ELECTRIC ROCK-DRILLS.

Description of the Electric Rock-drilling Machinery at the Carlin How Ironstone Mines at Cleveland.*

(By Mr. A. L. Steavenson, of Durham.)

Ironstone mining in Cleveland has now extended over a period of 40 years, during the whole of which the writer has been connected and conversant with its progress.

Mining by Hand-labour.—Hand-labour has been the general custom, and during the first five-and-twenty years, when skilled men were scarce and new-comers had to learn the work, it was usual for a skilled miner to take a novice with him as an underhand to break up and fill the stone, paying him a datal wage varying from 3s. 6d. to 4s. per shift. These underhands were known amongst the miners as "hagmen." The skill of the miner being exercised in getting as much stone with as few holes and as little powder as possible, the holes are drilled of a three-cornered section by the miner giving the drill a slight turn between each blow; they vary from 3½ft. to 4½ft. in depth, depending upon the backs or natural vertical cleavages in the stone. To drill a hole of 3½ft. requires about half an hour of steady work; the powder used is about 6oz. per ton of stone, and the usual price of getting from 10d. to 1s. per ton. Gradually, as the supply of skilled men overtook the demand, the two miners in each place shared the work and money between them, each man making 4s. 6d. to 5s. 6d. per shift.

Hand Ratchet-drill.—During the last few months hand-drills, made to revolve by a ratchet, have been introduced, the work being divided between the skilled miner and the filler. These drills promise good results in cases where machines are not available; but the question of prices is not yet definitely decided.

Compressed-air Rotary Drill.—About sixteen years ago Mr. William Walker, of Saltburn, introduced a rotary drill worked by compressed air. Of these the writer procured four; and by working double shift, and employing one skilled man to work the drill and another to fire the shots, with unskilled labour to do the rest, he has effected considerable economy. At the Skelton Park mines of Messrs. Bell Brothers these machines continue doing good work. The writer has always insisted upon the necessity for adopting the Colladon system of cooling the air by water spray during compression; but, notwithstanding the marked economy resulting therefrom, the great leakage arising from the length of pipes of various sizes, which amounts in this case to about eight miles, and from the consequent large number of joints, seemed to present an opportunity for improvement by the use of hydraulic power.

Hydraulic Drill.—At the Lumpsey mines, therefore, where there was a large body of water tubbed back in the shafts 600ft. deep, the writer designed a hydraulic drill to utilise this water, carrying pipes into the face of the working-places. The pressure of 250lb. per square inch at the shaft bottom was utilised at the drill by means of a small turbine made by Messrs. Gilbert Gilkes and Co., of Kendal, and placed on the machine. This plan has given excellent results; but, as the water has to flow back to the shaft bottom, it can only be used in places to the rise; and, moreover, it involves the cost of water-mains to convey the pressure.

Petroleum Engine.—The writer next introduced the petroleum engine of Messrs. Priestman, and a drill suited to its conditions. Five of these are now in use, and have done good work.

Electric Drill.—When electricity became applicable, its simplicity and regularity in working seemed to offer an inducement for a trial. With the assistance of Mr. Robert Clough, engineer to the mines and collieries of Messrs. Bell Brothers, the writer designed a drill to be worked by this power.

Dynamo.—The current for working the drills is generated at bank by a compound-wound dynamo, having an output of 20,000 watts, and capable of furnishing a current of 50 ampères at a pressure of 400 volts when running at 900 revolutions per minute. This dynamo is intended to supply current for working the first section of the plant—namely, three drilling-machines. The current required to drive each drill varies, of course, with the hardness of the stone the drill is working in; but it may be taken that, under ordinary conditions, and when the voltage at the drills is 300, the current absorbed per drill-motor is about 15 ampères, which is about six electrical horse-power; and when a dynamometer was applied to the drill-bar, six-horse power was obtained. The current from the dynamo is taken to a high-tension double-poll switch on the main switch-board, which is of enamelled slate and has mounted upon it the necessary fuses, measuring instruments, &c.

Cables and Junction-boxes.—From the switch the current is conveyed down the pit through cables covered with highly vulcanised indiarubber. The cables are run all the way in-bye on insulators, and are kept well in sight, so that, should a fall of stone occur, the damage can be quickly discovered and set right. The main cables are run to a point at a distance of 1,000 yards from the generator; and then from this point branch cables are run to the different junction-boxes, of which there are six to each drill, commanding twelve working-places. The junction-boxes were specially designed to meet the exigencies of the case by Mr. Bigge, and are really a combination of a junction-box switch and connecting-plug, as shown in Figs. 1 to 4. The plug is locked in position by a pin, and cannot be withdrawn without first of all lifting the switch, thus preventing sparking and wear on the contacts. Each district to be worked by the several drills is completely wired out, and fitted up with these junction-boxes, so that when the drill is moved from one working-place to another a box is always to be found within 50 yards distance. The plug at the end of the drill-cable is then inserted, the switch on the drill turned on, and within a few seconds the drill is again at work. Much time is saved by this method.

Drilling-machines.—As shown in the accompanying drawing, Figs. 5 to 7, the way in which the electricity is applied is neat and handy. The motor M is used not only to drive the drill gear, but also to act as a counterbalance to the weight of the drill itself and its gearing. The motor

* Paper read before the Cleveland meeting of the Institution of Mechanical Engineers.