

engineers, contractors, mine owners, and shareholders in mines to this all-important subject. They need only test the steel according to my directions to convince themselves that what I have advanced can be borne out in practice. When used for boring ordinary rocks, this steel is all but imperishable in its edge. Two hundred feet have been bored with a single borer in limestone rock without the bit requiring to be fresh dressed and tempered.

Apart from any interest of my own as an inventor, this matter is one of the deepest national importance; and the adoption of the steel in question in the Cornish mines would enable the miner's interest there to set foreign competition at defiance, and numbers of mines now barely paying cost would at once spring up into dividend mines, whilst a multitude of other mines now abandoned from the depression of the prices of copper and tin would immediately be brought into active operation.

R. MUSHET.

Cheltenham, Dec. 26, 1864.

Trial of a New Machine for getting Coal.

From the London Mechanics' Magazine, December, 1864.

On Wednesday last a coal cutting machine, on an entirely new principle, the invention of Messrs. Lock and Warrington, colliery owners, Kippax, and Messrs. Carrett and Marshall, engineers, Leeds, was tried at the Kippax Colliery, near Leeds, in the presence of a number of colliery owners and mining engineers, including Mr. Embleton, Mr. Morton, Mr. Pope, Mr. Rayner, Mr. Parker, Mr. Pickersgill, and other gentlemen. The trial in every respect was perfectly successful, and every gentleman present expressed his satisfaction at the manner the machine performed its work. The coal-cutting machines which have been tried recently in other districts have been worked by compressed air, and on the principle of the pick motion. This machine is, however, worked by water pressure, at 150 lbs to an inch, conveyed in $1\frac{1}{2}$ inch wrought iron pipes, from a small engine fixed near the bottom of the pit. The trial was made in the Allerton seam of coal, which is five feet six inches thick, but contains a layer of dirt three inches thick at the height of 20 inches from the floor, which separates the best and second seams of coal. The machine was mounted on four wheels, and traverse on the corf tramways. The "holing" or "baring," which is the hardest and most laborious part of the collier's work, was done remarkably well, in one even straight line, and to a uniform depth, at once passing over. The cutters were fixed in a slotting bar, worked with a steady longitudinal reciprocating motion at a slight angle, which ripped out the whole of the partition of dirt to a depth of three feet three inches. The apparatus being entirely *self-acting in all its operations*, it propelled itself forward, secured itself dead fast between the floor and roof, whilst the cutters were in operation, and again released itself with the return stroke. The machine is strong, and not at all complicated, and is likely to work with durability. It is beautifully arranged in its various movements, and works with such precision and exactness that any one might almost fancy it was endowed with intelligence. One man is all that is

required to attend to it, and he has nothing to do but to set it in motion and stop it when required. The machine worked on Wednesday two hours forty-nine minutes, and excavated the dirt out three inches thick and three feet three inches under for a length of twenty-two yards and two feet, and liberated from the solid bed of coal forty-four tons. The average cost of "baring" by hand labor at the same colliery is 8d. per ton; but the principal saving is in the economical working of the coal, without cutting such a large proportion into slack as is done by hand labor. The pressure of water can be increased to any required extent and its quantity needs only to be enough to fill the circuit of the pipes, the same incompressible fluid thus being used over and over again to convey the power any required distance from the source of power to the coal seam to be operated upon. The miners have named this new labor saver the "iron-man," and from his self-acting and industrious powers, it is probable he will never become tired. Messrs. Lock and Warrington are so well satisfied with the advantages of getting coal by machinery that we understand they are making more machines in order to take all their coal worked by them.—*Leeds Mercury*, Nov. 21, 1864.

On a New Formula for Calculating the Initial Pressure of Steam.

By Mr. R. A. PEACOCK.

From the *London Athenæum*, Oct., 1864.

Some years ago the author had occasion to attempt to calculate the probable pressure of steam at the highest known temperatures, and found, amongst other things, that between the pressures of 25 lbs per square inch and 300 lbs to the square inch, the latter being the highest pressure to which trustworthy experiments had been carried, the law of increase was approximately: That the temperature of high-pressure steam of, say, 25 lbs to the square inch and upwards, increases as the $4\frac{1}{2}$ root of the pressure; and that, conversely, the pressure of the steam of, say, 25 lbs to the square inch and upwards, increases as the $4\frac{1}{2}$ power of the temperature. At lower pressures than about 25 lbs per square inch, a different law prevails. As it is necessary to verify the new formula by comparison with some well known formulas and experiments, the author has attempted to do so in a very voluminous table, and graphically in a very carefully executed diagram. What is to be gathered from these is, that the new formula agrees with Dr. Fairbairn's experiments, from about 40 lbs to 60 lbs and very nearly with Regnault's, between 220 lbs and 336 lbs.

Experiments on the use of Petroleum as a Fuel for Propelling Steam Machinery.

From the *London Mechanics' Magazine*, December, 1864.

An elementary course of experiments was commenced last week in the factory department of Woolwich dockyard, with a view of testing the capacity of petroleum to supersede coal and other fuel on ship-board, and also in propelling steam machinery in the factories. The