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**COMPRESSED AIR DRILLING
IN THE YORKSHIRE DALES LEAD MINES**

by

J.M. DICKINSON

The mine owners of the 19th century in the Yorkshire Dales appear to have been rather slow in taking up the advantages of the compressed air rock drill, in fact it was only used in the late 1870s at the Sir Francis Level in Swaledale and the Hebden Horse Level at Hebden in Wharfedale.

The hand boring of shot holes was introduced to England by German miners together with gunpowder about 1670, and by 1759 the chisel bit or as it later became the 'jumper Bar' was in general use and stayed in use in most mining fields up to the early 1900s.

Richard Trevithick the steam engineer invented a rotating boring machine in 1813, the machine was built at the Hayle Foundry and used in a limestone quarry at Plymouth, but was not suited to underground conditions. In the 1820s several major advances were made in the detonation of gunpowder which removed much of the danger from loading shot holes. Harris in 1823 first saw the possibilities of electrical detonation but it was not until 1829 that Hoses Shaw of New York fired several charges of powder simultaneously by passing an electric spark through a primer of fulminate of silver. Then in 1831 Bickford of Camborne invented his safety fuse which opened up the way for full face firings. A direct action percussion drill was patented by Fowle of Philadelphia in 1851 without much success. During the driving of the [31] Mont Cenis Tunnel, one of the engineers devised a steam boring machine that met with some success, later another engineer on the same project, by the name of Sommeiller invented the first true compressed air drill which was used throughout the construction of the tunnel. The Germans who still led the field in mining techniques in the 1800s were quick to develop the air drill and they were in general use in the mines of Freyburg by 1857. In England Jordon and Darlington invented a valve-less drill with a ratchet wheel for turning the drill steel when boring in 1867 the same year as dynamite 'Was patented in England. The introduction of dynamite and similar explosives together with the Bickford safety fuse eliminated much of the danger in firing shots under ground. The latter used in conjunction with the air drill enabled miners to advance their workings by x feet a day rather than x feet per month as had been the case with hand boring and gunpowder. By the 1880s several makes and types of drill were in general use, most of them of the self advancing type and although they were large and heavy, drilling rates of 12 inches in 4 minutes for a 1 inch diameter hole were achieved in hard rock.

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The Germans who pioneered air compressors, for a long-time favoured the wet compressor, where the air was compressed against water in the compression cylinders. In England the dry type compressor (as in general use today) although not as efficient as the wet type was developed. These compressors usually had three to four cylinders being powered by water wheels or small steam engines, they delivered their air into large iron receivers of a much greater length than diameter, some of these can still be seen in our older quarries and some mining sites. The average receiver of the day held about 600 cubic feet.

In 1864 the A.D. Company started to drive the Sir Francis Level in Swaledale, its total length is 5,284 ft. The first 1,200 ft was driven by four men hand boring shot holes, they worked in pairs for two six hour shifts and averaged a driving rate of 10 ft a month. In 1874 the Company invested in a compressor and drill to speed up the work and the remaining 4,084 ft was driven in 5 years at an average rate of 68 ft. a month.

Only one drilling machine was used at the face, this was a McKean Machine wherein the valve was semi-rotated by a tappet set on a back piston rod, whilst the timing of the tool piston was effected by a spiral gear at the end and outside of the cylinder, the machine was of the self advancing type. An average of 30 holes were drilled to a depth of 48" to 60". Air supply to the face was by a 3" diam. iron pipe from the air receiver, from the fixed pipe flexible rubber hose of 1" internal diameter fed the drill.

In Wharfedale at the village of Hebden a horse level was started [32] in the late 1870s, the level was intended to cut and drain the Star Vein which had been worked from the mines in Hebden Gill and eventually reach the Bycliffe Vein in the region of Gate-up-Gill. The company formed to carry out this work was headed by a man called Chadwick from Leeds who soon had a water wheel erected in order to drive a compressor. After the level had been driven for over a mile the pressure in the pipes proved to be too low for efficient drilling and for some time the miners employed resorted back to hand boring only using the compressor when Chadwick visited the mine, then it is said as soon as he entered the level several men would tread the water wheel and thus enable the drill to be used at the face. Chadwick however had the wheel and compressor moved into the mine and erected underground just past Copper Gill Air Shaft. The level was driven for 1½ miles and was still being driven in 1888; it is said that due to an error in the surveying of the level it ended under Rams Close Farm instead of the Bycliffe Vein and was abandoned in 1889. It is worth noting that the level did in fact drain a large area around Hebden Moor but now local farmers can see the effect of the blockages in the level on their land which is now much wetter than in the past. Unfortunately no details of the compressor or drilling machine used in the level are known.