BRITISH MINING No.1

MEMOIRS
1975

Dickinson, J.M. 1975
" A Prototype Aerial Ropeway at Heden"
British Mining No.1, pp.11-16

NB
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A PROTOTYPE AERIAL ROPEWAY AT HEBDEN

J.M. Dickinson

PREFACE

Originally it was the intention of this paper to prove and describe the remains of the prototype of modern aerial ropeways. Unfortunately after two years of research no conclusive evidence has been found to support the latter intention. I therefore present the reader with a collection of facts and dates from which conclusions may be drawn, and possibly the research may be carried on by others.

One thing is reasonably certain; an aerial ropeway did run down Hebden Gill. The author can recollect being told of this some years ago by an old inhabitant of Hebden, now long since dead, and it must be admitted that the author then thought that the old man was telling a tall story. A study of the terrain and the small mines involved leads one to the conclusion that no advantage can be seen from having a ropeway at all, unless it was a purely experimental installation.

INTRODUCTION

The concept of an aerial ropeway has been with us for at least three thousand years. Pulley blocks with ropes made from date palm fibres were used by the ancient Egyptians. A fine specimen of bronze rope was found in the ruins of Pompeii and is now preserved in the Borbonico museum, Naples. A ropeway was erected by a Dutch engineer Adam Wybe of Harlingen for the city of Danzig in 1644. This ropeway connected the city ramparts with a hill outside the town. A single rope passed over pulleys suspended on high posts, the rope carrying a number of small buckets which were filled with earth on the hill and emptied on the ramparts. A similar ropeway was employed during the construction of the Moscow fortifications in the seventeenth century.

The ropeway as we know it today did not emerge until the invention of steel ropes. During the eighteenth century experiments in wire drawing were carried out in many European countries but the results were insignificant. In 1825 Professor Purkinje of Vienna was the first to apply an endless rope as a driving device on a funicular railway for the transport of goods. It was not until 1834 however that Albert, the leading mining advisor at Claustal in the Hartz mountains put into operation wire ropes in the mines. They consisted at first of three and later six strands, each of four wires made from sulphurless steel. Each wire had a strength of 5.691bs per [11] square inch. The ropes were stranded by hand and were called ‘Albert’ or ‘Longs Lays’ ropes after their English constructor. In 1839 production started at the first wire rope factory at Falun in Sweden and in 1840 at the Felten and Guilleaum factory in Cologne. James Ray Eddy when reporting to the Kinnaird Commission in 1864 quoted examples of ropes in use at the Burlington Slate

Quarries, one being made in 1844 and in continuous use for 14 years without a breakage. The Grassington Mines of the Duke of Devonshire in the 1860-80 period used ropes made by Henry Morton of Leeds and Garnock and Bibby of Liverpool. These ropes had a weight of 6-6½lbs of No.12 wire per fathom and were made of six strands of six wires, with a total diameter of three inches. These were later improved to 7½-9½ lbs per fathom of No.13 wire. At the Grassington mines a system of haulage from several shafts by wire ropes, powered by a central waterwheel, was in use. Rope runs of up to 4000 yards were not uncommon. It is therefore obvious that by 1850 wire ropes were a commercial success, being manufactured widely over Europe.

On July 28th 1856 a '*Provisional Specification of Improvements in Arrangements and Mechanism for the Conveyance or Transport of Loads or Weights*' was lodged at the Patent Office by Henry Robinson, a coal agent of Settle in Yorkshire. The Patent was sealed in 1857. No record has so far been found of Robinson or any other person using the patent to build a ropeway. A monocable ropeway was built by Baron von Ducker in the Hartz mountains in 1860, but it is a curious fact that in Eastern Europe Robinson is recognised as the inventor of the aerial ropeway whereas in Britain this distinction is given to Charles Hodgson of Richmond in Surrey. In 1868 this person patented an '*Improved Means of and Apparatus for Transporting Loads*', the basis of the present day double ropeway with one rope for suspension and another haulage. He also patented an almost direct copy of Robinson's monocable ropeway with suggested improved load attachment. Hodgson soon had a company, the Wire Tramway Company of London, erecting his monocable system the first apparently being built at Richmond in Surrey in 1869 followed by one at Bardon Hill granite quarry in Leicestershire and another at Brighton built in 1872. However, the Wire Tramway Company Ltd is reported as being declared bankrupt in January 1874. In 1873 a ropeway designed by John Fyfe and constructed by John M. Henderson and Co. of Aberdeen was installed at the Kemnay Granite Quarries in Aberdeenshire.

ROBINSON'S MONOCABLE ROPEWAY

Extracts from the patent specification: The invention is particularly applicable to the transport of coals and other minerals either above or below ground. It consists of a single or double endless rope or chain supported at intervals on pulleys which have their bearings attached to posts or pillars. The endless rope passes round a drum or series of pulleys at each [12] terminus. Rods are attached at intervals to the endless rope on which the load to be transported is suspended, the pulleys supporting the chain or rope have only bearings on one side of them, so that the rods on which the loads are suspended need only be bent on one side clear of the pulleys, or the endless rope or chain may be placed between two pulleys, so that the suspended rod passes between them. If the substance to be transported is of the character of coal or other mineral it is placed in baskets or other receptacles which can be readily attached to or from the suspended rods. Motion is imparted

by rotating the drum or the series of pulleys at one or both termini. When the endless chain or rope is loaded in only one direction, and the weights to be transported have to descend, a brake arrangement may only be required at one of the termini to prevent a too rapid movement.

Key to Plan of Hebden Aerial Ropeway

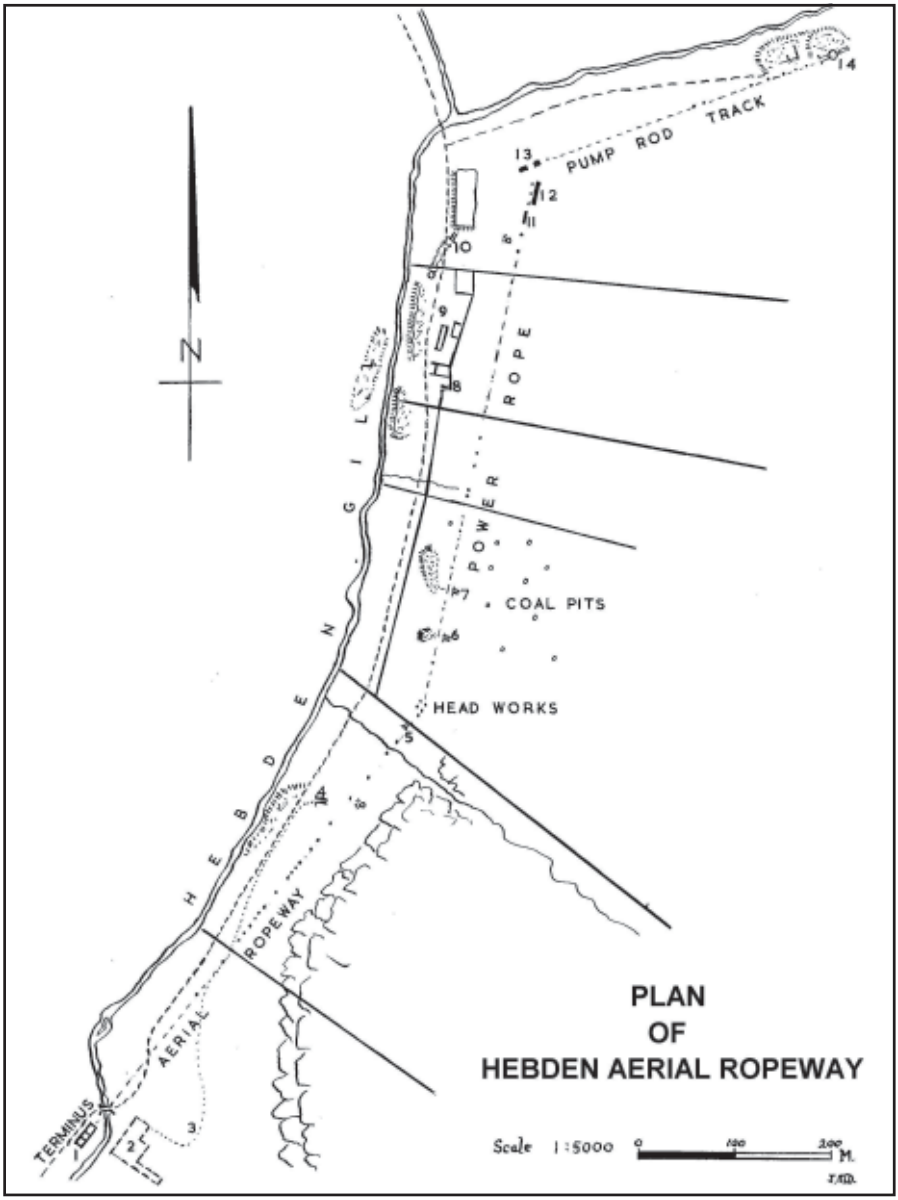
1. Remains of terminus and coal staithes.
2. Site of Hebden Moor Mining Company's Smelt Mill, c.1866.
3. 12 inch S.G. pipe thought to be water supply to bellows drive.
4. Longshaw Level.
5. Tensioning device for ropeway.
6. Coal Level. Explored and found to have worked a 5 inch seam.
7. Main coal level blocked at entrance.
8. Charger Level. Coal said to have been drawn out of this level.
9. Dressing floor of Hebden Moor Mining Co.
10. Bottle Level.
11. Bob pit on Power Rope.
12. Water Wheel pit approx. 45 feet diameter.
13. Bob pit and turn gear for pump rods.
14. Bolton Gill Engine Shaft.

The suspending rods are attached to the rope as follows: a piece is secured to the rope by rivets passing between the strands of the rope. It has a hole through it, into which fits the bent end of the suspending rod which is secured in it by a cotter or pin. This arrangement allows the rod to maintain the vertical position and accommodate itself to the inclined gradient of the rope. In another case the suspending rod is supposed to be attached to a loop formed by splicing a small wire rope into the main rope.

When coal is to be transported in wagons or baskets similar to those used in collieries, eyes are fixed to the wagons or baskets so that they can be readily hooked to the suspending rods. The wagons or baskets are attached to the suspending rods after they have passed the drum at a short distance from it, and they are detached before they arrive at the drum.

AN AERIAL ROPEWAY AT HEBDEN, GRASSINGTON, NORTH YORKSHIRE

During January of 1972 some members of the NMRS were examining the remains of a water powered pumping installation at the site of the Hebden Moor Mining Company's works in Hebden Gill. A 45 foot diameter waterwheel, sited parallel to the main valley has driven pump rods through a 59 degree turn, over a distance of 312.4 metres, to the Bolton Gill Shaft. In the line of the wheel, in the opposite direction running parallel to the valley are a series of large stone built bases indicating a possible further rod track. In past literature this has been said to have run to a coal shaft situated at a point 200 or 500 yards from the wheel. Inspection of the 200 yard site revealed a boggy area with a spring rising in it, but no trace of a shaft or



coal debris could be found. The Charger Level passes under this point with a collapsed rise or shaft on the eastern side of the level. The 500 yard site is an area of small [13] coal levels and pits.

A PROTOTYPE AERIAL ROPEWAY AT HEBDEN

The earliest plan of the Hebden mines held by the Society is dated 1866 and on this no mention is made of a coal shaft or indeed any coal workings, although a shaft is shown on the Charger Level corresponding to the 200 yards site.

Continuing on the line of the large bases past the 200 yards site a shallow trench can be followed across the field until near the dividing wall two small stone blocks with bolts embedded in them can be seen, The wall at this point has two holes built into it, one at mid-point and the other towards the base. Beyond the wall a further ten bases and a more elaborate trench covered by stone slabs can be followed across two fields until in an area of small coal levels and pits (500 yards site) five larger bases indicate a change of direction and purpose. We have named this point the Head Works of the Aerial Ropeway, and stone bases continue from here down a steep and rocky valley side to a ruined structure opposite the site of the Hebden smelt mill. We have named this site the Terminus of the Aerial Ropeway. In all 21 bases have been discovered, some ruined and others still retaining their bolts, down the valley side. They are set at irregular intervals although a spacing of half a chain appears to have been aimed at, allowing for the rough terrain, the longest gap being 105 feet. The bases still carry four one inch diameter bolts leaded into the gritstone slab at 13 inch by 9¾ inch centres. At the Head Works the larger bases have bolts up to 1½ inch diameter at 12 inch by 17 inch centres.

It is our belief that these stone bases are the remains of Robinson's prototype aerial ropeway. Although at the time of writing no evidence to support this theory has come to light other than the inventor lived 15 miles away, this does seem a strong possibility. The Head Works are situated only a few yards from the entrance of an old coal level with a substantial tip whilst small pits and other levels are situated in the immediate area. A track, possibly the site of a rail track, runs from the coal pits to the head works. At the terminus the ropeway appears to have passed over three paved floor bunkers, now in ruins, though we have not traced any bases in this area.

The total length of the ropeway is 595.4 metres with a rise of about 64.4 metres from the Terminus to the Head Works. The ropeway was presumably powered by the water wheel at Bolton Gill by a continuous power rope supported on 22 inch diameter cast-iron pulleys, the return portion of the rope running where ground contours required, in a covered trench. The trench is stone lined with the bottom support pulleys sunk into small wells 14 inches deeper than the bottom of the trench, which has an average depth of 16 inches from surface level. [14] Again the spacing of the pulley wheel bases is somewhat irregular, but in general the surface wheels are set at intervals of 30 feet. Of the bottom support wheels, only two have been discovered, one of which has been excavated and recovered, and these are situated in a section of the trench deeper than average where the spacing of the surface wheels

Return wheel in working position

Return wheel from power rope system

has been 180 feet apart. In some parts of the line the surface base must have supported a double tiered wheel arrangement as no underpass trench has been built.

The power rope has a length of 598.5 metres, which makes the Head Works of the aerial ropeway almost exactly the mid-point of the installation's length of 1.194 km. A tensioning device has been built near the mid-point of the power rope, the massive base of which remains almost intact. From the pulley wheel recovered, the wire rope appears to have been about 1¼ inches in diameter being sheathed with a thin outer cover of iron plate making a total diameter of 2 inches.

It is thought that the water wheel was originally built to serve this power rope as well as working the pump rods at Bolton Gill shaft, as it is difficult to see how the aerial ropeway and power line could have been fitted into the available ground area as an after thought. It my also explain why relatively large reservoirs were built in Bolton Gill and on Mossy Moor, due to the heavier demand for water.

Of the aerial ropeway nothing but the stanchion bases and some stanchion support wire anchors remain. However, it is thought that the stanchions carrying the aerial ropeway were of cast-iron and it is possible that four of these are still is use today incorporated in a small suspension bridge over the River Wharfe at Hebden. This idea stems from a report by Miss S.D. Brooks of Grassington which states that "*the Swing Bridge at Hebden was built by the village Blacksmith (Bell of Netherside) in 1887 from scrap metal obtained from the Hebden Moor Mines for the sum of £87, raised by the villagers themselves, this bridge lasting until 1930 when the County rebuilt it in the form known today*". More information is given in a report of the Highways & Bridges Dept., Wakefield, of 9th November 1929. "*The existing bridge is of the suspension type semi-stiffened by two 1 1/8 inch diameter wire ropes stretched between abutments and beneath the timber decking. Each rope consists of 5 strands of 6 wires round a hemp core. The towers consist of hollow cast iron columns, 9 inches external diameter and 1 inch thick at the tops, being 9 feet high and supported on masonry blocks. The rope passes through holes in the top of the columns and over pulleys inside the columns*". It is suggested that the columns, original ropes and suspender bars are items from the aerial ropeway. [15]

CONCLUSION

I believe that sometime after 1857 Henry Robinson built a prototype aerial ropeway in Hebden Gill, following closely but not exactly to his design as given in the patent specification of 1856. The ropeway was built to serve mainly design purposes but also carried coal commercially from a number of small coal pits with which Robinson may have been associated in his trade of coal agent. Of his connection, if any, with the Hebden Moor lead workings, nothing is known.

The lead workings were leased in 1853 by Winn of Haverah Park, who was granted a twenty-one year lease in 1856, this lease included the right to mine coal without royalty if used for a steam engine on the lead mine. Although

no steam engine was used, coal was mined at several points on the lease. In 1858 Winn transferred his lease to the Hebden Moor Mining Co., and a good production was maintained at the lead mine for a number of years. It would appear to me that this is the period during which the ropeway was most likely to be built, as the Hebden Moor Mining Co., would surely have an interest in the mine. A small smelt mill was built near the terminus of the ropeway and possibly coal for the hearths came via the ropeway. Lead production had almost ceased by the early 1870's and it is presumed that the ropeway worked up to about 1880 and then stood idle until being dismantled for scrap in 1887.

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December 1974
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