Cumbria Industrial History Society

BULLETIN

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EDITORIAL

We are getting well through the summer and so far the weather has not been too bad. The meetings so far have been well attended and have been very informative. Our thanks go to all the people who run the days and do the organisation. We are always looking for new ideas for day and evening visits, if you have ideas please let the committee know.

We have had a new volunteer for the committee but we are still short and more help would be appreciated. It is not a very onerous task with the committee meeting 6 times a year usually in a village hall to the north of Kendal on the A6. Most of the other business is conducted via email.

The Mike Davies-Shiel book is progressing with the first chapter having been sent to the printers to get layouts etc. sorted. If all goes to plan it is hoped that it will be launched at the spring conference in 2018.

In the meantime I do nearly have enough material for a volume of the Industrialist. If anyone has a piece of research they would like to see in print this could be you opportunity. Please contact me if you would like a chat.

The two articles in this edition of the bulletin are both chemical related. The chemicals industry was a significant industry in Cumbria going back to the early salt industry, and Coperas industry, upto the modern plants such as Marchon. The article on by-products is a side of the coal and steel industries that is usually overlooked by those people researching the better known sides of the industry.

Front Picture. Milnthorpe and its mills MDS collection March 1988.

Subject of the Autumn Conference.

SOCIETY EVENTS 2016

LOWCA AND PARTON SUNDAY 31ST JULY OLD HARRINGTON NO.10 COLLIERY PIT YARD. (NX 985 218) 11.00AM

A walk around the villages and the foreshore of Lowca and Parton to look at the remains of the industry in the area. Lead by Dai Powell.

KIMBERLEY TISSUE FACTORY BARROW 13TH SEPTEMBER 2PM.

This is a visit to the tissue paper factory in Barrow to look at the process. Numbers are limited, if you would like to go please let Helen know..

AUTUMN CONFERENCE INDUSTRIES OF MILNTHORPE. Saturday 15th October at Preston Patrick Village Hall.

See booking form included in this mailing.

NOVEMBER EVENING MEETING TUESDAY 15TH NOVEMBER 7,30 PM GREENODD VILLAGE HALL. THE WATER MILLS OF CARK. LES GILPIN.

Les is a well known member of the Society, who is probably better known for his railway history, but he has also a wide interest in the areas industrial and social history.

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SPRING CONFERENCE SHAP WELLS HOTEL APRIL 22ND 2017.

Next year's spring conference is well forward to being organised on the subject of water.

AUTUMN CONFERENCE

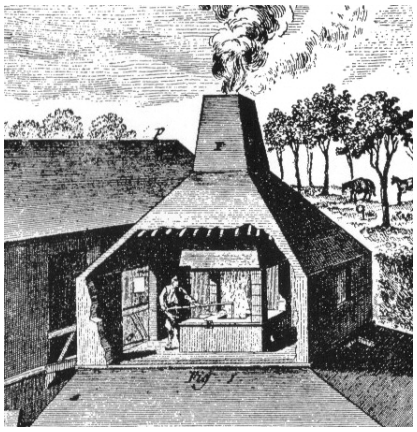
Plans for a conference in the Caldbeck area looking at the industry of the northern fell area. Anyone who feels they may have a talk on a suitable subject please feel free to contact the committee.

Further details of these events and the full programme for 2017 will be in the December Bulletin.

NON SOCIETY EVENTS

Proposed visit to Dyfi furnace, Friday 21st October

When we started work at Newland we had no idea that the walkway around the top of the furnace stack still existed. The firebrick lining had been removed from the top 12Ft and the rubble core had crumbled away leaving a steep funnel, overgrown with brambles, leading to a 20Ft drop to the hearth below. The furnace lining had to be replaced to support the rubble core but our only guide to the shape of the tunnel head was Duddon furnace which has also been reconstructed. This was the point where the ore and charcoal was fed into the furnace but also the site of the flame where the carbon monoxide was burnt off.



Measuring the depth of the charge. Detail from La Grande Encyclopedie

A visit to Dyfi has been arranged to see how much of the tunnel head survives there. CADW have agreed to show us the parts of the furnace which are not open to the public once the horseshoe bats have moved to their winter quarters. They have some plans and drawings.

In the afternoon there will be a trip to Ystrad Einion copper mine to see the underground waterwheel.

On Saturday 22nd Jon Knowles has agreed to offer a tour of the surface remains at Corris.

This is to be a joint CATMHS/NFT/CIHS meet. If you wish to go on one of the mine tours and do not hold a BCA card you will need to sign a "release of claims " form for insurance purposes. The Corris Slate District was the southern outlier of the Ordovician Slate on which the slate industry of Merioneth was based. Although never as large and certainly never as prosperous as Blaenau Ffestiniog to the north it had a unique charm which persists to this day and due to the nature of the rock had noticeably different methods of extraction. The area never made it big either as a slate producer or latterly as a tourist area and is less disturbed and retains many original features. The walk will show some of the remains of the Corris Railway, its feeder tramways and the quarries which

produced the slate. Depending on group size and ability there will be opportunity to go underground to get a feel for the size of the workings. Please bring walking boots, lunch, helmet and lamp/torch.

THE MANUFACTURE OF SULPHURIC ACID AT MARCHON WORKS,WHITEHAVEN

The Anhydrite Process

Marchon Products at Whitehaven made its first tentative steps in the manufacture of synthetic detergents in the early 1950s. An essential feedstock was sulphuric acid (H_2SO_4) which, at first, was purchased from external suppliers. As production of detergents increased external supplies became insufficient to meet the site's demands and so attention turned to manufacturing this acid on site at Whitehaven. The usual route of manufacture was to burn elemental sulphur in air. Unfortunately at this time supplies of this element from the United States were in short supply, due in part to the Korean war. The subsequent shortage of sulphuric acid resulted in the government encouraging its manufacture using indigenous raw materials. One such route of manufacture involved the roasting of iron pyrites and Marchon applied for permission to erect plant based on this technology. However since approximately 20 such plants were already under construction in the UK this permission was not forthcoming.

Quite fortuitously large deposits of anhydrite (anhydrous calcium sulphate - $CaSO_4$) lay beneath the Marchon site and it was known that this raw material could be used to manufacture sulphuric using a process originally developed in Germany. A drift mine was sunk at the south-west corner of the site to gain access to this material. This process also used shale as a feedstock and, again, fortune smiled on Marchon since this was readily available from the adjacent Hutbank Quarry.

Solway Chemicals Ltd was subsequently registered as a separate but fully-owned company thanks to generous government assistance. Its plant was established at the southern end of the Marchon site in order to process the raw materials and commence manufacturing sulphuric acid. In many ways although it was a fully-owned subsidiary Solway operated and behaved somewhat separately to the rest of the site. It seemed to have a separate culture together with its own dedicated laboratory, works canteen and first-aid post although a distance of up to 1 mile to the main site facilities went some way in explaining this phenomenon.

The 'anhydrite' process required that the anhydrite and shale were intimately mixed with coke and a small quantity of sand before roasting at up to 1450^{o}C in cylindrical rotating kilns (230' x 11'i.d.). Sulphur dioxide gas (SO_2) was driven off during heating and, following removal of entrained dust, was converted to sulphur trioxide (SO_3) by passing it over a vanadium pentoxide catalyst with dry air. The SO_3 was then absorbed into sulphuric acid producing oleum to which water was added subsequently.

A useful by-product from this calcination process was the cement clinker which was discharged from the kilns as a solid. Following cooling and milling with a small quantity of gypsum (hydrated calcium sulphate - $CaSO_4.2H_2O$) this was sold as cement to Blue Circle Industries.

The first two kilns commenced operations in 1955 and an annual production rate of over 100,000 tons of sulphuric acid was achieved. Capacity was increased by a further 70,000 tons/annum with the opening of a third kiln (240' x 13'i.d.) in 1961. Two more kilns (230' x 12'i.d.) were commissioned in 1965 taking the total capacity to 350,000 tons of sulphuric acid per annum with a similar quantity of cement also being produced. The increased capacity of sulphuric acid manufacture allowed a corresponding increase in the amount of phosphoric acid being produced as an intermediate in the manufacture of detergent materials.

However by the late 1960s the rising costs of manufacture by this route were causing some concern. The process was both labour and capital intensive and, because it was largely mechanical, maintenance costs were also becoming unacceptable. Therefore in 1971 the decision was taken to change over progressively to the manufacture by sulphur-burning since elemental sulphur was, by then, readily available again.

Sulphur-burning

The first Saacke sulphur burner was commissioned in 1973 and with an annual capacity of 200,000 tons of sulphuric acid enabled kilns 1 and 2 to be shut down. Number 3 kiln was replaced by the second burner in 1975; with the commissioning of the third burner in 1976 the final two kilns were taken out of service. However some of the original oxidation and absorption plant were incorporated into the new operation. The total annual capacity then stood at over 500,000 tons of sulphuric acid which meant that the Whitehaven site became the largest single-site producer of sulphuric acid in the UK.
Cement production, of course, was no longer possible but it has been estimated that some 4.4 million tons were produced over the 20 years in which the kilns were operational.
Operations at the anhydrite mine ceased with the closure of the final two kilns although it was kept open on a 'care and maintenance' basis for a few years, presumably on a contingency basis. It may now find another lease of life as the entry to the new coal mine proposed by the West Cumbria Mining Company.

The additional attraction for burning sulphur was the ability to raise steam using the heat of combustion. At a time of rising oil prices this capability was another economic factor in the decision to cease the anhydrite route since large quantities of steam were essential in the operation of what, by now, was a large chemicals manufacturing site. Some 4.5 tons of steam for export at 250psi was raised for each ton of sulphur burned.

Molten sulphur was shipped from Rotterdam to the Prince of Wales Dock, Workington where it was off-loaded into steam-heated storage tanks. The molten sulphur was transported to the Marchon site in insulated road tankers in ~20 ton quantities. On site the sulphur was off-loaded using compressed air and delivered into one of two mild steel

storage tanks which were both lagged and steam-heated to maintain a temperature of 145^0C.

The first sulphur burner produced SO_2 gas which was fed to Numbers 1 & 2 acid streams working in parallel. Each stream could produce 300tpd expressed as 100% H_2SO_4. Combustion of the sulphur was effected using dry, dust-free air and resulted in a furnace temperature of some 1070^oC and a gas concentration of some 11% SO_2 . The hot gas was fed to the main boiler in order to raise high pressure steam and resulting in its temperature being reduced to ~475^oC.

This (relatively) cooled gas stream was split into two fractions and cooled further to ~430^oC by the introduction of dry cold air. These streams fed each of the Numbers 1 & 2 acid streams operating in parallel. Conversion to sulphur trioxide (SO_3) was effected by passing the mixture of SO_2 and air through a converter containing five beds each with trays of pelletised vanadium pentoxide catalyst. As the gas stream passed through each bed the concentration of SO3 gradually increased until a conversion rate of ~98% was achieved.

The cooled gas stream from the converters was introduced into two packed absorption towers operating in series and into the tops of which was fed ~98.6% sulphuric acid. The SO_3 gas dissolved into this acid stream which was collected in a circulation tank where water was added to maintain a steady concentration. Acid from this tank was also fed to the drying towers used to produce the dry air used in the combustion of sulphur. The product acid at 96% H_2SO_4 was taken from the stream returning from these towers.
Mild steel storage tanks afforded a capacity of 11,000 tons as 96% H_2SO_4 and a further 1500 tons as 77% H_2SO_4.

The 'tail' gas after passing through the absorption towers passed through humidifiers and electrostatic precipitators before being discharged to the atmosphere via the 460ft high 'Solway' stack. This was a concrete structure containing an internal glass reinforced plastic flue and was erected in 1976 to replace the earlier slightly shorter chimney associated with the kiln operations. The gas steam discharged from the stack was expected to contain only 0.15-0.20% SO_2.

Numbers 4 and 5 acid streams operated in a manner very similar to that described above with the main difference being that each stream had its own sulphur burner and each was designed to produce 500tpd as 100% H_2SO_4. The converters only contained 4 beds of catalyst as opposed to the 5 on numbers 1 and 2 streams. High pressure superheated steam from numbers 4 & 5 streams was used to generate electricity by feeding it to a steam turbine in which its pressure necessarily reduced.

This turbine drove an alternator capable of generating up to 5MW of electricity and so theoretically could supply ~40% of the Marchon site's requirements. However the electricity generation rate was determined by the site demand for low pressure steam which was produced by this depressurisation of high pressure steam In 1983 electricity production amounted to 20209 MWh, equivalent to an average output of 2.3MW.

The main consumers of sulphuric acid on the Marchon site were the plants manufacturing phosphoric acid by the digestion of phosphate rock. The F3 and F4 phosphoric acid plants used 77% sulphuric acid and so the 96% product was diluted to this concentration with water in a mixing tank. The F3 plant closed in 1979 with the commissioning of the much larger F5 acid plant followed by the closure of F4 in the mid 1980s.

The F5 phosphoric acid plant was designed to operate with 96% acid but following its closure in 1992 much of the requirements for sulphuric acid ceased. Some 77% acid was still required in the UFEX phosphate purification plant but only one of the sulphur streams was now necessary. Requirements for sulphuric acid reduced even further with the closure of all phosphate operations (now owned by Rhodia) at the end of 2001.

One important product from the Solway sulphuric acid plant which must not be overlooked was liquid sulphur trioxide (M. Pt 16.9^{o}C). This extremely hazardous substance was obtained by its distillation from 28-31% oleum (100% H_2SO_4 +28-31% SO_3). It was used in the sulphonation of fatty alcohols and ethoxylates to produce intermediates used in the manufacture of synthetic detergents (surfactants). It was stored in liquid form in a purpose-designed storage tank.

With the ever-reducing on-site demand for sulphuric acid and only one stream operational facilities were installed for the off-loading of sulphur trioxide purchased from external suppliers into its dedicated storage vessel.

In 2001 the Huntsman Corporation purchased Rhodia's Whitehaven surfactants operations and, after initially encouraging statements, decided to withdraw from the business. In 2005 site operations ceased and with them the requirements for any of the products once manufactured in such large quantities on the Solway Chemicals site.

BRIAN QUAYLE

WEST CUMBERLAND BY-PRODUCTS CHEMICAL MANUFACTURERS, FLIMBY.

In 1908 the Flimby & Broughton Moor Coal and Firebrick Co. managed by the Wilson Bros. of Broughton Grange, built 40 new regenerative coke ovens to replace the old beehive coke ovens, which they had built at Risehow c1878. The new coke ovens produced 15 – 20% more coke and of better quality. This new coke plant was also capable of extracting crude tar in the process, which had previously gone as waste.

In October 1910, Messrs Metcalfe Ltd, chemical manufacturers of Oswaldwistle, Lancashire applied to the Maryport Harbour Trustees for land at the head of the Senhouse Dock on which to build two large storage tanks to hold creosote from their new chemical works at Flimby. The chemical plant at Flimby was built on land leased from the Flimby & Broughton Moor Coal and Firebrick Co that adjoined their new coke ovens. The chemical plant was built to refine the crude tar produced from the coke ovens.

On December 31st 1910 a meeting was held at Church, near Oswaldwistle to form a company to take over the Flimby Chemical Works. Wilfred Irwin was elected Chairman and Saul Jackson became Managing Director. Arthur Heap became company secretary and The London City and Midland Bank Ltd, Cockermouth as the company's bankers. The registered office was The Risehow Chemical Works, Flimby. An agreement was entered into by Wilfred Irwin, Saul Jackson and others to raise capitol by issuing 10,440 shares at ten shillings each to purchase from Messrs William Metcalf Ltd the chemical works, the purchase was completed in February 1911. A further 251 shares were issued, making 10,691 shares in all.

An agreement was entered into by the chemical works to supply sulphuric acid for 3 years to the following companies, - Moresby Coal Co. Ltd. - Allerdale Coal Co. Ltd. – Harrington Coke Ovens Ltd. – St Helens Colliery & Brickworks Co. Ltd. A lease was drawn up with the Maryport Harbour Trustees for the company to lease a piece of land by the Senhouse Dock for 10 years at £6 per annum. A General Meeting was held at Church in March 1911 with 12 shareholders plus the two directors and a further 4808 shares were issued making 15,499 shares in total. A further £4000 capitol was required to build additional plants to produce Benzole and Carbolic acid.

Ernest Prior joined the Maryport Benzol Company in 1911, after two years Ernest was appointed the company manager, a position he held until the company ceased trading in 1931, due to an insufficient supply of products due to the recession at the time.

The Sulphuric Acid plant was completed, making it capable of producing 100 – 110 tons of acid per week, and three of the seven tar stills were completed. In 1912 an extra acid plant the New Glover acid tower was installed, the works were now capable of producing 6000 tons of acid and 8750 tons of distilled tar. It was envisaged that further 50% expansion in production would be required to meet future demand involving an estimated £6/7000 expenditure, further shares were issued making a total of 36 shareholders in the company.

At the 3rd A.G.M in Feb 1914 at Aspen House, Church, Lancs it was announced the works had produced 6250 tons of sulphuric acid and 16882 tons of tar distilled. It was decided to issue a further 1000 £1 shares. At the meeting it was decided to form a new company to manage the refining of crude Benzol at the company's modern plant on the Senhouse Dock, the new company would be known as the Maryport Benzole Co Ltd.

An agreement for this company was drawn up between J.E. Henson of the Flimby & Broughton Moor Coal & Firebrick Co. Ltd, J.James of Oughterside Coal Co Ltd, W.J. Douglas of St Helens Colliery & Firebrick Co and A. Heap of West Cumberland By-Products Co. The number of directors, not less than two and no more than seven, first named A.C.Scoular of St Helens Colliery & Brickworks Co, Lloyd Wilson of Flimby & Broughton Moor Coal & Firebrick Co. Ltd, J.Williamson of Oughterside Colliery Co, each company holding 1000 shares. Wilfred Irwin, consulting chemist, Derwent Lodge, Papcastle, Saul Jackson, Cambridge Road, Southport, manager of private company, each, to hold 500 shares. The last two, representing the West Cumberland By-Products Co were elected for life, in the event of either no longer representing the company; the company could appoint another director.

After the crude tar was distilled from the coke ovens, it was transferred to the chemical plant and placed in large stills heated by coke boilers, eventually the stills were replaced by large vats also heated by coke and later oil boilers were used. As the crude tar was heated, the first vapour lowest to be given off was benzol, this was condensed to a liquid. The benzol was then placed in a centrifugal separator and naptha was extracted as a solid. Naptha was a highly inflammable substance from which liquid napthalene was made, one of its uses was in the manufacture of fire lighters, when mixed with sawdust or wood shavings.

One of the uses for benzol, was as fuel for early motor cars; and sold in gallon tins to local motorists.

At a slightly higher temperature creosote was given off and condensed, this was a dark brown oil used as a wood preservative, a heavier creosote followed this, then came tar. After impurities were removed from the tar, creosote was added to gain the correct viscosity and this mixture was used for road surfacing. The residue from this process was pitch, a resinous dark brown substance, semi-liquid when hot and solid when cold, pitch was then allowed to harden in vats 5 ft thick, when hard it was broken with wedges and heavy hammers and sold by weight. Another source of coal tar, was the local gas works, they used a similar coking process to extract coal gas.

The sulphuric acid plant at Flimby works used the lead chamber process where furnaces burnt spent oxide, another by-product from producing coal gas. At the gas works, coal gas was passed through a mixture iron oxide, peat and sawdust to absorb sulphur from the gas. This spent oxide was then burnt at the chemical works in furnaces, which produced sulphuric dioxide, this was then converted with nitrous oxide into 70% sulphuric acid, there was a ready market in West Cumberland for the acid. This plant became obsolete c1962 and was demolished.

The West Cumberland By-Products Co over the years had contracts with most of the gas companies in Cumberland to purchase their tar and spent oxide. One of their largest customers for tar was Dumfriesshire County Council. They had a large net work of roads to improve and maintain. The tar plant at Flimby continued until c1969, then closed with the introduction of North Sea Gas.

In 1913 the Flimby and Broughton Coal and Firebrick Co. began the layout for a new colliery at Risehow and sinking a shaft began in 1915. In 1915 George Stacey Wilson one of the partners in this new pit died and in 1917 the company was sold, the new owners were the Flimby Colliery Coking & By-Products Co. Ltd one of the shareholders was the United Steel Co. In 1919 the new company began deepening the Risehow pit and plans were made to erect a further 60 coke ovens. During the 1920's the Flimby Colliery Coking & By-Products Co suffered financially because of the miner's and general strikes and in 1928 the company was taken over by the United Steel Co.

from Lloyd Wilson.

By 1920 the chemical works had been a very successful venture, they had increased their dividends annually and their share price had doubled since the company had been established. The directors also regulated the value of the company's share price. In 1920 the West Cumberland By-Products Co purchased the lease for the chemical works site at

Flimby from Wilson a former director of the Flimby Colliery Coking & By-Products Co for £750. It was shortly afterwards that Wilfred Irwin was advised by his doctor to take a two-month break from work.

The chemical works suffered in the 1920's, first with the miner's strike in 1921 and with the general strike of 1926; there was very little coal available, so there was very little tar on the market. After each of the strikes had been settled in the 1920's, some pits never reopened, as they had become too dangerous to work due to flooding in the seams. During the strikes the Flimby works were virtually closed down, the shortage of tar and the competition for what tar was on the market, the Flimby plant made the decision to concentrate on their sulphuric acid production.

Over the years the Flimby company had obtained contracts with most of the gas companies in Cumberland to purchase their tar and spent oxide. One of their largest customers for tar was Dumfriesshire County Council. They had a large net work of roads to improve and maintain. The tar plant at Flimby continued until c1969, then closed due to the introduction of North Sea Gas.

Another by-product from the Flimby plant was sulphate of ammonia; this was used as an agricultural fertiliser, with Fisons, fertiliser manufactures of Silloth as a major customer.

In March 1928 Wilfred Irwin died after a sudden illness while on holiday, he had gone to study salt in the Dead Sea and the River Jordan. He was interred in the Friend's Burial Ground, Bamallah, Jerusalem on the 11th April 1928. Wilfred was an authority in the science of chemistry and a Fellow of the Chemistry Society and the Institute of Chemistry.

John J. Irwin, Wilfred's residuary legatee offered his services as managing director of the West Cumberland By-Products Co, Saul Jackson backed the appointment. He had known John in business for 40 years, but suggested he would act as joint managing director as well as chairman, the shareholders backed the appointments.

On the 31 December 1929 the Flimby chemical company purchase the Ulverston Distillery along with 13 acres of land and property for £5,000.

At the A.G.M. in 1932 Major Cuthbert Irwin outlined a scheme for the production of Carbon Disulpide. In 1936 an agreement was reached between the West Cumberland By-Products Co and North British Rayon Co of Wigton, for a joint venture to produce Carbon Disulphide. The Flimby Company then built a new plant by the German Company Zahn who were world leaders in the chemical industry. This plant continued working until c1975, by then the plant was too small to compete with larger rivals and over capacity, and was eventually demolished.

In 1937 Cuthbert Irwin took over as managing director from John J. Irwin and the following year Sidney Jackson took over as chairman from Saul Jackson.

In 1939 Arthur Heap died aged 68 years at his home Park Hill, Maryport after holding the position of company secretary and manager since 1911, for the last 7 years he was a director of the company. Mr Heap was a native of Lancashire. Mr Thomas H. Stokoe succeeded Arthur as company secretary.

Mr F. Schon of the Solway Chemical Company of Whitehaven approached the Flimby chemical works expressing an interest in a possible take over, nothing came of the enquiry.

In c1973, Major Cuthbert Irwin retired as managing director and Dennis Clark who had started with the company in 1943 at the age of 18 years, as an industrial chemist, took over the running of the company. He began developing the transport side of the business, which had played a small part up to this point.

In 1978 Dennis Clark took over West Cumberland By –Products totally by purchasing the remaining shares in the company from about 20 shareholders who were living in the Lancashire area, these shareholders were all women.

The company then became transport agents for the Solway Chemical Company, taking over their transport department. By the late 1980's the West Cumberland By-Products Co had a fleet of 40 articulated lorries and 50 tankers and trailers, in 1990 the West Cumberland By-Products Co were taken over by the national haulage company Tank Freight.

Keith Thompson.

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