLS AND THEIR USES.

"These drills are used either mounted on a tripod or attached to a vertical column or a horizontal duplex swivel-jointed bar, according to the location in which the boring is to be performed. In vertical work, either the horizontal bar or tripod may be used, the former, however, only between comparatively narrow side walls, against which the bar can be made firm. The legs of the tripod are arranged to telescope, so that they can be lengthened or shortened at will, thus allowing holes to be bored in very difficult places and at almost any angle. The column, with an arm, is particularly advantageous in all kinds of tunnel work, and the horizontal bar is more especially advantages in shaft sinking. The latter is one of the most valuable inventions which has been brought out for some time. It allows two drills to operate simultaneously at any angle by means of the supplemental jointed bars. The rapid blows given by the drills upon the solid rock cause great vibration; this would tend to loosen the bar by turning the jack screw in the nut; to prevent this a lock nut is used, which keeps the screw in place and prevents any loosening of the bar after it is once set up. It can readily (sic) adjusted, the arms folded parallel to the bar, with the drills mounted upon them, and

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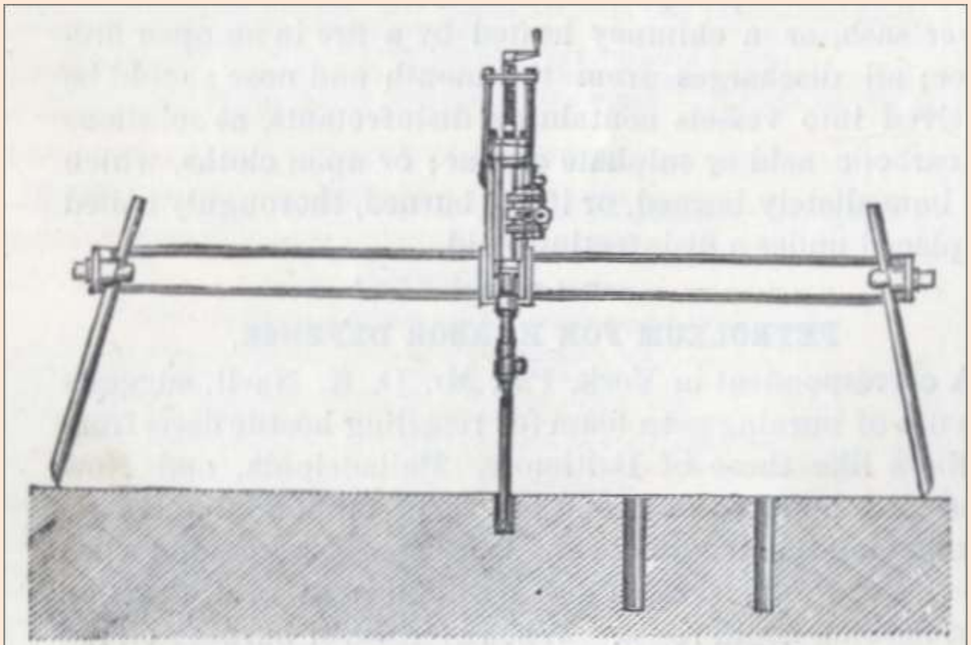
the whole plant lowered to its place in the shaft by the hoisting rope. By the use of rock drills, mounted in this manner great economy is effected in the sinking of shafts, the work being done at half the cost and in one quarter of the time as against hand labor.

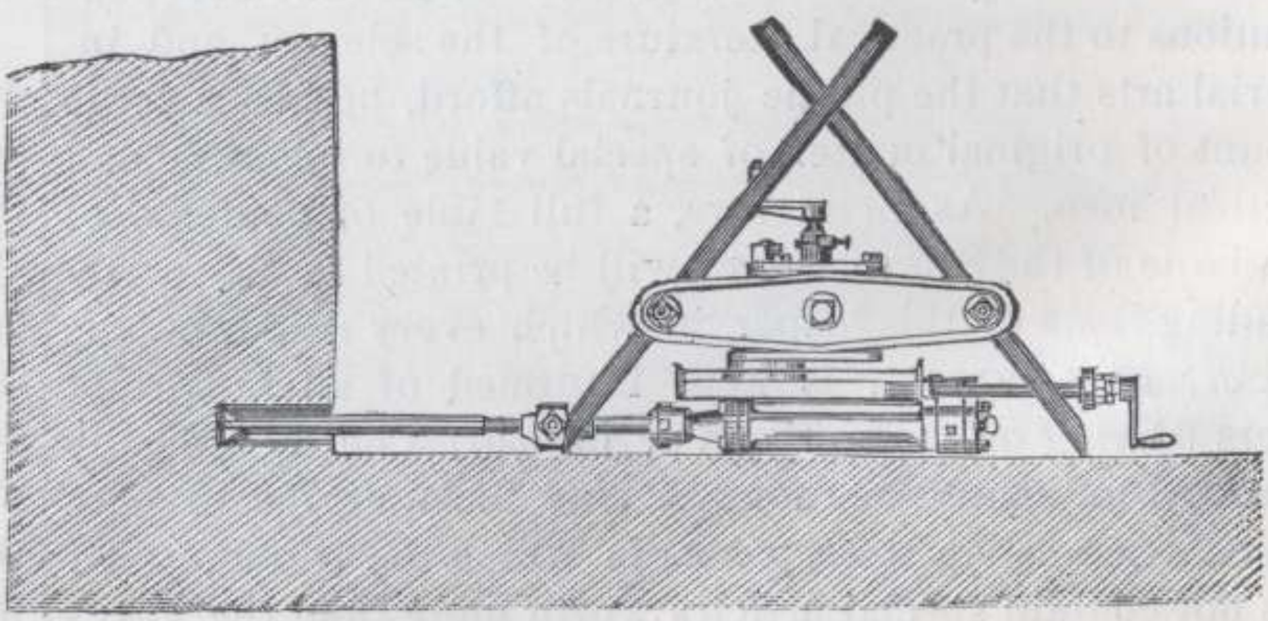
“For rock drilling under water, where the work is to be done from the surface and not by tunneling rom a sunken shaft, it is usual to anchor a platform or scow over the site of the proposed work. The company have an improved description of drill scow for this class of work, in which the drills, instead of passing through the vessel as formerly, are placed at the ends, and suitable mechanism is provided for raising and lowering them in a vertical line. The bits extend down through tubes attached to moveable carriages. The scow is lifted bodily out of the water, if necessary, by spuds forced down against the rock, thus forming a firm stationary platform. One of these scows was used in deepening the St. Lawrence River near the mouth of the Lachine Canal, where the cutting amounted to 9 feet of rock under 9 feet of water, in order to make a clear channel of 18 feet in depth. Four Rand drills, of 5 inches diameter, were employed, and during 1878 and 1879 the scow worked on an average six months per year, removing in that time about 45,000 yards of rock.



DRILL MOUNTED FOR QUARRY WORK.

“These drills are regularly rated, as to size, from No. 0, which weighs 150 lb., and bores holes from ½ inch to 1 inch in diameter, to No. 6, which weighs 900 lb. and drills 3 to 4 inch hole 30 feet deep. These are intended to cover all ordinary classes of boring, from the lightest plug and feather work to the heaviest bores required in deep cuts, railroad tunnels, mining, and submarine drilling, the size of the drill and the speed at which it should be run differing according to the location and the quality of the rock that is to be operated on. The heavier the drill the slower are the strokes generally, but experience has shown that several other conditions must govern in regulating the speed at which the drill is worked, so that while the rock is fractured and the hole bored without quick destruction of the bits the water will wash out the *débris*. The machine drill is far less destruction of bits than hand drilling, for the piston end of the drill is never damaged, as is the hand drill, by the blows of sledges; but yet it has until lately been assumed that in some classes of work hand drilling was the most advantageous. In regard to this point some recent testimony from an iron mining company on Lake Superior is of practical value. The agent in

ROCK DRILL WITH COLUMN.



QUARRY MACHINE.

charge says that with these drills ‘we have no difficulty in drilling the hardest quartz or jasper, though we never before have been able, with power drills, to do as well as men could with hammers in such ground.’ Besides the abundant proofs (sic) of superior efficiency and economy in the working of the Rand drill with the Rand air compressor, which have been afforded in practical experience, the company have had made a series of scientific tests, in which the speed of the drill and the consumption of air at different temperatures, and all the conditions governing the work, were accurately determined. The blows given by the drill were received by a mass of iron, a blunt-headed rod being used instead of a pointed drill. The maximum stroke of the piston was 6 ¾ inches, and the average stroke during these experiments was 6 inches. The indicator diagrams were taken from the drill cylinder at speeds varying from 111 to 298 double strokes per minute, and at pressures of from 25.5 to 26.5 lb. per square inch above the atmosphere, the piston of the drill being proved practically tight before commencement. When not striking the speed of the drill was controlled by the throttle valve, but for the other runs the throttle valve was pinned wide open, and a constant pressure maintained in the reservoir. The principal results shown by the diagrams are as follows:

No. of Diagram.	1.	2.	3.	4.	5.	6.
Pressure in reservoir, per sq. in.	....	12·5	26·5	....	12·5	26·5
No. double strokes per minute	135	200	298	135	203	298
Scale of indicator springs	$\frac{1}{16}$	$\frac{1}{16}$	$\frac{1}{24}$	$\frac{1}{32}$	$\frac{1}{16}$	$\frac{1}{24}$
Mean effective pressure, pounds per sq. in	5·78	8·54	13·6	6·66	8	11·5
Ratio of pressure in cylinder working to pressure in reservoir	....	0·95	0·89	....	0·98	0·89
Fraction of stroke completed to exhaust	0·87	0·85	0·76	0·72	0·73	0·76
Fraction of stroke completed to cushion	0·71	0·81	0·78	0·84	0·83	0·70

Reducing the results obtained in ten experiments, the following facts were obtained:

No. of Experiment.	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
Pressure in reservoir	15	20	25	30	35	40	45	50	55	58
Double strokes per minute	225	259	280	309	333	348	395	415	429	452
Temperature reservoir deg. Fah.	75	82	85	90	100	105	130	135	150	160
" valve chest, "	70	70	70	70	71	75	80	80	80	80
" exhaust, "	57	52	48	46	44	42	43	44	44	44
Velocity of air in the exhaust pipes	246	358	510	724	850	1,012	1,250	1,484	1,600	1,788
Cubic feet air exhausted per m. at exhaust temperature and atmospheric pressure	22·3	32·3	46·1	65·4	76·8	91·4	112·9	134·1	152·7	161·5
Probable equiv. of air exhausted at reservoir pressure and temperature	10·4	12·2	14·5	17·9	18·7	19·2	20·0	20·8	21·9	21·2
Cubic feet of air used per minute, calculated from piston displacements	11·1	12·8	13·9	15·3	16·5	17·2	19·6	20·5	21·2	22·4

“The air compressor which the company have built for use especially for their drills, but no less desirable for all other work for which compressed air may be needed, has met with general favor. Its cylinder is composed of three shells, forming two annular spaces around the working cylinder; the outer space affords a passage for the air after compression and a vessel for collecting any moisture there might be in the air, while the inner space forms passages for the water used in cooling. The heads of the cylinder, as also the piston and piston rod, are hollow, with passages for water for cooling, In this way the heat caused by the air compression is effectually got rid of. Self-lubricating piston rings are used, reducing friction to a minimum, and only cool dry air is furnished.

“The drills and air compressors of the Rand Drill Company have been long enough in use to have their merits abundantly attested, as they are in the most flattering terms by some of the most extensive and successful mining companies in the country. In California, Colorado, Nevada, Utah, and in the whole Rocky Mountain region, in the Lake Superior mining districts, in Pennsylvania, New Jersey, and New York state, they have in many cases furnished the entire working machinery and in all the different classes of mining work, as well as in tunneling and excavating of every description, their simplicity of construction, non-liability to get out of repair, the amount of work they will do, and the economy of their operation, the machines have recommended themselves to practical men everywhere.

“The New York office and salesroom of the company is at No. 21 Park Row.”