

WARWICKSHIRE

WIAS

Industrial Archaeology Society

NUMBER 47 February 2013

PUBLISHED QUARTERLY

FROM THE CHAIRMAN

Recessionary times

No-one needs to be reminded of the parlous state of the British economy and of government finances, but it is interesting to reflect on the impact that this might have on the recording and preservation of our industrial heritage.

In simplest terms, recession might have a number of impacts. The likelihood of closure of firms is heightened, and although this is most frequently brought to our attention via the retail sector, there must be a considerable effect on the manufacturing firms supplying these outlets, some of which may be housed in older premises. The desire to make most effective use of available funds has produced a boom in internet sales, once more adding to the potential loss of retail outlets. Slump conditions also mean existing vacant buildings remain empty for longer (with attendant problems of deterioration), and the prospects of the conversion and revitalisation of old industrial premises becomes less likely. These problems are often compounded by a potentially lethal combination of concentrations of large unoccupied industrial premises in areas of low incomes, high unemployment and social deprivation. The view of a former industrial building (with potential for renovation were it located elsewhere in the country) suffering the inexorable impact of neglect and vandalism is indeed a sorry sight.

Nor is this a problem that exists elsewhere in the country but not in Coventry and Warwickshire. There are several examples that come to mind of premises that deserve renovation but it is, indeed, difficult to see how funding might become available.

In terms of financing, there are many features that put pressure on funding. The quest to reduce (at least in real terms) the volume of government spending (both central

and local) could see budgets for industrial heritage as suitable candidates for pruning. Libraries, museums, record offices, archaeological services could find staffing levels reduced and funding re-allocated elsewhere.

At the individual level, subscriptions to societies may be one of the items scrapped from household budgets, and the cost of visits to museums carefully considered.

National leaders of the industrial heritage movement are well aware of these problems, and English Heritage's *'Industrial Heritage at Risk'* programme highlighted many of these issues. One significant feature of Shane Gould's impassioned presentations on this issue has been the *'public attitudes survey'* and the confirmation of the importance that the general public do indeed place on our industrial heritage. A good source of information is Issue 67 of English Heritage's Conservation Bulletin *'Saving the Age of Industry'* (available online – or to borrow from WIAS).

As part of this process is the role of voluntary effort and support. There is a heightened need to monitor what is happening locally, and to lend support for national organisations such as the Association for Industrial Archaeology. We hope that our WIAS meetings can make a small contribution to this process, combined the efforts of individuals on particular projects.

One building that certainly is under our watchful eye (as well as being our society logo) is the Warwick gas works in the Saltisford, Warwick, which – after many years of being empty – is now planned for conversion. We shall monitor this carefully, particularly in terms of not losing the balanced, manageable scale of the streetscape fronting the Saltisford.

Willans Works Archive

In view of the pressures on funding outlined above, it is with enormous pleasure that I am able to pass

on the news that the application for funds to help the cataloguing of the Willans Works Archive has been successful. With professional input and the voluntary contributions of John Willock, Peter Coulls, Arthur Astrop and Alain Foote the future of the Archive looks safe.

Sad news

It is with much regret that I announce the death of two of our members – Tony Poole and Peter Mason. Our sincere condolences go out to their families and friends.

Next issue

The editor – Mike Hurn – is very willing to receive input for the next issue, due to be published in June. Text and/or photographs for the middle pages insert should reach him by 31st May. Please send to mikedhurn@btinternet.com, or hand to him at a WIAS meeting.

Change of meeting

In the programme shown below, there are two changes from the previously issued list. In May, the speaker will be Simon Buteux who has replaced Elizabeth Perkins as Director of the Birmingham Conservation Trust, and the June meeting will now be Anthony Coulls speaking on The Railways and National Railways Museum of Sierra Leone.

PROGRAMME

February 14th 2013

Members' Evening

March 14th 2013

John Yates (Inspector of Historic Buildings, English Heritage)
The First Iron-framed Building in the World: Ditherington Flax Mill - History and Restoration.

April 11th 2013

Richard Thomasson:

Ariel motorcycles from Selly Oak.

May 9th 2013

Simon Buteux (Director, Birmingham Conservation Trust):
Newman Coffin Works, Birmingham.

June 13th 2013

Anthony Coulls:

Railways and the National Railways Museum of Sierra Leone.

NEWSLETTER

Meeting Reports

November 2012: Ian Mackintosh

400 Years of Stroudwater Textiles

Ian Macintosh, resplendent in a 'Stroud Scarlet' waistcoat, gave us an illuminating tour of the Stroudwater valley – The Land of the Clothiers. As a trustee of the Stroudwater Textile Trust, he has an authoritative command over the subject which combines many aspects of industrial archaeology as well as English social history. In particular, he showed how the textile industry demonstrated adaptability and flexibility over several centuries and was always international in its outlook.

Woollen cloth manufacture has been important in the Stroud valleys since medieval times. The local streams are dotted with mill sites and their courses have been straightened and interrupted with weirs and millponds over the ages. Towns like Stroud and Nailsworth developed because of the industry while more ancient foundations like Cirencester, Dursley, Painswick, Tetbury and Wotton under Edge prospered.

Besides British markets the cloth was sold to Europe, the Native Americans and Asia in such large quantities that at one time there were over 170 mills working. The Royal families of Great Britain and Russia, the Queen's guards, The East India and Africa Companies as well as the Papal Court were all customers, and in the 1880s 21 ships a year are recorded leaving for Canton with the bulk of their cargo being West of England cloth from Stroud. A special double sided cloth, dark on one side and reflective light on the other woven simultaneously, was used for tents in the Crimean War and in India

Evidence of the wealth of some merchants is that one Samuel Capel left on his death £3,000 worth of cloth in his London factor's house and a further £2,000 worth elsewhere.

The Stroudwater Textile Trust seeks to preserve this rich textile heritage, which extends to over 400 years, to promote awareness of the past importance of the woollen industry in the Stroud Valleys and to bring together past and contemporary textile art. The Trust was established in 1999, consolidating ten years of volunteer activity in the preservation and restoration of historic textile machinery, the provision of educational materials and the organisation of tours of the surviving mills.

The Trust's activities are centred on the Dunkirk Mill, with its impressive waterwheel and regular demonstrations of 'West of England' cloth being finished using historic textile machinery, and at Gigg Mill where there is a weaving workshop with demonstrations and classes. At two other historic mills, St Mary's has a large waterwheel and a Tangye steam engine, whilst at Stanley visitors can watch demonstrations of carding machinery and spinning mules in a Grade I listed building.

The historical part of Ian's presentation utilised many contemporary paintings that not only showed the beauty of the valleys but also contained many illustrations of the mills themselves together with the extensive outdoor activities involved in producing the cloth. These notably showed the variety of colours produced in the district: apart from the scarlet were green, beige, yellow and navy blue.

A number of well-known sayings come from the cloth industry. Dyed in the wool and dyed in the piece originally signified differences in quality whilst being on tenterhooks derives from the tenting frames on which the dyed cloth was hung out to dry stretched onto the tenterhooks.

Water has always been important, whether as a source of power to drive machinery or for the washing and dying

processes or for transportation of raw materials and finished goods. As early as the 1790s the Stroudwater canal provided a link to the River Thames. Mills were usually named after their owners and these place names sometimes survive even though the buildings are long gone. Four medieval mills within the course of a single mile of the river would seem to indicate plenty of demand for West of England cloth.

Turning to the technology, there was an early need for mechanical assistance to drive the fulling stocks where wet broadcloth, produced by a network of cottage hand-loom weavers, was pounded to consolidate the material. The fulling stock preserved by the Trust last worked in 1964 and takes six men to lift it. The process creates much heat and noise and a mill runs continuously, 24 hours a day for six days – Sundays off. In Nailsmith, 38 fulling mills ran full time and it was said that ladies of a nervous disposition should not live near to a fulling mill!

After fulling the cloth nap was raised using three grades of natural 'teazels' prior to 'shearing'. The shearmen were the elite tradesmen amongst the cloth makers and the description given by the Textile Trust is an evocation of times past. "The gentlemen shearmen considered themselves the "dons" of all the branches of cloth making, cutting the nap to give the cloth an even and dressy appearance.

They worked in pairs in shirt-sleeves, generally held above the elbow by a strip of scarlet cloth - their badge - on a shear board about 18 inches wide and 8 feet long packed with coarse pillowing cloth made for the purpose. The shears weighed 40 to 50 pounds and a block of lead was placed on them to press them down steadily on the cloth which was strained out tight by hooks over the pillowing. One brought his shear to the list or selvedge; the other began in the middle so they finished at the same time. The shears and weight had to be carried off the cloth every time a 'board' was cut. Some allowed a 'colt', a strong lad, to pay them to learn the trade.

Dyeing became an important element as the Stroud industry became more vertically integrated and dye houses were added to spinning, weaving and finishing operations. Indigo was an important material providing blue for naval uniforms and black for Victorian gentlemen's formal attire. The famous Stroud scarlet had its origins in Montezuma's cloak. The Spaniards imported prickly pears on which to raise the cochineal beetles that were crushed to make the dye. Later the secret came to Stroud.

The industrial revolution came late to the Stroud district but it brought pollution, notably in the winter when smoke was trapped in the steep valleys where the mills were concentrated for lack of room to expand. A complainant was told to fit better windows! At the same time, increased demand for water from unreliable Cotswold streams caused friction amongst the mill owners that was only resolved with the increasing adoption of steam power which brought with it more pollution and accidents. The dye houses were particularly notorious for fumes that caused illnesses.

Nonetheless, technology from the cotton industry was gradually adopted. Water-powered carding and slubbing mills produced yarn material for the spinning jennies. The shearman was replaced by a mechanised 'cross cutter' that boys could operate. Incidentally, this cross cutter gave birth to the cylinder grass mower.

Today, two mills are working producing cloth for billiards tables and tennis balls. A far cry perhaps from the Royal orders of past times but proof that the adaptability of the Stroud textile industry remains in place.

Members' Contributions

John Willock

The 3.7" Anti-Aircraft Battery at Goodrest Farm, Leek Wootton.

On Sunday, November 18, 2012, members of the public had a rare opportunity to view a surviving second world war anti-aircraft gun battery situated at Goodrest Farm, Rouncil Lane, near Leek Wootton. The site, comprising a command and control bunker, observation post and four emplaced 3.7" anti-aircraft-gun installations, has been surveyed and carefully conserved, over a number of years, by the Friends of the Anti-Aircraft Battery at Goodrest Farm.

Designated H25, Bannerhill Camp, this battery was brought into operation in 1941 as part of a ring of defences protecting Birmingham and Coventry. At its operational peak nearly 200 service personnel, many of them young women of the ATS, served at the camp to enable 24 hour operation of the guns. Members of the ATS operated the observation posts, the predictors (an electro-mechanical device that computed the time of flight of the shell) and assisted in the command room. All this information was fed to the guns, which were manned by men of the RA. Before each shell was fired the fuse had to be manually set, in accordance with the information supplied by the predictor. Much later in the war, with the advent of the British designed and American made proximity shell, the need to fuse set was obviated.

The site, which is on private land, has been restored to something of its former state and shows a typical installation of the early war period; the concrete command and control bunker being a particularly early example of its type - possibly a prototype. Surrounding each of the four gun emplacements are a number of small concrete receptacles for ammunition storage. Each shell weighed 28lb (12.7kg) and up to twenty could be fired per minute, depending on the actual variant of 3.7" gun being used, and could be fired to an effective height of 39,000 ft (12,000 m) with later marques of the gun. The battery worked in conjunction with a mobile searchlight unit that was situated a little distance away along Rouncil Lane.

Accommodation on the site was provided by a number of Nissen Huts and living conditions were particularly spartan for all the service personnel. In 1943 the guns were removed and transferred to the south coast. The camp then took on a new role as a small prisoner of war camp for about 80 Italian and German prisoners of war. It is thought that some of the prisoners from Bannerhill Camp may have been employed at the Cherry Orchard Brickworks at Kenilworth.

It is not known if the battery recorded any definite enemy aircraft "kills" during its operational life at Goodrest Farm. It is probably unlikely: during the early stages of the war, without the benefits of radar-assisted prediction and proximity shells, the chances of actually hitting a high flying enemy aircraft were extremely small. What battery H25 did, along with other similar AA units, was to give attacking aircraft a hard time, forcing them ever higher and thus making target acquisition more difficult. In addition, there was also the not inconsiderable propaganda effect derived from the sound of retaliatory gunfire!

Warwickshire Industrial Archaeology Society Newsletter: Number 47



Command and Observation Bunkers.

The Command Bunker is of a particularly early type - possibly a prototype.



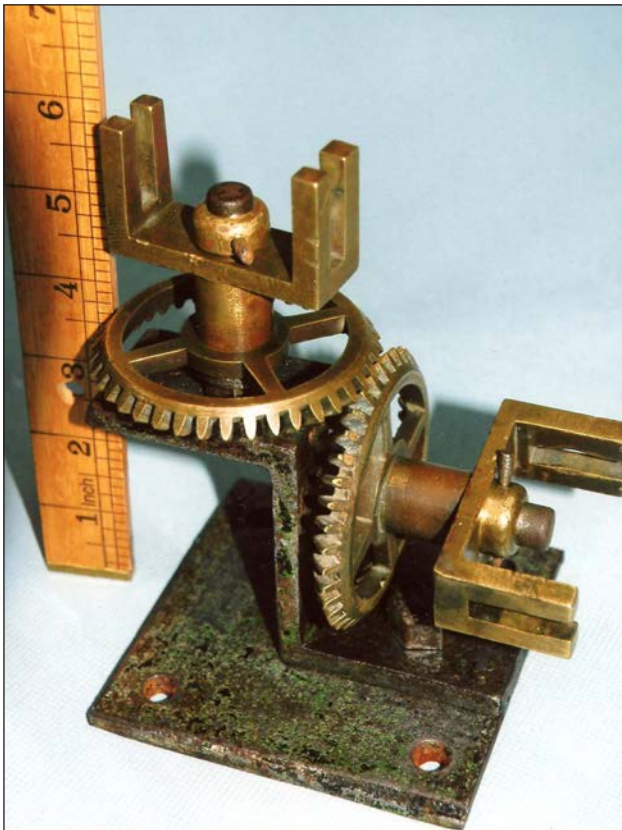
3.7" Emplacement. The receptacles surrounding the concrete plinth were for ammunition storage. At Goodrest Farm there were at least four emplacements, with just possibly a fifth.



Members' Contributions

John Copping and Arthur Astrop

Flotsam or Jetsam? Or perhaps a thingumbob.

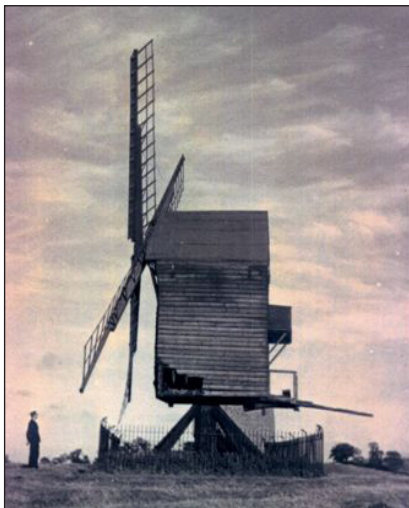


Amongst a group of friends, John Copping is perceived to be knowledgeable about old tools etc. One has, over recent months, developed the habit of putting this to the test. He was politely surprised when the use of a small folding magnifying glass was identified as for counting the number of threads per inch in a piece of fabric. He was not to know John's grandfather was a haberdasher.

The next challenge he posed was to interpret the mechanism illustrated here. The owner was only able to say that it was found on a beach.

Peter Chater

Memories of the Burton Dassett windmill.



These pictures were taken on consecutive days, 25th and 26th July 1946 by a person unknown. Peter and his two sisters are shown beside the picture of the fallen mill. It was obviously a Post Mill and is thought to have been built around 1664 and ceased working about 1912.

Its effect is to change the direction of a rotating drive through 90 degrees. There is no change of gearing, but an unavoidable reversal of the direction of rotation. It seems pretty certain to come from a ship, maybe only a boat. The possibility of its use in a lighthouse prompts consideration also of a light-ship. The bronze parts provide resistance to corrosion. However, a study of this photograph shows that each rotating sub-assembly needs to rotate on its fixed spigot, which is clearly steel. That obliges the use of bronze for the sleeve, even if not for the gear wheels. If the mechanism needed to transmit significant torque, the gears themselves would realistically have been hobbled onto iron castings. The logical conclusion is that the load to be transmitted is relatively light. Equally, the informal style of the whole, including the provision for transmission to shaft by some form of 'dog' to fit in the slots in the bronze lugs, strongly suggests intermittent rather than permanent operation.

It seems likely that the unit served as part of a control mechanism providing, for instance, the ability for a helmsman to operate a piece of kit further up the deck without need to leave the wheel. According to a member well placed to advise about such things, such an application could easily be envisaged on a canal boat.

Arthur Astrop adds: I agree with the conclusions drawn about the possible usage of the device. As for a possible application, one suggestion I can offer is as follows. Some years ago, while on holiday, I had the opportunity to use a boat with a small inboard engine and originally designed for steering by a tiller-operated rudder at the stern. The owner, however, had converted it to steering from the bow-seat by a small-diameter steering wheel which, through a set of bevels like those in the photo, turned a vertical shaft carrying an aluminium drum.

Around this drum was wound a length of Bowden cable which ran internally towards the stern, along both sides of the boat, close up beneath the gunwhales. The cable then wrapped around another aluminium drum, of identical diameter to the first, but attached to the rudder post. Small movements of the steering wheel to left or right thus turned the rudder by the same amount.

In short, the bevel drive was subject only to light-load usage, applied intermittently. Members may be interested in this 'holiday remembrance'!



Martin Green:

Salt of the earth; salt of the sea.

The AIA's visit to Maldon, Derek Hurst's talk on the Droitwich salt industry, and the sheer volume of salt required to treat the roads in the current (January 2013) snow-covered landscape reminds one of the essential role that salt has played - and continues to play - in our society. Freezing temperatures also turns one's mind to sunnier climes and the production of salt in entirely different conditions to those pertaining in the UK.

In the northwestern corner of Sicily, along the coastline between Trapani and Marsala, lies a large area of salt pans that have an extremely long history and remain in production to this day. They also retain features that attract the attention of the industrial archaeologist.

With evidence of salt extraction in this region traced back to the Phoenicians, the current landscape has a timeless quality, particular with parts of the area given protection via the creation of a nature reserve. Salt production along this coast probably reached its peak in the mid-nineteenth century (after the Unification of Italy in 1860), when 31 salt pans produced over 100,000 tonnes per year, much of which was exported throughout Europe, including Norway and Russia.

The combination of high summer temperatures, the dry North African winds and the high salt content of the Mediterranean (3.5^o to 4.5^o Baumé) provide the ideal combination of conditions for the successful extraction of salt via evaporation. Apart from the mosaic of salt pans and the piles of evaporated salt lying under the protection of terracotta tiles, the dominant feature of the landscape is the collection of windmills that remain a testimony to the techniques used to extract and treat the salt. The windmills were used both to drive the Archimedean screws that lifted water from one level to another, and also to grind the salt once it had been extracted.

The typical windmill has a conical tower, capped with a conical roof, and six trapezoidal vanes made up of cloth sails attached to wooden frames. The roof (and, hence, the sails) can be turned to exploit the wind to best advantage. The sails can rotate at a speed of 20km per hour and generate a power equivalent to 120 horsepower.

There is also a single example of a much later so-called American Mill ('Mulino Americano') with metal blades. This mill was used solely for the transfer of water from one pan to another.

The water moves from those ponds closest to the seawater ('fridda') through a number of ponds each with increasing salinity, until the final evaporation ponds are reached ('cassedri') and the salt is ready for harvesting. My visit was in April well before the harvesting of the salt. This occurs in July and August when extreme summer temperatures would frazzle most Warwickshire industrial archaeologists, whatever their level of interest! Even so, I was fortunate enough to see the modern removal and transportation of the salt from the protected piles - not photographs that would gain an entry in the travel brochures, but perhaps deserving of a place in the WIAS Newsletter. Three thousand tons are produced each year, with the 100% natural salt occupying a niche market, possessing a higher concentration of potassium and magnesium than common salt.

There is a small museum - the 'museo delle saline' - housed in 300 year-old buildings - telling the story of the salt pans over time, with relics of the industry on display. Further information about the windmills and saltworks is probably best secured online, although those fluent in Italian could consult '*Saline e Silinai*' (Salt and Saltworks) by Maria Manguerra!



Windmills near Trapani



The American Mill

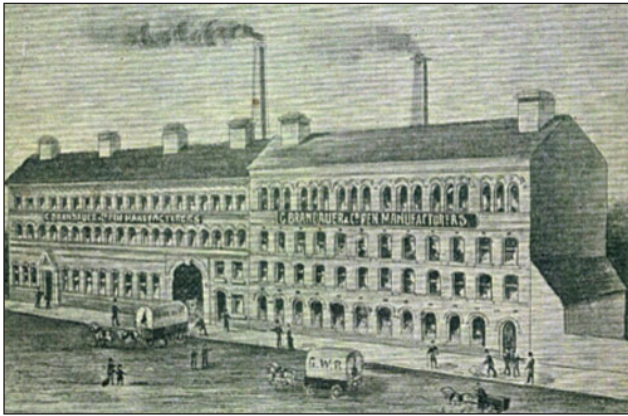


The Saltworks Museum - with obliging flamingos!



Moving the salt from the protected piles

From Pens to Particle Physics: the story of a Birmingham family business



Left: The Brandauer factory in the 1890s.
Right: Steel pen production was highly labour intensive. This is a Slitting Room where the all-important slit was added to the pen by ladies using fly presses.



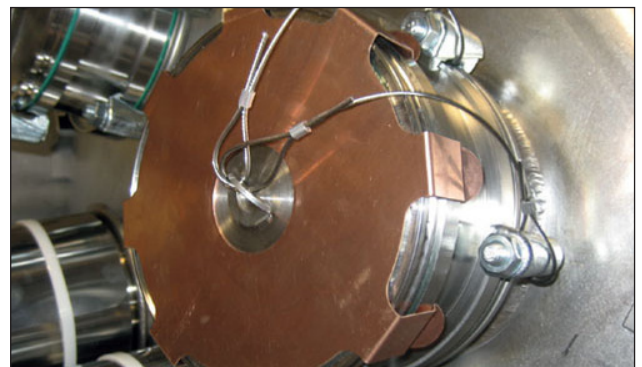
Mrs Fanny Phillips 1877 - 1972. The Company's longest serving employee with 71 years service!



A point-of-sale advertisement for one of Brandauer's most popular pens



Left: Charles Dickens featured in this typical example of early Brandauer advertising.
Centre: BSR Record Changer. Right: Parts for use in Push-fit Plumbing fittings, typical of today's mass production. Below Left: Airspeed Oxford leaving Canley. Below Right: Large Hadron Collider pressure relief spring.



December 2012: John Berkeley OBE*From Pens to Particle Physics: the story of a Birmingham family business*

Report by Arthur Astrop

By the mid-19th century, Birmingham was firmly established as the world's centre for the manufacture of steel pens. In fact the City was at one time home to more companies involved in that trade than in the whole of the rest of the world put together. Most of the companies were small to medium-sized, and the majority were to be found in the City's Jewellery Quarter, but 1862 saw the arrival of a newcomer. The frontage of its premises, a substantial 3-storey building at 403/407 New John Street West formerly owned by Thomas Derrington, a rifle and pistol maker, bore the name C Brandauer – Steel Pen Manufacturer. The new company was destined to become a significant force in the pen trade, and later to hold a similar position in the high-precision small-parts presswork industry, an activity in which it prospers to this day. The year 2012, therefore, saw it celebrating its 150th Anniversary.

It would be difficult to find anyone better qualified to trace the history of the Brandauer Company than WIAS member John Berkeley who, as that Company's Chairman, led the celebration of its 150th anniversary. John has lately retired as chairman but remains a director, and under the title *From Pens to Particle Physics* he delivered a memorable presentation to the Society's final meeting of 2012.

The demand for steel pens (nibs) and pen holders throughout the world, pouring in from schools to offices, from draughtsmen to map makers, from calligraphers to artists was, until approximately the mid-20th century, apparently limitless. Hence the number of companies offering and producing them in huge quantities and in an enormous range of different styles, colours, qualities and shapes.

At first sight, the steel pen is a deceptively simple item, but in practice its manufacture required a large number of successive operations, from preparing the raw strip steel in strictly-controlled gauges, through to the finished product. In between, each pen was subjected to a series of blanking, stamping, forming and slitting operations, often performed by tools in manually-operated fly presses, with annealing processes in between, and culminating in de-burring, heat-treating and chemical colouring. The 'colouring' of pens was generally regarded as a trade secret and in a Brandauer Board minute as late as May 1946 it was recorded that three of the Directors 'had been initiated into the processes of the No 4 Department', the area of the factory dedicated to the arcane art of pen colouring.

Traditionally, the industry employed large numbers of female operatives, not least because of their innate manual dexterity, and it was customary for each to perform one operation only. Thus, long rows of benches with fly-presses arranged side-by-side were a common sight, and each operator, once trained and having become skilful, would handle very large numbers of pens per shift.

For some operations, drop presses were also required, driven by overhead pulleys and shafting. Each press was tripped by a foot pedal, so that the operator could use both hands to position a pen accurately in its die. When a battery of such machines was in 'full song' striking simultaneously (but not necessarily in synchronism!), the noise must have been deafening. No ear-defenders in those days, nor safety guards and there are records of boys as young as 9 ½ in the raw material departments.

Finished pens were packed in small highly-decorated cardboard boxes, many of which bore outstanding examples of artistic design and colour printing, and to this day are regarded as highly collectible. Each box would contain a gross (144) of nibs, the quantity determined by weighing rather than by counting.

By today's standards, working hours were long (often as much as 57 or more hours a week), and conditions were rigorous. Workshops were heated by coal fires, but employees were required to provide their own fuel, and were also required to clean the windows of workshops regularly. Failure to meet these conditions, also to maintain quality standards of manufacture, was dealt with by a complex system of fines. It was those rules that undoubtedly contributed to the formation of a Penworkers Union in 1897.

In November 1901, the Company became C Brandauer & Co Ltd, the name under which it trades to this day, and in its first full financial year it recorded a payout to directors and shareholders of £13,200, equivalent to over £1m today. Business was booming, but all too soon WW1 came and the factory turned to producing war material such as pressed steel rifle cartridge clips.

The end of WW1 saw a return to established product ranges which, in the mid-1930s, also included a variety of nibs for the fountain pens that were becoming increasingly popular. Soon, however, minutes of Board meetings show that the Company was investigating the possibilities of diversifying into other types of light press work. WW2 saw Brandauer once again involved with war work, receiving contracts from, among others, Lockheed in Leamington, for components including 'undercarriage parts' for Airspeed Oxford aircraft, then being made by Standard in Coventry. The pre-war decision to widen its range beyond pens and into 'steel pressings in general' had proved to be a wise policy.

In the 1950s, Birmingham Sound Reproducers (BSR) introduced a range of manual and automatic record players, and by the 1970s was turning out no fewer than 250,000 per week. Brandauer was a major contributor of the many small pressed-metal components incorporated in those fantastically popular units.

But by then, time was fast running out for the manufacture of steel pens. The ball-point pen was increasingly dominant and in 1961, with the manufacture of steel pens down to only two days per week, it was decided to bring their production to a close.

And Birmingham itself was now changing rapidly. Old parts of the City were being redeveloped and one-time landmarks demolished. Brandauer had already adapted itself in the new needs of industry for light pressings, in many exotic materials besides steel, and demand equalled, indeed sometimes even exceeded, that for its steel pens. Components were now being made for Singer sewing machines, for the Harrier jump-jet aircraft, and not least for the Anglo-French Concorde.

Described by John Berkeley as 'probably its proudest and most significant achievement' is Brandauer's contribution to the Large Hadron Collider in CERN, Switzerland. Along both sides of the 27-kilometre long twin high-vacuum beam tubes of the LHC are pumping slot strips produced by Brandauer, their function being to maintain the operating temperature in the tubes at a constant -217 deg C.

In January 2001, Brandauer moved from its historic factory to more modern premises, albeit only a mere 200 metres away in Bridge Street West. Brandauer's original factory, now a Grade 2 listed building, stood empty for some years and time inevitably began to take its toll.

Fortunately, before its decline became irreversible, plans to redevelop it as a multi-occupation business centre have been drawn up and the intention is for the building to continue to bear the Brandauer name on its frontage.

January 2013: Alain Foote

The English Electric Company 1918 - 1968

Member Alain Foote opened the New Year with our second highest attendance of 78 people who enjoyed a comprehensive review of the English Electric Company's 50 year history. This covered its formation, growth and demise and reviewed the products and plants involved.

EE was formed as a public company in 1918, merging a number of participants in the electrical industry, primarily, Dick, Kerr & Co and The Coventry Ordnance Works, to meet the expected demand for electrical machinery following the end of WW1. The founding directors all had backgrounds in shipbuilding and railway equipment.

Dick, Kerr dated from 1863 and incorporated a number of diverse engineering companies including Britannia Engineering in Kilmarnock, English Electric Manufacturing in Preston and notably, Willans & Robinson in Rugby. AEG Electric was acquired from the Controller of Enemy Property followed by The United Electric Car Company in Preston and The Phoenix Dynamo Manufacturing Company in Bradford. The Coventry Ordnance Works was a joint venture by shipbuilders John Brown, Cammell Laird and Fairfield to manufacture heavy guns in competition to Vickers and Armstrong Whitworth.

Post war growth continued in 1920 with the purchase of the Siemens Dynamo works at Stafford which had been compulsorily acquired by the government during the war. Another Siemens company jointly owned was Siemens & Electric Lamps Co.

At the British Empire Exhibition at Wembley in 1924 an engine plaque showed English Electric headquartered at Queen's House, Kingsway in London with five principal subsidiaries: Ordnance Coventry, Dick-Kerr Preston, Siemens Stafford, Willans Rugby and Phoenix Bradford.

However, this sprawling conglomerate did not find commercial success in the 1920s and in 1927 sold its half share in Siemens & Electric Lamps to raise cash. The next year the Coventry Ordnance Works, practically dormant since 1922, was closed and later sold in 1930. In 1929 a loss of £47,000 was declared and Lazard's stepped in with new capital. In 1930, Westinghouse of the USA and other American backers took control appointing George Nelson from Metropolitan-Vickers as managing director.

Nelson set about a badly needed reorganisation and the company slowly recovered, much helped by the rearmament programmes of the late 1930s. EE made a great contribution to the war effort and in 1942 took control of Napier, the aero engine maker. The company expanded greatly to employ some 30,000 and double its assets to £16.5 million by the end of the war. From inheriting a near bankrupt business in 1930, Nelson now headed one of the largest engineering companies in the UK.

Post-war EE developed its interests in aviation, electronics, computers (in collaboration with NPL) and heavy engineering. In 1960 EE sought a merger with GEC but its approach was rejected. In the same year, under government pressure, EE Aviation was merged with Vickers-Armstrong, Bristol Aeroplane and Hunting Aircraft to form the British Aircraft Corporation. The loss-making Napier business was sold to Rolls Royce and diesel engine manufacturer W H Dorman was acquired in 1961.

In 1963 the computer interests expanded with a joint venture with LEO Computers (Lyons Electronic Office) as English Electric LEO, to which EE's Marconi computer operations were later added. The guided weapons division went to BAC. Ruston & Hornsby and Elliott Automation were the last major acquisitions by EE and in 1968 the Wilson government created International Computers (ICL) by merging EE's interests with those of International

Computers & Tabulators (ICT). In the autumn of the same year Plessey made an unwanted £260 million bid for EE but a white knight in the person of Arnold Weinstock's GEC gained government approval and the General Electric and English Electric Company came into being. Within a couple of years English Electric was quietly dropped and so ended 50 years of mixed fortunes in engineering.

A review of EE's products in the 1960s shows that it had spread itself too thinly for its resources and sowed the seeds of its own demise as a result. The main products included: generating plant for steam, water, gas, oil or atomic power; electric traction and transport; marine equipment; aircraft, equipment and guided missiles; transmission systems, switchgear and controls; meters, instruments and relays; substations and converting plant; electrical equipment; computers and domestic appliances.

All these activities were liberally illustrated with some evocative slides. Steam turbines and generators impressed by their scale as did water turbines. Gas turbines reminded us of the adaption to peak lopping generators of aircraft engines, notably the RR Avon. The diesel engine interests ranged from stand-by generators to rail traction, including the interesting but troubled 1750 hp Napier Deltic engine also used in minesweepers and fast attack craft. Trams, trolleybuses and locomotives included an early (1934) diesel-electric unit and later mainline locomotives, even a gas turbine version.

EE was more successful with its aircraft. A number of the founding companies had been involved in aircraft manufacture during WW1. The first EE aircraft, the Wren, flew in 1923 but after building a few flying boats the aircraft department was closed in 1926. However, under the rearmament programme begun in 1936 EE was chosen to build the Handley Page Hampden medium EE bomber. By the end of the war EE had built 2,500 Halifax and 770 Hampden bombers. In 1944 contracts were awarded to build de Havilland Vampire jet fighters of which over 500 were produced.

Two outstanding aircraft from EE were the Canberra and the Lightning. The Canberra, inherited from Westland, was the first jet-propelled bomber produced in Britain. It first flew in 1948 and was the most advanced aircraft of its kind in the world at that time. 1,400 examples were built over a service life approaching half a century. Production of the Lightning was held back by the belief in the late 1950s that manned fighters would become obsolete, but eventually 337 examples of the Mach 2 capable machine were built over some 30 years.

A specification for a Canberra replacement was drawn up in 1957. The design was extremely ambitious and the government decided that it would be built by Vickers-Armstrong and EE. This aircraft became the BAC TSR-2, and we all know what happened to that project!

EE's contribution to guided weapons, Thunderbird and Bluewater was limited in extent but its domestic appliances included cookers, refrigerators and televisions. Of greater importance was its contribution to the early development of computers in the UK. The Luton Analogue Computing Engine (LACE) resulted from war-time work on thermionic valve technology, whilst the Digital Electronic Universal Computing Engine (DEUCE) came from collaboration with NPL to develop the ACE (Automatic Computing Engine) inspired by Alan Turing and built by NPL in 1946.

The well-illustrated review of EE's many sites served again to demonstrate how widely the company's assets had been spread and the potential for rationalisation and cost saving that existed. All in all, a salutary reminder of an interesting period in Britain's industrial history.