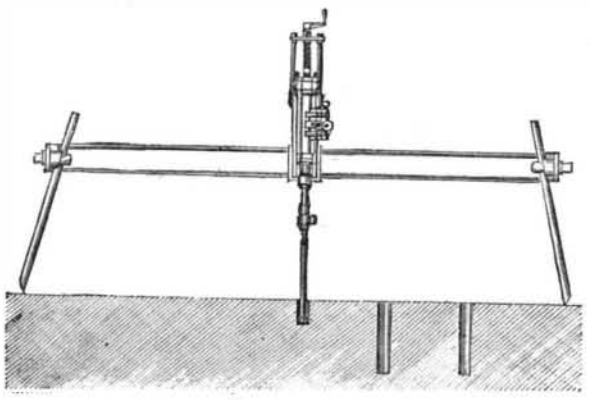
AMERICAN INDUSTRIES.

[*Continued from first page.*]

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 from 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 movable 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.

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 holes 30 feet deep. These are intended to cover



DRILL MOUNTED FOR QUARRY WORK.

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 destructive 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 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 do with hammers in such ground." Besides the abundant proofs 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 6¾ 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 12·5 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	½	½	¾	⅓	½	¾
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:

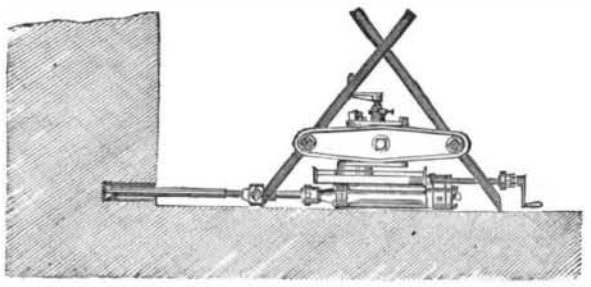
No. of Experiment.	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
Pressure in reservoir	15	20	25	30	35	40	45	50	55	58
Double strokes per minute	225	259	280	309	333	348	395	415	429	452
Temperature reservoir deg. Fah..	75	82	85	90	100	105	130	135	150	160
" valve chest, " ..	70	70	70	70	71	75	80	80	80	80
" exhaust, " ..	57	52	48	46	44	43	43	44	44	44
Velocity of air in the exhaust pipes	246	353	510	724	850	1,012	1,250	1,484	1,690	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	22·3
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 with 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 abundant-

ROCK DRILL WITH COLUMN.

ly 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



QUARRY MACHINE.

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.

WESTERN SIDEWHEELERS.

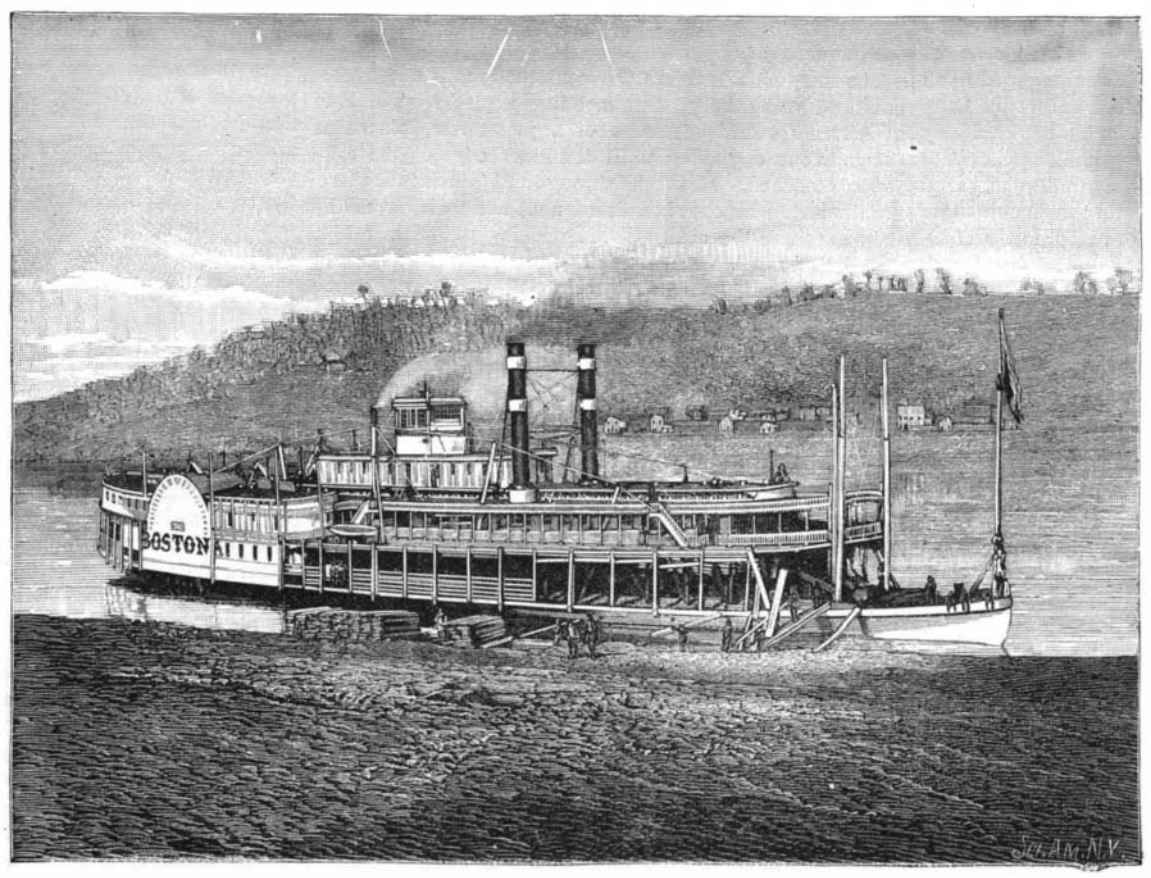
The illustration is not only an accurate delineation of one of the most remarkable steamers ever built, but it may be taken as a representative of the general appearance and detail of the Western river steamers as a class. The wheels in these boats are always abaft midship, and the boilers are located on the lower (main) deck amidships.

The Bostona, shown in the engraving, was built at Cincinnati, in 1879, to ply on the Ohio between that city and Huntington, W. Va., the western terminus of the Chesapeake and Ohio Railway. She measures 302 feet long, 43½ feet beam, 6 feet hold, and carries 1,000 tons freight, yet with steam up and fuel aboard, draws only *slightly over two feet*. She has complete accommodations for about 200 passengers. There are four steel boilers, 30 feet long, 47 inches in diameter, with six return flues each; *two engines*, horizontal, high pressure, 25 inches diameter, and 8 feet stroke. The wheel shafts are located 98 feet from the stern.

As this trade demands that the freight be handled as quickly as possible, all cargo is carried on deck. This brought about an ingenious arrangement, by which the fuel box, which heretofore had encumbered considerable space on deck, was done away with and the unused hold utilized. A double railway track is laid throughout the length of the steamer's hull, on which are a number of small cars containing the fuel.

By the shifting of these coal cars the steamer is trimmed even when running light.

H. L. BRIDWELL.
Hillsboro, Ohio.



THE LIGHT DRAUGHT STEAMER "BOSTONA."

NEW GUN OF REMARKABLE POWER.—Sir W. Armstrong & Co. have lately produced a five ton (95 cwt.) gun that discharges a 120 lb. projectile with a velocity of 2,064 feet per second, which is equal to 3,545 foot tons of stored up energy, or 746·3 foot tons per ton weight of gun