THE TREVITHICK SOCIETY

KOWETHAS TREVITHICK

NEWSLETTER 190 WINTER 2020

The next generation takes the helm! Apprentice engineer James Woodward steers the Puffing Devil on its only 2020 outing.

Reg. Charity No. 1,159,639

EDITORIAL

As you will see from the enclosures, Council have decided to hold the 2020 AGM as a virtual event. We had a successful Zoom Council meeting, organised by Mark Newman, and so are confident we can meet our legal requirements and stage an AGM through that medium. The November Council meeting was the first one since the lockdown so it was great to virtually meet up again and discuss Society business. Not that there was a great deal to discuss given that most Society activities have been suspended due to coronavirus. Hopefully normality will return in the coming months and the sleeping TS giant will awaken.

We were, however, able to welcome our new Minutes Secretary, Rod Clarke, who afterwards remarked how convivial the meeting proved to be.

In the last newsletter an article was published concerning Boscaswell Downs Mine. Unfortunately I had lost the original email and did not know who sent it to me. It now transpires that it was written by Tony Brooks. Thanks Tony.

Our Membership Secretary, Sheila Saunders, has asked "are any members, other than ones already having the newsletter emailed, who would like to have it emailed to save postage?". She quite understands if members wish to keep hard copies. If you fall into this category please contact Sheila on:

membership@trevithicksociety.info

CNF

CORRIGENDA

Jim Lewis would like to point out that he is listed amongst the 'Notes on Contributors' for the recent Trevithick Journal but there has been a mix-up. He is described as John with a stellar academic and teaching career. Sadly, this is nothing to do with him. Instead he is the retired manager of Lloyds Bank in Newquay with a particular interest in Cornish copper mining in the early 19th century. The necessary 'corrections' are in the pipeline.

NEW MEMBERS

Unsurprisingly, with all the Society events cancelled, as well as those attended by the yellow tent and the Canary Crew, there have been no new members since the last newsletter.

DECEASED MEMBERS

The Society is saddened to report the passing of the following members:

Tim Smart from Plymouth.

Derek Giles from St Austell.

Our condolences to their families.

Copy date for next newsletter:

March 15th 2021

TM

Established 1935

JOHN STENGELHOFEN

John Stengelhofen 1939-2020

As mentioned in the brief note in the Autumn newsletter, John Stengelhofen died in July following a fall. He was very active in the initial years of the Trevithick Society following the merger of the CEPS and CWPS. He was primarily responsible for the introduction of the Society's Journal in 1973 and was its Editor for the first seven issues. He also designed the Society's logo. At that time he was a Research Fellow at the Institute of Cornish Studies where he oversaw the publication of William West's memoir. It was also at that time he used his architectural skills to design Wheal Martyn China Clay Museum, then becoming its first Director in 1975. He moved to the National Maritime Museum in charge of their outstation at Cotehele, with the Tamar sailing barge Shamrock. During his period as President of the Royal Institution of Cornwall, 1984-1986, he had a major hand in the acquisition of the adjacent premises enabling the Royal Cornwall Museum to expand. With Michael Messenger he founded Twelveheads Press in 1978 to publish books on Cornish and other industrial history. He was also active in the Cornish Buildings Group for fifty years, recently campaigning for such important industrial monuments as St Erth station and Wheal Busy smithy. For fifty years he made a substantial contribution to Cornwall's industrial heritage.

Michael Messenger

COMPLAINT

It is sad to report that the King Edward Mine management have registered a strong complaint with the Society in respect of one of our members who visited the site accompanied by a guest close to the end of the season in September. It appears that the member initially did not wish to comply with the arrangements in place to cope with the covid outbreak. From what we are told he was extremely arrogant and told the guides he knew more about the site than they did and would not accept a guided tour. The complaint also stated that much embarrassment showed from the body language of his guest. These tours are in place so there is supervision over visitors and social distancing can be applied for everyone's safety. Upon refusing to take a tour he then attempted to make his own way into the mill but was stopped by staff in there and was told once again it was guided tour only. Eventually common sense took over and he and his guest went on a tour.

This type of attitude does little to enhance the reputation of one of the oldest societies of its type in the country and will not be tolerated. I feel it should be unnecessary to tell members that whatever sites they visit they must do and act as asked by the resident staff, especially so in these difficult times. Invariably the staff at sites are volunteers, not necessarily experts, but enjoy meeting the public and try to do their best and should not have to accept verbal abuse from visitors. The Society has many members who assist at any number of sites in Cornwall and many upcountry members are volunteers at sites in their own locality where their knowledge and skills are greatly appreciated and we thank them for their efforts in supporting the Society's aims.

This unfortunate incident is now closed and I trust nothing similar will occur in future.

K.J.T.R.

MARTHA'S SHAFT, WAIHI GOLD MINE, NEW ZEALAND

The Inverted Vertical Compound Engine on Martha's Shaft, Waihi Gold Mine, New Zealand

Following the interesting article about the Waihi Engine House (Newsletter 189 p.4), I thought Society members would like to know more about the engine that was installed in it.

In 1902 the Waihi Gold Mining Company Limited of New Zealand ordered an Inverted Vertical Compound Cornish Pumping Engine from Hathorn, Davey and Company, Leeds, West Yorkshire. It is referred to as the No. 5 pump on Martha's Shaft, and also as 'C' pump.

In fact, this was the second Inverted Compound engine that the Waihi Company had ordered from Hathorn, Davey. The first was ordered on the 23rd September 1895, listed as order 5284 A to N: it had 45 inches and 90 inches, high and low-pressure cylinders, respectively, and an 8 feet stroke. It cost, together with 19" plunger pump and sinking pump, etc, £6,100. The second engine would be larger.

In fact, only parts of the second engine are listed in the Hathorn, Davey Order Books because in 1901 the Company had converted to a Private Limited Company, and their factory (The Sun Foundry, Dewsbury Road, Leeds) was undergoing a major reconstruction.

The Martha's Shaft engine had a 60 inches high-pressure cylinder with a 6' stroke, and a 110 inches low-pressure cylinder with a 12' stroke. Figure 1 shows the low-pressure cylinder and piston ring. The pump plungers were 23" diameter, the first set being placed at a depth of 700 feet from the surface, the engine being designed to raise 1,500 gpm from a total depth of 1,550 feet.

Casting a low-pressure cylinder of this size would probably have presented some problems. It would have been the largest that the Company would have

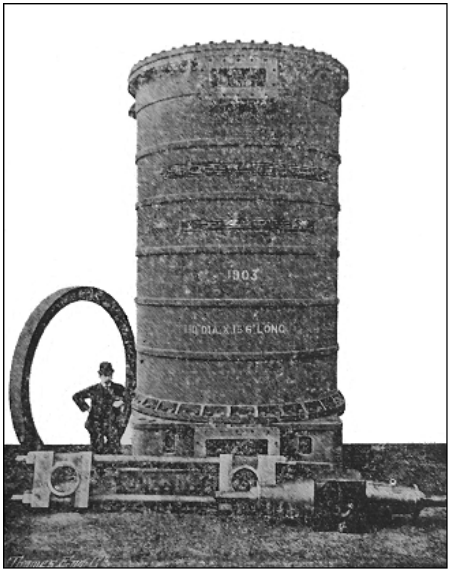


Figure 1. Waihi: The Low-pressure cylinder

ever made. So it seems reasonable to assume that the ability to fulfil the Waihi contract in the specified time was their major consideration. Consequently, many of the major parts of the engine were manufactured elsewhere. The work was divided among the following firms:

Messrs. Hathorn, Davey and Company Limited was responsible for the pump plunger and plunger case. Messrs. Harvey and Company, of Hayle, supplied the high-pressure cylinder; Messrs. McOnie, Harvey and Company of Glasgow made the low-pressure cylinder. The large beam for the pumps, which weighed 50 tons, was constructed by Messrs. Findlay of Motherwell. The pistons were packed with the patent metallic packing made by Messrs. Lancaster and Tonge, of Manchester, who also made the stuffing boxes for the piston rods of both cylinders, and also the piston rings. The whole of the work for installing the engine and pumps was entrusted to Mr. John Henderson, the mine engineer of the Waihi Company.

An article in Engineering (18th March 1904) provides further information about the various components. The

engine was to work at 7 strokes per minute. The beam, constructed from mild steel plate and angles, with massive cast iron centres for the shaft and pins, was 48 feet long overall, and 8 feet deep at the centre. The centre shaft was 22 inches diameter. The plummer blocks and sole plates that supported the beam weighed 14 tons. The condenser and air pump were placed in a sump at the side of the engine house. The engine was supplied with Davey's differential gear, which would have stopped the engine before damage occurred, should the load be removed suddenly by rod breakage, for example. The low-pressure cylinder was 15' 4" long over the flanges and 2¼" thick. Together with the bedplates and cover it weighed 41 tons. Obviously a cylinder of that size and weight presented some transportation difficulties. Figure 2 shows how the low-pressure cylinder was transported to the mine site. It was presumably towed by a traction engine.

The Mining Journal's New Zealand correspondent described the starting of the engine on 28 April 1904. 'The ponderous machinery, which is very much simplified compared with the smaller, more antiquated type [Possibly a reference to the first Hathorn, Davey engine at Waihi], moved off into duty just as simply as the starting of an eight-day clock. Two or three strokes per minute of the large Findlay balance bob with the long plunge of the rods – viz., 700 ft., with a direct lift for the whole of the distance, very shortly found out by a few pump columns, which opened out and burst, necessitating a short stoppage to replace them.

The probable cause of these defects may be due to too rough handling in shipping and trans-shipping, and it is just as well to experience the temporary drawback at the first, as later on they may prove inconvenient when the deepening of the shaft is resumed'.

Henry Davey, who designed the engine, used the Martha's Shaft engine as an illustration in the second edition of his book on pumping machinery (Figure 3)

The Hathorn, Davey Company were only ever involved with the production of seven Inverted Vertical Compound Engines. Constructed to Henry Davey's specifications, they were the two engines at Waihi; the hybrid engine on Marriot's Shaft, South Frances Mine, Cornwall [they supplied the differential gear]; one on San Rafael's Shaft, Cerro Muriano Mine,

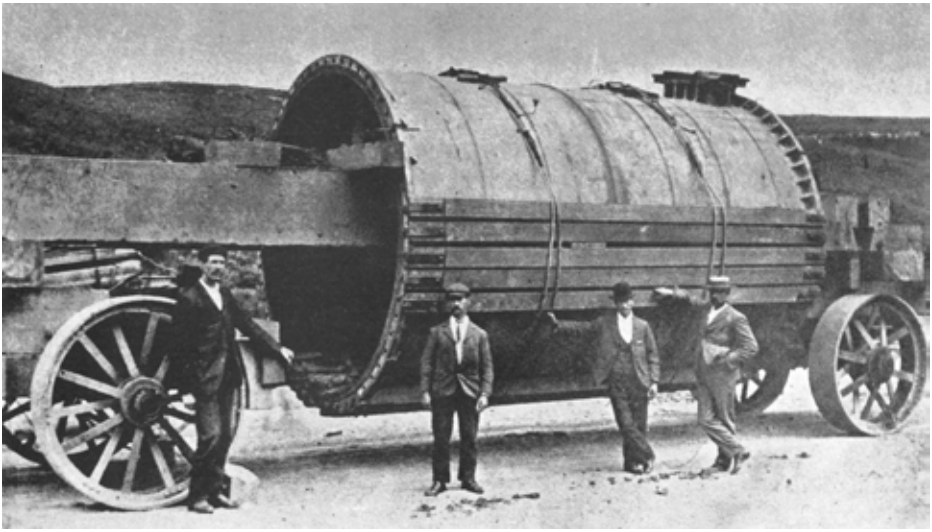
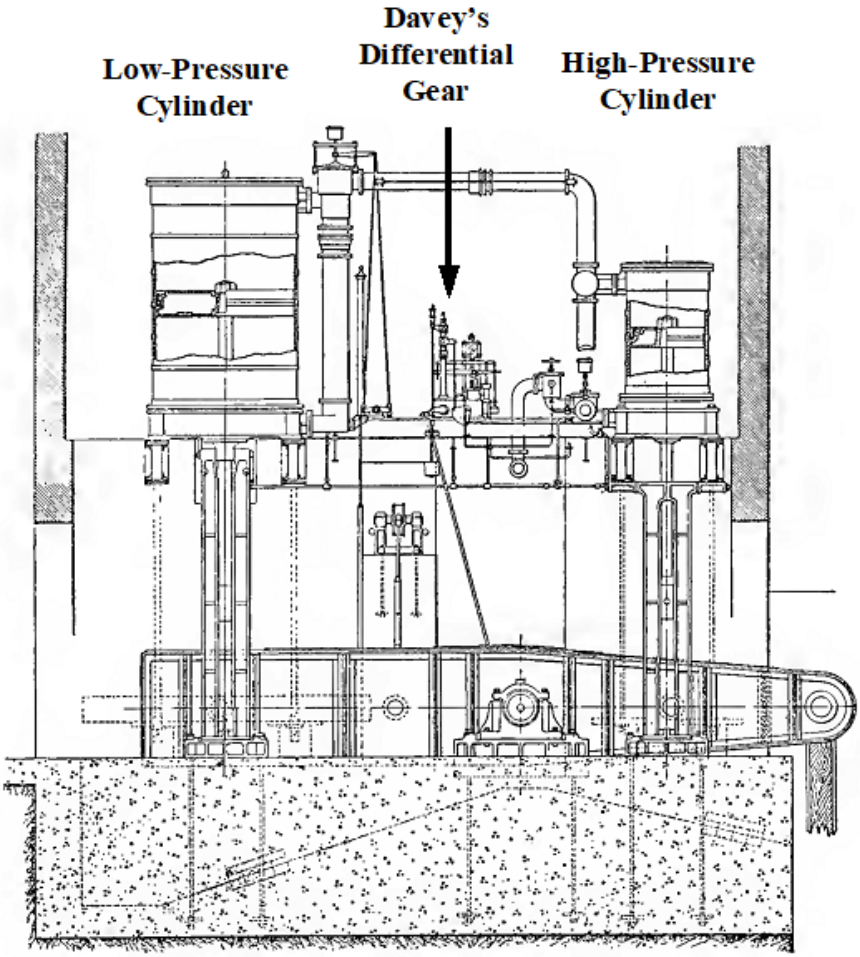


Figure 2. Waihi: Transporting the low-pressure cylinder



Córdoba Province, Andalucía, Spain [The engine house still survives]; and three engines for the South Staffordshire Mines Drainage Commission.

My next book, 'A History of the Hathorn, Davey Company, Limited', will be available in the early New Year.

Rob Vernon
rbrtvernon@aol.com

https://secretlibraryleeds.net/2020/08/21/hathorn-davey-and-company-limited/

Figure 3. Waihi: The Vertical Inverted Compound Engine on Martha's Shaft

LEVANT REPORT

Previously on the Levant engine, there had been no provision to slowly warm the steam main with a pressure reduction valve. The boiler inspector advised that some form of arrangement should be incorporated into a new steam main.

In addition, the drivers had to use the regulator to bleed a small amount of steam through to warm the engine which was causing scouring on the valve seat. To rectify this, a 2" globe valve was included in the steam main, immediately down steam of the crown valve.

The operational arrangement is fitted with a dial which has two settings marked on it, the first to warm the pipe and pressure reduction valve and the second to allow more steam through to warm the engine.

John Woodward
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TELEVISION ENQUIRIES

In addition to the filming of the Puffing Devil for the *Devon and Cornwall* Channel 4 series the Society was contacted regarding a forthcoming programme about Vicky Young, the Deputy Political Editor of BBC News, who was born in Camborne and whose Father and Grandfather worked at Holmans. We were asked about archive footage of Holman Bros.

A second enquiry concerned a new programme called Rick Stein's Cornwall. For the episode filmed in Camborne they wanted footage of the Puffing Devil and Holmans. Specifically they wanted to use a video posted on youtube of Trevithick Day 2017 when Tony Mason (Cornishpastyman) spent a great deal of the day filming the engine. He very kindly granted the television company permission to use the footage and asked that the Trevithick Society be credited. We were also able to help out with archive shots of Holman Bros. from the 1940s, plus interior stills from the 1970s and 1980s. The programme should have been shown by the time you read this.

CNF

PUFFING DEVIL

The Puffing Devil has now successfully completed its second ten year boiler test. This was combined with the fitting of a blow down valve to replace a drain plug due to the threads approaching the end of their life.

Following on from the report in the last newsletter, Sean Oliver spent a second day working on the engine. He removed the water tank and external fittings and pipework to enable three new plugs to be fitted to the rear of the boiler. These have been added to enable a water pressure hose to be used to help flush out the boiler after each outing. Sean then spent five hours inside the boiler using a needle gun to thoroughly clean the rust off the interior. This was a very dirty and noisy job and when he surfaced he looked even more rusty than Donald Trump.

When the firebox came back from being sand blasted it had, what looked like, hair-line cracks along the welds. Fearing the worst a non destructive test was undertaken by Relay Engineering Ltd. of Glasgow. Thankfully, no fault was found in the welds, which would have been a difficult and very expensive repair job.

The next stage in this saga was the replacement of the drain plug on the front of the engine below the firebox (see red arrow below), plus the three new plugs at the rear. These were fitted by Henwood Engineering and the three new plugs can

be seen on the photograph below.

The stage was now set for the first part of the ten year boiler test. The boiler was open and clean and every part of the engine was accessible enabling the Boiler Inspector to crawl all over it, inside and out, and ultrasonically test the thickness of the metal.

Once the engine had passed its cold test, Henwood Engineering cut out and fitted a new gasket and then re-inserted the firebox and securely bolted the front plate of the boiler. It was then filled with water and pressurised. The water pipe is still connected to the front of the boiler, just above the firebox hole, in the photograph on page 8.

Sean and I then returned and rebuilt the rest of the engine ready for its hydraulic and steam test. This took place a few days later and was filmed for the *Devon and Cornwall* documentary. I could not be present that day, so Sam Henwood steamed the engine. It must have been a baptism of fire as he had not operated the engine before. I did get several phone calls during the day so was able to give advice and was kept abreast of progress. All went well and the engine passed its second ten-year boiler test.

For the final part of the documentary the television company wanted to film the engine moving with the crew in costume, plus shoot Sam Henwood steering it. In the event they hired part of Perranporth Airfield for the day. It is an active airfield, so we all assembled near the near the offices and were escorted over the main runway to our filming location. A single aircraft landed that day.

We then unloaded the engine from the trailer and prepared and lit the fire. It was a cold, very windy, day with a couple of short showers. Worried that the cold wind would severely retard the steaming process, two vans were parked by the engine to provide a wind break, plus John Woodward had some lagging which he laid on the boiler. Once we reached 25 psi the boiler held its pressure well and after that the needle rose with increasing rapidity.

Once the engine was ready to drive the crew donned their costumes and drove up and down the runway. There were Gopro cameras attached to the engine, a cameraman filming from the ground and a drone buzzing overhead. The latter was a novelty, so everyone is especially looking forward to seeing the aerial footage.

The crew were joined by John Goodyear. He actually volunteered to help out in 2019 but due to the cancellation of events in 2020 this was the first opportunity for him to participate.

Perranporth Airfield at Trevellas, proved to be a good surface for driving the engine, but it was a bleak, cold and very windy place. Indeed, by the end of the day the windsock had shredded on its pole. The film company were very pleased with their filming and got shots of Sam Henwood steering the engine which provides a fitting conclusion to the story they wished to convey. They also interviewed the crew at various points during the day, including John Sawle, who wore his vintage Holman workwear specially. After the filming John Woodward's son James had a go at steering (see front cover).

Thanks to Sean and Molly Oliver, John and James Woodward, John Sawle, John Goodyear and Sam Henwood for all their help.

Soon after the filming event I received the following poem.

CNF

TREVITHICK DAY

We will remember
the month of December
Richard Trevithick the famous inventor
Smoke, Smell, Steel and Steam
Puffing Devil is indeed supreme
Water and fire is burning
The wheels are now turning
The steep and hard climb
up Camborne Hill
Will she make it, that she will
A proud day for Cornwall
And Richard Trevithick and one and all!

John Goodyear

Sean Oliver, John Woodward, John Sawle, Sam Henwood and John Goodyear.

Whilst the Puffing Devil was being worked on at Sam Henwood's engineering works it was fascinating to watch his staff working on traction engines. The photograph below shows hot rivets being neatly compressed and shaped by a most impressive rivet squeezer.


We have found the pot of gold!

Photo: Molly Oliver

BEAM ENGINES IN NORTH AMERICA XIII: IRON MOUNTAIN'S "CORNISH PUMP"

The town of Iron Mountain in the Menominee Iron Range of Michigan's Upper Peninsula (Fig. 1) is home to "The Cornish Pump," one of the most remarkable stationary steam engines ever built in North America. Neither a beam engine in the conventional sense, nor a Cornish engine in any sense, the preserved engine is, nonetheless, an engineering marvel on a par with the Lehigh zinc company's remarkable 110-inch beam engine known as the "President" (see Newsletter 162, p. 8-15), only the house of which survives. In fact, the tantalizing possibility exists that the arrangement of the Chapin engine (e.g., the use of double action and a flywheel linked to the beam) was influenced by the President and the Cornishman, John West (nephew of Cornish engineer William West), who designed it. Two excellent accounts of the Iron Mountain engine and the mine it served can be found in "Iron Mountain's Cornish Pumping Engine and the Mines it Dewatered" (1984, 2012) by historian William J. Cummings of the Menominee Range Historical Foundation, and a third in the commemorative brochure "Chapin Mine Pumping Engine" produced to accompanying the engine's recognition as a National Historic Mechanical Engineering Landmark by the American Society of Mechanical Engineers in 1987. It is from these sources and others available on site and on-line that the following summary has been drawn.

The engine was built in 1889 to serve the Chapin Mine, which exploited one of the richest iron deposits in the Precambrian banded ironstones of the

Figure 1: Location of the Chapin Mine's "Cornish Pump" at Iron Mountain in Michigan's Upper Peninsula, some 60 miles southwest of Marquette on the south shore of Lake Superior.

Lake Superior region. Iron ore was first discovered near Iron Mountain in 1878, but the massive deposit that would become the Chapin Mine was located in 1879 following exploration by pioneers of the Menominee Iron Company in wilderness leased in April of that year from Henry Austin Chapin. By the end of 1880, eight shallow shafts had been sunk in the sandy ground, a small engine had been brought to the site, and production had started with a shipment of over 34,000 tons of ore. Mining was initially by room-and-pillar method, the pillars needing to be almost as large as the rooms because the ore was soft and friable. By 1881, a sawmill had been erected and 900 people were employed, a significant number of whom were engaged in stabilizing the mine with timbering.

As the most economical power source, compressed air was chosen to run the mine's machinery and, to this end, the Hydraulic Power Company was formed in 1881 in conjunction with the neighbouring Ludington Mine, to purchase and harness the power of the Upper Quinnesec Falls on the Menominee River, a little under three miles to the SSE of the mine site. The project was completed at a cost of $325,000. The 100-foot by 60-foot compressor building, which was erected in 1882 and housed two (and, by 1884, three) pairs of Duplex Rand compressors (32-in cylinder, 5-ft stroke), survives beside the waterfall, which is known to this day as Hydraulic Falls. The compressors were driven by two (and later three) Victor turbines built by the Stillwell and Bierce Manufacturing Company of Dayton, Ohio. Running at 150 revolutions per minute, the compressors operated at 40 strokes/minute and had the capacity to compress 2.3 million cubic feet of air in 24 hours. By the start of 1884, compressed air was being fed to the mines at a pressure of 60-65 psi by way of an aerial 24-inch wrought iron pipeline.

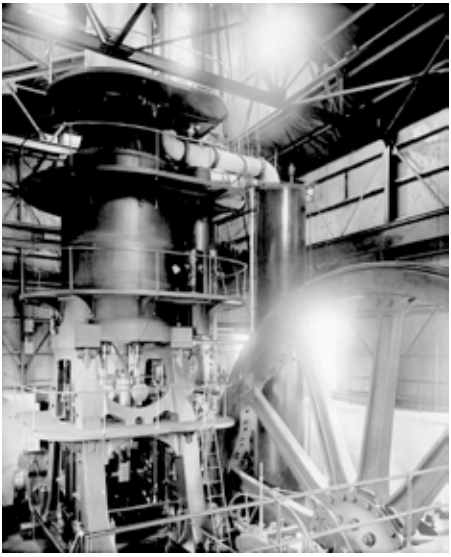
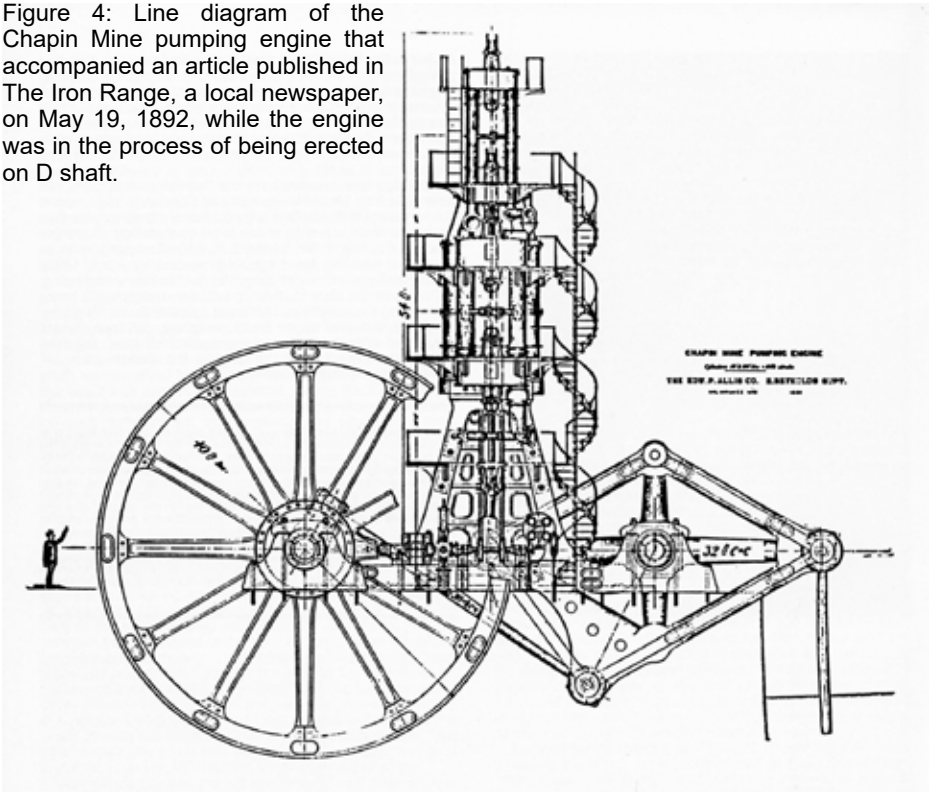


Figure 2: Edwin Reynolds' "Cornish" pumping engine at work on C Ludington shaft in October 1912 (Menominee Range Historical Museum).

Figure 3: The preserved "Cornish Pump" at the Chapin Mine designed by Edwin Reynolds in 1889, built by the E.P. Allis Company of Milwaukee, Wisconsin, in 1890-91 and set to work in January 1893 (2013 photo J.R. Manning).

Figure 4: Line diagram of the Chapin Mine pumping engine that accompanied an article published in The Iron Range, a local newspaper, on May 19, 1892, while the engine was in the process of being erected on D shaft.



The room-and-pillar method proved increasingly inadequate as the mine deepened and, by 1885, by which time the mine had reached the fifth level, demand for lumber had reached five million feet/year and almost half of the underground workforce was employed in timbering. The original method of mining was therefore abandoned in favour of sinking several deep shafts in the middle of the cedar swamp beneath which the main part of the deposit was located. This work was continued by the Chapin Mining Company following its acquisition of the property in 1886, at which time two shafts (B and C) were opened, and a third shaft (D) had been started. D shaft, however, encountered quicksand and in order for it to be sunk, the mine contracted the Poetsch Sooysmith Company of New York to freeze the ground around the shaft to the depth of the ledge at 100 ft using enormous refrigeration compressors. The shaft was additionally lined with a tubular cast-iron casing as it was sunk.

Water seepage from the overlying swampy ground also became a major problem as the mine expanded and it soon became clear that deeper mining would require pumping capacity well beyond that of the horizontal pumping engine then in operation. Erected in 1882, this engine had twin 24-inch cylinders making seven 10-foot strokes per minute, and a 20-foot flywheel working a 12-inch suction pump.

To address the water problem, the mine, which had recently changed hands and been re-organized, contracted the E.P. Allis Company of Milwaukee, Wisconsin (forerunner of Allis-Chalmers), in 1889 to build a pumping engine that would be adequate for the task. The assignment fell to Edwin P. Reynolds, the company's chief engineer (best known for

developing the Reynolds-Corliss engine), who looked to the pumping engines then in use on mines in Cornwall for ideas (hence the name "Cornish Pump"), although the final design was very much his own (Fig. 2).

Assisted by his nephew Irving H. Reynolds, the behemoth that Edwin Reynolds designed was one of the largest stationary steam engines ever constructed in North America (Fig. 3). The engine was a steeple compound condensing engine (Fig. 4), a form of tandem compound with a cylinder arrangement resembling that of a Sims' engine with the smaller high-pressure cylinder mounted on top of the larger low-pressure cylinder (Fig. 5), both worked by a common piston rod. Beyond that, however, all resemblance to a Sims' compound engine ceased. Reynolds' engine was an inverted vertical engine with the beam mounted below the cylinders (Fig. 6). It was also double acting and so required a flywheel (Fig. 3), which was driven off the beam by a connecting rod attached to a rather ungainly extension of the bottom kingpost (Fig. 4). The valve gear was operated by eccentrics driven off a bevel gear on the flywheel axle. Unfortunately, the eccentric rods operating the valves have been removed and the piston rods have been severed above the crosshead, both measures likely dating from the time of the mine's final closure. Further details of the engine's operation will doubtless come to light when recently discovered blueprints (presently being digitized) become available.

A report published in the local newspaper The Iron Range on May 19, 1892, described and illustrated the engine at the time it was being erected: "We present to our readers this week an illustration (Fig. 4) of the mammoth pumping engine now being erected at D shaft, Chapin Mine, under the supervision of Mr. Chas. Tyler, erecting engineer, and through the courtesy of the builders, The E.P. Allis Company, of Milwaukee, we are able to give the following description of this wonderful machine: This engine is what is known as a steeple compound condensing engine, and was designed by E. and I.H. Reynolds, and the contract calls for ninety million foot pounds duty. It will be capable of lifting 200 tons of water per minute, 1500 feet, 100 feet flow, which will be equivalent to 4,000,000 gallons on 24 hours. So it will be seen that the Chapin Mining Company, in putting in this machine, is providing for any contingency that is likely to arise as the mine is deepened to 1500 feet from the surface. The length from the end of the bob to the back of the fly wheel is about 75 feet and the height above foundation is 54 feet. The high pressure cylinder is 50 inches in diameter and the low pressure cylinder is 100 inches in diameter, and the pumps, to be located about 200 feet apart in the shaft, are 28 inches in diameter, with 120 inches stroke. The bob weighs about 120 tons, and the fly wheel about 160 tons. The fly wheel, as indicated in the illustration, is 40 feet in diameter. The rim of the wheel is 24 inches thick and

Figure 5: Cylinder arrangement of Reynolds' steeple compound condensing engine with the smaller, 50-inch high-pressure cylinder mounted on top of the larger, 100-inch low-pressure cylinder (2019 photo Mark Connar).

24 inches wide. The immensity of this machine is illustrated in the engraving in a most striking manner by the representation of a six foot man standing near the fly wheel. The shaft on which the fly wheel revolves is 27 inches in diameter. The bob is made in seven pieces and firmly held together by 21 wrought iron links shrunk on to the lugs as shown by dotted lines in the engraving. It is further strengthened by eight wrought iron tension rods, 8 x 16 inches, shrunk on to the sides and held in place by pins (Fig. 6). The engine is fitted with a surface condenser with 1049 one inch tubes, and a Reynolds' patent air pump. The mine water will be used in the condenser for cooling purposes. The boilers being once charged with water, as it is evaporated and the steam performs its office of driving the pumping engine, it exhausts into the condenser and is there cooled to a liquid state and pumped back into the boilers by a pump attached to the air pump, thereby affecting the greatest economy possible in the use of water and the making of steam. But to supply any deficiency arising from possible leakage or waste of any kind a small pipe is connected with the city water works. The boiler plant at present consists of four Reynolds patent boilers, but as the mine increases in depth four more will be added as needed. This engine is the largest and most powerful of its kind ever constructed, and the long established reputation of the builders is sufficient guarantee that it will perform the duty for which it is designed in a perfectly satisfactory manner. The E.P. Allis Company has contracts for and is building nine triple expansion engines of 165,000,000 gallons daily capacity, and among those of this type already built is one with steam cylinders of 40, 70 and 104 inches by 60 inches for the American Water Works Company, of Omaha, Neb[raska]."

The original engine house was four stories high and measured 42 feet by 36 feet at the base. Excavation for its 23-foot thick foundation was begun in autumn 1889 and the building was largely completed the following year. The engine house faced north with the shaft and shaft housing ahead, the boiler house (for four and later eight Reynolds' patented boilers) alongside to the east, and the stack built into the SE corner (Fig. 7). To handle the machinery, a 30-ton travelling crane was placed within the engine house, while a 10-ton steam winch handled the pitwork. Just northeast of the shaft stood the house of the winding engine, which measured 56 feet square with a 9-foot thick concrete foundation. Erected at the same time to hoist with flat (½-inch by 4-inch) cables, the winder started work in November 1891. All three buildings were constructed of local red sandstone.

Figure 6: Engine's crosshead (rear) and diamond-shaped underbob with one of the eight wrought iron tension rods added to provide additional strength (1997 photo Damian Nance).

The pumping engine, which was designed in 1889 and built in 1890-91, was set to work at 2:20 pm on Tuesday 3rd January 1893, having been erected beside D shaft the previous year under

the supervision of the E.P. Allis Company's Charles Tyler. The price tag for the pump was $82,000 and the entire installation is estimated to have cost $250,000. An account of the engine's historic, if fitful, start appeared in the January 7th edition of *The Current* (the weekly newspaper of neighbouring Norway, Michigan): "The new pump at shaft D of the Chapin is at last doing duty. Tuesday it was started up and the column partially filled with water, but owing to a slight trouble with one of the pump valves no water was brought to surface. Wednesday, the trouble having been found and remedied, the ponderous machinery was again started, but owing to the slowness of the start and the weight of water in the partially filled column, the engine centred. The hydraulic crane was brought into use, the fly wheel pulled over and at 1:30 o'clock another start was made and the water soon made its appearance, coming up with such force and in such quantity that the "collar launders" provided and thought amply large enough, were found scant in size. The pump was worked at varying speed from 4½ to 10 strokes per minute for a short time when it was found necessary to stop for want of water, as the quantity let into the sump had been exhausted and the five feet barrier in the water level toward the east had not been blasted out. The blasting out of this will give the full flow of all the water in the mine into the sump by valves in the dam. Messrs. Reynolds and Lewis of the Allis works and master mechanic Kent were conspicuous during the trial of Wednesday, loosening a nut here, tightening one there, opening one valve a little and closing another until at last everything seemed to their liking and they and Supt. MacNaughton settled down to a condition of extreme satisfaction. The big pump is a success as far as appearances and its ability to do the work assigned it, goes, but one of the bystanders remarked that though it brought up lots of water, it was the driest affair he had ever seen. He even asserted that the whisky jacks used in some part of the construction work were dry.

The new pump is built to raise, if needed, 3,000 gallons of water per minute from a depth of 1,500 ft., but at present

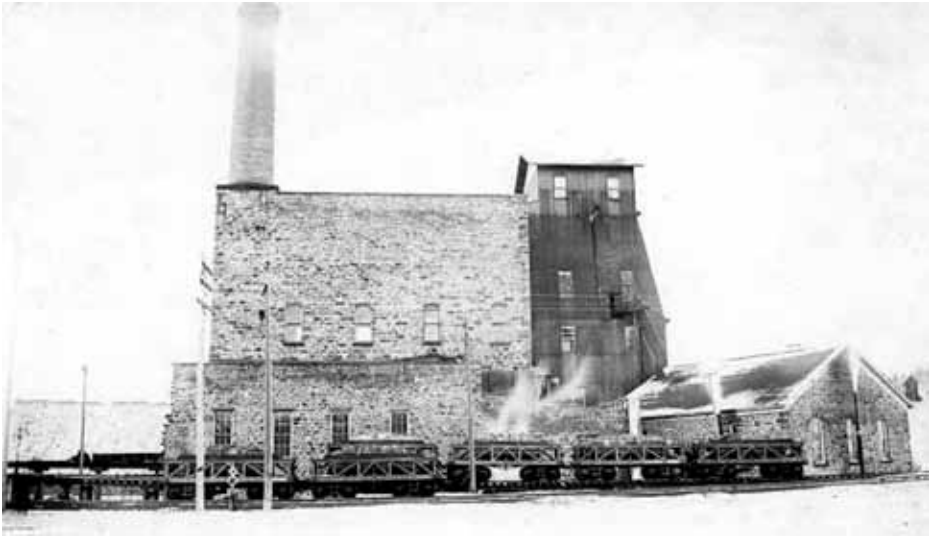


Figure 7: Original engine house of Reynolds' Cornish pump on D shaft, quarter of a mile ESE of the engine's present location. Built of local red sandstone, it was erected in 1889-90 and the engine started in January 1893. The attached boiler house contained four, and later eight, Reynolds' patented boilers. The winding engine housed in the building to the right was started in November 1891 (Menominee Range Historical Museum).

less than half that duty will be required. Of the stability of the work but a glance is required to convince one who looks around on surface, while in the shaft nothing has been left undone and the steel girders which carry the weight have a load of 3000 tons with a breaking strain of 30,000 tons. This pump has cost a good round sum of money and has many opponents on the questions of duty and economy, and we trust that at no very distant day comparisons may be made which will interest the mining public."

Even as the engine was being built, Iron Mountain was becoming a boomtown. In 1890, employment at the Chapin Mine reached 1800-2000 people, over 41,700 feet of levels and shafts were driven or sunk, and a record 742,843 tons of ore were shipped. By 1891, D shaft, on which the engine would later be erected, had been sunk to the eighth level, and in March 1892, a record 1,898 tons of ore were raised in a period of 24 hours. Four sets of pumps would later be used in D shaft to raise water from a depth of 600 feet.

In 1894, the Chapin Mining Company, now newly owned by the Marcus A. Hanna and Company, acquired neighbouring Ludington Mine and also the Hamilton Mine, the ore body of which had been discovered adjacent to the Ludington in 1882. Both mines had closed in 1892 as a result of flooding and, despite being successfully dewatered the following year, had not reopened as a consequence of a depressed iron market and, instead, had been allowed to flood. The Chapin Mine, however, struggled on and, by mid-1896, had successfully dewatered both mines. D shaft was connected to the Hamilton Mine in 1897 and the Chapin and Ludington mines were linked in 1898, shortly before a

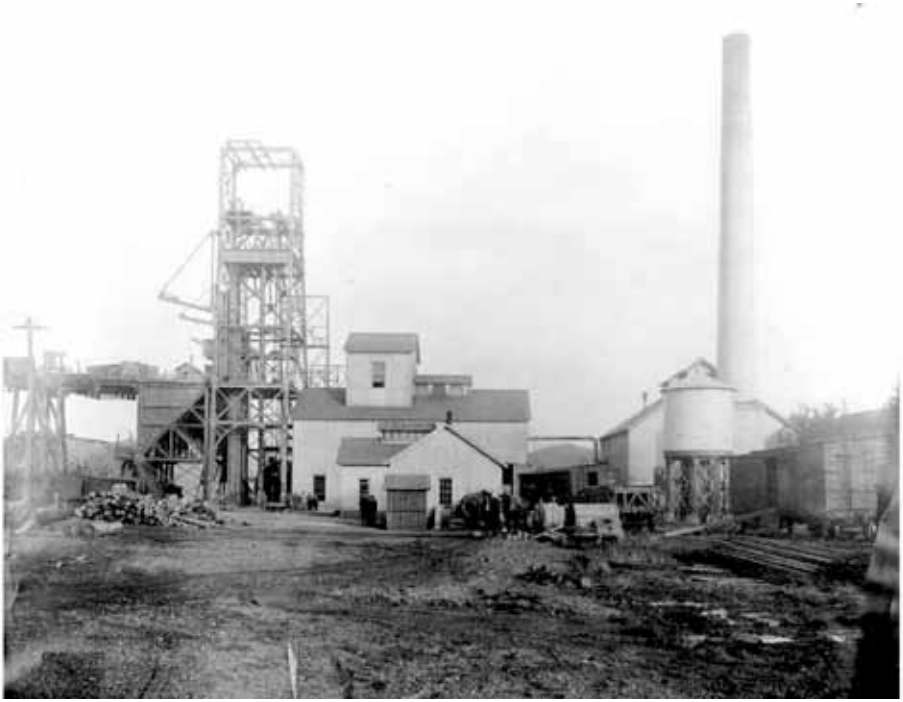
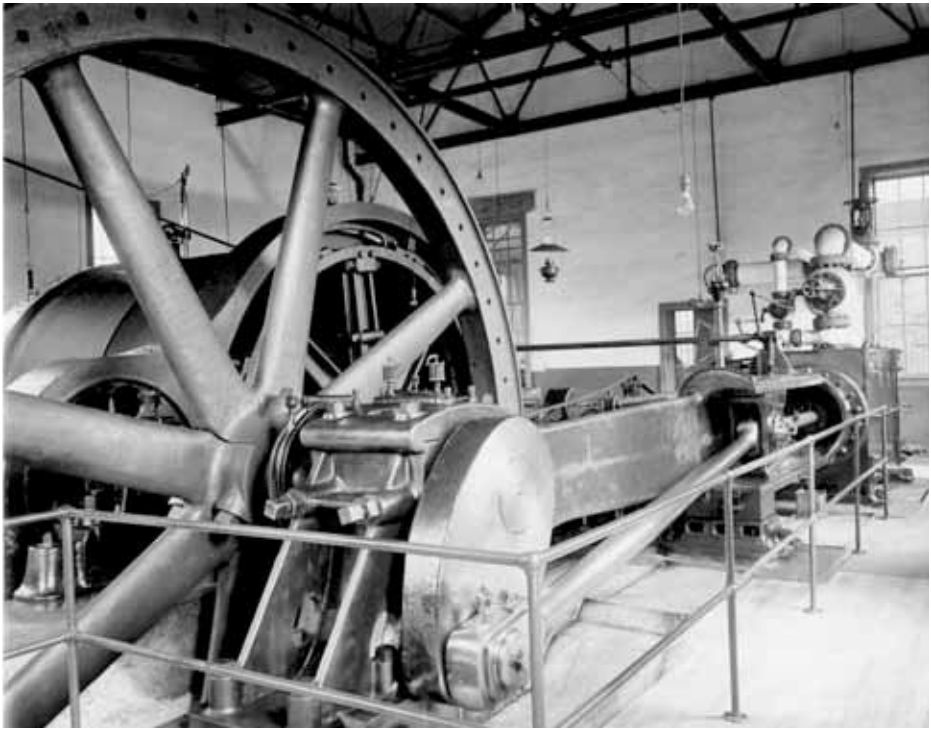


Figure 8: Postcard of the engine house (right) on C Ludington shaft, looking west, with the separate boiler house and attached stack to the rear (left) (Postmarked March 1908 William J. Cummings).

Figure 9: Horizontal 34-inch by 6-foot reversing Corliss winding engine built by the Allis-Chalmers Company of Milwaukee, Wisconsin, and set to work at C Ludington shaft in July 1908 (October 1912 Menominee Range Historical Museum).



deal was struck for the sale of the Chapin Mining Company to the newly formed National Steel Company. In 1900, the Chapin Mine achieved peak production when a record 1,012,000 tons of ore were raised and total production since 1880 reached 9,451,963 tons.

Prior to the mine's acquisition by National Steel, however, a dramatic decision had been made to remove Reynolds' massive pumping engine, which had been misaligned since 1896 as a result of underground movement. Removal of the engine would also allow recovery of the rich ore in the mine pillar supporting it. Dismantling began in July 1898, by which time cracks had appeared in the engine house as a result of settling of the ground surrounding it. By the end of August, the engine had been dismantled and placed in storage. The stack was salvaged but the engine house was left to collapse with the settling ground.

The engine remained in storage until 1907 when the Oliver Iron Mining Company (a subsidiary of the U.S. Steel Corporation, which had acquired the mine with its purchase of National Steel in 1901) decided to re-erect it at its present location on the then recently completed C Ludington shaft, which had been started in 1903. Erection of the engine was completed in 1908 and, at its new site, it faced NNE. The engine was mounted on a local sandstone foundation and housed in a corrugated iron building, with the boiler house a short distance to the rear, to the west of which towered a 135-foot tile stack (Fig. 8). Operation of the plant, including the engine, boilers and shaft house, required a crew of 60 men working in three shifts. The vertical four-compartment

shaft the engine served was one of the largest in the region with two 5-foot by 8-foot hoisting compartments, a pumping compartment measuring 10 feet 4 inches by 11 feet 1 inch, and a 5-foot by 10-foot 4-inch cageway. The water was lifted by eight sets of pumps placed at intervals of 170 to 192 feet to a total depth of 1,522 feet. The engine's pumping capacity from this depth was 319 gallons per stroke or almost 4.6 million gallons in 24 hours at 10 strokes per minute. To produce sufficient steam, its annual consumption of coal was about 11,000 tons. It was later noted in the July 1915 issue of Power magazine that: "During a 12-month period this pump operated 99.5 percent of the entire time at a rate of 6.63 rpm, pumping 1,922 gallons per minute against a head of 1,513 feet. The average delivered horsepower was 736, and the average indicated horsepower 831, making the mechanical efficiency 88.5 percent. The duty performed was 86,200,000 feet-pound of work per 1,000 pounds of steam, including all auxiliaries."

The hoisting plant erected a short distance to the east was the largest in the Lake Superior region, comprising a duplex, 34-inch by 6-foot reversing Corliss engine built by the Allis-Chalmers Company of Milwaukee, Wisconsin, and worked at 50 rpm (Fig. 9). With a winding drum 12 feet in diameter and 10 feet across, the engine hoisted two 4,000-pound skips, each capable of carrying 14,000 pounds from a maximum depth of 3,000 feet. The engine was set to work in July 1908, after which C Ludington shaft became the mine's chief hoisting shaft.

The pumping engine served the needs of the Chapin, Ludington and Hamilton Mines until 1914 when it was replaced by electric pumps and kept only as a back-up. Two sets of centrifugal pumps were installed in the newly refurbished Hamilton shaft, the first at the 12th and the second on the 16th level at a depth of 1,430 feet.

Following World War I, the iron market collapsed as demand for steel fell and, in 1921-22, the Chapin Mine was forced to close for almost 8 months. Thereafter, the mine's production declined and with the stock market crash of 1929 and the Great Depression that followed, the mine permanently was closed in August 1932, having raised in total 27.5 million tons of iron ore.

The pumping engine, however, had been left in place and, in 1934, the Oliver Iron Mining Company donated it to the local county (Dickinson) as a "relic for sightseers to visit," to which end the engine house was removed and the engine given a coat of aluminium (and much later orange and yellow) paint. Local efforts saved it from the scrapyard during World War II, and in 1978 it was purchased for a dollar by the Menominee Range Historical Foundation with a view to developing a permanent historic mining site. In 1981, the site was listed on the National Register of Historic Places, and in 1982-83 the foundation had Smith Metal Structures, Inc., erect the present 80-foot by 70-foot metal building at a cost of $101,000 to ensure its preservation.

Damian Nance

SOCIETY MAILING

I know some of you like oddball facts and figures. The last mailing of the largest journal we have ever produced plus the newsletter with it produced a mammoth mailing. This mailing, ignoring the foreign ones, required twenty one Royal Mail sacks which were each filled to the post office limit of eleven kilograms. No mean feat to get it to the Sorting Office!

K.J.T.R.

FROM THE ARCHIVE

Beach Tin Operating Co. (Gwithian) Ltd.

Buckets which looked like barrels cut in half lengthwise were strung from an aerial ropeway between Gwithian Beach and the treatment works beside the Red River. These were loaded with tin-bearing sand from the beach and conveyed across the Godrevy flats by the aerial ropeway ready for processing.

The Beach Tin Operating Co. (Gwithian) Ltd. processed sand from a stretch of beach below the low cliffs of Gwithian. Centuries of mining in the catchment of the Red River will have washed Cassiterite particles out to sea and a proportion would have washed ashore and concentrated along the beach. The mill used round buddles, frue vanner and James shaking tables and the storage silos each held 1,000 tons of sand ready for processing. There was also a calciner indicating that the ore originated deep underground.

For further details see the very informative and illustrated web pages by David Oates (Google *Gwithian tin*):

http://cornishstory.com/2020/10/26/gwithian-tin-sand-works-part-1-location-and-recovery/

http://cornishstory.com/2020/11/30/gwithian-tin-sand-works-part-two-processes-and-people/

CNF

There were two aerial ropeways at Gwithian. This is thought to be the second one which carried lime-rich sand from the dunes. When I was a teenager I remember being told by Mr Charlie Tregidga that he used to get bags of sand from Gwithian, as a boy, and would then sell the sand to homes inland to be spread out on their kitchen floors.

Both photos taken July 1937.

NEWS FROM THE NATIONAL TRUST

Just a very brief report and 'nadelik lowen' to all – I'm sat here at Levant in a cold office, with a grey sea but feeling very positive as work has resumed today on the engine that was put on hold last March

Having been through a very challenging year recent work to confirm our teams for the mining sites we care for has been top of our priorities for a while. Now we are nearing completion on this and are beginning to look forward to opening in 2021.

It is planned that both East Pool and Levant will re-open with a different arrangement next season with pre-booked tickets being a necessity for visiting – this will enable us to better manage our resources and provide a better visitor welcome. Our target date for re-opening is March 31 with each site being open for 5 days a week, slightly overlapping so as to provide an overall 7 day mining site opening from March to October.

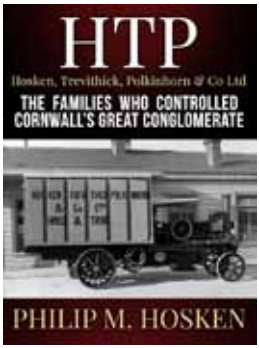
There's a huge amount of work required to redesign our visitor experience and we are excited to be working with our staff, volunteers and other stakeholders again to ensure we celebrate our world heritage sites appropriately and share their amazing stories with our visitors.

We're also currently putting together maintenance plans for each site ready for when the new financial year kicks in and looking forward to welcoming visitors back on site. Maybe we'll see some of you during the year too.

James Breslin

Operations and Development Manager - Tin Coast and East Pool Mine

BOOK REVIEW



Former Society Chairman, Phil Hosken has not been idle since leaving office. One result of this, long awaited by those who knew of its gestation, is his history of his family company, that great trio of names, Hosken, Trevithick, Polkinhorn & Co. No one else could have done justice to that empire other than Phil and the story that emerges is full of interest with a cast of truly Cornish characters.

HTP, known disrespectfully to some as 'Hot Turnip Pasties' was a sprawling ramshackle empire and its survival over many years seems remarkable bearing in mind the lack of overall direction of the company and the independent paths pursued by some of its constituent parts. With his access to family records, Phil has been able to make sense of its tortuous story.

His book sits well alongside Edmund Vale's, The Harveys of Hayle, in recording a slice of Cornwall's commercial history and can be recommended as a fascinating read. It should be noted that this volume ends at 1934 and that a second volume is planned to take the story forward. Phil would like to hear from those with information on HTP's successor organisation, Farm Industries.

HTP: The Families who controlled Cornwall's Great Conglomerate is published in a hardback edition at £30. For more details and to order a copy, go to www.htpbook.co.uk.

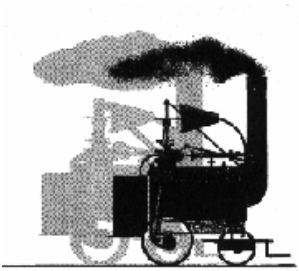
Graham Thorne

PUBLICATIONS

The Society's book, *The Redruth & Chasewater Railway: A Journey along the Line*, came out at the end of October and at the time of writing seems set to be a local best seller. This large format paperback of 94 pages and with 150 photographs is excellent value at £10. The Society is delighted to have brought Eric Rabjohns' years of research to a wider public. Reader Peter Totman wrote to tell us how much he enjoyed the book and also sent a photograph of his splendid models of the line's locomotives.

Thanks also to Michael Messenger for his support in bringing the book to market.

Graham Thorne



Holman

It seems that Holman Bros. of Camborne have left a legacy in Kenya. The logo above comes from the website of Holman Brothers (E.A.) Ltd. which is based in Nairobi, Kenya and is one of East Africa's leading dealers in the whole range of air-compressors, power generators, construction and heavy equipment, farm machinery, plus lifting and hoisting equipment. Holman Brothers (E.A.) Ltd. have been in existence since 1962 when they were presumably set up by the Camborne firm to sell its compressors and mining equipment. Interestingly the present company does not appear to sell CompAir equipment.

See: info@holman.co.ke

CNF

MEMBERS' BENEFITS

Trevithick Society members are entitled to free entry (on production of the membership card) to the following attractions:

- King Edward Mine
- Cornish Engines at Pool (East Pool Mine and Michell's Whim)
- Levant
- Geevor Museum
- Poldark – free entry to site and reduced fee for underground mine tour

Also:

- 10% off book purchases at Tormark.
- 10% off purchases at KEM shop.

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The Trevithick Society, a registered charity, is a recognised body of the study of industrial archaeology in Cornwall. Membership is open to all who are interested in the region's great industrial past, whether or not they live in Cornwall. The Society takes its name from one of Britain's foremost inventors and pioneers of the Industrial Revolution, Richard Trevithick, a Cornishman whose name is inseparable from the development of steam power. This newsletter is published quarterly and, together with the annual journal, is distributed free to members. Letters and contributions are always welcome and should be sent direct to the editor.

The views expressed in this newsletter are those of the authors and not necessarily those of the Trevithick Society.

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