WARWICKSHIRE WIAS
Industrial Archaeology Society

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NEWSLETTER

FROM THE CHAIRMAN

The final edition of the year gives me the opportunity to thank Mike Hurn for all his efforts in putting together the quarterly Newsletter of WIAS and for providing such a valuable record of the meetings and work of the Society. It is quite a responsibility and Mike carries out the task in an quiet, good-humoured and effective manner. Mike always welcomes contributions from members, and he is very grateful for those received. Thanks are also due to our former editor, Arthur Astrop. Arthur is unable to attend meetings because of his wife's ill-health, but maintains contact with the Society via his proof-reading of each edition of the Newsletter.

This final edition also enables me to give notice of the AGM of the Warwickshire Industrial Archaeology Society to be held on September 9th. 2010 at 7.30 p.m. in the Pyne Room, Warwick School. No major changes are planned for the working of the Society, although we will have a new treasurer, with Victor Lobb kindly agreeing to take over from Richard Hartree. Formal thanks will be delivered to Richard at the AGM. but it has been very re-assuring to know that the Society's finances have continued in such good health under Richard's careful stewardship.

The full programme of meetings for next year will be delivered in the annual mailing over the summer, but the mix will again be that of industrial archaeology, history and heritage, covering local sites and those further afield, with speakers drawn from within the Society as well as outside speakers. I really do believe that contributions from members are vital to the long-term success of the Society, and this has been fully reflected in the excellent talks delivered by members over the past twelve months.

The programme for the remainder of 2010 is shown below. The December meeting will be a talk by those WIAS members who attended the AIA Conference in Cornwall in September. Although we have enjoyed several fine talks on Cornwall over the years, the AIA conference gives access to some areas and sites not normally open to the public. In addition, this year is the 100th anniversary of Tom Rolt's birth, and in his memory - and in place of the traditional Rolt Memorial Lecture at the Conference - there will be a symposium on the theme *'Remembering Tom Rolt'*, and members hope to be able to report and reflect on the content of the symposium.

Martin Green

Shrewley Horse Tunnel

'Continuing the series of occasional articles on historic civil engineering works in Warwickshire by Roger Cragg.'

At Shrewley the Warwick & Birmingham Canal (later part of the Grand Union canal system) passes through a 433 yard tunnel under a ridge of high ground. The tunnel was opened in 1799 and, as was the manner at that time, there is no towpath through the tunnel. Consequently the towing horse would need to be unhitched from the boat and led over the hill to rejoin the canal at the other end of the tunnel.

Although the canal tunnel itself is not particularly remarkable, the distinctive aspect of this tunnel is that at the west end the towpath, after rising from the side of the deep cutting leading to the canal tunnel, passes through a short tunnel of its own high above the canal before emerging to reach the village of Shrewley. This feature is believed to be unique. At the entrance to the tunnel the towpath is about 15 ft. above the level of the canal.

The towpath tunnel is about 176 ft. long and 8 ft. high. It has vertical walls and a semicircular arched roof and rises on a steepening gradient The width of the tunnel varies from 9 ft 6 in at its lower end to 8 ft 4 in at the upper end. Most of the tunnel is paved with brick with raised courses to afford a grip to the hooves of horses but the highest 32 ft of the tunnel has recent concrete steps. The towpath tunnel can be accessed down a narrow footpath between the houses on the west side of the main street.

The horse path crosses the village street and continues down a footpath to rejoin the canal at the east end of the tunnel.

National Grid Reference:SP 214673

Roger Cragg

PROGRAMME

September 9th 2010
Annual General Meeting of the Warwickshire Industrial Archaeology Society.
Followed by *'The Last Picture Show'*: a showing of 35mm slides by members to reflect the work of WIAS over the past 21 years

October 14th 2010
Mike Glassson, curator of the Walsall Leather Museum, and author of several books on the leather trade:
The Walsall Leather Industry

November 11th 2010
Sarah Chubb, borough archivist for Sandwell Community History and Archives Service:
Chance Brothers – glassmakers of Smethwick

December 9th 2010
WIAS members who attended the AIA Conference in Cornwall:
'Aspects of the industrial heritage of Cornwall'

Meeting Reports

March 2010: A Joint Meeting with The Leamington Society
Matthew Rhodes and Bernard Perkins: *Past and future renewable energy from the Leam*

William Louis de Normanville was the Borough Engineer and Surveyor of Leamington Spa for 35 years, from 1882 - 1917. During this time he engineered the river, built the Mill, York and Adelaide Bridges, renovated the Pump Rooms building, laid out Victoria Park, created York Promenade, made the Mill Gardens, was architect of the Boat House and the Pump Room Swimming Baths with its unique roof. He also sorted out the town's sewage system. Today, most of de Normanville's buildings and landscapes are listed by English Heritage and the place where he lived, 6 Clarendon Crescent, is commemorated with a Warwick District Council plaque.

Janet Storrie, who wrote this appreciation of de Normanville for The Leamington Society, has chronicled his life and works in her book: *William Louis de Normanville: Engineer, Architect and Inventor, 1843-1928, and His Role in Creating Royal Leamington Spa* (Weir Books).

It was, therefore, very appropriate that the first joint meeting of The Leamington Society and WIAS should be concerned with an engineering aspect of de Normanville's legacy and Bernard Perkins & Matthew Rhodes of the Environmental Consultancy, Encraft explained the past and examined the future prospects for extracting renewable energy from the Leam.

Before looking at de Normanville's efforts to use the Leam to power a pump, Bernard Perkins reviewed the history of the site at Mill Road. There is a reference in the Domesday Book to 'Mills on the site of a weir' but the remains at Tamworth of an 8th Century horizontal wheel mill of a similar configuration to the Dounby Click Mill on Orkney and a 10th Century Anglo Saxon Charter for a Mill near to Stratford point to earlier uses of the Leam as a power source. The Domesday record is for 2 mills at 24 shillings in Lamintone.

Over the next 1,000 years there are references to mills in 1520, 1635 and 1684 and Bernard Satchwell (1732-1809) recorded a mill in a painting. Oldhams Mill 'a heavy building with tall chimneys' was built in 1832 on the South side of the present Mill Bridge and lasted until 1889. At the turn of the 20th Century, de Normanville produced a proposal to utilise the Leam to pump water to the reservoir on Campion Hills and in summer for the swimming baths.

The benefits would include: savings in coal bills, an improvement of the Mill Property and the opening up of the grounds to the Willes Road. Technically, the proposal would locate a turbine in the storm culverts of a new weir, charged via a penstock at its outlet end, with pumps fitted in an adjoining chamber in the abutment. An output of 3½ - 18 Horse Power (2.6 to 13.5 kW) would pump 9,700 gallons/hour (44,000l/hr) at 28 rev/min.

In 1902 S Owens & Co of Whitefriars, London tendered de Normanville (referred to as 'Waterworks engineer') for a turbine and pumps to be manufactured by Gilkes of Kendal, 'the whole delivered and fixed Leamington for the sum of £335.00'. When Encraft approached Gilkes during the feasibility study process, Gilkes were able to recognise the reference and believed that original paperwork still existed in their archives. By 1903 the turbine was finished and a grand opening ceremony took place on 23 February with a full report in the Leamington Spa Courier. The next year saw some heavy rain and flooding , fortunately with no permanent damage to the installation. Its maintenance passed into the hands of the Waterworks Committee and is recorded in the Borough Engineer's Handbook (1887-1933).

Coming up to date, the story of the current Restoration Project was taken up by Matthew Rhodes. The project also includes work on the second Leamington mill site, the weir at Princes Drive, which will involve an Archimedes screw installation. Matthew concentrated on the Mill Bridge where a number of studies have been undertaken, partly in conjunction with the restoration of the Jephson Gardens, to utilise the Leam again for some useful power.

The proposal is to install new equipment inside the existing bridge abutments, but now for electricity generation not water pumping. A number of issues have had to be addressed, some of which would be familiar to de Normanville. These include: variable water flows, fish protection, civil engineering, leisure use, environmental impact, grid synchronisation, flood defence and financing. As Matthew noted, de Normanville has already done a lot of the difficult technical work and the chambers and sluices are all in place, as is the weir.

The principle issue today is how to produce electricity economically for as much of the year as possible given the very variable seasonal flow of the river. Cost considerations mean that the proposed design will have two 13.5 kW Kaplan turbines which will operate together for 20% of the year and one only for a further 20% of the year, giving a typical generating season from October to February. The estimated annual output is 110 MWh (sufficient for 30 households) from Mill Bridge only and the combined annual output of Mill Bridge and Princes Drive is 200 MWh.

Encraft have carried out a preliminary Environmental Impact Assessment, and will commission a full report before proceeding although a scheme producing less than 500kW, such as this one, does not legally require an EIA. Amongst the criteria for consideration are: residual flow, conservation and biodiversity, pollution, water quality (turbidity), fish protection (screens and bypass over weir), townscape and visual heritage, traffic and access, public safety, noise, climate change, the community and jobs and not least, health and safety.

Another important consideration is flood defence. It is necessary to plan for possible flooding to half a metre above the Mill Bridge deck. Totally waterproof electrical rooms are needed and the scheme must allow for additional control and water paths for at least 10 cu. M/s and to add a controlled sluice to the boat bypass. However, if serious one in 125 year floods occur (as in 1998) Encraft consider that the weir structures become redundant and lost in a wider picture of flooding.

The Environmental Agency have detailed models for upstream and downstream flows which will be used to evaluate the scheme and, if necessary, to suggest extra control measures before proceeding with the scheme which will require 4 licenses from the Agency.

As with any project of this nature, the list of bodies to be consulted is lengthy and includes: The Environment Agency; Warwick District Council as the relevant planning authority and as landowners; statutory environmental bodies such as English Nature and the Countryside Commission and non-statutory bodies like Warwickshire Wild Life Trust; fisheries bodies or those with an interest in fisheries (e.g. angling clubs); Severn Trent; Central Networks; The Leamington Society and local residents.

There is also the small matter of financing the project whose total cost (including Princes Drive) is £380,000 of which the Mill Bridge is £235,000. A grant of £250,000 has been applied for from Natural England and one of £35,000 from Advantage West Midlands. The total value of the output, net of maintenance costs (£12,500 p.a.) and feed-in tariffs is £30,000 to £40,000 (indexed-linked). This would give a payback with grants of 2 to 3 years or 10 to 15 years without grants for a project with a life of 50 to 100 years. It is worth noting that the payback includes the costs of possible flood defence measures which are not normally accounted for in this way.

The present position can be summarised briefly. Await the outcome of the grant applications, after which the main stakeholder, Warwick District Council, has to decide on the preferred project structure. The balance of funding has to be raised; possibilities include loans, a community bond and public subscriptions (just like the Victorians). Agreement will be needed on the allocation of income; free electricity to Jephson Gardens, a community energy efficiency fund for free/cheap local insulation measures, general environmental projects or possibly returns to community bond holders.

All who attended thought the meeting set an excellent precedent for further joint events on subjects of mutual interest. As regards the proposal for a new micro-generation installation, the outcome will be looked at with much interest.

April 8th 2010: Dr Malcolm Dick

Matthew Boulton (1728 – 1809) and the celebration of Industrial technology

Malcolm Dick is the Director of the Centre for Birmingham and Midlands History at the University of Birmingham. His talk showed not only his grasp of the great issues at play in Britain at the onset of the Industrial Revolution but also his feel for the character of one of its leading players - Matthew Boulton. It was not by chance that Dick subtitled his collection of essays on Boulton *A Revolutionary Player* and described him as an industrialist, landowner, scientist and a contributor to transport development and the arts.

Boulton's importance was examined through his biographical details, how he was viewed by his contemporaries and colleagues and the environment and cultural milieu of his times. In particular Malcolm Dick's key theme was celebration; the celebration of Soho and manufacturing, the celebration of managing labour and the celebration of steam power.

Matthew Boulton was born in Birmingham in 1728, the son of a local manufacturer, and died in 1809. In partnership with James Watt, he developed the reciprocating and rotative engines which improved the quality of steam technology and stimulated its adoption into the British and world economies. In 1762 he opened the Soho Works, on the outskirts of Birmingham at Handsworth, which produced high-quality metal work, including buttons, ormolu and silverware, and became, reputedly, the largest factory in the world. Soho changed manufacturing by concentrating production under one roof. There were stores, drawing and design rooms and manufacturing units. Boulton moved into Soho House, a Georgian villa but no palace, close to his factory in 1766. It was one of the meeting places for the Lunar Society and the core of a landscaped estate. In 1787 Boulton established the Soho Mint and in 1795 the Soho Foundry in Smethwick, which was the first purpose-built plant to manufacture steam engines.

Boulton's educational background is unknown but he seems to have had no higher education and worked for his father from an early age. He was clearly both talented and ambitious and able to tap into the rise of Birmingham as an industrial centre with its focus on advanced technology and processes. He was also successful socially, marrying two sisters, each of whom brought a welcome dowry that he used to expand his business empire. Successful as Boulton was, his ambitions always outstripped his resources and his businesses were chronically undercapitalised. He demonstrated a desire to manage his image through the carefully chosen portraits painted at different times of his life and by exploiting Birmingham's place on the 'industrial grand tour' by potential customers.

Boulton lacks a proper biography, especially when compared to his Lunar Society contemporaries such as James Watt, Josiah Wedgwood, Erasmus Darwin and Joseph Priestley all of whom are arguably better known. There is a huge amount of archive material available on Boulton's activities which would present a daunting task for any potential author. Fortunately, James Watt and James Keir each wrote short appreciations of Boulton shortly after his death and a more detailed biography was written later by Samuel Smiles.

The Lunar Society was a centre for intellectual ideas and its members formed a network that extended from the Midlands to London, the Continent and the USA. It has been described as one of the most extraordinary and influential groups of late-eighteenth-century England. Collectively, its members comprised a clearing house for the ideas which transformed their country materially, socially, and culturally within a generation. Their major mutual interest was the sciences, pure and applied – particularly concerning the problems of industry. Exposure to such stimuli must have been exhilarating to a man of Boulton's temperament.

Dick used a selection of contemporary illustrations of the Soho Manufactory and its setting to give a vivid impression of Boulton's vision as well as the practical elements such as the complex arrangements for providing water power to the machinery which remained in use even after the installation of Watt's steam engines. The Manufactory's classical facade echoed the nature of much of the product range. Erasmus Darwin, writing in 1768 praised a place which united landscape, production, elegance, technology, profit, chemistry, art and amusement.

Turning to the celebration of the management of labour, Dick emphasised Boulton's achievements in applying pioneering techniques in the division of labour. A button, for example, passed through the hands of ten people; each workman being responsible for only a small part of the process. A number of visitors to Soho have recorded their impressions, often remarking on the degree of mechanisation and 'the management of machinery' which led to the stimulation of production. Whilst the employment of female and child labour was observed, comment on social conditions was usually absent except that it was cheap and so reduced the need to employ scarce and expensive skilled men.

In 1767 Dorothy Richardson described Soho as a sensual and intellectual learning experience which connected beauty, elegance, spiritual enlightenment, science, commerce and education. Ten years later, an Italian, Carlo Castone made a comment that has a surprisingly modern ring. He said that the substitution of technology for skilled labour reduced industrial espionage: 'the consequence of letting the machines do the work is that the artisans do not know completely the whole process of work and cannot pass on the idea of how to design the products. The artisan is not able to pass on details of manufacturing to anyone else, because he does not understand the whole process.'

Celebrating steam power was one of Boulton's passions. Not only was it the most commercially successful of his many ventures but it justified his support over many years for the manic depressive Watt. The oft repeated, and paraphrased, comment, 'I sell here, Sir, what all the world desires - POWER', could serve as the motto for Boulton & Watt's partnership as well as one of the earliest of publicity slogans. Thanks largely to Boulton's insistence, Watt developed a rotary motion version of the engine that transformed manufacturing by freeing factories from the vagaries of water power. Interestingly, and giving the lie to any suggestion that Boulton lacked mechanical aptitude, he contributed the design of a vital link associated with the revolutionary sun and planet gearing of the rotative engine.

Erasmus Darwin celebrated Boulton's use of steam power poetically. In *The Economy of Vegetation* (1791), he transformed the engine into a giant of masculine energy which raised water and dug ores from the feminine earth, filled bellows with air to smelt metals, supplied towns with water, ground corn and released the copper from the mines of Anglesey which was then transformed into coinage at Soho.

Boulton's application of steam power to his ground-breaking coining machinery allowed the last of his great enterprises to flourish. The Soho Mint showed the way to produce coinage in high volumes (30 to 40,000 coins per hour) that was so accurate and consistent that forgery was virtually impossible. A flourishing export trade developed as a result.

Malcolm Dick concluded that Matthew Boulton was an enterprising promoter of industrial production who was communicating, literally, on an industrial scale. According to the evidence, those who visited the site absorbed positive messages about the quality of the Soho complex, the efficiency of labour management and the power of steam. Boulton established a set of markers of how to view industrialsation. These were dominant perspectives for the growing industrial *bourgeoisie* and others outside this class who welcomed industrialisation as a positive transforming force, but they were not the only ones. Industrial activity could be viewed intellectually as dimensions of the new sciences of economics, geography and geology (Adam Smith or James Keir) or it could be viewed critically – a dimension that was represented by conservative critics (Anna Seward or William Wordsworth) and radicals (like Thomas Spence or Robert Owen).

This talk was a fitting tribute to a great man.

May 2010: Peter Coulls, Alain Foote and John Willock
Willans Works

Many members were surprised to learn the history of Willans & Robinson, a steam engine builder at the turn of the twentieth century whose products set the standards for others to try and emulate but of whom few of us had heard.

Thanks to the present management of Alstom in Rugby a significant archive of Willans & Robinson material has been deposited in the Warwickshire County Record Office, Warwick consisting of photographs, glass plate negatives, engine index books, drawings, commercial documents and much more - invaluable primary sources. Peter Coulls, Alain Foote and John Willock have been cataloguing this treasure trove and the first fruits of their labours was a fascinating and profusely illustrated review of this little known, but very important engineering company in Rugby.

Established in 1880, at Thames Ditton, Surrey, Willans & Robinson manufactured a unique series of high speed steam engines incorporating the patents of Peter Willans. Designed specifically for electrical power generation, Willans & Robinson central valve engines, at their peak, powered 68% of Britain's installed electrical capacity. In 1916, weakened by poor financial control, the company was consolidated into the Dick, Kerr Organisation which then became part of English Electric in 1919. English Electric at Rugby became GEC Turbine Generators in 1968 and in 1989 this became GEC Alsthom and later Alstom.

Peter Coulls began by outlining the lives of the two partners. Willans (1851-1892) was the engineering brain whose life was tragically cut short by an accident. He is commemorated by a plaque placed in Thames Ditton church by the workforce. An alumnus of Penn of Greenwich (a name that has occurred frequently in recent talks), Willans took out a series of patents for valveless engines for steam launches, and joined forces with Mark Robinson (1844-1923) to exploit them. Robinson seems to have been a very well connected administrator with a background in the Admiralty. He succeeded Willans as chairman but retired due to ill health in 1909. Robinson, however, was treasurer of the I Mech E for many years and also Vice President of the Institution.

Prior to the formation of Willans & Robinson, launch engines had been manufactured by sub-contractors including Tangye and Hunter & English, but never satisfactorily to Willans high standards. In 1880 the Ferry Works site in Thames Ditton was acquired and a comprehensive, vertically integrated factory created. Clearly capital was available for this and soon 400 people were employed producing engines for the launches of wealthy patrons including one Gordon Bennett, editor of the New York Herald. Patronage might have been secure but luck never was and in 1888 the works were destroyed by fire; rebuilt to higher standards including a very early example of flow-line production, they were severely damaged in devastating floods in 1894.

The archive has a wealth of photographic material covering these early years. We saw the full extent of the production process, including the use of jigs and fixtures, the staff and management and the wharf location. The works continued to be used after Willans & Robinson relocated to Rugby in 1896 for some component manufacture and subsequently it was bought by AC Cars and used until 1980 when car production ceased and then redeveloped for light industrial use. Some of the original structure survives to this day.

Rugby was chosen because of its central location, good and developing communications and particularly for an available pool of skilled labour. Further evidence of the capital available to Willans & Robinson is seen in the quality of the buildings of the Victoria works (echoing the Gothic architecture of the town and Rugby School) and the size of the workforce - some 950 at the outset. Again, the archive provided a wide range of photographs to illustrate the new works, its offices and other departments and it was particularly interesting to see the quality and ornateness of the interior fittings. Scagliola ionic coloumns are not common in drawing offices nor gothic stone staircases in entrance halls. The welfare of the workforce was not neglected with a dining room and on-site bathrooms for the foundry workers.

A good example of the international nature of the business was shown in a group photograph commemorating the visit by the American Society of Mechanical Engineers in 1907.

John Willock then took us through the technicalities of the central valve steam engine. Its essential simplicity combined with scaleability allowed for a wide range of outputs from a few horsepower to 2,000 hp. This was vividly illustrated by a photograph of a workman holding a small piston and conrod alongside a large example that must be two and a half times his height. The Willans engine claimed to give great economy of steam together with durability and silent running at high rotative speeds. Durability was enhanced by having all the moving parts working in compression with no reversal of forces at any time.

The engines were designed to operate at near constant speed and steady loads and so were ideally suited for electicity generation. The development of the public electricity supply industry was good for the Company and there were many examples of engines coupled to generators in a wide variety of applications; base-load power stations and standby generation in department stores, clubs and offices. A 2,000 hp engine was shown at the Paris Exhibition of 1900 and others provided power for the first electrified London Underground train system.

Patents filed in 1890 and 1892 for forced lubrication in steam engines by the forerunner of Bellis & Morcom, a competitor of Willans & Robinson, allowed the development of the double acting steam engine which became a serious competitor to the central valve engine. Willans & Robinson were forced to consider their options and around 1900 the board decided that the steam turbine was the future.

Alain Foote then took up the story with the appointment of H F Fullager, who had worked with C A Parsons on steam turbines. He soon departed over differences of opinion on mechanical design and the board concluded a rather restrictive licence with C A Parsons in 1905. The licence authorised Willans & Robinson to build steam turbines in the UK only and not for marine propulsion. The licence fee was £1,000 with a royalty of 1/6 per kW of output if coupled to an electrical generator. Notwithstanding these conditions, a number of Willans-Parsons generating sets were produced for municipal authorities.

It was clear that any long term future depended on circumventing the Parsons restrictions and in 1906 attention was turned to the impulse turbine and experimental disc & drum and Curtis turbines were built. Eventually, the disc & drum type with a Curtis wheel at the high pressure end was adopted as a standard and many steam turbine powered generating sets were produced, often for export.

The early years of the twentieth century saw several other attempts at diversification, usually under licence despite the earlier experience with Parsons, and usually unsuccessful. These included: oil engines, condensers, various pumps, the Niclausse boiler, Vanadium alloys (which gave rise to the Izod impact testing machine, now a standard piece of materials testing equipment in laboratories around the world), high grade iron castings and even a boat disengaging gear. Perhaps the oddest venture was the Heilmann (steam-electric) locomotive which was an overweight and underpowered failure.

During WW1 the works manufactured a wide variety of items for the war effort including the Salmson aero engine. In some ways this engine typified the loss of technical direction that had followed the death of Peter Willans in 1892. A water-cooled radial engine with poppet valves it was an attempt at an advanced engine but not a 'first division' product. It is, perhaps, no surprise that Willans & Robinson failed to survive as an independent business but its legacy remains in Rugby with parts of the Victoria works now incorporated into the Alstom factory and known as Willans' Works and still involved with the manufacture of steam turbines and associated components.