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Bourn Windmill; New Lanark Mills; K8 phone boxes; MRIAS; the architecture of waterworks; 4th East-West Workshop; Crofton Beam Engines; a Northumberland grain silo; restoration grants update; ERIH; AIA tour of Portugal

INDUSTRIAL ARCHAEOLOGY NEWS

The Newsletter of The Association for Industrial Archaeology

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Chair's Letter to Members

Dear Members

I have been informed by our Editor that it is customary for the Chair to provide some words of wisdom at the start of each IA News. I'm not sure I can promise that, but I can say I am completely honoured to welcome you to this issue of IA News as the newly elected Chair of the AIA.

I had the very great pleasure of meeting many of you at our 50th Anniversary Conference at Bath University [more on this in the next issue - Ed], and I hope that over the course of the next few years I can encourage more people along to our fantastic organisation and annual events.

It is rather pertinent that this be my first issue of IA News as Chair, noting the cover image from James Douet's recent publication *The Architecture of Steam*. As some of you may already know my own area of experience and expertise is indeed the archaeology of water supply, and I was actually asked by Liverpool University Press to review James' text (no spoilers - but it is brilliant). I am so pleased that the book is getting the recognition it deserves, and I hope this issue of IA News serves to further the reach and appreciation of water archaeology.

Now that I've imparted any aforementioned wisdom, all that's left to say is a huge thank you to you from me, and from all of us on Council, for supporting the work of the AIA. Please do share this issue with your friends, families, and networks in hopes that they may too choose to join us as members, enabling us to continue to champion industrial archaeology research and conservation.

Zoe Arthurs, AIA Chair

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Copyright: James Douet

Bourn Windmill, Cambridgeshire, Re-opens After Three-Year Restoration

One of the UK's oldest working windmill, Bourn Mill is to reopen to the public after the completion of extensive repairs. According to new Historic England research, the main post of Bourn Mill is from a tree felled in the first half of the 16th century, making this the earliest main post of a mill yet dated. Rot was discovered at the Cambridgeshire mill in 2020, which was taking hold of its timber beams.

A three-year project to save the mill began, supported by £148,456 from the National Lottery Heritage Fund, £54,000 from Historic England, £500 from SPAB Mills, and £20,000 raised by nearby communities. This funding allowed the mill's supporting wooden tresses and brick foundations to be replaced. The completion of the work means the structure was able to reopen during National Mills Weekend in May, when more than 300 windmills and watermills are open to the public to celebrate

Bourn Windmill. Image courtesy of Historic England & Patricia Payne



milling heritage. Only 50 post windmills remain in the UK. Bourn Mill is owned by Cambridge Past, Present and Future, and is cared for and opened to the public largely through the efforts of volunteers from the local community.

Graham Bruce, Joint Chair, Bourn Windmill Volunteers called the restoration a “truly a collaborative effort, involving an architect, structural engineer, millwright, carpenter and more.”

Robyn Llewellyn, Director, England, Midlands & East at The National Lottery Heritage Fund, added: “Investing in heritage means investing in the community it belongs to, which is why we are proud to have supported Cambridge Past, Present & Future in repairing and reopening this historically significant site, thanks to National Lottery players.”

Crofton Beam Engines Receives NHLF Grant for the 'Crofton 2030' Project

Crofton Beam Engines has received a grant of £27,760 from the National Lottery Heritage Fund for a project to develop and test ideas for increasing the number and range of people engaging with Crofton. The 'Crofton 2030' project will help Crofton Beam Engines retain its position as a premier heritage attraction, worthy of its Grade 1 listed status, and ensure that they can keep the engines operating to 2030 and beyond.

The grant is made possible by money raised by National Lottery players, and builds on a previous Heritage Fund grant in 2018 which funded repairs to the historic buildings, new visitor facilities such as accessible toilets and improved interpretation around the site. The project has four main elements:

- to review engagement and 'value added' activities at similar heritage sites;
- to carry out market research on potential opportunities to broaden audiences and increase income;
- to develop a Site Master Plan, making best use of our existing facilities and developing new facilities where needed and possible (given the limitations of the site);
- And to develop a business strategy for Crofton running to 2030, and a more detailed three year forward plan.

Crofton have now appointed two heritage experts to assist us in this work, Riah Pryor and David Tucker. The project is being managed by a project group headed by Chris Bolt, Treasurer of The Kennet and Avon Canal Trust and Vice-Chairman of the Crofton Branch. Chris commented that: "Crofton Beam Engines is one of the most significant industrial heritage sites in the UK and a fascinating visitor attraction. We want to increase the number and range of people who can enjoy and learn from our unique site. We are very grateful for the support of the Heritage Fund to help us do that."

Riah Pryor said: "I am excited to be working with Crofton Beam Engines. There is great potential to expand its activities and I want to help find the best ways of doing this so that the future of this special part of Britain's industrial heritage can be assured." David Tucker added: "Having carried out some initial work for the Trust last year about ways Crofton Beam Engines could increase its appeal to visitors further, I am looking forward to helping the team develop clear plans which turn their ideas into reality."

The Crofton 2030 project will be completed in the autumn. Crofton Beam Engines is owned by The Kennet and Avon Canal Trust:
Website - www.croftonbeamengines.org.

Ironbridge Gorge Museum Trust and Keele University Join Forces to Research Industrialisation

Keele University and Ironbridge Gorge Museum Trust (IGMT) have joined forces in a new partnership that will develop student opportunities and open doors for new research on the museum's collections and the Ironbridge landscape. The aim is to tackle topics as diverse as how industrial heritage can remain relevant to many different communities, what 'just' means in terms of memory and history, and the challenges and roles for industrial heritage sites in a changing climate. To coincide with the launch, a roundtable discussion took place on the evening of 3 July bringing together voices from Keele University and the Ironbridge Gorge Museum Trust. The discussion was chaired by Professor David Amigoni, Professor of Victorian Literature, Director of the Keele Institute for Social Inclusion and a member of Ironbridge Gorge Museum Trusts Collections and Learning Committee. The speakers were from IGMT Abbie King, IGMT's Chief Operating Officer, and Dr Michael Nevell, Industrial Heritage Support Officer, and from Keele University Dr Ben Anderson, Senior Lecturer in Environmental History, and Professor Ceri Morgan, Professor of Place-writing and Geohumanities.

The next stage of the new partnership has seen three Keele University internships hosted by IGMT over the summer of 2023. This includes work on the current operation and use of historic stationary steam engines in England which will be reported on in IA News 206.

Section of Historic Yorkshire Railway Line Removed Over Safety Fears

Part of the old 'Nagger Line' which runs across Lime Pit Lane, in Stanley, Yorkshire, was removed in July over road safety fears. The narrow gauge track was part of a network of tramways dating back to the late 1700s that were used to transport coal from the many mines in the area.

Matthew Morley, Wakefield Council's cabinet member for highways, said the line was being removed as its deteriorating condition was creating a traffic hazard. He added that it is hoped the some of the line can still be retained. The council had the lines independently assessed by civil engineers after receiving complaints of damage to passing cars. This concluded that the lines were twisted and badly damaged, causing them to move and lift parts of the road. Local residents expressed concerns on social media over the loss of a much-loved piece of local history.

The colliery tramway lines at Lime Pit Lane, in Stanley, Yorkshire, before removal.



New Visitor Centre Opens at Masson Mills

A new visitor centre has been opened at Masson Mills. Part of the mills complex, which sits within the Derwent Valley World Heritage Site, was previously occupied by a retail village which was forced to shut at the start of the pandemic in 2020 and never recovered. However, the textile museum remained open for tour bookings. The mills were bought by

the Derwent Hydro group of companies, a business owned by the Needle family which has operated hydropower stations since the 1980s, in 2022.

The new visitor centre, which was once the manager's offices, is accessible at the front, roadside, of the building and has an array of historic mill-related artefacts, photographs, and equipment, and is open Monday to Friday, 11am to 4pm. Guided tours of the mill and its working machinery are now available every weekday at 2pm. Visitors are encouraged to book in advance to avoid missing out but walk-ins will be possible subject to space.

Jamie Needle, director at Masson Mills and Derwent Hydro, said: "It's really exciting to be able to welcome people back through the doors to learn more about the history of industry in the World Heritage Site. There is nothing like being able to hear and touch the old machinery to illustrate the realities of early factory working. Our business started with water power and it's hugely significant to me that factories also began with water power, this museum brings the two together in a fantastically tangible way."

The new owners are also improving the existing hydropower scheme at the mill, which was installed in 1995. The entire site is supplied with renewable energy produced by its hydroelectric turbines with any surplus fed into the National Grid. The hydroelectricity produced emits no emissions to air, land or water, thereby minimising the carbon footprint of Masson Mills and those visiting the site.

Rare London Underground Phone Boxes Listed

In July 2023 four rare K8 telephone boxes, found on several London Underground stations, were listed. Dating from the 1960s these are located on the platforms at the Chalfont and Latimer, Chorleywood, High Street Kensington, and Northwick Park stations.

The K8 was designed in 1965-66 by architect Bruce Martin who was commissioned by the General Post Office, which owned the public telephone network at that time. They have been listed at Grade II by DCMS on the advice of Historic England. Most of the remaining K8s are in Hull, nine of which were listed earlier this year (see elsewhere on this blog).

The tube station phone boxes survived privatisation in the 1980s as they were owned by London Underground and housed an internal telephone system for station staff. Each of the boxes are painted in different colours, as a way of denoting this private use. Only around 50 such telephone boxes now survive, despite more than 11,000 being built between 1968 and 1983. There are only 24



K8 listed phone box on the platform at Chalfont & Latimer station, London Underground. Image courtesy of Historic England.

listed examples in England, and Historic England will consider listing applications of any unrecorded K8s where suitable evidence is provided to support the case for listing.

Former Electrical Substation in Bristol Listed

The 1906 Underfall Yard substation, on Avon Crescent, Bristol, had been designated as a Grade II Listed Building for its early and innovative use of concrete construction and as a rare survivor from a pioneering period of electricity development. It was built to service the adjacent docks. The listed substation is among a number of structures around the Cumberland Basin to receive national protection. The Grade II Cumberland Basin walls and junction lock swing bridge have now been listed jointly. The swing bridges over entrance locks and Brunel's south entrance lock have also been listed together with greater detail about their historic and architectural importance. More information has been added to the listing of the pioneering Brunel's swivel bridge, which has been categorised as Grade II* since 1972. The change was part of Historic England's review of the listed building and scheduled monument designations in and around the Cumberland Basin and Underfall Yard.



Avon Crescent substation, Underfall, Bristol. Image copyright Betty Woolerton

Regional director Rebecca Barrett said the review has “helped to uncover what’s special about this historic part of the city, to help shape its future”. She added: “It confirms the importance of Cumberland Basin as a brilliantly engineered water management system, built and adapted to respond to the rapid growth of international trade in the 19th century. It’s an important place in Bristol’s story and in our national story.”

Canal & River Trust to Campaign Against Proposed Grant Cut

The Canal and River Trust (CRT) has launched a campaign to reverse budget cuts proposed by DEFRA over the summer of 2023. The reduction in the grant funding DEFRA provides amounts to a more than £300 million budget cut in real terms over a 10-year period from 2027. The CRT says that this will threaten the future of the nation’s historic canals, leading to their decline, and to the eventual closure of some parts of our cherished waterways network. CRT are asking the public under the tag #KeepCanalsAlive to email their local MP urging them to provide the nation’s canals with the funding they need to protect them for future generations. The Inland Waterways Association has pointed out that the proposed grant cut will impact on the regeneration of historic buildings and on local communities along the nation’s canals.

Reprieve for Claughton Moor Aerial Ropeway

Robert Carr writes: Near Lancaster is Britain’s last-working overhead aerial ropeway. It was expected that this unique industrial survival was going to close. Splendid news is a reprieve - Lancaster City Planning Department granted an extension for it to



The Claughton Moor aerial ropeway, May 2023.

operate until 2036, on condition that it must then be dismantled and removed. Built in , this aerial ropeway has changed little since it was built. It transports shale from a quarry at Claughton Moor to a brickworks which is about a mile and a quarter away, just to the north of the A683 main road from Lancaster to Kirkby Lonsdale. The ropeway is worked entirely by gravity; the quarry is 750 feet higher than its point of delivery at Forterra brickworks, now part of the Hanson group. Bricks have been made at the brickworks for 180 years although production ceased for a few years following a fall in demand. Forterra now employ 57 full-time staff and make a million bricks a week. Most of the bricks are used for housing in the north of England and Scotland and it is estimated that there is enough shale in the quarry to continue for 100 years. The site was visited, briefly, during the AIA conference at Preston, Lancashire in 2007. There is an exciting YouTube video of the Claughton ropeway in operation.

Restored Coal Lorry Launched

Ipswich Transport Museum is formally unveiling it's newly restored Morrison Coal Lorry at the Museum's Old Trolleybus Depot in Cobham Road at noon on Sunday 11th June 2023. The battery electric coal

The restored coal lorry. Copyright Ipswich Museum.



lorry was new to Ipswich Co-Op in Derby Road depot in 1951, and was used for door-to-door domestic coal deliveries for thirty years. It was donated to the museum in derelict condition in the early 1980s, and has been restored to working order by a loyal group of volunteers, led by Leo Brome, over the last five years. Much of the original vehicle has survived, including some of the original paintwork and signwriting. The electrical system had to be completely rebuilt, the motor overhauled, and £15,000 worth of new batteries installed - the later assisted by many 'battery benefactors' who visited the museum and contributed to the restoration fund. The project was also assisted by a donation from the Association of Industrial Archaeology. Museum chairman Mark Smith explained 'We are delighted to see another restoration complete. We believe this is the only working battery electric coal lorry in the UK at the present time'. The vehicle is powered by 40 2V lead acid batteries feeding a 19 HP refurbished electric motor and can carry a full load of 1cwt sacks double stacked at 10mph. Leo Brome added: 'We're looking forward to showing it off. We hope visitors will come and meet the restoration team, and enjoy watching us explain what we did, and how the vehicle works'. The official launch of the vehicle was on Sunday 11th June 2023. For further details see: www.ipswichtransportmuseum.co.uk

Four Scottish Industrial Sites to Receive £4.4m in Grants

In August grants worth £4.4m were awarded to four Scottish industrial heritage sites by the National Heritage Memorial Fund. This is part of the Covid-19 Respond Fund to counter the impacts of the pandemic. New Lanark Trust has been awarded £2.3m to undertake maintenance and repairs across the 18th century Mill Village, which sits alongside the River Clyde. Inscribed as a UNESCO World Heritage Site in 2001, New Lanark Trust will use the capital to undertake maintenance of a number of Category A listed buildings on the site, which had

New Lanark Cotton Mills, Scotland



been delayed because of the pandemic. The grant will also enable specific work on the roofs of the School House, Nursery and New Buildings and Long Row to take place. The National Lottery Heritage Fund said prior to the pandemic New Lanark averaged 320,000 visitors per annum, making it the leading paid visitor attraction in South Lanarkshire. The funding is hoped to support a return to these numbers.

Also awarded funding was Tall Ship Glenlee, a 125-year old ship and one of only five of its kind still afloat today. £1.8m has been awarded to address the repairs backlog that arose due to the pandemic. Wanlockhead Museum Trust was awarded £75,752 to support repairs to the historic Miners' Library, Straitsteps Cottages and Goldscaur Cottage, part of the Museum of Lead Mining. The pandemic forced the museum to close and put their fundraising campaign on hold, with resulting deterioration to the buildings putting the historic structures and collections they contain at risk. Finally, the Scottish Railway Preservation Society was awarded £144,290 to complete the restoration of a locomotive on long-term loan from National Museums Scotland. The funding will enable the locomotive to run on the Bo'ness & Kinneil Railway. The restoration was being undertaken in other parts of the UK when the pandemic hit, putting the locomotive at risk of not being reassembled.

UNESCO Approve 'Žatec and the Landscape of Saaz Hopps' in Czechia as a World Heritage Site

At its latest annual meeting in Saudi Arabia UNESCO nominated a range of new cultural and natural landscapes as World Heritage Sites. These included a significant industrial landscape located in the north west of the Czech Republic, in the basin of Žatec, by the middle of the course of the river Ohře as representing the uniqueness of the local hop heritage. This cultural landscape has been shaped for centuries by the living tradition of cultivating and trading the world's most renowned hop variety, used in beer production around the globe. The inscribed landscape includes the hop fields near the river Ohře that have been farmed continuously for hundreds of years, as well as its historic villages and buildings that have been used for processing hops. Urban elements of the inscription include the medieval centre of the town of Žatec and its 19th to 20th century industrial extension, known as the "Prague Suburb" (*Pražské předměstí*). Together, these elements illustrate the evolution of the agro-industrial processes and socio-economic system of growing, drying, certifying, and trading hops from the Late Middle Ages to the 21st century.

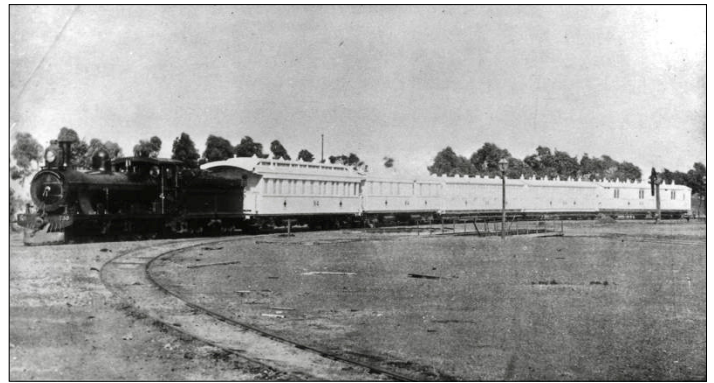
Manchester Region Industrial Archaeology Society

Tony Wright writes: Our passions in the Manchester Region Industrial Archaeology Society are the history of industry, technology, and transport. Our programme of talks begins in October each year ending in May of the following year with a pause for the Summer when we undertake visits and walks (which in 2022/23 included a walking tour of Oldham).

The last presentation before we parted for our summer break in May 2023 was a captivating talk by Dr. Mohr on the subject of ambulance trains; 'Ambulance Trains of World War One by Dr. Peter Mohr'. Although the title of the talk indicated the period of study was the First World War, Peter covered the development of the ambulance train starting with the Boer Wars and via the Second World War leading up to the present continuing Russian/Ukrainian conflict. This placed the whole subject in context.

For those with an interest in the subject Peter recommended *Trains of Hope. Ambulance Trains in Times of Conflict* published by the Friends of the National Railway Museum and indeed a visit to the National Railway Museum in York where there is an historic railway carriage exhibited which provides the atmosphere of a First World War Ambulance train. Ambulance trains transported millions of sick

William Huskisson, seen here in a painting by Richard Rothwell.



The Boer War Red Cross hospital train, Image courtesy of the British Red Cross archive.

and injured soldiers right throughout the 1914 to 1918 conflict and in York the train shows a ward and a pharmacy together with a nurse's mess room. In the museum you can see film, sound and digital projection with stories told by the wounded and the hospital staff in their own words by letters, diaries, drawings and photographs. The livery of Museum carriage is based upon a First World War overseas ambulance train.

Peter started his talk reminding us of the story of the Right Honourable William Huskisson, one-time President of the Board of Trade, Secretary of State for War and the Colonies and Leader of the House of Commons. His life was cut short when he stepped out of history and in front of Robert Stephenson's locomotive 'Rocket' at the opening ceremony of the Liverpool and Manchester Railway in 1830. His was the first widely reported fatal railway accident. He was struck by the locomotive in Newton-le-Willows and taken to Eccles by train where he later died, despite two surgeons attending him from Manchester.

The London and North Western Railway (LNWR) between 1912 and 1919 had two ambulance trains in England, seven in Europe, four for the United States and six Naval trains. They were equipped with dual brakes, vacuum brakes and the patented Westinghouse air brakes (the "most important safety device ever known"). Coaches included pharmacy, mental, sitting, telephone and telegraph. In 1917 a LNWR coach for Commander in Chief, British Expeditionary Forces in France, Field Marshal Sir Douglas Haig, was exhibited to raise funds.

The talk encompassed the Crimean War including the contribution made by Florence Nightingale, Prussian casualty carriages in the 1860s, The American Civil War, the Netley Military Hospital near Southampton and the Princess Christian Hospital Train during the Boer War 1899-1902. The hospital train was also known as 'The White Train', was manned by Red Cross personnel and run by the British National Society for Aid to the Sick and Wounded in the war.

For details of current activities and events visit: www.mrias.co.uk

The Architecture of Steam: Waterworks and the Victorian Sanitary Crisis

James Douet writes about his latest book published by Historic England and LUP:

This new publication from Liverpool University Press and Historic England looks beyond architectural styles and fashions to explain the choices made by the men who designed steam-powered pumping stations for water and sewage. Interestingly, these were only occasionally architects. Victorian water engineers were apprenticed to older men, often their own fathers, picking up the knowledge that they needed as they went along – surveying, hydraulic engineering, soil mechanics, steam engine operation, project management and construction, as well as, evidently, architectural styling.

They worked within one overwhelmingly tangible constraint, the size and operation of the steam engine and its boilers, and one much more psychological one, the growing sense of a sanitary crisis in the towns and cities being transformed, from the end of the eighteenth century by the dramatic processes of industrialisation. Until the 1860s, steam engines had to be constrained and supported by their engine house. Later engines were independent, and freed from any structural role waterworks displayed increasingly civic rather than industrial characteristics as their role in saving urban communities from the Victorian Sanitary Crisis became explicit in their architecture.

The first dedicated designs for steam waterworks pumped from a tributary of the River Thames in East London, and was erected between 1817 and 1826. The three austere but elegant Georgian engine houses were influenced by the great warehouses of the London docks where their designer had trained. When complete, Old Ford formed possibly the largest concentration of steam power in the country.

Kew Bridge pumping station, with the 1848 addition behind. Courtesy of the Historic England Archive.



The two engine houses at Whitacre (1871-84). Courtesy of the Historic England Archive.

As steam-powered water supply was adopted in other towns, engineers tried out different formats for the engines and architectural solutions for the waterworks. At Kew Bridge in West London, where the Grand Junction water company moved in search of cleaner water from the Thames further upstream, all four engines were enclosed in a single building but one which looked reassuringly domestic, as if it were a parsonage. The beam engine, built in 1838, is still running on live steam in what is today the London Museum of Water and Steam.

The influence of Edinburgh and the Scottish Enlightenment shines out of the innovative Perth waterworks, built in 1832. Engine house, cistern, and even the chimney fitted the academic designer's Grecian concept. The beam engines were a new compact format, held within a frame of iron columns, while the remarkable water tank, from a Dundee foundry, has been claimed as the earliest cast-iron architectural façade in the world.

By the 1850s, the then-fashionable Italianate style began to be accepted as the idiomatic architecture for waterworks, in time recognisable all over the world. It made its appearance in 1848 at Kew Bridge beside the first engine house. The difference is scale as well as style, showing how beam engines were growing bigger as well as more powerful. Twenty-first-century water pumping stations continue to deploy these same architectural elements – though usually stripped back – as signs to indicate that they are providing clean and wholesome water.

Steam engines were first used as part of a sewage drainage scheme in 1860. Four massive pumping stations formed the essential elements in the Main Drainage plan to intercept Londoners' waste before it reached the Thames and lift it so it could drain

under gravity beyond the metropolis and out to sea. For the first time, an architect was commissioned to build a pumping station, the two biggest being the work of a railway station designer called Charles Driver. His experience is evident in the lively and colourful pumping stations at Crossness, south of the river, [see front cover image - Ed] and Abbey Mills on the north side.

The two chimneys which were both demolished during the Second World War were at either end of the range of boilers, while each of the wings of the cross-shaped engine house with the tall lantern contained two massive beam engines, making eight in all.

The association between water supply as a lever for civic improvements and the architecture of the pumping station is particularly explicit in Birmingham. The city adopted a 'civic gospel' of municipal interventions to improve the conditions of the populace which supported remarkable waterworks along with public schools, libraries, baths and town hall. The two Gothic engine houses beside the railway line out of Birmingham were designed by architects closely implicated with the civic gospel, Martin and Chamberlain.

The final period during which waterworks were used as a public statement of health, sanitation, and well-being opened with the last phase in the development of reciprocating steam engines. Vertical triple expansion engines used the steam three times at successively lower pressures, the cylinders mounted in a frame and coupled directly to pumps below the floor. Freed from any structural role, engine houses became yet more expressive and varied.

The East London Water Company employed a local architect to develop a company style, which was a

Ponder's End, London (1898). Courtesy of Thames Water



George V pumping station (1913). Courtesy of the Historic England Archive

late version of Queen Anne or Old English, as at Ponder's End and several other waterworks along the Lee Valley.

With the invention at the beginning of the twentieth century of more compact diesel engines and then submersible electric pumps, the steam waterworks entered its last decades. Some of the most magnificent pumping stations were built by London's Metropolitan Water Board following the municipalisation of the private London companies in 1903. A good example is the George V pumping station, which bears a close resemblance to Nicholas Hawksmoor's orangery in Kensington Palace.

Steam waterworks were obsolete by the 1930s, and the last finished operation in the 1950s. Steam engines were cut up and scrapped, and many fine buildings ended up in a pile of rubble. This included Elkesley in Lincolnshire, which was regrettably demolished before the possibilities for a second life could be considered.

Most of the surviving historic pumping stations were listed by English Heritage in the 1990s, and many have been recycled to take advantage of their attractiveness and interesting spaces: Ponders End as a pub, Perth an art gallery, Everton in process of being converted to an event space. Many more are on still-active sites, Victorian wells and boreholes continue to provide water even though the waterworks at the surface are no longer operational. A number are open as heritage attractions and can be visited by the public including The London Museum of Water and Steam, Papplewick Pumping Station in Nottinghamshire, and The Waterworks Museum in Hereford.

The Architecture of Steam chronicles the rise and eclipse of this unique British building, and celebrates how Victorian water engineers stepped up to the impact of industrialisation.

This article first appeared on the Liverpool University Press website as part of its publication partnership with Historic England. Many thanks to James Douet, LUP, and HE for allowing its reproduction.

Crofton Beam Engines Mechatronics: Marrying Two Hundred Years of Technology

Crofton Beam Engines writes: Set deep in the Wiltshire countryside, our historic Boulton and Watt and Harvey beam engines are still working today, able to keep the Kennet & Avon canal full of water just as they have done since 1809. They work at full load pumping over 10 cubic metres a minute, making them the oldest working examples in the world.

We have a duty of care to ensure our engines continue to run safely for future generations. Our key aims are to understand and prevent any damage to the engines and to see if we can make any changes to reduce stresses. To do this, with the help of Bath University students and graduates from the Atomic Weapons Establishment (AWE), we have invested in some 21st century technology to monitor their vital characteristics.

Known as Mechatronics, we are able to replicate mechanical methods devised by James Watt, and used for many years to understand the performance of steam engines. We are using a Dewesoft system, extensively used in F1 racing cars and aerospace applications. So far we have installed a number of sensors to monitor and record pressures, temperatures, movement of the engine and the timing of valves. Armed with this data, which is freely available to accredited academic establishments, we can look for early signs of where maintenance might be required and immediately understand any changes in performance.

Measuring the performance of such engines is not a new idea. Since the early days of steam power there has been a need to maximise the work done against the amount of coal consumed. In the early days this was described as the 'Duty' of a pumping engine measuring how many pounds of water could be lifted (lb x ft) per bushel (around 90 lbs) of coal. For very early engines the Duty number was around 10 million. Over the years James Watt, Richard Trevithick and others improved the performance of engines raising the Duty to over 40 million. We think the number for our engines is around 20 million which is not bad for a 200-year-old machine.

Another important measurement, also devised by James Watt, is the production of an Indicator Diagram for the engine. This is a plot of pressures inside the engine against the displaced volume of the piston. From this diagram a number of observations can be made, including the effect of adjusting the valve timing and the calculation of the horse power (hp) of the engine. Ours have been

measured at around 40hp. Over the years there have been many designs for instruments to produce Indicator Diagrams. At Crofton we have on display a 19th century Richards Indicator, which was used at Crofton in the 1970s, where it was mounted in place of the lubricator on our No.2 engine. The pressure is measured directly from above the piston and the displacement of the piston, and hence volume, by a string attached to the beam. A paper roll unwinds by clockwork therefore plotting the graph.

Today we are also able to accurately examine the timing of the opening and closure of the valves which we think has not been done before. Overall we believe we are now producing the most accurate measurements ever, for such an historic machine.

Over the last four years (2019-23) we have been very fortunate to work with undergraduates from the University of Bath and graduates from the Atomic Weapons Establishment (AWE). Bath University students produced an initial Indicator Diagram and went on to calculate the forces on our beams. They also investigated future options if we are no longer able to purchase suitable coal. AWE graduates initiated our Mechatronics programme, exploring options and recommending the Dewesoft system. They have subsequently recommended suitable sensors for beam displacement, valve timings and pressures. They are currently exploring the best way to accurately measure the amount of water pumped.

So far, we have installed thirteen different sensors. Outputs are fed into the Dewesoft Data Acquisition System (DAQ). This produces real time displays for the benefit of visitors and post steaming analysis. Up to 1 million readings are recorded after a typical steaming day. We have identified a number of additional items to measure in the future such as the measurement of the water pumped and the temperature of flue gases.

Figure 1 shows a typical Indicator Diagram produced after the engine has warmed up and is running smoothly. It shows both above and below piston pressures and shows that for the major part of the cycle pressures are below atmospheric. The approximate position of the valve timings is also shown.

Figure 2 shows the plot of a single cycle of the engine against time. The precise timing of the opening and closing of the valves can be observed. Variations in the pressures over the cycle can be seen, with fluctuations, most likely resulting from leaking valves or the piston.

Earlier this year we experienced a problem with our No.2 engine in that normal operation could not be sustained without driver intervention. Subsequent analysis of the data showed a progressive loss of vacuum. Subsequent examination of the condenser

Crofton Beam Engine No.1 Indicator Diagram

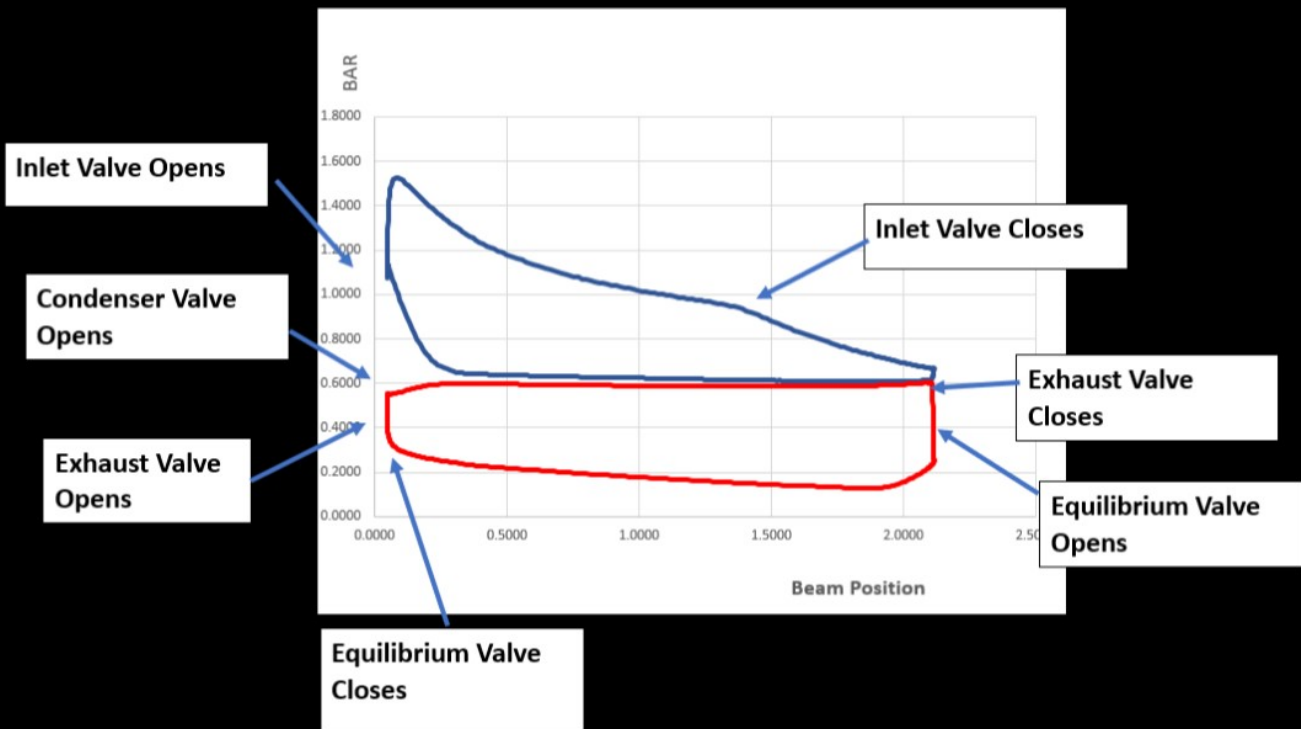


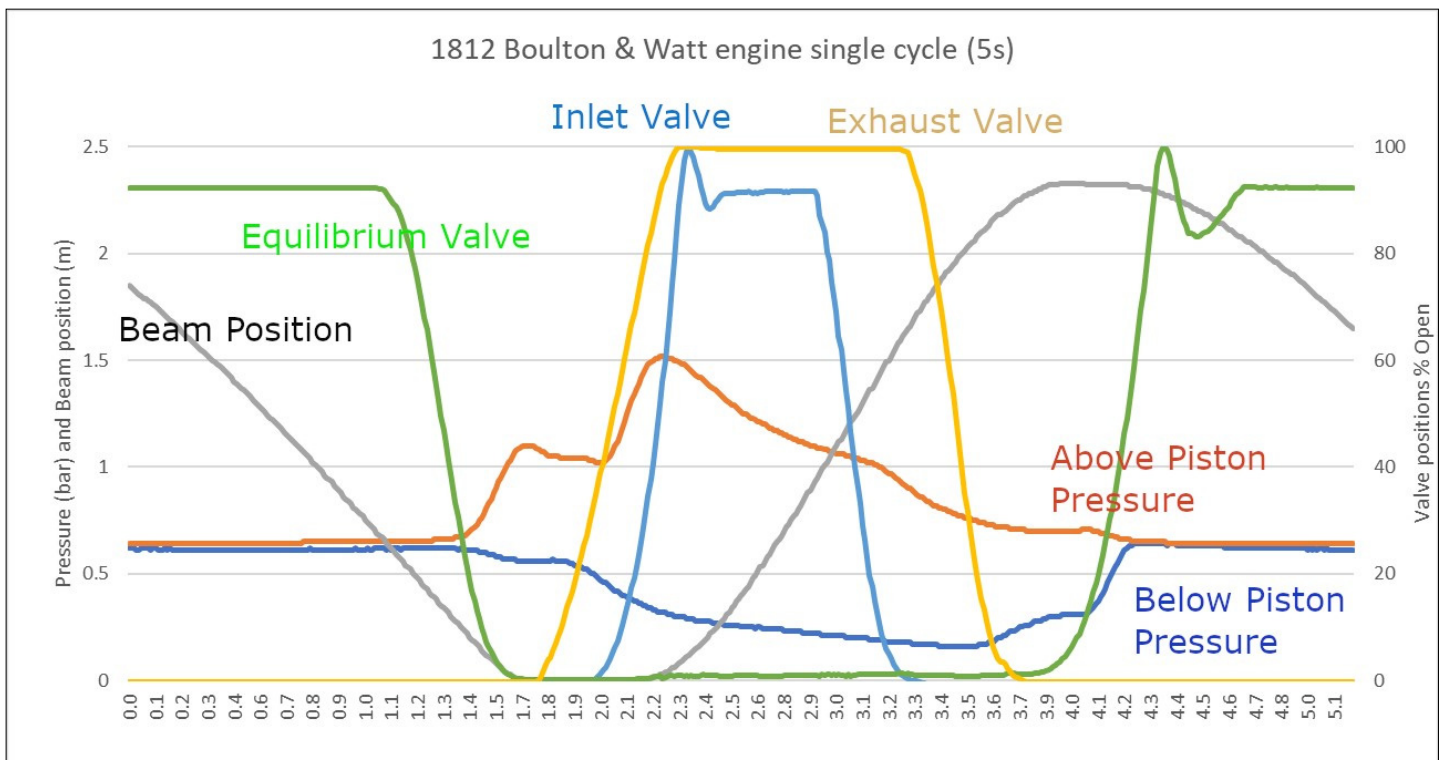
Fig 1: Crofton Beam Engine No.1 indicator diagram.

injection valve revealed that it had significantly corroded and displaced, rendering it inoperable and requiring replacement.

We believe our Mechatronics system provides Crofton with a significant tool to assist in enabling our historic machines to continue in operation. We do not think such accurate and detailed information

has been obtained from such ancient stationary engines before. By analysing unusual occurrences and comparing results over time we are in a unique position to identify any problems, ensuring early intervention if required. Analysis of the data can also significantly increase our knowledge of how these amazing machines work.

Fig 2: The cycle of the 1812 Boulton & Watt engine.



Armstrong's Silo Illuminates its Cragside Heritage

Lou Renwick writes: New evidence has been found to date a listed building in Northumberland. The Cragend Farm Hydraulic Silo is a Grade II* listed building formerly on the Cragside Estate.

Historic Houses organisation, mentors and supports Cragend Farm. As a result of their assistance Cragend Farm has proved that financial support has a positive result that benefits the local community, and enriches the local history of the area.

Heritage is one of Britain's Unique Selling Points (USP) and although there are no secrets to success, as a result of preparation, hard work, and learning from failure great things can be achieved within the sector.

So, when they were told 'No' it was like a red rag to a bull for The Renwick's who persevered when their National Lottery grant application was blocked because they are a private residence.

An emergency grant from Historic Houses in 2018 came to the rescue, and has been integral in shining a light on new evidence about the building as part of the Cragside Estate in Northumberland. It enabled damaged floors in the Grade II* listed building to be replaced and created an opportunity to open for historic buildings enthusiasts. It is now an opportunity to visit a Building at Risk site, site that had previously been too dangerous to enter.

The inquisitive visitors have offered many suggestions to the mystery of how The Cragend Hydraulic Silo may have been built and worked, as it was assumed there were no documents to give any details. Historic England archaeologists had estimated a date based on buildings at The Cragside Estate, Rothbury, the home of The Magician of the North, Lord Armstrong of Cragside.

Past employee and curator of Armstrong Vickers in Newcastle-upon-Tyne Peter McKenzie came on

The northern elevation of the silo at Cragend Farm.
Copyright Lou Renwick.



The Cragend hydraulic machinery in the silo.
Copyright Lou Renwick.

one of the Historic Houses 'Invitation to View' tours at Cragend Farm in 2020. Intrigued, he suggested that the Renwicks search The Tyne and Wear Archives at The Discovery Museum in Newcastle, where the main collection of technical drawings from this world-famous company is now housed.

Where to start? The T&W Archivist required specific detail in order to select from the thousands of documents housed there.

The electric lightbulb moment, (excuse the Armstrong pun) came in a flash! Closer inspection of the machinery was made possible due to these HH repairs, and the Giant Hydraulic jig standing over 4m tall was researched for archaeological purposes, when, stencilled on the side of it was No 1306, an early model of Armstrong patented water powered hydraulic lifting machinery.

Unlike many of the machines on the Cragside Estate that have since been renovated and repainted, the Cragend Hydraulic machinery is as it was in Victorian times.

I searched through many rolls of greased linen technical drawings from over 140 years ago for this specific number. Eureka! There it was. The large A0 drawing has a date and demonstrates how Armstrong devised this magnificent building to assist his farm workers and feed his cattle silage made from water power.

The date of 1884 on this document means that it is considerably older than Historic England listed and is now being amended. It sheds light on how this building worked and was powered. This unique building is testament to our great British heritage and worth a visit. Both the building and documentary evidence can be viewed at Cragend Farm, along with centuries of historic interest.

Other searches have also been done because of these tours and newspaper articles can confirm the Royal visits to see this amazing new building in 1887 and 1888 and also more details on how the men worked the machines within it. Tour visitors can have access to the research papers as well as a physical tour of the building.

A farm archaeologist from Beamish has been able to identify many of the workings of the building and how day to day life would have been for the workers here, because of this information.

All thanks to the inspired vision of HH to help preserve a listed building which in turn has ignited a passion in its owners to present this site for tours with ample research for an earnest historian to explore, and which covers not just the Victorian age but goes back to the days of Edward III.

To find out more book a tour through Historic Houses website or direct from Cragend Farm website. Booking by appointment: 01669621533; Accommodation also available at: www.cragendfarm.co.uk, or emaillourenwick@cragendfarm.co.uk

The 4th East-West Workshop on Industrial Archaeology (The Archaeology of Technology)

Zhimo Zhang and Qianran Wang (University of Science and Technology Beijing) write: The 4th East-West Workshop on Industrial Archaeology was successfully held online on May 27, 2023. This series of workshops is jointly organised by the Institute for Cultural Heritage and History of Science & Technology (University of Science and Technology Beijing, USTB) and the Association for Industrial Archaeology (AIA) together with its Young Members Board to exchange ideas and experiences from the East, the West and beyond. The fourth edition counted on speakers from Australia, China, and England and gathered colleagues from different Australasian, Asian, and European countries to discuss the archaeology of technology.

Associate professor Juan M. Cano Sanchiz (USTB and AIA) welcomed the attendees and explained that the fourth edition of the workshop aimed to

revisit the original technocentric approach of industrial archaeology with a diversity of cases, approaches, methods, and geographies. Such diversity of geographies led us, for the first time in this series, to have an archaeological look at the outer space. Cano Sanchiz explained that during the meeting we were going to examine what archaeology can tell us about the technologies of space exploration and their cultural, social and environmental dimensions; the alum industry in China and how the history of technology and industrial archaeology can feed back each other; and the practical, technical and ethical aspects involved in the restoration of historical machinery and engineering works.

Associate professor Alice Gorman from Flinders University in Adelaide, Australia delivered the presentation *Beyond the Rocket: the Archaeological Study of Space Technology*. With a very thought-provoking talk, Gorman called attention to the diversity of the materiality of space exploration to be found on Earth, in orbit and on other celestial bodies, which, contrary to what one could think, goes far beyond spacecrafts. Reframing space junk as material culture, she proposed a wide range of research questions that she explored through four short case studies: amateur spacecraft, the International Space Station, the Lunar surface, and Indigenous space. Gorman revealed how historical archaeology can build alternative accounts to the hegemonic narratives of space exploration and reintegrate into its history chapters and actors often ignored, such as amateur ingenuity and indigenous communities.

In her presentation *Wenzhou Alum Mine from the Perspective of the Archaeology of Technology*, Dr. Shujing Feng (National Academy of Innovation Strategy and Tsinghua University, China) offered a complete overview of her PhD research on Wenzhou Alum Mine (Zhejiang province, China), which she investigated combining industrial archaeology and the history of technology. Grounded on fieldwork and satellite imagery, Feng introduced the industrial landscape of Wenzhou Alum Mine and explained the configuration of its mining and refining sites. After that, she combined the material and documentary records to clarify the production processes carried out on the site, and how the technologies used there evolved to meet production demands and the changing context. Feng concluded that industrial archaeology and the history of technology depend on each other. For her, the former provides detailed physical evidence and data for the latter, while the latter helps to explain the technical characteristics and connotations of industrial remains.

Finally, Geoffrey Wallis C.Eng MIMech.E (GW Conservation/Dorothea Restorations & AIA) delivered the paper *Developments in Practical*



A late 19th and 20th century ironworks in China.

Engineering Conservation. The Works of Dorothea Restorations Ltd. This was a brilliant master class on the theoretical and methodological issues regarding the conservation and restoration of technology and other metalworks. Wallis used several projects carried out by Dorothea Restorations Engineers Ltd., which he co-founded and directed for about 30 years, as an example. He discussed conservation ethics (minimal disturbance and loss of evidence, retaining as much existing material as possible, etc.) and introduced some traditional and modern

materials. After that, he brought theory into practice with a wealth of diverse cases, from constructions and machines to metal artworks. Wallis explained some of the challenges of restoration and provided some keys to solve them. Grounded on his long experience, he showed how conservation and restoration practices have changed together with the evolution of technology and the appearance of new tools (drones, 3D scanning and printing, VR, etc.).

The presentations were followed by a Q&A section in which it was discussed, among other topics, how the archaeology of outer space exploration challenges some traditional archaeological concepts, such as spatial context and the divide site-artefact; the typology of furnaces in the alum industry and its evolution; and the difficult balance between conservation ethics and practical demands, especially when the restored constructions or machines are intended to remain operational. All in all, the East-West Workshop on Industrial Archaeology succeeded again in providing an international forum to exchange ideas and promote the diversity of understandings and practices within industrial archaeology. Cano Sanchiz thanked the speakers, attendees, and organising institutions, and announced that the fifth edition of the workshop will happen in November 2023 with a focus on the architecture of industry. Stay tuned!

European Route of Industrial Heritage (ERIH)

European Route of Industrial Heritage Fossil Fuel Survey

The European Route of Industrial Heritage (ERIH) launched in Spring 2023 a survey of its members to gather data from industrial heritage museums and sites on their medium/long term need for fossil fuels for operating and interpreting purposes. This data gathering exercise is an element of the European 'Working Industrial & Mobile Heritage' lobbying and awareness raising project, a partnership of umbrella bodies from the transport and industrial heritage sectors. For further details see their website:

ERIH Re-certified as a Cultural Route of the Council of Europe

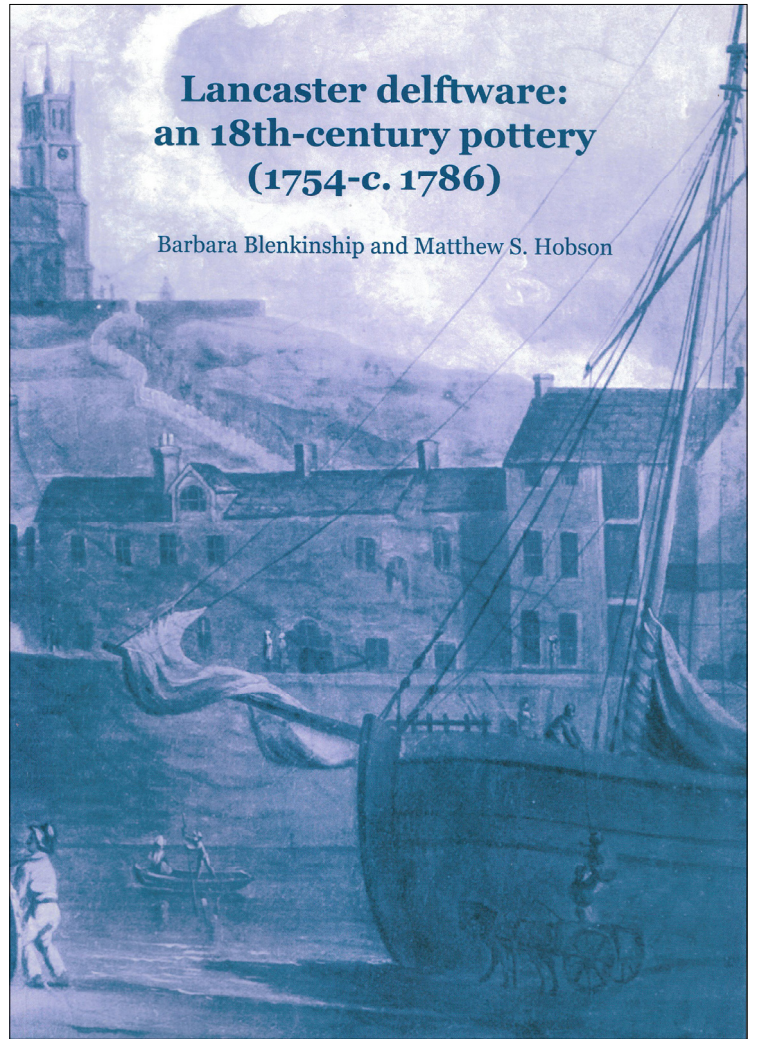
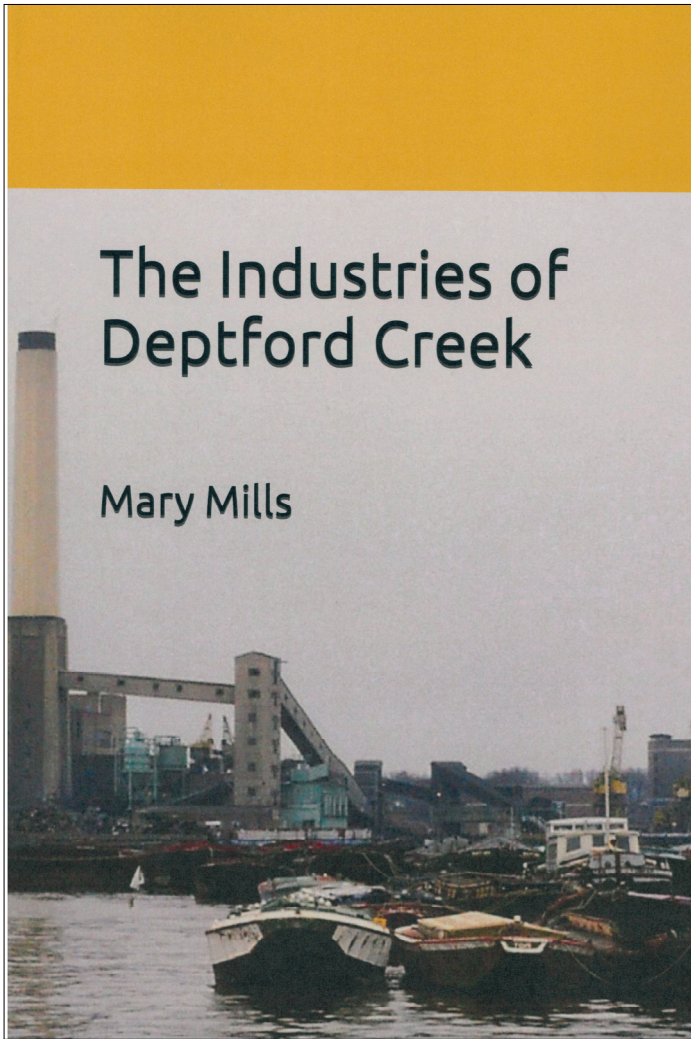
With its comprehensive network of sites and routes, preserving and enhancing the tangible and intangible heritage of Europe's industrialisation, illustrating its historical significance and highlighting its common features across different regions of Europe, ERIH first qualified as a Cultural Route of the Council of Europe in 2019. The criteria for the label are reviewed every three years. ERIH

successfully passed its re-certification process in 2023 (slightly delayed by the COVID-19 pandemic),

Along with the re-certification, the Governing Board of the Enlarged Partial Agreement on Cultural Routes of the Council of Europe (EPA) issued recommendations to provide guidelines for ERIH until its next regular assessment. The three most important are:

- Encourage cooperation among the Scientific Committee and both artists and art curators to develop high quality interdisciplinary contemporary art content.
- Expand existing projects and explore other topics for workshops, debates and actions integrating young people within the network, such as Green Deal strategies, creative industries, slavery heritage linked to industrialisation, etc.
- Enhance the strategic development of tourism through closer cooperation between National Coordinators and the ERIH Board. The creation of specific a Working Group on Cultural (Industrial) Tourism is suggested.

ERIH President Professor Dr Meinrad Grewenig and Board Member Peter Backes presented the ERIH network to the EPA Governing Board in Luxembourg in May as part of the evaluation.



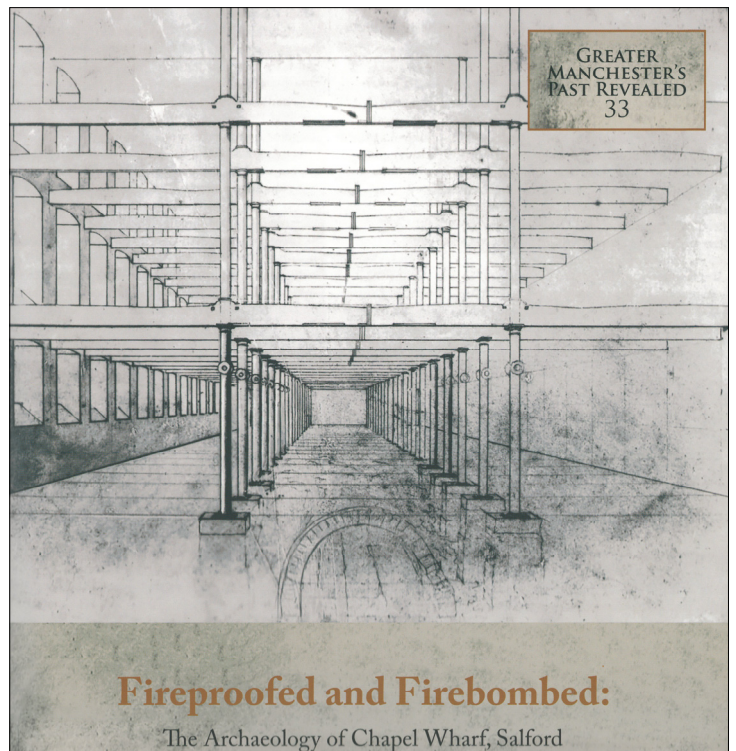
Amongst the latest industrial archaeology and heritage books and booklets to come to the attention of the Editor are the following three volumes:

Mary Mills, *The Industries of Deptford Creek*. Amazon Print, 2023. ISBN 979-8-367282115.

Katie Fletcher, Ian Miller & Joe Brooks, *Fireproofed and Firebombed. The Archaeology of Chapel Wharf, Salford*. Greater Manchester's Past Revealed No. 33. Salford Archaeology, 2023. ISBN 978-1-7397929-2-3.

Barbara Blenkinship & Matthew S Hobson, *Lancaster delftware: an 18th century pottery (1754-c.17896)*. Titus Wilson Ltd, Kendal, 2022. If you have a volume you would like reviewed in *IAR* or to bring to the attention of *IA News* readers please email:

ianews@industrial-archaeology.org.



Smith Rodley Steam Crane, Amberley Museum

Richard Vernon writes: Amberley Museum is extremely grateful to the AIA for an £18,000 grant to restore our Smith Rodley steam crane. As many will know, Amberley Museum exhibits southern industrial history, transport, communications and traditional crafts in some 41 acres of former chalk pits in the South Downs National Park in West Sussex. Several buildings and lime kilns are Scheduled Monuments and the c.50,000 items in the collection are restored, maintained and demonstrated by nearly 350 volunteers, who are supported a small staff. Further information on Amberley Museum can be found at www.amberleymuseum.co.uk

Included in the collection is a steam crane that was made by Thomas Smith & Co. Ltd., from Rodley, Leeds in 1952. Production of these cranes ceased in the late 1950s. Retired from Charlton Sawmills, near Chichester in 1986, it was donated to Amberley Museum and, after a servicing overhaul, was demonstrated there until 2014. A need to recondition the steam boiler, overhaul the mechanical parts and restore the track on which it operates was identified but restoration has awaited financial resources. The AIA grant has enabled us to begin this process.

Previously we had provided an update on the project about a year ago which was reported in the spring 2022 edition of AIA News. Since then, we have made steady, if not spectacular progress. It would be fair to say that it has been a voyage of

discovery so far for all on the team. Lacking drawings and details of how the crane fits together has been a real problem. However, a visit to the Didcot Railway Centre established that there is a roughly similar privately owned, non-operational Smith Rodley crane there. What was exciting for us was that the owner had a set of original technical drawings, which he has kindly lent us. These have now been sorted (over 150), catalogued and very recently professionally scanned. These will be of immense benefit to us. Prior to the receipt of the drawings, we had removed and dismantled various items for inspection:

- The boiler has been removed, sent to Rushmore Engineering, and returned fully certified and refurbished.
- The Museum machine shop has recreated the T shaped boiler holding down bolts.
- The water tank has been removed and inspection showed it will need a replacement because of corrosion.
- The steam cylinders have been removed, dismantled and inspected.
- Steam feed pipes have been removed.
- Brake bands have been removed for inspection and replacement of friction material.
- Bearings have been inspected
- Areas have been jet washed to remove flaking paint and some areas wire brushed, Kurusted and painted with red oxide.
- Lubrication systems have been located, inspected and in some cases will need replacement.
- The plates forming the box section side structure have been ultra-sound tested to check metal

The Smith Rodley steam crane after painting. Image copyright Richard Vernon.



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War Office	

A 1939 advertisement for Thomas Smith & Sons.

thickness – we know now what’s there but await to find out what it was originally. The technical drawings will help.

- Records, labelling and photos have been taken and made so we know how to put it back together – very important.

It would be easy to report that restoration of old mechanical objects is a simple and easy process – it is not! For example, one of the current headaches is figuring out how we can remove the weights in the counterweight boxes. The drain holes in these boxes have been blocked and the weights – rail sections and rail chairs – need to come out to check the box bottom for corrosion. Unfortunately, these box tops are capped by the crane jib at the front and the swinging counterweight at the back so this checking may need to wait until we have the crane in steam to allow us to rotate the base section.

Recent works have included painting the jib. This sounds straightforward but being constructed of angle irons, it is very “bitty” and slow. A tower scaffold and PASMA training was required to access the jib safely and we are now about half way along its length – the process is suspend the hoist rope on the jibbing ropes clear on the jib top, wire brush the section accessible from the tower, Kurust the section, leave it to dry, and then red oxide the section. A suitable topcoat (2 coats required) has now been identified for overpainting the red oxide primer and which will give a long service life.

The cylinders and pistons have been partly measured and checked and this work will be completed shortly. Once completed, these dimensions can then be checked against the dimensions and tolerances outlined in the crane drawings. To state the obvious, the importance of this is paramount to ascertain what remedial works, if any, are required on the cylinders, pistons and piston rings. A welding company has visited the site to determine the work required to replace the rusted

through sections on the crane “cheeks” which support the hoisting and jibbing pulleys, ropes and just about every moving part on the mechanism. It has also become apparent, as we move along the jib painting, that areas of corrosion have eaten into some angle sections and will required weld filling and grinding back for safe operation. This same welding company will be tasked with constructing the replacement water tank.

Access to the drawings will make an enormous difference to the team on the refurbishment. Being able to (hopefully) see the tolerances and dimensions of the crane construction will determine what needs to be totally replaced, honed or rebored, etc. Although we now believe that the drawings represent the details of the construction through its design evolution, enough information should be available to move forward.

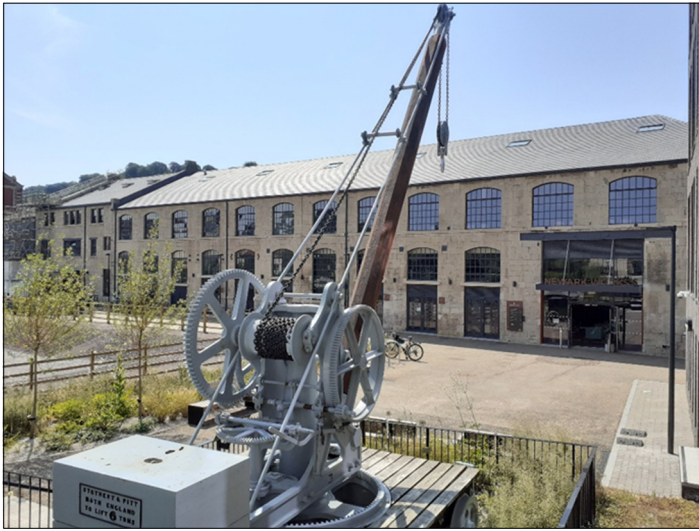
The purpose of providing this rather detailed technical list of what we have done is to emphasise the challenges faced by restorers of a complex piece of machinery that is over 70 years old. Moreover, this is being done out in the open by our wonderful dedicated Volunteers. Weather has been a major factor in holding back progress and we are investigating installing a tentlike structure over the rear of the crane to allow work to continue in inclement weather and during the winter.

AIA on the Handover of the Stothert & Pitt Stone Quarry Crane

Keith Flaconer, AIA President, writes: I was very pleased to be asked to represent the Association for Industrial Archaeology at this handover of the crane this morning [prominently re-erected in the Newark Work site on the bank of the River Avon in Bath in June 2023]. The AIA, which is celebrating its 50th anniversary later this summer at a conference up in the University of Bath, is the national society for the study, the preservation and the promotion of the industrial heritage.

Rather appropriately, the AIA is the direct descendent of the Bath Industrial Archaeology Conferences held in the late 1960s. These conferences, which attracted both national and international attendees, led to a series of British Industrial Archaeology Conferences and at the third of those, the Association was constituted with Tom Rolt, the noted author on transport and engineering history, as President and Angus Buchanan, of the University of Bath, as Vice-President.

Angus, who ran the Centre for the Study of the History of Technology at the University and followed Tom Rolt as President in 1974 sadly passed away in



The restored Stothert & Pitt stone quarry crane at Bath. Image copyright Keith Falconer.

2020. But as such a champion of historic local industries I am sure that he would have been thrilled to see this magnificently restored crane erected at this prominent site.

The Association is certainly equally pleased! Over the last 50 years, the AIA has, through legacies and donations, funded awards for research and publications and latterly grants for restoration of industrial sites and artefacts. Thanks to the huge generosity of several anonymous donors, over the last 14 years, its Restoration Grants programme, which I co-ordinate, has allocated over one and a quarter Million pounds to some 90 projects run by volunteer charities. In 2020, The Stothert & Pitt Crane, we celebrate today, was awarded one of these grants and indeed is a very worth recipient of such a grant!

As (Geoff Wallis) one of my colleagues on the AIA restoration Grant Panel has recently stressed: *This magnificently restored crane is an iconic example of a project illustrating the huge financial multiplier provided by volunteers. For a few thousand pounds cash invested, a restoration worth in the region of £50K has been carried out by skilled people to a high standard.*

Geoff himself was involved as a volunteer in the dismantling and moving of the crane when its very survival was in some doubt some years ago. Indeed, as Geoff has commented: *It would be unthinkable that such an historic crane should be lost from the city that was famous throughout the world for Stothert and Pitt cranes.*

It is also a rather lovely co-incidence, that the late David Pollard, who instrumental in saving this crane so many years ago, should, last year, been awarded, posthumously, the AIA Peter Neaverson Award for outstanding scholarship in industrial archaeology for his book *Digging Bath Stone – a quarry and transport history*. David, for half a

century was the go-to expert on the quarrying and use of Bath stone. Indeed, in the late 1980s advised me on the various origins of the masonry used in the building of the GWR's Swindon Railway Works when I was recording the Works leading to protection through Listing.

Altogether, therefore, the AIA, and I personally, are both delighted to have participated in the return of this emotive crane to its birthplace. Certainly, delegates to the Association's 50th Anniversary Conference will be pointed, with pride, to view the crane on their visit to the city later this summer.

Stephensons 1834 Lift Bridge Update

Steve Cramp Writes: I'm pleased to say that there is much progress to report with the lift bridge restoration as of June 2023! As reported in my last update, the restoration has moved onto the higher parts of the bridge, which has necessitated the erection of scaffolding around the structure. We were fortunate to find a local scaffolding contractor who agreed to loan us the scaffolding free of charge for 12 months, leaving us with just the erection and dismantle costs to pay, This represented a significant saving opposed to other contractors who either wanted us to rent the scaffolding or buy it off them, due to the long period of time involved.

We have also developed a plan utilizing a 3 tonne winch system for lifting the larger heavy components, which should save us all of the anticipated expensive crane hire, which leaves a much greater portion of your grant to be spent on the restoration and repair of the bridge components.

Already the large four corner posts have been lifted into place and the four large original winding wheels have been lifted on top. Additional vertical timbers have been added to the corners and the two large half tonne main beams have also been lifted up onto the scaffolding ready for fitting shortly. The next stage is the fitting of the top cross bars at each end of the bridge.

The partially restored Stephenson's lift bridge in June 2023. Image copyright Steve Cramp.



Highlights from the AIA Spring Tour 2023 to Portugal

Bill Barksfield writes: Despite having had a late and not very intensive industrialisation, Portugal proved to have many interesting examples of industrial heritage. Apparently there has been much destruction of industrial sites, mainly in urban centres, but our visits to Lisbon, Porto and the Serra da Estrela region revealed numerous interesting sites covering aspects of manufacturing, milling, power generation, textile production, railway infrastructure and much more. We also saw some of the Industrial Heritage Circuit of S. João da Madeira, south of Porto, one of several industrial tourism projects which have emerged in recent years. In all we visited 13 Industrial Heritage sites from which I have selected a few highlights.

We started our tour in Lisbon and went south of the Tagus river to the former industrial area of Seixal. It was in Seixal that the brothers Vasco da Gama and Paulo da Gama built vessels for the voyage to India by way of the Cape of Good Hope (1497–1499) which was the first to link Europe and Asia by an ocean route. The construction of the ships was the beginning of what is known as the 'Portuguese age of Discoveries' and Seixal's industrial tradition dates from this time.



Monument to da Gama and Paulo da Gama, Lisbon. Copyright Buill Barksfield.

The Gunpowder Factory in Vale de Milhaços, part of the Seixal Municipal Ecomuseum, was first established on the site in 1894 but an explosion in 1897 destroyed part of it and what remains to be seen today is the works as rebuilt in the years following that.

The now wooded site covers an area of about 13ha and has about 25 buildings, physically separated to reduce the effect of an explosion in any one part.

Each had a particular function such as warehousing, grinding, mixing, sieving, packaging etc. Materials were moved between the buildings in drays pushed by workers on a Decauville type railway line.

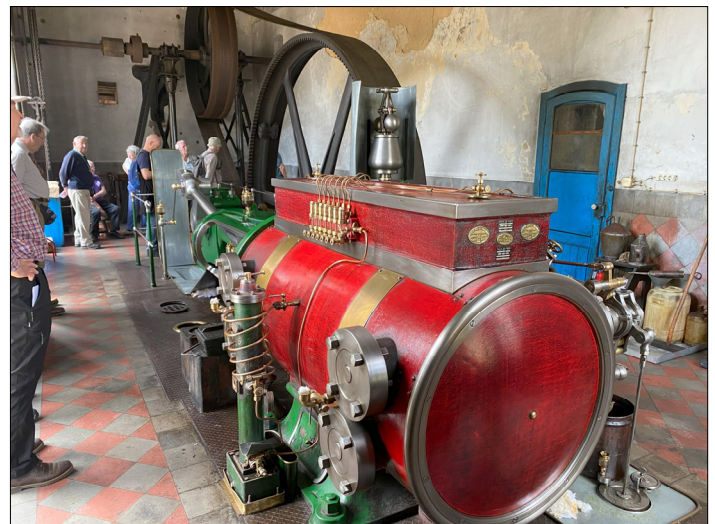


Gunpowder Factory in Vale de Milhaços. Copyright Bill Barksfield.

Of particular interest was the transmission of mechanical energy around the site from building to building, including some right angle turns, by endless aerial steel cables and we were very pleased to see a live demonstration of the engine and transmission system. Energy was produced by a single cylinder, horizontal engine producing about 123hp by Joseph Farcot, Paris dated 1900. One of the two Cornish boilers is maintained in working order, manually fired with wood - any sort of wood they can get their hands on as money is tight!

We were very ably guided by the curator Graça Filipe who gave us a great deal of information including some of the trials and tribulations of conserving a site of this nature and making it available to visitors.

Steam engine built by Joseph Farcot in 1900 at the gunpowder factory. Copyright Bill Barksfield.





The exterior of the Tejo Power Station. Copyright Bill Barksfield.

The very impressive red-brick building of the Tejo Power Station lies on the north bank of the Tagus. The original plant, whose buildings no longer exist, was built in 1909 and operated until 1921. It had fifteen small Belleville boilers and five generating sets with a 7.75MW output. There were many stages of expansion and modernisation culminating in the 1950s with four large Babcock & Wilcox high pressure boilers and two AEG generating sets (still in place) producing 60 MW, which made it the largest generating station in Portugal at that time.

Many thanks should go to Luís Cruz who led the group on a brilliant guided tour taking us, at one point, *through* one of the huge B & W boilers intended I suppose to impress on us the size of these things as well as showing us how it looks inside what is normally a completely enclosed space. The station remained in full production until 1968 and on standby until 1975.

At the Barbadinhos steam pumping station where we were guided by Bárbara Bruno, Director of the Museum, we learned that in the late 19th century the population growth in Lisbon meant that the quantity of water supplied by the 18th Century Águas Livres Aqueduct was no longer sufficient. To meet the demand, a new aqueduct was built to transport water collected 114km north of Lisbon from the Olhos de Água sources on the Alviela river to a new reservoir and a new steam pumping station was needed to raise the water from there to the city of Lisbon. It went into operation in 1880.

The station has 4 engines, by E. Windsor & Fils (Rouen), acquired in 1876 installed on the first floor and on the ground level is the "Pump Room" where the respective pumps were housed which remained in operation until 1928. The engines were demonstrated under electrical power creating an impressive sight.

North and east from Lisbon is the town of Covilhã, situated between 450m and 800m above sea level.

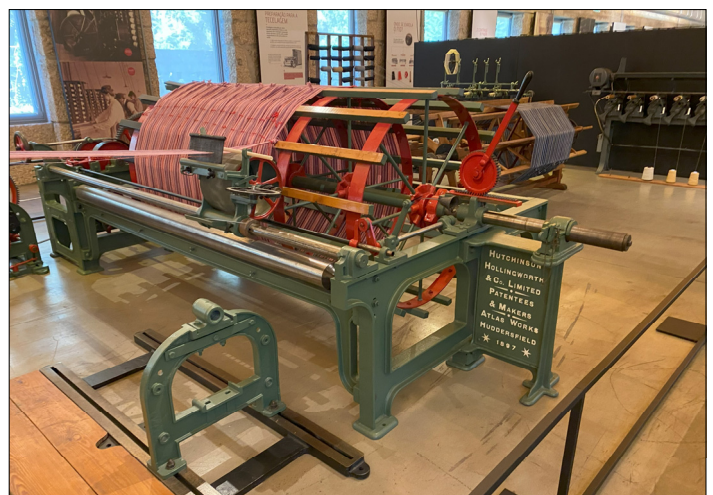


One of four engines on view at the Barbadinhos steam pumping station. Copyright Bill Barksfield.

Sometimes known as 'the town of wool and snow' Covilhã is nowadays most popular for its proximity to the winter sports areas in the mountains of the Serra da Estrela. We, of course, were more interested in its history as a centre of woollen textile production. Prof. Rita Salvado was our guide through the Royal Veiga Wool Factory complex named after José Mendes Veiga who began here with a dyeing mill in 1784. It was headquarters to a business complex that, during its peak period (1835 to 1891), included about twenty manufacturing units. From 1916 up to the last decade of the 20th century, several companies established themselves within this complex, carrying on different activities linked to the wool industry. The buildings are now part of the University.

We saw a great collection of machines (some made in the UK!) including carding, spinning, weaving and finishing equipment representing the technological evolution that occurred in the woollen manufacturing sector in the 19th and 20th centuries. The machines were driven initially by water coming down from the Serra da Estrela and later by steam. Of particular interest were more recent excavations of the early dyeing vats.

A textile machine made in Huddersfield on view at the Royal Veiga Wool Factory. Copyright Bill Barksfield





One of the weaving machines at the Mesclamalva factory. Copyright Bill Barksfield.

Our route from Covilhã took us through the Parque Natural Serra da Estrela past the highest point in Portugal at about 2000m above sea level. Dropping back down into the town of São Romão, we were able to learn more of the wool industry with a visit to the Mesclamalva factory. We were shown the whole process of the creation of woollen cloth from fleeces brought in from the surrounding to the production of the finished material but this time in a genuine production process seeing a variety of different machines of different ages. It is a family business and we were guided by António Camello and his son, the present manager, who was happy to spend his time with us demonstrating the machines and allowing us to inspect them closely while they were working.

The morning of our last day was spent on the Industrial Heritage Circuit of S. João da Madeira, south of Porto. This set of industrial tourist circuits has the objective of combining the preservation of the industrial archaeological legacy with the promotion of the industries considered traditional and the new creative and technological industries.

Explaining the Manufacture of pencils at the Viarco Pencil factory. Copyright Bill Barksfield.



Paper processing machinery on view in the Museu do Papel Terras de Santa Maria housed in a former paper mill. Copyright Bill Barksfield.

At the Viarco Pencil factory the proprietor was at pains to point out that the traditional pencil making business in Europe has been completely undermined by enterprises in the Far East who are able to produce everyday products at a fraction of the cost. The only solution is to steer the business towards specialist markets where margins are much higher. Although we had been warned that there would be no production on the day we visited, our guide was eager to demonstrate some of the machinery and explain how pencils were made – which was certainly new to some of us.

The Museu do Papel Terras de Santa Maria, south of Porto, is Portugal's first museum of the paper industry. People in the region were engaged in the making of paper from the early eighteenth century, and the last mills continued working until the end of the twentieth century. The museum is located in two former paper Mills, the Azvedos Mill, and the Custódio factory, a water-powered mill dating from 1822 that had new machinery installed in the late nineteenth century and continued working until 1989.

We saw many of the machines in operation and the methods of drying and folding were demonstrated. The paper produced now is principally from recycled materials.

We couldn't visit Porto without a thorough investigation of the Port industry! Our last visit of the week therefore was to the Ferreira Port House situated beside the River Douro. Our guide explained that this was the only Port Cellar to be continuously owned by Portuguese interests - most of the others having been good examples of close cooperation between Portugal and Britain. A short lesson in the production methods and differences between different types of Port led to the tasting room and the end of a great tour.

Our thanks must go to all the curators and guides at all the sites for their help in making our visits both intellectually rewarding and entertaining. But principally we must thank retired Professor José Manuel Lopes Cordeiro who gave us so much of his time both before and during the tour and without whom the whole event would not have been possible. [Practical arrangements for the tour were managed expertly, as usual, by Bill Barksfield at Heritage of Industry - Ed].

Newsletters and Bulletins

- Freshspring Magazine, No. 35, Summer 2023.
- GI Gas International (Incorporating The Historic Gas Times), August 2023.
- Greater London Industrial Archaeology Society Newsletter, No. 326, June 2023.
- Manchester Region Industrial Archaeology Society Newsletter, No. 171, Summer 2023.
- Northamptonshire Industrial Archaeology Group Newsletter, No. 167, July 2023.
- SIAS e-Newsletter No. 162, August 2023.
- Sussex Industrial Archaeology Society Newsletter, No.199, July 2023.
- Sussex Mills Group Newsletter, No. 199, July 2023.
- The Trow, No. 200, Summer 2023.
- Waterworks. Waterworks Museum News (Hereford), Spring 2023.

Journals

- Hampshire Industrial Archaeology Society Journal, No. 31 (2023).
- Irish Railway Record Society, Vol 30, June 2023, No. 211.
- London's Industrial Archaeology, No. 21 (2023).
- Sussex Industrial History, No. 53, 2023.

Please send future Journals, Newsletters, and Bulletins to Dr M Nevell, 3, Baxter Road, Sale Cheshire M33 3AJ, or electronic copies to ianews@industrial-archaeology.org

A Warm Welcome to the Following New Members

Ian Barclay, Bovey.
Tracey Green, Shrewsbury.
Dr Stephen Hoskins, Kingskerswell, Devon.
Susana Pacheco, Portalegre, Portugal.
Jason Parker, Norwich.
John Tabern, Ormskirk, Lancashire.
Ian Terrell, Cranfield, Milton Keynes.
Sarah Walters, Bolsover.

We were saddened to hear of the deaths of Paul Yunnie and Elain Hardwood. Appreciations of their lives and work will appear in the next IA News.

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The views expressed in this newsletter are not necessarily those of the Association for Industrial Archaeology.

Final Copy dates are:

1 January, for February mailing

1 April, for May mailing

1 July, for August mailing

1 October, for November mailing.

The AIA was established in 1973 to promote the study of Industrial Archaeology and to encourage improved standards of recording, research, conservation and publication. It aims to assist and support regional and specialist groups and bodies involved in the preservation of industrial monuments, to represent the interests of Industrial Archaeology at national level, to hold conferences and seminars and to publish the results of research. The AIA publishes a twice yearly Review and quarterly Newsletter.

Notes for Contributors

IA News, being the main paper communication organ for the AIA, is issued quarterly. It covers the Association's activities, including the work of AIA Council and the Young Members Board and that of our Affiliated Societies, together with both regional and international news.

Items for inclusion should be emailed as attached **Word** documents. The number of words will naturally depend on the nature of the report. Typically, a short news item could be up to 250 words. A large report could be up to 1,500 words. If necessary a report will be edited to fit the space available. If an author feels that editing may detract from the substance of the report, please include a note to this effect.

Photographs accompanying a report should be sent as separate **jpg** files (for best quality printing). Please do not embed them in the text. Short captions should be provided. For copyright reasons the origin of all reports must be credited and, where appropriate, the author's name and position included. Photographs, too, should indicate to whom credit should be given.

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The Lavenham Gasholder Restored



Robert Carr writes: Gasholders are becoming increasingly rare. Most surviving examples are due to be demolished so it is refreshing to find a complete example that is not just listed but is a scheduled ancient monument, as here at Lavenham. This small historic town in Suffolk completed their gasworks fairly late, in 1863, and remarkably the remains of the gasholder installed there in 1862 still exist. The tank is constructed from

cast iron plates bolted together and caulked for waterproofing. Surprisingly this ancient gasholder was still in use until 1993. The bell or lift which contained the gas is still inside the tank. It is not visible from ground level. The bell was included in the scheduling as part of the monument. The gasworks itself has gone but the surviving gasholder was renovated and information panels outlining the gasworks' historical importance have been installed.