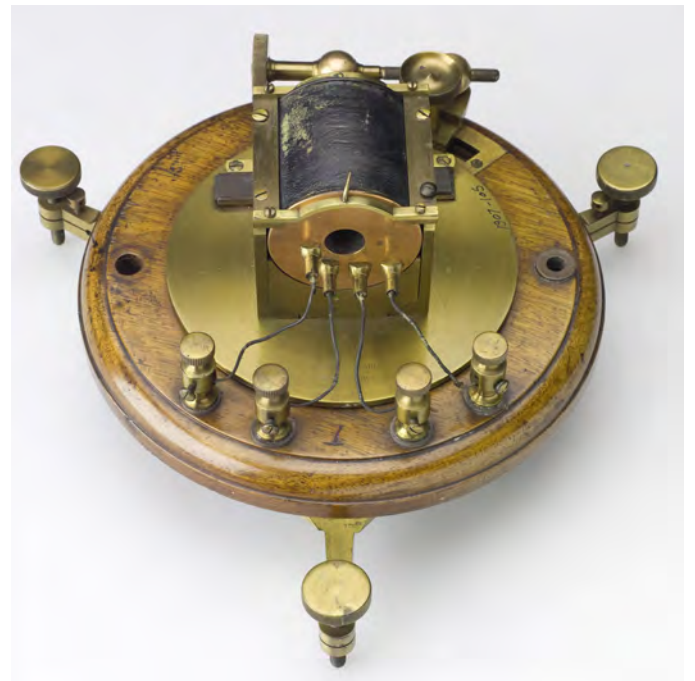
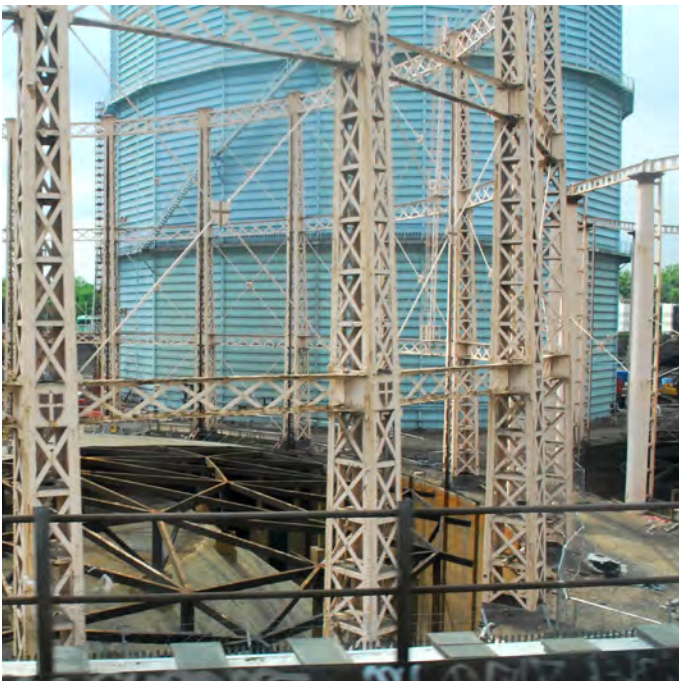


# NEWCOMEN Links

*Information Age;  
History in Manchester;  
Puffing Billy, Wylam Dilly & Billy;  
STICK in Scotland;  
Battersea's Gas Holders;  
Watchmaking; Slacklands;  
Post-graduate Courses;  
BL's Sound Archive;  
news; events  
& more.....*





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*The Newcomen Society President:*  
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### The front cover images

Clockwise from top right: A sectioned, operating, model of Wylam Dilly ©National Museums Scotland.

A Thomson mirror galvanometer (land type), 1858, ScM Inv 1907-105. ©Science Museum / Science & Society Picture Library.

The Battersea No. 6 holder from the east.  
©M Tucker

**Jonathan Ayle** chairs the North Western Branch of the Society and a member of Council. He is currently researching development of cold war technology at the Manchester Institute of Innovation Research of the University of Manchester.

**Michael Bailey** is a Newcomen Fellow, who joined the Society in 1973. He is an author and lecturer on early railway and locomotive history, and represents the Newcomen Society for the 'International Early Railways' Conference series, and is a co-editor of the Conference publications.

**Robert Carr** pursued an academic career initially in theoretical physics. More recently he has been engaged in industrial archaeology.

**Andrew Cunningham** is a Chemical Engineer by training, who spent his career in the Chlor-Alkali industry in Cheshire. He has a long-standing interest in engineering history and industrial archaeology.

**Alexander Hayward** is a Member of Council, Founding Chair of STICK and Keeper of Science and Technology, National Museums Scotland.

**Stephen Hughes** is Projects Director, Royal Commission on the Ancient & Historical Monuments of Wales and Vice-President ICO-MOS-UK

**Philip Ingram** had a career in IT with ICI, and is now extending his interest in historic technology out of the 21st century to earlier times. He regularly attends Newcomen Society meetings in Manchester and is now on the group committee.

**John Liffen** is Curator of Communications and Electricity Supply at the Science Museum, London, and is a content developer on the Information Age project team.

**John Porter** has degrees in mechanical engineering and naval architecture, and spent all his working life with merchant ships. Sailing on steam driven ships led to an involvement with the preserved Cornish engines at the Kew Bridge Steam Museum.

**Fred Starr** is a metallurgist who has specialised in gas manufacture and electric power generation. He is greatly interested in technical developments in the 20th Century and recently helped set up the Conference on the Piston Engine Revolution. This tied in with his other main interest, the history of aircraft design. He is the London meetings' Secretary.

**James Sumner** is a lecturer at the Centre for the History of Science, Technology and Medicine, University of Manchester

**Malcolm Tucker** is a chartered civil engineer, formerly with Ove Arup and Partners. He makes use of his special interests in the history of structures including 19<sup>th</sup>-century structural ironwork, and nearly a lifetime's experience in industrial archaeology, as a freelance engineering historian and archaeologist.

## Writing for Newcomen Links

Relevant articles and items of news may be submitted to be considered for inclusion in Newcomen Links.

**Articles** should be a maximum of 1000 words and sent in Word format by email.

**Images** should be sent separately by email in jpg (digital) format of 300dpi minimum. They should not be embedded in the text of the Word document.

**Copyright and reproduction** issues on images, including diagrams, must be considered and wherever possible permission for publication granted. It is not possible to receive photographs/scans of images in books etc.

**The copy date for the next issue is 1 August 2014**

Please submit articles, information, details of events etc to:  
The Editor,  
Deborah Jaffé at: editor.links@newcomen.com  
07798 603000

**Copy date for the next  
issue of**

**Newcomen Links**

**1 August 2014**

editor.links@newcomen.com  
www.newcomen.com

## From the President

Since our last Newcomen Links significant administrative changes have taken place. Sarah-Jane Stagg has been appointed as Administrator and Margaret Heath as Bookkeeper. They are both very experienced in their respective work, and have worked for charities. We welcome them to the Society and its members. Our office at The Science Museum has been 'rationalised' and is being rearranged to accommodate not only our new administrator and bookkeeper but also the Society's smaller meetings.

In March, Vice President Michael Grace, Company Secretary Julia Elton and I as President, met our Patron, HRH The Duke of Gloucester, at Kensington Palace. His Royal Highness has a wide interest in technology, construction and transport and we updated him on the Society's work and plans for the future. Our discussions ranged over interesting topics from electricity generation and distribution to the Ctesiphon system of construction as recorded in Michael Grace's article in Newcomen Links No 228 (December 2013). His Highness viewed videos of both the Elsecar atmospheric engine and the full-scale working replica engine at the Black Country Living Museum. We outlined the Society's programme of events and are delighted that he has graciously accepted our invitation to attend a day of this year's Summer Meeting.

The Meeting runs from 14 to 18 July and will include interesting visits to the Rolls-Royce aero-engine factory, Airbus Industrie; Cattybrook, a vast modern brickworks on an historic site; Bristol University's internationally renowned seismic vibration test-laboratories; the Library and extensive 'large objects' collection of the Science Museum, and the GWR's unique chain-testing laboratory in Swindon. A highlight will be a visit to the ambitious Bloodhound Project, Britain's new challenge to the world land-speed record. A Typhoon fighter-jet engine and a rocket together producing over 20T thrust, will power the vehicle up to 1,050 mph, faster than a bullet fired from a Magnum 357!

I look forward to welcoming delegates at the President's Reception on 14 July in Swindon.

*Geoff Wallis*

## From the Editor

I am delighted that Newcomen Links has increased from 24 to 28 pages due to the vast amount of material that is submitted. It will now be possible to publish relevant articles of up to 1000 words. Even with four extra pages, this issue is packed.

Articles often evolve and what began as one on Puffing Billy at 200, following John Liffen's lecture at the Science Museum, has become a compilation on Puffing Billy, Wylam Dilly, Billy, an Inauguration and a Publication. There are also: two views of being a Meetings' Secretary; a preview of Information Age, the Science Museum's new galleries; a report on the gas holder rest frames, now being dismantled, at Battersea; photographs from the Slacklands collection of 'engineering' constructions, many from the Cold War and in ruins that appear on the landscape; a description of the minutiae of watch making and its long history in Geneva; articles on the Scottish Technology and Industry Collections and Knowledge, Edinburgh International Science Festival, Manchester Histories' Week and postgraduate studies in the history of engineering and technology as well as news and diary events, including a big conference in Wales.

I have compiled a stage-by-stage guide on how to access the Members' Area of the website – please do not be put off, it is very easy. It is important to access this area, not only for our own archive of past papers, but also as more material is web based and articles have an increase in the number of internet links some of which will be posted here. Stephen Hughes' report on the Atlanterra Project is a case in point. This is a detailed report with many links to web sites, on line animations and You Tube. So, a précis of the introduction is published here, and the full report with live links will be posted in the Members' Area.

Reports from the Branches are an integral part of Newcomen Links. Fred Starr's lecture on Frank Whittle's Turbojet is apposite as much of the laying out and design of this issue was done whilst listening to the captivating music of Public Service Broadcasting and especially the Spitfire track. Rather like Steampunk, they illustrate the influence that the history of engineering and technology can have on the creative mind.

Once again, many thanks to the authors and news gatherers for their contributions and to the SSPL at the Science Museum; the National Museums of Scotland; the Musée Patek Philippe in Geneva and Margaret Howell Ltd for permission to use their excellent photographs.

The September issue will have reports of the Summer Meeting and also a complete listing of all the Branch events for 2014/15. Please, do keep sending me articles, news, and other material. The joint effort makes this an exciting enterprise!

Have a good summer.

*Deborah Jaffé*

# Newcomen Matters

## Publicity Material

We have designed a publicity postcard to accompany the canvas bags. The A6 size postcard has details of the Society and contact information on the reverse. It is ideal for handing out at public meetings and to place on exhibition stands as a means of publicising the Society and enticing new members.

The postcards and the canvas bags are available from the office.

Please contact:  
editor.links@newcomen.com  
for more information.



## Book Reviewer Needed

Are you able to review a book?

The book is:

Punched-Card Systems and the Early Information Explosion, 1880-1945, Baltimore: Johns Hopkins University Press, £34

The review is for publication in The International Journal for the History of Engineering and Technology - The Newcomen Society's Journal. You may not be interested yourself but know of a suitable person and the reviewer keeps the book afterwards.

If you are interested please contact Robert Carr at:  
rjmcarr.london@gmail.com

## The Office

We welcome Sarah-Jane Stagg on her appointment as our office administrator our new book-keeper Margaret Heath. Sarah-Jane can be contacted at:  
office@newcomen.com  
020 7371 4445

## At the AGM

Jonathan Aylen, Edward Marshall and Matt Thompson were elected to Council at the AGM in February.

## Congratulations

Congratulations to Michael Bailey, a Past President of the Society, on his appointment as President of the Stephenson Locomotive Society, the world's oldest railway society and on the publication of his new book *Loco Motion*.  
*See pages 11 and 25*

## We welcome the following new members:

Tim Barmby, Peter Boaden, Sean Bottomley, Mark Bowman, Bob Cann, Margaret Doring, Neil Hardwick, Roger Hennessey, David Higginson, Piers Hugill, Charles Johnston, Donald Mackinnon, David Morgans, Timothy O'Connell, Gina Ramsay, Malcolm Ross, Xianbin Sun, Russell Thomas, Colin Tyson, Willem de Vries, John Wilson and Fraser Yates

## Did you receive a copy of NewcomenLinks e-news by email?

The first issue of Newcomen Links e-news was emailed in April. It is intended to email the e-news between the print issues of Newcomen Links - about six weeks after publication. Its purpose is to keep members updated on the latest news, as well as slipping in those

short pieces that 'miss' the copy date. It is emailed as a single sheet PDF without illustrations so will not use up too much printing ink.

In no way is it a replacement for Newcomen Links, but an addition and way to improve the Society's communication with its members. We are, howev-

er, aware that there were some problems with the mailing. Some members got a 'corrupt' file and others did not receive it at all.

If you were one of these people, and have an email, address please let our Membership Secretary know by emailing: [membership@newcomen.com](mailto:membership@newcomen.com)

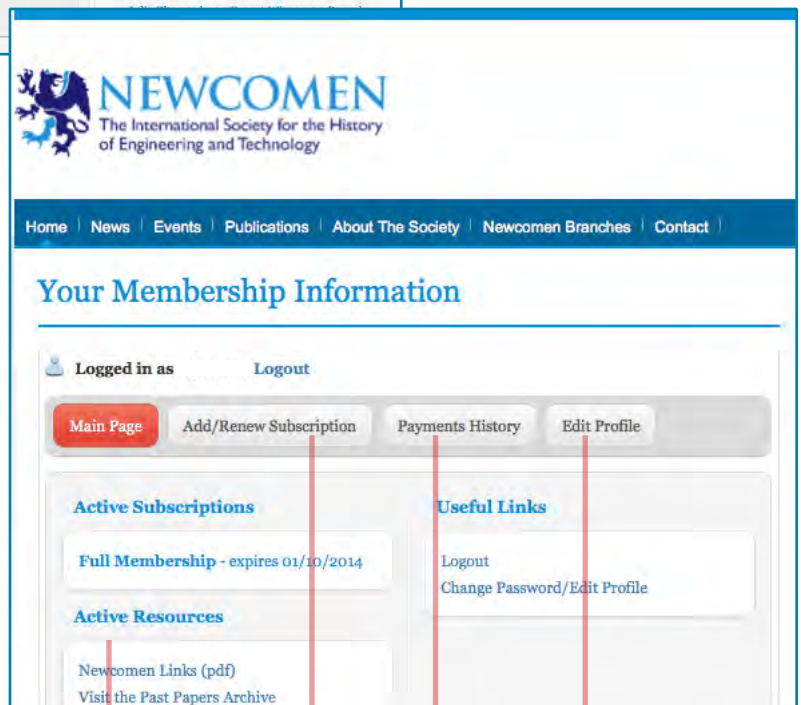
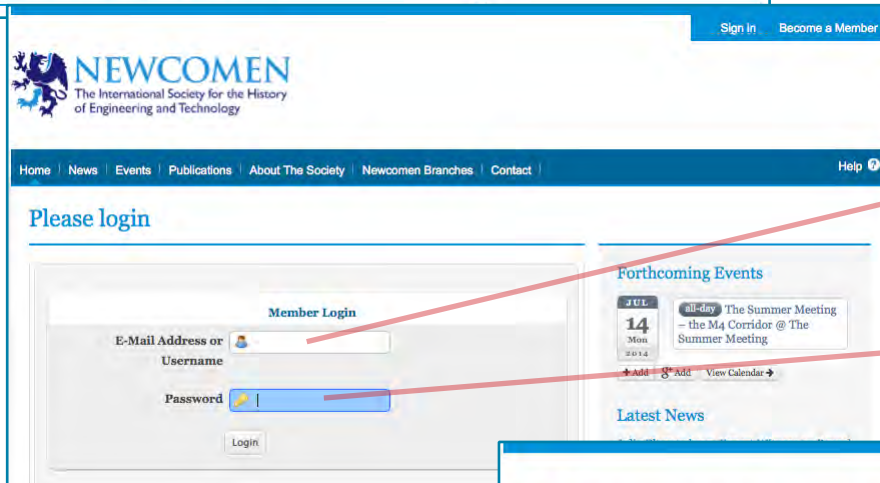
NEWCOMEN  
Links.....e-news 1

e-news from the Newcomen Society  
April 2014

Welcome to e-news from the Newcomen Society. This is an update to members of the latest news, events, reminders and items that have 'just missed' a copy date of Newcomen Links. It is not a replacement for NLinks or the website. We are aware of the costs of printing sheets of paper with colour images so we are keeping it simple - there are no pictures or colour, just a black and white text document.

# Using the Members' Area of the website - www.newcomen.com

how to get there in stages



1. Go to [www.newcomen.com](http://www.newcomen.com)  
The Home Page  
Click on Sign in

2. This will bring you to the login page of the private, Members' Area.  
Enter your email address  
3. and password.  
These should be the same as the ones the Society has for you.

Arrive at your Membership Information of the Members' Area:

4. When it is due, renew your subscription here.

5. Check your payment history.

6. Edit your profile - change of email, postal addresses etc.

7. Under Active Resources see the content of the Members' Area and click on which ever one you want to bring up.

4

5

6

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# On Being a Newcomen Meetings' Secretary.....

## Perks of the Job

**Fred Starr**

Being the Meetings' Secretary of what some people call the London Branch, and others that of the Headquarters, is that I am able to invite the lecturers to have a coffee and cake in the Science Museum café, before we go over to the Directors Suite. A pub would be even more convivial, but I have learnt from (not my own, I hasten to add) experience that the partaking of that kind of beverage leads either to a complete drying up when on the stand, or unwarranted over confidence in whatever words of wisdom and jokes that spring to mind.

These pre-meeting gatherings often result in *mini-conversazioni* between Newcomen members and guests. Often, the lecturer brings a number of non-members, who have a special interest in the topic. So, they join in too. There is the possibility of recruitment to the Society, which is important, of course. But through the breaking-of-the-ice, there is more chance of these people joining in the discussion, following the lecture.

Since last Christmas, we have been especially fortunate with these pre-match sessions. In January, we had Jonathan Ayles' talk on how Britain's engineers literally put together the "Blue Danube", our first atomic bomb. This attracted a number of "strangers", who might get us entry to unusual sites.

The last three talks have had, directly or indirectly, the common theme of milling. In February Geoffrey Smith gave us another "bang-on" talk on the invention and development of gunpowder. A sixth form student, doing a project on the history of gunpowder was accompanied by her mother, and a PhD student from York University, researching Robert Boyle and gunpowder, joined the *mini-conversazione* before the lecture. Both of these young women were looking for new insights and contributed to the post lecture discussion. Geoff has determined the cause of a rather odd phenomenon that occurs during the milling/grinding of the components that make up gunpowder. For centuries, it has been noted that during this procedure, the gunpowder gets damp. Geoff thinks that this is the result of a reaction between the calcium nitrate, which is an impurity in saltpetre, and traces of potassium carbonate in the charcoal. The by-product of this reaction, insoluble calcium carbonate, is responsible for the white fog of war which enveloped battlefields until the turn of the 19<sup>th</sup> Century. Another astonishing fact, reported by Geoff, is that gunpowder will not burn in a vacuum. The volatiles which are needed for ignition are lost. How this surprising observation must have impacted on Boyle's nascent views on the mechanism of combustion is food for thought

The other two lectures have been on flour milling *per se*, modern and medieval. Rob Shoreland-Ball spoke to us in March about the need to give recognition for roller milling as "new" industrial history. Although rolling milling of flour dates back to the 19<sup>th</sup> century, it took some time to become established in Britain. Most of us have heard of roller milling and the impact it began to have on health, but do not quite know what goes on. It is simple. There is a speed difference between the pairs of rolls, so that the grains of wheat pass through are sheared. But just as roller mills have replaced the classical method of producing flour with mill stones, a very large number of roller mills are disappearing as the industry becomes more centralised. The massive buildings, housing sets of rolls, with flour and grain conveyors going up and down the floors are either being demolished or are being converted into



*A mini-conversazione*

apartments and offices. With them go classical brands of flour like McDougalls and BERO. A big question is just how one should go about preserving a roller mill from, say the 1930s? It is good that Rob, with his long experience in the field of industrial archaeology and preservation is taking up this cause.

In April, Colin Rynne, from the University of Cork, spoke about medieval water mills in Ireland. He explained that the hilly terrain and high rainfall resulted in the construction of numerous mills of the horizontal type. Here the mill axis is vertical, and a jet of water impinges on the blades of the wheel. Some of the designs were extremely sophisticated, having curved and shrouded blades. During the *mini-conversazione*, at the Science Museum, Colin told us of his family's connections with many of the key people in Ireland's literary and political history.

As Meetings' Secretary I am looking forward to many more *mini-conversazioni*. So if your pockets are deep enough to withstand the cost of refreshments at the Science Museum, do come and join us. You will learn things you did not know about our industrial history and a lot more besides!

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*The Newcomen Society  
Calendar of Branch meetings  
and listings of other events  
are on pages 26-28*

*The full listing of lectures  
for  
2014/15  
will be published  
in the September issue*

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## Seen...



### A Wooden Door with Holes

Robert Carr has found this intriguing door and is curious to know more about it. It is in the street at the back of a public house in North London and at first sight it appears infested. The door itself is about 3ft 3in high and is roughly 5ft from the pavement, with a pair of steel doors beneath it. The holes in the wood are probably there for ventilation. Is this a unique one-off example or quite a common object, perhaps the result of ingenious adaptive re-use? Has anyone seen this kind of thing before - they might have been ubiquitous once?

## Comment.....

### Engine or Engines?

*John Porter responds to Robert Carr's letter in Newcomen Links 229, March 2014*

I think Robert Carr is looking for too much logic in the definition of whether a marine steam propulsion unit is an 'engine' as a whole, or is made up of individual 'engines', each one associated with a crank throw.

In the 19<sup>th</sup> century it was not unusual to refer to the 'engines', as Kipling does in McAndrew's Hymn published in 1894. In this case, Kipling was drawing on his experience in voyaging to New Zealand in the 'Doric', a steamer of 4784gt. It was built by Harland and Wolff in 1883 for the White Star Line, but chartered out to the New Zealand Shipping Company at the time of Kipling's voyage. By 1894, talking about 'the engines', meaning the components of the main propulsion unit, must have been confusing given the advent of twin, and triple screw ships and three and four cylinder triple expansion engines. A multi-cylinder propulsion unit must have become an 'engine', just as it is today.

Having written the above, I then tried to find out more about the Doric's engine. The little data I could find states that, although she had only one screw propeller, she had two compound steam engines with a total of four cylinders. I have yet to work that one out!

Some reading of the contemporary literature is called for.

**Please send material for the Seen and Comment Sections to: [editor.links@newcomen.com](mailto:editor.links@newcomen.com)**

## What Makes a Great Evening at Newcomen?

*Jonathan Ayles*

Newcomen members are a bloodthirsty lot. Analysis of attendance at recent Newcomen branch meetings in Manchester suggest military topics head the list of popular topics. Naval calamity among World War 1 submarines and cracking the Enigma code in World War 2 brought big audiences to recent branch meetings in the North-West. These topics are not just attractive to members, they bring guests in droves and act as a showcase for the Society.

That is not to say all meetings should be scheduled as crowd-pullers. There has always been a strong element of scholarship among Newcomen members. Traditional topics often provoke detailed debate among the membership. As one new recruit to Newcomen said in 2014, 'Forget the topic - I'll join for the discussion within the audience.'

Early steam engines are central to the culture of the Society, but modern internal combustion engines are also a controversial and hotly discussed issue. Members often have a deep understanding as a result of many years maintaining and refitting petrol and diesel engines.

Electronic topics are popular too reflecting the fact that many members work in the fields of computing and automation. Society members have experienced the switch from analogue to digital in their working lives. There was lively discussion after a recent North-West Branch session on how the cassette tapes fought off the challenge from digital recording techniques. While the cassette tape player may seem a footnote in the history of technology, it brings into sharp focus issues such as consumer appeal, ease of use and the way we all get locked into particular technologies.

The response of audiences to the humble cassette player suggests Newcomen is missing a trick in its lack of coverage of domestic technologies. Where are the detailed papers on fridges, TVs and washing machines? These too were engineered. They were major innovations that transformed lives. Fortunately the London branch is due to hear Martin Gregory's talk on the sewing machine. Manchester will learn about Frank Hornby's transformation of all our childhoods with his mechanical toys. But there is nothing on shopping, or modern logistics in current branch programmes.

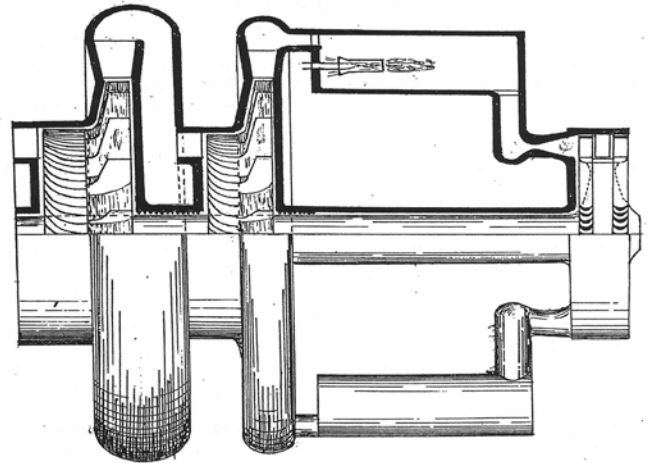
In many fields of technology the interests of Newcomen overlap with those of other societies with local branches. The Institution of Civil Engineers has an active historic engineering group which has done much to record the structures which form part of our engineering heritage. It makes sense for Newcomen branches to collaborate with other professional bodies to bring in audiences in key areas of overlapping interest in civil and structural engineering. Again, in Manchester there is an Association of Engineers who focus on mechanical engineering. Their members are keen to join Newcomen meetings to learn of past practice as well. It is often the case that an informed audience makes the meeting, just as much as the speaker.

# Lost Opportunities: The Whittle Turbojet Demonstrator of 1929

## A Lecture to the Western Branch by Dr Fred Starr

This was an eagerly awaited talk, especially as Sir Frank Whittle's son, Ian Whittle, was in attendance and had made some of his father's early papers available to the speaker. They had met some time ago when Fred Starr had heard a lecture by Ian Whittle, in which the unbuilt jet engine demonstrator was mentioned.

The speaker described the engine proposed in Whittle's 1928 thesis, written while still a student. It was really a kind of turboprop, but the concept was quickly developed and in 1929 the turbine driven propeller gave way to simple nozzles producing thrust. Whittle's great invention is illustrated in his well-known patent sketch. The turboprop, had its supporters in the Air Ministry, led by Griffith, and the two of them met to discuss Whittle's novel ideas. Famously they disagreed, and even at this late date their disagreement produced a lively debate after the talk; each having their supporters.



Sketch of the proposed jet engine demonstrator

It is very strange that the superior high temperature properties of KE965 seem to have been unrecognised in this country. Instead, when Whittle began work on his prototype jet engine, the WU, in 1936, his turbine blades were made from Stayblade, which seems to have been inferior to KE965. Stayblade was found to be barely acceptable, since like all the engines of the time, the Whittle WU used a single stage turbine, in which blade stresses were very high. Accordingly, after 1940, Stayblade was replaced by Rex 78, the first useful British alloy.

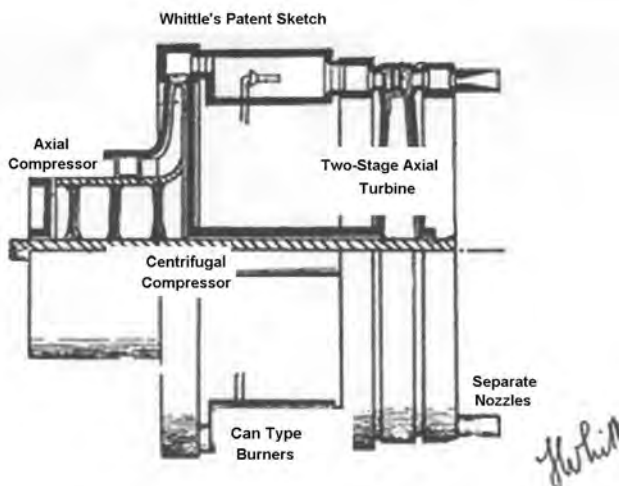
The speaker concluded by suggesting that Whittle's demonstrator could have first run in 1931 using KE965. The weight of the demonstrator would, he thought, have been similar to the axial flow machines built in Germany in the 1940s and given Britain a five-year lead in this important technology. There would have been a production version producing 1700 lb thrust in 1935, leading to a 450 mph Spitfire in 1937, and perhaps the sound barrier could have been broken in 1942. All of which produced wry smiles from all present, including Dr Starr.

Ian Whittle made particularly useful and supportive remarks on the paper, which were greatly appreciated and there was a lively discussion.

In thanking Dr Starr and Ian Whittle for their presentation, it was mentioned that Gordon, in 1845, had produced and demonstrated a jet propelled boat using a bellows to blow low-pressure air into a sealed brazier of burning coal, and expanding the hot exhaust products in a tailpipe that led from the brazier into the water, producing enough thrust to propel the boat.

*Dr Starr will be presenting a modified and developed version of the talk, in London, in April 2015, with support from Ian Whittle. He had raised many useful and interesting points, but his alternative history was expounded, perhaps, with his tongue firmly in his cheek!*

**A full listing of Frank Whittle's patents can be found at the European Patent office website:  
[www.worldwide.espacenet.com/search](http://www.worldwide.espacenet.com/search)**



Whittle's patent sketch of his jet engine showing axial flow and centrifugal compressors, can-type combustion chamber, two stage axial turbine to drive the compressors, and separate nozzles to produce thrust.

In 1930 it was entirely possible to build the demonstrator, and the excuse usually offered that it was impossible as there were no suitable high-temperature alloys, was erroneous. The proposed demonstrator would have used two centrifugal compressors, in series, and a two-stage Curtis turbine.

Fred Starr has made the design calculations for the demonstrator using, wherever possible, the data from Whittle's papers. Firstly, he pointed out that turbine blade temperatures are much less than turbine inlet temperatures and showed, by calculation, that the first stage blade temperature was only 575°C when the turbine inlet temperature was 715°C, even though the blading was un-cooled. These calculations are supported by experimental and other data from jet engines of the 1940s. He also noted that Whittle's use of a two-stage turbine, gave a low rotational speed, more than halving blade stresses compared to single-stage designs. The actual value was only 4.7 tons/in<sup>2</sup>.

Given these values of stress and temperature Fred Starr, a metallurgist by profession, demonstrated that KE 965, the standard alloy used in British spark-ignition engines for exhaust valves, from 1928 onwards, would have been quite adequate. But it was never employed for turbine blades in this country, although General Electric used it in turbochargers from 1928-32, until they began using a similar American alloy.

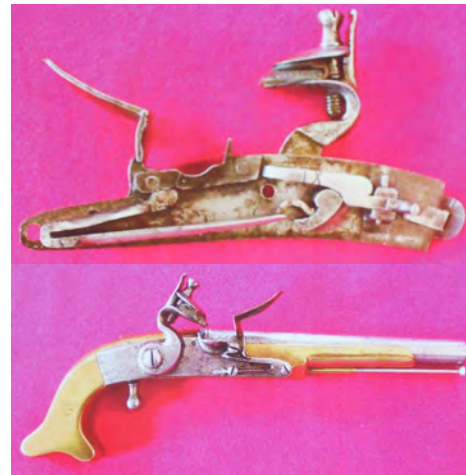
# Early Military Gunmaking in Birmingham and the Black Country

## *A Lecture to the Midlands Branch by Professor David Williams*

This talk aimed to add to the picture of the Birmingham military gun trade during the flintlock era from the rearming of William III to the Napoleonic Wars – the time of the Brown Bess. It sought to answer three questions on the trade: What came before the Birmingham trade and who were its competitors; How did the trade grow in 18th century; What was it like in the trade?

The early Birmingham trade, its approach of specialisation, and key competitors in London and the Low Countries was described. There followed an introduction of work to examine the known William III military muskets and the, as yet, unsuccessful efforts to locate one that was traceably made in Birmingham. Professor Williams continued by outlining the history, products and lifestyles of some of the town's key gunmaking dynasties including the Farmers and Galtons, the Ketlands, and the Richards. He described their part in supply to the Board of Ordnance and other customers including in the Americas. The different mechanisms for the control of quality and barrel proof were a recurrent theme in the presentation – these being ultimately resolved by the formation of the Birmingham Proof House in 1813. Some manufacturing processes were examined, including hot forging and the use of important hand tools, such as the gunmaker's hollow mill and the tumbler mill - specially designed to make one of the most complex components. David identified less well known but significant small tool suppliers including the Whitehouse family.

The talk was followed by a vigorous discussion. This included questions focussed on the practicalities of flintlock and other early military small arms: what was the match used in a matchlock actually like – a cord soaked in saltpetre; how big were the bores – big; how fast could they be shot – about 3 times a minute; was there any adjustment of trigger pressure – no, muskets were not aimed like rifles but shot in volleys so this was not appropriate; and how long did muskets last – notionally 12 years.



*Birmingham made military "Scottish" pistol of the 1780s by Issac Waters with a brass stock and showing the use of armourers marks (IX) to denote the set of components making up the lock.*

Other questions focussed on the processes used: how were things hardened, especially the springs, and how many reversals could they endure; how was rifling made and how long did it take; and, how many muskets and rifles were made. Responses to these reflected on the craft skills of the 18<sup>th</sup> century trade and the number and energy of people making things largely by hand. The discussion returned a number of times to the question of interchangeability – Henry Nock, born in Tipton, and his interchangeable screwless lock of the 1790s had been mentioned. This led to discussion of the approaches led by the French in the 18<sup>th</sup> century, and the 19<sup>th</sup> century use of machines, the influence of standards – including Whitworth and his threads (not liked by the gun trade because of their relative coarseness in the many thin plates used by the trade) and his work on rifling. David emphasised that in the 18<sup>th</sup> century gauging was used to control critical dimensions like the bore of the musket and to manage the fit of lock to the stock, but, within, for example the mechanism of the lock itself much was fitted with matched sets of components being identified with armourers marks typically made by strokes of the file.

## The Atlanterra Project and the Development of Interpretative Animation & International Slate Studies

*Stephen Hughes reports on the 'The Atlanterra Project and the Development of Interpretative Animation & International Slate Studies'. This is a report with many relevant, digital links. Below is part of the introduction, the full report, with live links, can be accessed in the Society's Members' Area.*

The development & international diffusion of innovatory survey & presentation techniques was one of the objectives of the Atlanterra: Green Mines Project which was brought to a conclusion in early 2014. The Project Partners also laid the Foundations for international studies of the building-stone and slate industries. The project examined the valorisation of the mining heritage and laid the foundations for World Heritage Studies of the building-stone and slate industries. It looked at the mining heritage from both a geological and archaeological/historical viewpoint and explored how to showcase it using new, digital technologies.

As a result The Royal Commission recently won the first Peter Neaverson Award for Digital Innovation, given by the Association for Industrial Archaeology, for its animation of

world's largest early/mid 19<sup>th</sup> century copper works - Hafod Copperworks in Swansea, south Wales, which can be viewed at: [www.youtube.com/watch?v=1Y8DAXaMihc](http://www.youtube.com/watch?v=1Y8DAXaMihc). Other industrial archaeological interpretative animation films can be viewed at: [www.youtube.com/user/RCAHMWales](http://www.youtube.com/user/RCAHMWales).

Utilising a wealth of survey carried out by the RCAHMW and their in-house expertise in industrial archaeology, combined with historic images from the West Glamorgan Record Office and Swansea Museum, the animation recreates the detail of buildings, machinery and processes on the site as well as a sense of the highly industrial nature of the Lower Swansea Valley.



*One of the surviving engine sheds and rolling machinery at the Hafod Copper Works site. Crown Copyright:RCAHMW*

**Please go to the Members' Area of the website to read the full report.**  
[www.newcomen.com](http://www.newcomen.com)

# 200 years

# of Adhesion Steam Locomotive Operations.....

This year marks the 200<sup>th</sup> anniversary of the first locomotives designed and built by William Hedley in Wylam and George Stephenson in Killingworth, both in the Northumberland coalfield. Two events have commemorated these important achievements, which began the development of the locomotive that led to the creation of a world-wide network of railways.

On 24 March John Liffen (member) gave a paper titled 'Puffing Billy 200' to an afternoon audience at the London Science Museum. In it he described Hedley's work in developing his first machine, now well known as *Puffing Billy*. After initial man-powered adhesion trials in 1813, Hedley made a first trial locomotive that was not itself too successful, but that led on the following year to two other, successful, locomotives which worked coal trains on the Wylam Wagonway for many years. *Puffing Billy* became very well known when it was acquired by the Commissioners of Patents (later London Science Museum) in 1865, where it continues to be displayed as the world's oldest surviving steam locomotive. John showed fascinating photographs of Puffing Billy including one from 1862, others of its arrival at the Science Museum and on display there.

Anthony Coulls, Senior Curator, Rail Vehicles at the National Railway Museum, spoke about the making and running of the reproduction Puffing Billy, now at Beamish. He described the intricacies and importance of making reproduction engines. Detailed knowledge can be gained of the engineering within these engines, even though Health and Safety directives might hinder exact replication, they do

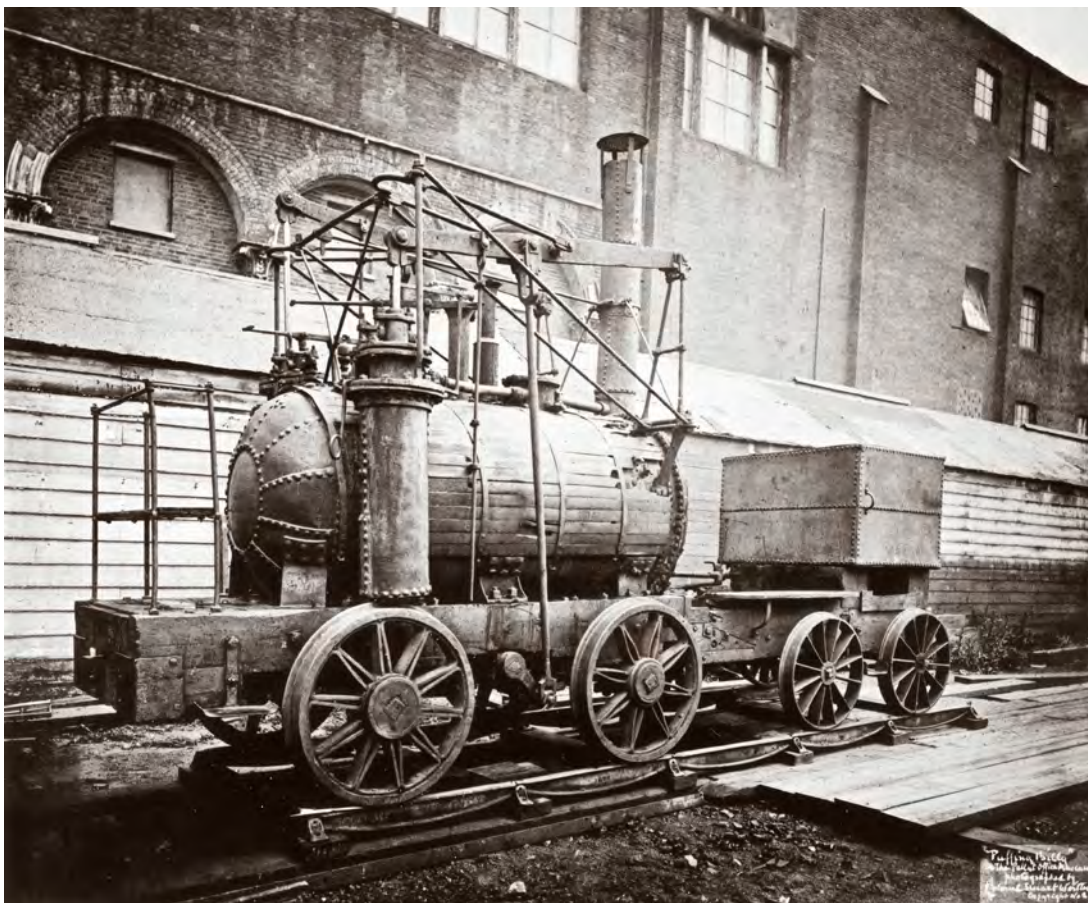
operate in steam with all the compromises that present-day requirements demand.

The second locomotive, now known as *Wylam Dilly*, also worked for many years until it was retired in 1868. It was acquired by Hedley's two sons, William and George, and was presented to the Museum of Science and Art in Edinburgh, now the National Museum of Scotland, in 1882.

On 9 May, the Stephenson Locomotive Society arranged a seminar to commemorate George Stephenson's locomotive work from 1814. Four papers were given: John New on 'Why Displace the Horse?'; Andrew Dow on 'The Development of Railway Track'; Michael Bailey on 'George Stephenson's Earliest Locomotives' and Colin Mountford on 'George Stephenson's Rope-Hauled Railways'.

The seminar followed the inauguration of Michael Bailey as the new President of the Stephenson Locomotive Society, the world's oldest railway society. Michael is only the sixth holder of this prestigious position in its 105-year history, and thus feels confident he will be blessed with longevity! Michael has also been in the news recently following the publication of his new book, *Loco Motion: The World's Oldest Steam Locomotives*, which describes all those locomotives and components made up to 1850, now preserved in the world's museums of science and transport.

Michael's paper to the seminar included reference to the locomotive known as *Billy* since 1881 when it was presented to the Corporation of Newcastle by one of the then proprietors of Killingworth Colliery, Charles Palmer MP. His speech at that year's Stephenson Centenary celebrations



*Puffing Billy steam locomotive, outside the Patent Museum, London, 1876. The photograph, taken in 1876, is one of the earliest known photographs of Puffing Billy. It was taken outside the Museum building in c1876 when Puffing Billy was moved from the Patent Office Museum (located near what are now the V&A's cast courts) to the Special Loan Collection of Scientific instruments. ©Science Museum / Science & Society Picture Library. All rights reserved*

# .....Puffing Billy, Wylam Dilly, Billy, an Inauguration & Publication



*Billy, on display at the Stephenson Museum in North Tyneside*

in Newcastle included reference to *Billy* as being the second oldest locomotive in the world. The clear inference being that he acknowledged that *Puffing Billy* was the oldest.

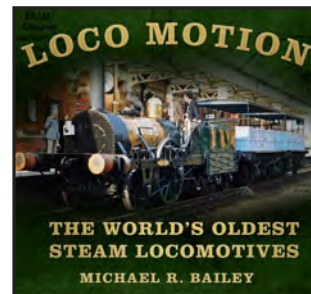
It appears that William and George Hedley may have chosen this remark to place *Wylam Dilly*, which had been in their private collection, back into the public domain apparently to prompt an understanding that it actually had the title of the world's second oldest locomotive. In 1882 they strangely exhibited their engine at a large marine exhibition in Tynemouth, at the closure of which *Wylam Dilly* was acquired by the Science and Art Museum in Edinburgh.

Michael Bailey argued in his paper that, comparing *Billy*, now displayed in the Stephenson Museum in North Tyneside, to the known details about Stephenson's other Killingworth locomotives, it was probably originally built in

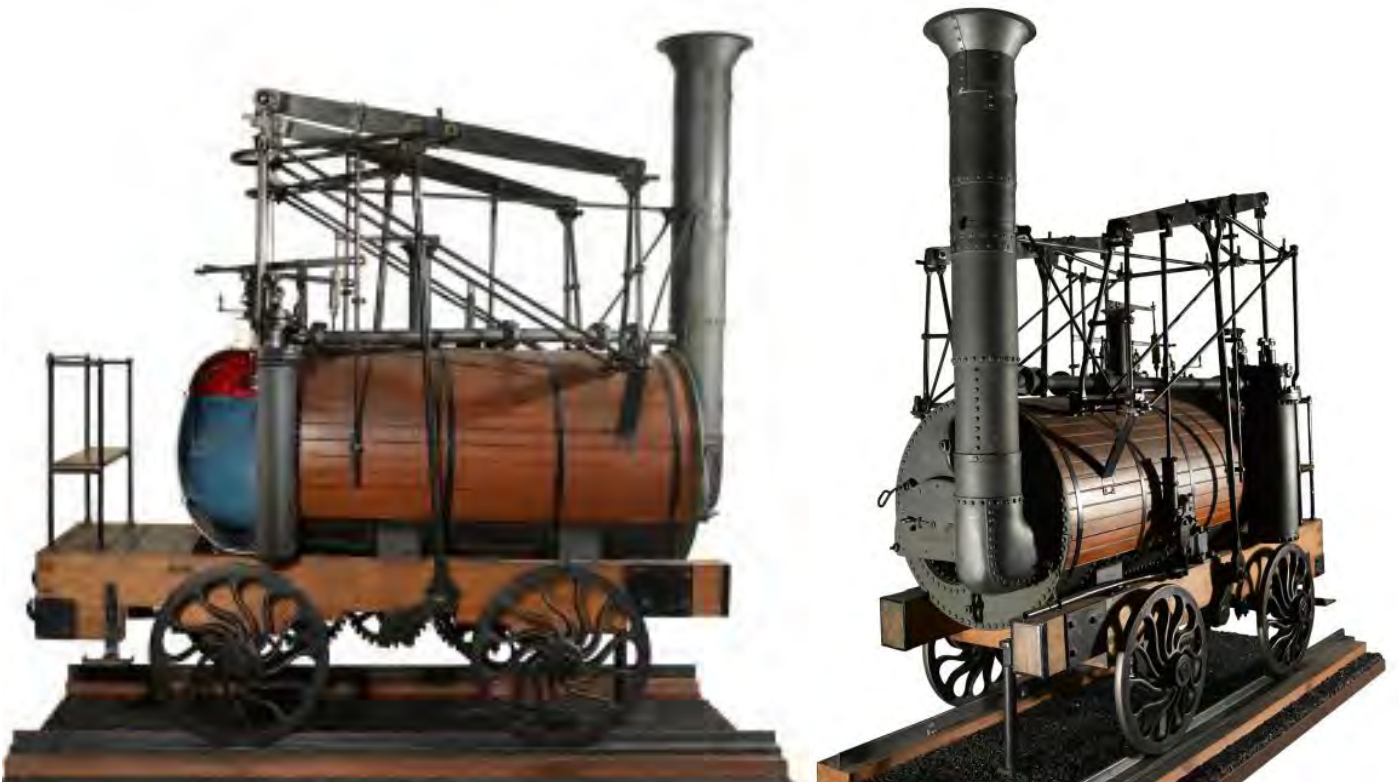
1815. It thus justifies the title of the third oldest surviving locomotive, even though it has been much rebuilt on several occasions.

*Right: Michael Bailey gave his Presidential inauguration speech to the Stephenson Locomotive Society wearing the Presidential insignia and stood in front of Gladstone of the London Brighton and South Coast Railway, the locomotive donated by the SL Society to the National collection' – Brian Dotson, SLS*

*Below: Details of Michael's new book, 'Loco Motion', are on page 24 of this issue of NewcomenLinks.*



*With thanks to: Michael Bailey, Alexander Hayward and John Liffen for their help in the preparation of these pages*



*Above left and right: Wylam Dilly was built by William Hedley in 1813 and presented to the Edinburgh Museum of Science and Art (a forerunner of the National Museum of Scotland) by Hedley's sons in 1882. It was one of the first historical exhibits to be displayed at the museum; before this date the museum's collecting focussed on contemporary (modern) technologies. In order to demonstrate the internal workings of Wylam Dilly a sectioned, operating, model was constructed in the museum's workshops, and this model accompanied the display of the full size locomotive. Both are still on display in the museum today. Image: ©National Museums Scotland. All rights reserved*

# STICK - Scottish Technology and Industry Collections and Knowledge & Edinburgh International Science Festival



*A working model of a patent Corliss engine to the design of Douglas and Grant of Kirkcaldy, scale 1:6. This model was made in the workshops of the Edinburgh Museum of Science and Art (one of the predecessors of the National Museum of Scotland) in 1876. Douglas and Grant were early exponents of the Corliss engine in Scotland. It will be redisplayed in the museum's new Energy Gallery, currently under development. Image © National Museums Scotland*

## **Alexander Hayward**

In Scotland much of the activity around the history of Engineering and technology which will be of interest to Newcomen Society members centres on the STICK network. STICK (Scottish Technology and Industry Collections and Knowledge) was founded in 2006 following a meeting held in the National Museum of Scotland, with the aim of promoting the care and enjoyment of these collections. Through research, stewardship and advocacy, STICK encourages wider engagement with the transport and industrial heritage, both modern and historical, across Scotland. Since then the group has held themed annual meetings and conferences at interesting venues (including the sailing ship Glenlee in Glasgow and Lady Victoria colliery (National Mining Museum for Scotland)) together with other gatherings such as a knowledge exchange event in Dundee in May 2012, entitled 'Steam Engines in Scotland'. This was promoted jointly with the Newcomen Society as part of the commemorations of the tercentenary of the Newcomen engine but looked also at a broader legacy, including Scottish engines by Boulton & Watt and Stirling, as well as more recent developments in the power technology sector.

A key objective of the group is to support informed, efficient and confident decision making in the acquisition and long-term care of the transport and industrial heritage across Scotland. A project was launched in 2009 with the name Old Tools New Uses which aimed to identify the treasures and duplicates of hand tools and domestic technology in Scottish museums. Participants were able to learn the importance of items in their collections from a specialist advisor, get access to a schools resource about identifying and using hand tools, and to dispose of duplicate items to artisan communities in Africa in partnership with the charity Tools for Self Reliance. Building on the success of this project STICK is now planning a similar project to review machine tool in collections across Scotland, and another initiative reviewing technologies of textile production (funded by the Royal Society of Edinburgh and jointly run with the University of Glasgow) is well underway.

STICK is now planning its autumn conference which will explore the Scottish industrial diaspora – the world-wide spread of Scottish engineering products and expertise such as shipbuilding in Japan and Australia, and textile production in Europe. Further information about this event will be circulated to Newcomen Society members as it becomes available.

Other (non-STICK!) news includes the recent Edinburgh International Science Festival (5 – 20 April 2014), where displays around the theme of 'Making It' were brought together in the Grand Gallery of National Museum of Scotland. Thousands of visitors were able take part in 3-D face scanning, mechanised face drawing, and see copies of favourite museum objects being made on a 3-D printer. Such new technologies will be represented in the suite of new science and technology galleries which are currently being developed at the museum, which will also include a Jacquard loom, c1960, CNC milling machine, historic and modern prosthetics, medical scanning technologies and renewable energy sources. The new displays will also feature many of the fine working models of locomotives, marine and stationary engines made by the museum in the late nineteenth century, and which no doubt inspired many future engineers at that time.



*Making It festival at NMS. Image ©Trustees of National Museums Scotland. All rights reserved*

**Further information at: [www.stickssn.org](http://www.stickssn.org)  
National Museum of Scotland, Chambers Street,  
Edinburgh EH1 1JF  
Tel: 0300 123 6789. [www.nms.ac.uk](http://www.nms.ac.uk)**

# Newcomen at Manchester Histories Week

*Jonathan Ayleen*

Manchester Histories Week is a celebration of every aspect of Manchester history, from the Romans to rock music, from the architecture of Edgar Wood to the zoological gardens at Belle Vue. Given Manchester's role as "the Shock City of the Industrial Revolution", Newcomen was keen to promote the history of engineering and technology as part of this year's festival held from 21-30 March.

The week culminated with the main event: a huge history fair in Manchester Town Hall, but there were also 180 events distributed across the city running throughout the week. This was an increase of two-thirds on the previous city-wide Festival which itself managed to attract some 10,000 visitors in 2012. The event attracts a new audience to history. Feedback on earlier festivals show a third of all participants were new to history and heritage events. Almost a half of were new to the particular venue they were visiting.

## *Selling Newcomen at the Festival's Celebration Day*

*Philip Ingram and Andrew Cunningham*

The North-West Branch of the Society took the opportunity to bring our interests to a wider public at the Manchester Histories Celebration Day. Sandwiched between the Heritage Lottery Fund and the Friends of Platt Fields (a park in South Manchester), we chatted with dozens of people about the Society and the activities of the local branch. The committee delegated most of the organisation to Andrew Cunningham and Philip Ingram. Andrew produced a Powerpoint presentation that Philip converted to run as an endless show on a Raspberry Pi (credit card sized computer) nestling under the table. In addition to The Society's banner, we sourced text and images to put on the backdrop. The star of the display was a working model of a Newcomen engine, built and demonstrated by John Glithero. Sadly, Health and Safety rules meant that it couldn't be steamed but even as a hand operated model, it was a winner with the visitors. Our team was further enhanced by Michael Bailey, whose interest in horses led to an interesting discussion with a visitor studying the history of the racing industry.

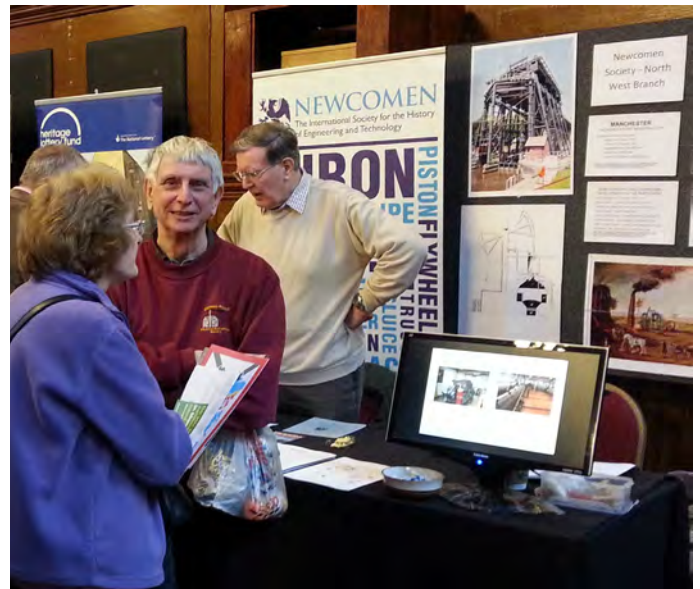
We distributed 120 copies of our 2014-2015 programme and collected twenty e-mail addresses. Some of our visitors had very specialised interests: one described himself as a thermodynamicist and another was deeply into the history of printing. Our visitors included a gratifying number of young engineers, both male and female. It would be very good to welcome these into The Society. The most junior of our visitors appreciated the A4 sheets with cut-out models of a taxi and a double-decker bus. The head of the local transport museum accepted one of the latter with due gravitas.

### *Some learning points for selling the Society:*

- The Newcomen engine model was very well received. The inherent simplicity of the concepts involved meant that visitors didn't feel overwhelmed.
- A large photo of the Anderton Boat Lift caught the attention of many visitors. Those who could identify it (many) seemed to engage with us easily. The photo was printed on four sheets of A4 photo paper stuck together as A2. Many standard printer drivers have a poster printing facility, but not many people know it's there. The image

Manchester Histories Week is sponsored by two Universities, Manchester and Manchester Metropolitan, but it is essentially a popular and amateur event. It is citizen science in force. The history fair encompassed everyone from small local societies dedicated to canal restoration or fire service history through to well established groups such as the National Trust or English Heritage.

Newcomen in the North-West celebrated in two ways. The Town Hall "Celebration Day" was a great opportunity to promote the Society and acquire new members. A report on our exhibition stand and the lessons learned is given here by Andrew Cunningham and Philip Ingram who took charge of this lively promotion. We also opened up our Newcomen Society meeting given by Richard Brook on Tuesday 25 March called 'Masterplanning Mobility: Mancunian Methods'. This talk focused on the post-war era and transport planning in Manchester, a highly appropriate topic for a week dedicated to Manchester history.



*Michael Bailey on the stand*

used was 12Mpixels which proved so sharp at A2 that A1 would be quite realistic. It was good to be able to comment that the photo had been taken during the 2013 Newcomen Society Summer Excursion.

- All four of us were often busy at the same time. Fewer people on the stand would have meant missed opportunities. More would have been impractical given the 2 metre stand length.
- Visitors, especially young ones, expect flat screens to be touch screens.
- Moving images gave us an edge over adjacent stalls, which just had static pictures and leaflets.
- A bowl of sweets on the stand was popular, though we are not sure they had quite the 'rooting' effect that was expected! But they certainly were a conversational gambit.
- We seemed to be very successful in talking to people, so our objective of 'unspecified raising of the profile' has probably also been achieved.

**Further information at:**

**[www.manchesterhistoriesfestival.org.uk](http://www.manchesterhistoriesfestival.org.uk)**

# Information Age

## a new, permanent gallery at the Science Museum in London

*John Liffen*

More than 200 years of invention and innovation in information and communication technologies will be celebrated in *Information Age: six networks that changed our world*, a new permanent gallery at the Science Museum, London, opening this autumn. It will be the biggest and most ambitious gallery to open at the Science Museum for many years and feature over 800 important objects from the collections, some of which have not been displayed for years. Many recent acquisitions will also be shown, including the spectacular aerial tuning inductance from the very-low-frequency transmitter, callsign GBR, from Rugby Radio Station.

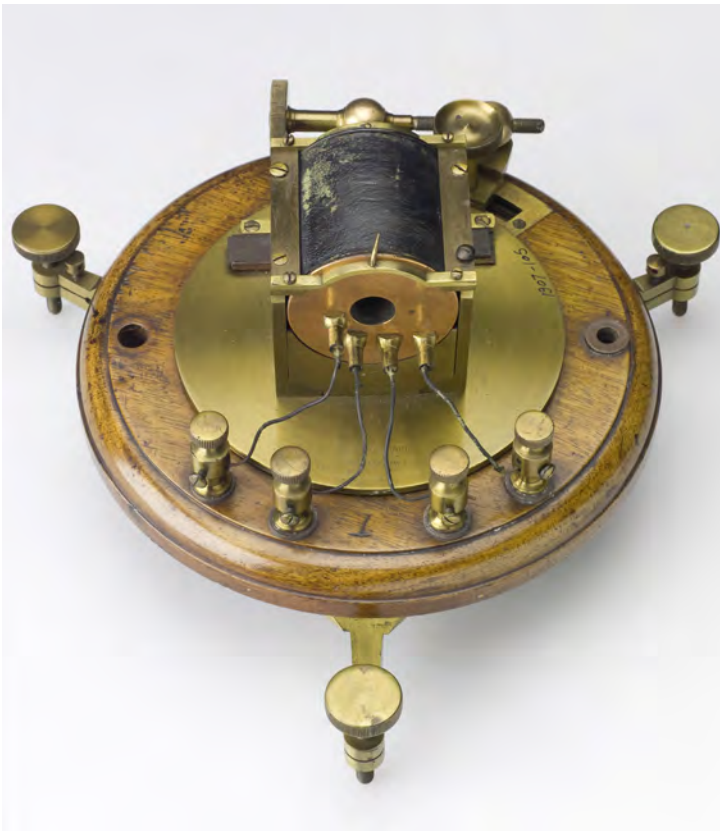
*Information Age* will explore many of the major technological advances that have helped shape the connected world we live in today, and feature some remarkable personal stories which show how these developments have transformed peoples' lives. The gallery, occupying about 2500 sq m, will be divided into six zones (networks) which focus on different communications technologies from Orsted to Berners-Lee and beyond. The interpretation will be innovative. A number of 'transformative events' in the history of communications have been identified and the object selections will feed into these narratives. They will be supplemented by many specially-commissioned audiovisual exhibits. A new Science Museum book, *Information Age: six networks that changed our world*, will be published concurrently with the gallery opening. Following this in November, the Museum is hosting a three-

day conference which will discuss how the history and material culture of information can be made relevant for today's audiences. The conference, 'Interpreting the Information Age: new avenues for research and display' takes place between Monday 3 and Wednesday 5 November 2014.

Two of the more significant objects to be displayed in *Information Age* are described in detail here: the Thomson mirror galvanometer which made long-distance oceanic telegraphy a practical possibility in its early days, and part of the first transmitter which inaugurated the BBC's Regional Scheme in 1929.

In the earliest years of the submarine telegraph cable there was limited understanding of the electrical performance of such cables over long distances under water. It was found that the received signal was very weak, with scarcely enough power to overcome the inertia of a conventional galvanometer. The reason for this was what became known as the 'capacitance effect', in that a large mass of sea water surrounding the cable tended to increase its capacity for absorbing electric currents. This slowed the signal by a small but significant amount and absorbed most of its energy. In the 1850s the electrical solution to this problem was unknown and remained so until the 1890s.

Consequently, telegraph engineers had to work with what they had. What was needed was a highly sensitive galvanometer that would respond to the most feeble currents and present them in a way that made the transmitted message intelligible at the receiving end. The official 'electrician' to



*Thomson mirror galvanometer (land type), 1858, ScM Inv 1907-105. Images ©Science Museum / Science & Society Picture Library. All rights reserved*

the Atlantic Telegraph Company was the flamboyantly-named William Orange Wildman Whitehouse, but he was not a trained physicist and had a limited understanding of electrical theory. Fortunately, William Thomson (later Lord Kelvin) had a much greater understanding and took a close interest in the problems that long-distance submarine cables presented. It is said (though confirmation is difficult to pin down) that Thomson arrived at the solution to the problem by accident one day while swinging his monocle around on the end of its lanyard. The monocle momentarily reflected the sun's light on to the far wall of the room. Though the monocle made only a small movement, the reflected light on the wall moved a far greater distance, effectively magnifying a tiny movement and making it easily readable.

From this it was only a small step for Thomson to devise a highly sensitive galvanometer comprising a bar magnet glued to a small circular mirror mounted by silk threads so that it could swing laterally. The mirror was mounted inside the coil through which the signal currents passed. A beam of light was focused on the mirror so that its reflection shone on to a longitudinal scale placed some 300 mm or so in front of the galvanometer. The delicacy of the mounting meant that it was sensitive to minutely small currents and Thomson found that tiny movements of the mirror caused the beam of reflected light to move a significant distance along the scale, quite enough to make a succession of signals readable.

Thomson produced the first examples of his 'mirror galvanometer' in the spring of 1858. This was in time for examples to be available for use with the 1858 Atlantic cable-laying expedition. One was installed at the Valentia (Ireland) cable station and another was used at the Newfoundland cable station at Trinity Bay. After many vicissitudes the cable was successfully laid across the Atlantic, with each end brought on their respective shores on the same day, 5 August 1858. As it happens the first message through the completed cable from Trinity Bay was received at Valentia on a conventional galvanometer made by W T Henley & Co (also to be shown), but the cable soon began to deteriorate and such instruments became almost unusable. Messages could only be passed at a slow rate and the mirror galvanometer proved to be much quicker and more

reliable in operation. Though the 1858 Atlantic cable had failed completely by 20 October, the Thomson mirror galvanometer proved to be the key that made trans-oceanic telegraph cables a commercial proposition. It became the usual form of receiving instrument until Thomson devised a modified version in 1870 where the mirror and scale were replaced by ink-writing the morse signals on to a paper slip (tape). This was a significant improvement as the operating procedure for the mirror galvanometer required two people, one to watch the light beam on the scale and read the letters and one to write down the message.

Broadcasting in Britain began on 14 November 1922 from the transmitter housed in an attic room at the London offices of Marconi's Wireless Telegraph Co Ltd (henceforth 'Marconi company'). The transmitter had the callsign 2LO and though it was only of low power it became famous throughout Britain as many of its programmes were broadcast simultaneously from other transmitters over landlines provided by the Post Office.

The 2LO transmitter was pioneering and it showed.



*Low-power A unit, BBC Brookmans Park regional transmitter, 1929, ScM Inv 1980-818. Image ©Science Museum / Science & Society Picture Library. All rights reserved*

It was an assemblage of components and was continually being modified. It was so much of a lash-up that this author believes that the Marconi company suppressed publication of photographs of it, fearing it would reflect badly on their technical competence. In 1925 a new transmitter for 2LO was opened at Selfridges department store in Oxford Street but the older transmitter was kept at Marconi House as a stand-by.

In 1929 the BBC's Regional Scheme was inaugurated. This was intended to replace a large number of city-centre low-power transmitters with a smaller number of high-power transmitters offering a choice of programmes. The first of the Regional stations to open was that serving London and the south east. It was located at Brookmans Park, Hertfordshire, about sixteen miles north of Charing Cross. The building, by the architect L R Guthrie, was of striking modernist design and in its impressive transmitter hall the two medium wave transmitters, designed and built by the Marconi company, showed the dramatic development in technical design in only seven years. Each transmitter was arranged to face each other, mirror fashion, and comprised four stages or units housed in five cabinets. The low-power A unit superimposed the signal from the studio on the carrier wave frequency and was known as the modulated amplifier; the B unit was a single-stage amplifier; and C1 and C2 comprised the final amplifier, in two units with the valves connected in push-pull. These units were located each side of the D unit, which contained the radio-frequency output circuits. Each unit was designed with an aluminium framework covered with enamelled steel panels for screening, and the sight of the five cabinets in line inside the spacious and lofty hall gave a strong impression of ultra-modernity and power. Such was the contrast with the original 2LO transmitter that Noel Ashbridge, the BBC's chief engineer, arranged for it to be brought to Brookmans Park to add interest for invited guests (and thereby ensuring its eventual preservation by the Science Museum).



EMERGENCY! LONDON 1914  
LONDON METROPOLITAN  
ARCHIVES

In response to the outbreak of the First World War, the London County Council established the Emergency Measures committee to report on the state of the city and its people. Keeping tabs on food supplies and employment, reports were compiled by council officers and filed at County Hall. Taking these fascinating reports and building a picture of the city with photographs, maps and documents from the period, this exhibition will explore London as it was one hundred years ago, looking at changes to the city and the lives of Londoners as the country went to war.

**Exhibition runs until 30 October. LMA is open Monday to Thursday (except Bank Holidays) and some Saturdays. Further details at: [www.cityoflondon.gov.uk/lma](http://www.cityoflondon.gov.uk/lma).**

The first of the two transmitters at Brookmans Park, that carrying the London Regional programme, opened on 21 October 1929. The other, carrying the National programme, was put fully into service on 9 March 1930. Both transmitters continued in use on varying frequencies for over forty years, latterly in a stand-by role, until March 1978. By that time new transmitters installed at Brookmans Park allowed their retirement. Most of the original equipment was scrapped, though members of the British Vintage Wireless Society organised the distribution of many small components as souvenirs. However, both A units were claimed by the Marconi company and were taken to their factory at Chelmsford for refurbishment and eventual display. Within a year, though, there was a change of mind and one of the A units, restored, was offered to and accepted by the Science Museum. It was delivered to the Museum's store at Hayes (Middlesex) on 28 May 1980, the present author supervising its unloading. The fate of the other A unit is unknown but may have been cannibalised to make one complete unit.

Early plans for display at South Kensington withered on the vine and the A unit has remained in store for thirty-four years. Now, at long last, it will be shown in the Information Age gallery from this autumn and will be joined there by the original 2LO transmitter of 1922, thus re-creating the contrast that Ashbridge first contrived in 1929. The Brookmans Park A unit has never been on public display before and 2LO was only been shown by the BBC on a few brief occasions, so something really special awaits the Science Museum's many visitors.

**The Science Museum  
Exhibition Road  
South Kensington  
London, SW7 2DD  
[www.sciencemuseum.org.uk](http://www.sciencemuseum.org.uk)**

## NEWCOMEN SOCIETY CONFERENCE

### THE IMPACT OF WORLD WAR I ON THE DEVELOPMENT OF ENGINEERING AND TECHNOLOGY

SEPTEMBER/OCTOBER 2015  
CALL FOR PAPERS

The Call for Papers for this conference is still open. The organisers are interested to receive prospective papers on in-depth surveys of how existing industries changed, and how new ones came into being, during and after World War I. They welcome those speakers who are offering well-researched assessments of how WWI accelerated technical change.

There will also be a place, at the conference, for shorter presentations that show how niche developments led to major improvements in productivity, these continuing into the inter-war era. Their origins have often been forgotten. For instance, we have the change in the firing of open hearth furnaces, using producer gas, to firing with fuel oil, this paralleling the switch away from coal on Britain's capital ships.

Presentations that focus on niche developments can be of a less weighty nature. Our aim is to provoke excitement at the conference, whatever the type of paper.

It is proposed to hold the conference in September/October 2015, at a prestigious venue.

**For further information please contact the Newcomen WWI Conference Organising Committee:**  
[newcomen.starr@yahoo.com](mailto:newcomen.starr@yahoo.com)  
[office@newcomen.com](mailto:office@newcomen.com)

# Watchmaking and Patek Philippe, Geneva

*Deborah Jaffé*

Switzerland is synonymous with watchmaking. However, one rarely gets the chance to devote a whole afternoon to marvelling at the development of the wristwatch. But all this changes at the Patek Philippe Museum in Geneva. This museum holds an extensive collection of over 2000 timepieces including tiny automata, art objects, and enamel miniatures that show the city's 500-year history of watchmaking. It is also a museum of the history and development of Patek Philippe as a company, in Geneva, from 1839.

The museum emanates from the collection of Philippe Stern, who in the 1960s, whilst working at Patek Philippe became fascinated by the company's complex, automata type watches. He broadened his interest to include watches and other horological innovations from the 16<sup>th</sup> century onwards. He also collected precious Geneva enamels which were used to decorate some of the watches. Gradually, he amassed a magnificent collection of timepieces not only of the finished pieces but also of the changing technologies and developments in timekeeping.

The museum is on three floors. One is devoted to the history of mechanical timepieces from the 16<sup>th</sup> to the 19<sup>th</sup> century. It includes a drum watch from c1530-40, and incredible, highly decorative and fantastic timepieces from the early 19<sup>th</sup> century. Although most were produced in Geneva, there are some pieces from other European workshops. Computer imaging clearly shows, whilst looking at the outer casing, the inner workings of automata timepieces. The detail of these automata watches is amazing, especially those depicting birds that 'tweet' or waterfalls that 'flow'. This development in automata technology had repercussions beyond watchmaking; the toy makers of Nuremberg found uses for it in the development of automata toys.

This is also a 'company history' museum with an extensive archive. The origins of Mr Patek and Mr Philippe's partnership and company is shown in letters, notebooks, drawings and photographs. Handwritten letters describe Antoine Norbert de Patek's business trip to the United States around 1850. There are numerous technical notebooks, sketches and original drawings by Jean-Adrien Philippe. The archive holds 800 books of company records on the all timepieces it has ever made. Sales ledgers, on display, show that Mr Patek visited Buckingham Palace in the 1850s when Queen Victoria and Prince Albert made purchases. Walls are covered with photographs and the many awards at the international exhibitions. Over 8,000 books on watchmaking and related topics can be found in the library.

There are numerous cases of Patek Philippe creations from 1839, including the Calibre 89, which purports to be the world's most complicated, portable timepiece. Watches that once belonged to royalty, pocket watches and wristwatches are here too. Developments in technology changed what a watch could do, but fashion is also at the fore from the fine detail of Art Nouveau, Art Deco, the 1960s and onwards.

Another area is devoted to the actual manufacture with the benches used by watchmakers, jewellers, engravers, and enamel artists, and over 1000 tools and machines from the



*Above: Workbench, with photograph of the Patek Philippe craftsmen at work  
Below: Workshop equipment*



*Left: Plaque of the ANC. Manufacture d'Horlogerie Prix 1900  
Right: Display cases containing some of the watches*



18<sup>th</sup> to the mid 20<sup>th</sup> centuries. The wheels, pinions, balances and hairsprings show the minuscule parts needed in this fine engineering. Then there are the methods with which cases and dials were decorated - polishing, engraving, enamelling, guilloching and gem setting.

This is a fascinating and rather overwhelming museum and I will never check the time in the same way again.

**Patek Philippe Museum,  
Rue des Vieux-Grenadiers 7, 1205 Geneva, Switzerland.  
Tel.: +41 22 807 09 10 [www.patekmuseum.com](http://www.patekmuseum.com)  
Opening hours: Tuesday – Friday: 2 pm to 6 pm  
Saturday: 10 am to 6 pm. Closed on Monday**

# Gasholder Rest Frames Revealed at Battersea



*The No.5 water sealed holder from east showing its shallow-domed rest frame. Image: M Tucker [MTT3066\_143]. All rights reserved.*

## **Malcolm Tucker**

Demolition started in mid May of the three water-sealed, telescopic gasholders at Battersea in south London and the whole site including the giant waterless holder is expected to be cleared by the end of the year. The railway lines that pass the site on both sides afford unparalleled views of the dismantling process - take Southern trains out of Victoria, stopping at Battersea Park, for views from the west and Southeastern trains into Victoria for close views from the 'Chatham' side.

The first operations removed the light, riveted crown sheeting and revealed the rest-frames, something not often seen and deserving some explanation. The shallow dome-shaped crowns of gasholder bells were supported when in use by the pressure of the gas being stored, but when lowered and depressurised they needed alternative support. Conventionally this was provided by trusses spanning radially across the bell, the trusses usually landing on a central post for extra support. The light sheeting of the crown was then riveted to the trusses and purlins. An alternative approach, used at Battersea, was the 'untrussed crown', where the crown sheeting was unstiffened, in the manner of the skin of a balloon, and descended onto a rest frame fixed in the tank and shaped to the curvature of the crown. The rest frame was usually built of timber (protected from rot by the oxygen-free conditions) and was supported by posts from the dumpling (the truncated-cone-shaped bottom of the in-ground tank). Omitting the



*Battersea No.5 guide frame from west, with steel rest frame of No.4. Image: M Tucker [MTT3066\_087a]. All rights reserved.*

trusses in this manner significantly reduced the weight of a bell, particularly when of large diameter, so that less pressure had to be generated by the exhausters to lift it.

The Battersea holder station was one that I researched in depth in a report for English Heritage in 2001<sup>1</sup>. It was established in 1871 by the London Gas Light Company, which already had three holders at its Nine Elms works. The numbering at Battersea therefore followed on from Nine Elms and culminated with No.7, the 295-foot-high MAN waterless holder completed in 1932. The three water-sealed holders now being dismantled are:-

- No. 5, completed in 1876 with a guide frame of cast-iron columns in a giant single order, 62 feet (19m) tall (the last of these in existence but common in the period 1850-75). Bell of two lifts, 182ft 6in. (55.7m) outer diameter, holding 1.5 million cubic feet.
- No. 6, completed in 1883 with a wrought-iron guide frame of early box-lattice construction, approx 92 feet (28m) tall. Bell of two lifts, 197 feet (60.1m) outer diameter, for 2.6 million cubic feet.
- No.4, originally a twin of No.5 but rebuilt as a spiral-guided holder of 5 lifts in 1963. The rest frame of No. 4 was evidently rebuilt then, using rolled steel sections instead of timber.

It is worth noting the changes with time in the proportions of untrussed crowns. When first used successfully in 1851 they were constructed flat, like drum skins, and so prone to fatigue. The first Battersea holders built in the 1870s had a crown rise 1/29 of the span, which looked distinctively shallow compared with later practice. Crowns then began to rise higher for greater structural efficiency, although increasing the inaccessible volume of gas in the crown. No. 6, completed seven years later, had a crown rise of 1/22, while No. 4 when rebuilt in 1963 was given a crown rise of 1/13.

The demise of the Battersea gasholders is very sad. I had rated them very highly in a supplementary report, but National Grid applied for and got a Certificate of Immunity from Listing in 2009, not consulted upon by English Heritage. In objection to the demolition application of 2013, the Greater London Industrial Archaeology Society asked for some structural components to be salvaged for future display on the redeveloped site, but without success - in addition to natural indifference to such a proposal it's quite a congested site, and



The No. 6 holder from east with MAN holder No.7 beyond. Image: M Tucker [MTT3066\_137]. All rights reserved.

the two railway lines would make the manoeuvring of cranes particularly difficult. Some cast-iron company shields will be salvaged to satisfy the cultural values of those involved, and laser scans will create data clouds for a 3-D digital record, although I fear rather too coarse for the details – we wanted a full survey as original drawings seem not to have not survived.

The site owners, National Grid, have a dedicated website at [www.batterseagasholders.com](http://www.batterseagasholders.com), while the demolition is in the specialist hands of Coleman and Company. Article ©Malcolm Tucker 2014

1. Tucker M T, *London Gasholders Survey – The Development of the Gasholder in London in the Later Nineteenth Century*, unpublished report for English Heritage, 2000

## Millennium Mills

### Robert Carr

This derelict flour-mill in East London on the south side of the Royal Victoria Dock has over time become more than just an item of industrial archaeological interest. A perhaps unlikely survivor, this massive roller flour mill building is now listed grade II and awaits possible redevelopment as flats. As a housing block it might be appropriate for loft apartments. Painted white, the north side of Millennium Mills featured as a screen for the projection of lighting effects in two concerts by Jean Michel Jarre in October 1988. Called Destination Docklands, there was an audience of 100,000 people at each performance.

Apparently now ‘a well-loved icon of post-industrial Britain’ it has made an appearance in a number of pop music videos, been used as a setting for television series like *Ashes* to *Ashes*, and films such as Derek Jarman’s *The Last of England*. This is a poetic and deeply personal depiction of what he felt was the loss of traditional English culture in the 1980s. In particular the Millennium Mills are a prime target for the dangerous pastime known as urban exploration - essentially entering abandoned and decaying industrial premises for the thrill of it, taking photographs, and posting them on the internet. The intention is not to steal or do damage and it seems that the principal ‘leave only footprints and take only photographs’ is generally adhered to. From our point of view the many photographs on the web, often of good quality, provide useful information.

Originally built in 1905, the Mills were severely damaged in the horrific Silvertown explosion of 1917, in which 50 tons of TNT detonated at the nearby Brunner



Mond works. Seventy three people were killed, 400 injured and there was devastation over a wide area. Subsequently repaired, Millennium Mills were further rebuilt in 1933 with the central block being replaced by a ten storey concrete building in art deco style. The west wing of the old mill, in an Edwardian style, also survives and can be seen on the left in the photograph, taken from the south. Air-raid damage occurred during the 1939-45 war and was repaired from 1945 to 1950. The Mill was initially powered by a large horizontal steam engine built by Carels Frères of Ghent, not unlike the type in use in the big Lancashire cotton mills and, as in those, there was a rope race with rope drive to the various floors. It is very likely that this engine continued to power the flour mill until the central art deco block was built in 1933. It may have survived longer, although the machinery in the central block was almost certain to have had individual electric drive by this date. Intriguingly a photograph posted on an urban explorer website clearly shows a rope race with ropes still in situ. Further information is being sought.



## Slacklands, in search of lost times



Corinna Dean at the Archive for Rural Contemporary Architecture (ARCA), has produced *Slacklands*, a photographic guide to Britain's strange and often overlooked rural, 20<sup>th</sup> century architectural sites. It includes Cold War relics and functional typologies, as well as the poetic and aesthetically daring structures that have left indelible marks on Britain's landscape. The title, *Slacklands*, refers to the perimeter around which the site boundaries create conditions of unease and backdrops of uncertainty. These challenging landscapes raise critical awareness of the narratives of industrial demise, the relics of cold war structures and the Brutalist aesthetic of Britain's power stations and how they have impacted on the landscape. *Slacklands* take the reader on a journey to these sites. ARCA is an exciting initiative led by architect, curator and writer, Corinna Dean, who has searched to find these outstanding rural structures, bringing together 35 sites, all contributing to an appreciation of the countryside from a very different perspective to that seen in Constable's rolling green pastures.

**Slacklands by Corinna Dean,**  
**published by Slack.**  
Available from Margaret Howell Shop,  
34 Wigmore Street, London W1U 2RS.  
+44 (0)20 7009 9009  
wigmorestreet@margarehowell.co.uk



*Image titles from top left: Torness, Grain, Ardeer, Canvey.*

*Images: © ARCA/Corinna Dean. All rights reserved*

# Postgraduate Study in the History of Technology



*John Francis (far right) with fellow CHSTM students and staff on a day trip to Sellafield, as part of the group's investigation of British nuclear culture*

## **James Sumner**

If you are interested in studying the history of technology or engineering more formally, meeting others who work in related areas, and finding out about relevant approaches in other fields, why not consider taking a postgraduate degree?

Several universities (see below) offer Masters' programmes that combine a wide-ranging taught curriculum, based on lectures and discussion classes, with specialist research projects supervised by experienced historians. These programmes regularly recruit students who are returning to study after careers in industry, who can often bring the benefit of their experience to new research.

One student who took this approach is John Francis, a former printed circuit board production engineer whose career included work for firms including TDS Circuits and running his own maintenance and import business. After taking a first degree through the Open University, John came to the University of Manchester's Centre for the History of Science, Technology and Medicine (CHSTM) to take our one-year Masters' course.

"Primarily," says John, "I did a massive amount of reading of almost universally interesting and different topics covering a wide subject area." John's interest in the history of process control led to a dissertation research project on the Ferranti Argus computer, based on the collections at the Museum of Science and Industry in Manchester. John describes this experience as "...unexpected and probably the most enjoyable part of the year." With his fellow students, John also organised the 'Bleak Film Club', a weekly screening of Cold War nuclear films, which was not only fun but also fed into his current work staffing the media resources department at a further education college.

The programmes vary in what they emphasise, but all integrate the history of technology with other themes. Don't

expect lists of names and dates, or a strong focus on LTC Rolt-style biography. Courses are equally likely to examine broad questions such as how the sciences and engineering professionalised; how experts communicate with audiences who don't know their ideas (but may control their funding!); and how users adapt technologies in ways their producers didn't intend.

A typical Masters' qualification takes 9 or 12 months of full-time study. Some universities offer a part-time option, usually over two years, and some are set up to accommodate students who cannot attend the university regularly. At some universities it is alternatively possible to take the same courses as part of a Postgraduate Diploma (usually equivalent to two-thirds of a Masters, without the research element) or Postgraduate Certificate (usually worth one-third of a Masters). Successful Masters' graduates may also be able to register for further study, including PhD programmes, which are fully focused on research and typically take three years of full-time or five to six years of part-time study.

Joining a postgraduate community may have other advantages, too. As John Francis points out: "At my advancing years I yet again made a new group of friends who I continue to be in touch with. Some of them are even persuaded to make an annual pilgrimage to Keswick to extend their comfort zones in my company. In recent years we have made icy winter ascents of Glaramarra, Dale Head and descended into abandoned slate quarries and copper and graphite mines. We won't talk about the cardboard box of gelignite I found in one old working."

***Please turn the page for a listing of relevant postgraduate programmes available at universities in the UK***

## Relevant postgraduate programmes currently available at universities in the UK include:

**Cambridge.** MPhil History, Philosophy and Sociology of Science, Technology and Medicine. Full-time, nine-month course providing opportunities for focused research under close supervision by senior members of the University. Students gain experience of presenting their work and discussing the issues that arise from it with an audience of their peers and staff at the Department of History and Philosophy of Science. They will attend lectures, supervisions and research seminars in a range of technical and specialist subjects central to research in history, philosophy and sociology of science, technology and medicine.

[www.hps.cam.ac.uk/studying/graduate/mphil.html](http://www.hps.cam.ac.uk/studying/graduate/mphil.html)

**Edinburgh.** MSc Science and Technology in Society (SaTiS). Examines the social, political and cultural dimensions of science, technology and innovation. Provides a comprehensive introduction to the interdisciplinary field of science and technology studies. Particular strengths in historical and contemporary studies of biotechnology and the life sciences. Good connections with the Scottish Government and National Museum of Scotland's Science & Technology collections. Part-time students welcome.

[www.stis.ed.ac.uk/study\\_stis/postgraduate\\_study](http://www.stis.ed.ac.uk/study_stis/postgraduate_study)

**Kent.** MA History of Science, Medicine, Environment and Technology. Teaching staff focus on eighteenth- to twentieth-century history, including modules that combine imperial, ethical and military history with history of science and medicine. Students are introduced to major historiographical and methodological approaches and learn how different societies, cultures and races have conceptualised disease, reacted to changes in environment and created different technological artefacts and scientific knowledge.

[www.kent.ac.uk/history/postgraduate/programmes/taught/science-medicine-environment-technology.html](http://www.kent.ac.uk/history/postgraduate/programmes/taught/science-medicine-environment-technology.html)

**King's College London.** MA Science, Technology and Medicine in History. Encourages a distinctive approach to history, integrating the study of science, technology and medicine and being particularly concerned with addressing big historical and policy questions. Located within the history department, with connections to History and Policy, the Centre for Medical Humanities and the department of Social Science, Health and Medicine. Easy access to London's many museums and archives. One-year full-time or two-year part-time options.

[www.kcl.ac.uk/prospectus/graduate/science-history/details](http://www.kcl.ac.uk/prospectus/graduate/science-history/details)

**Leeds.** MA History and Philosophy of Science; MA History of Science, Technology and Medicine. Taught programmes that combine a core module or two with a broad range of electives and a research dissertation. Part-time students welcome.

[www.leeds.ac.uk/arts/info/125152/postgraduate/1984/taught\\_degrees](http://www.leeds.ac.uk/arts/info/125152/postgraduate/1984/taught_degrees)

**Manchester.** MSc History of Science, Technology and Medicine. Focuses on post-1800 history, particularly strong on twentieth-century cases such as Cold War science and technology policy. Broad subject coverage, but specialist options in history of technology. Good connections to the Museum of Science and Industry with its major collections on manufacturing, utilities and transport. Part-time students welcome and can usually take the course with one or two days' attendance per week.

[www.chstm.manchester.ac.uk/postgraduate/taught/](http://www.chstm.manchester.ac.uk/postgraduate/taught/)

**University College London.** MSc History and Philosophy of Science. Broad coverage of history of science, philosophy of science, and integrated history and philosophy of science. Closely integrated with a sister MSc programme in Science, Technology, and Society, which emphasises the study of science policy, science communication, and sociology of science. The Department of Science and Technology Studies has close links with London museums, including the Science Museum and the Natural History Museum. Part-time students welcome.

[www.ucl.ac.uk/sts/prospective/msc/uclmastersdegrees](http://www.ucl.ac.uk/sts/prospective/msc/uclmastersdegrees)



*Devil's Bridge looking west from the south side of the road east of the bridge*

## An I.K Brunel Bridge in Bleadon.....

**Devil's Bridge**, also known as Bleadon Road Bridge or Uphill Bridge, is the largest of 21 'flying bridges' built by the B&ER Company (Engineer: I.K. Brunel) between 1839 and 1843. Brunel's son described the principle of construction thus: 'Instead of arches resting on piers and abutments, the bridge has a single arch, reaching from one side of the cutting to the other, and springing from the slopes'.

He noted that this class of bridge of 'striking outline' was first used on the B&ER and subsequently on many other railways. In 1841 William Gravatt (1806-1866), Brunel's Resident Engineer on the B&ER, claimed credit for 'contriving the peculiar sort of bridges, now known by the name of Flying Bridges'.

A small group of Newcomen members 'discovered' the bridge in March. It is on the Bristol & Exeter Railway at Uphill, outside Weston-super-Mare. OS Ref SS 328581,

# Obituary

## Robert Cox, 1922-2013

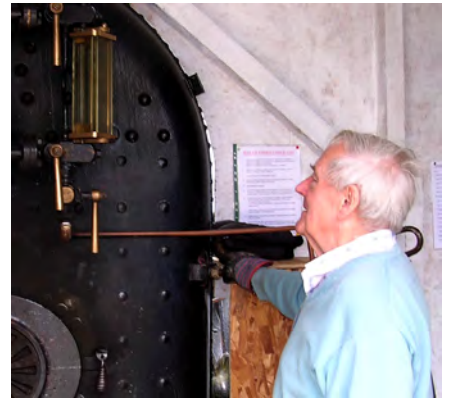
With great sadness, we have to report that Bob Cox passed away in November 2013. Bob was born in Maidenhead in August 1922. His father, who had been an apprentice at Swindon under William Dean, owned a building business in Maidenhead. Bob, too, had an early and lifelong interest in railways - and in mechanical engineering in general - but he was destined to take over the reins of the family building business.

While still in his teens, his career path was interrupted by the start of WWII. He joined the Royal Navy, and his very active service took him from one extreme to another - from Arctic convoys on a frigate to dramatic action in the South Pacific on the aircraft carrier HMS Formidable. He was on board when she was hit by Kamikaze planes. Fortunately, the carrier was saved by having an armoured deck, and was able to continue in action, albeit with the loss of a number of lives. Immediately after the war the ship was docked in Sydney for repairs, and Bob had fond memories of the warm welcome given by the locals during their stay.

Service in the Royal Navy at that time would surely have encouraged his interest in steam, but after the war, it was back to the building business, and his engineering interests had to be fitted into his spare time. However, a building recession in the late 1960s put paid to the traditional family business, and Bob took a job as a security officer in Slough. There, he would make good use of his time on shift, leaving home with boxes of engineering history documents for nocturnal study. Retirement came in 1986, and Bob and his wife moved to Dorset. His sons recall how the itinerary for family camping holidays always happened to include places where industrial steam was to be found. On one holiday, the small car's cargo of family and camping equipment was augmented by the cast iron chimney of a scrapped industrial loco! This now graces the grounds of Westonzoyland Pumping Station.

Bob was a very enthusiastic industrial historian, and his knowledge of engines and their makers was broad and deep. He would go to great lengths to answer any queries about firms and their products. His name often crops up in references and acknowledgements from authors of articles

about steam engines and related matters. An area of particular interest was the work of Willans and Robinson, encouraged by his discovery of the remains of an engine in the 1970s. He undertook extensive research into the Company's history, with a view to writing a book.



In keeping with his seafaring background, Bob joined the Steam Boat Association. He belonged to many other societies, too, including The Newcomen Society, the ISSES, Westonzoyland Engine Trust, and local industrial archaeological groups, including SIAS and DIAS, and the Bristol Society of Model and Experimental Engineers. He was also involved with the revival of the Welshpool and Llanfair Railway.

Bob would often drive from his home in Bridport to Westonzoyland on one day, only to repeat the journey the next to Taunton for a SIAS meeting. He was doing this even after a major operation in his late 80s, and rarely missed attending to the boiler on Westonzoyland's steaming days, his last session being as recently as last summer. For someone in his nineties, his energy and enthusiasm were remarkable, and he still had ambitions to become a computer user to aid his research.

It was a delight to be able to discuss with Bob any aspects of engineering history. An education, too, to eavesdrop on Bob's conversations with a fellow builder and Westonzoyland member, about nearly-forgotten aspects and equipment of the building and decorating trades, such as graining tools and paint mills for hand-grinding of pigments.

The term 'gentleman' has perhaps been devalued by familiarity, but Bob was indeed a true gentleman, ever considerate and polite, and his first thoughts were always for others. Bob will be sadly missed by those who had the good fortune to know him. Our thoughts and sympathy go to his sons Julian and David and the rest of his family.

*John Ditchfield*

## .....and one in Frampton Mansell

Weston-super-Mare sheet 182 of the 1:50000 series. It is the second overbridge south of the southern junction of the Weston-super-Mare station loop with the avoiding line. The bridge has become much more visible due to the recent clearance of trees from the slopes of the cutting, because they were interfering with electric cables across it. The tree clearance caused the slopes of the cutting ( I estimate it was at least 20 metres deep) to slip, necessitating an extensive soil stabilising exercise with ground bolts and netting.

**Jackdaw Bridge**, also known as Rampant Bridge, was built by the Cheltenham & Great Western Union Railway Company (Engineer: I.K. Brunel) in 1844-5 to enable the owner of surrounding woods to slide felled trees down a hillside and over the railway line, to the Thames and Severn Canal below, on a gradient of 1 in 3. Brunel's resident engineer,

Charles Richardson (1814-1896), designed it as an arch with one springing level 12ft. higher than the other. The shape of the arch is almost certainly unique in the British Isles, and is based on a form of curve which has the inverted profile of an asymmetrically loaded cord hanging between two points that are fixed at different heights. Brunel himself is reported to have been 'so pleased with the appearance of Richardson's drawing that he would not allow the beauty of the proportions to be interfered with'.

See image at: [www.flickr.com/photos/90727415@N00/3300567395/](http://www.flickr.com/photos/90727415@N00/3300567395/)

*Thank you to Roger Cline and David Greenfield*



**Chemical Heritage Foundation**  
LIBRARY • MUSEUM • CENTER FOR SCHOLARS

315 Chestnut Street | Philadelphia PA 19106-2702 | 215.925.2222 phone | 215.925.1954 fax  
chemheritage.org

The Chemical Heritage Foundation (CHF) in Philadelphia, USA, is excited to announce the construction of a new research group on the history of matter, materials, and culture.

We seek applications from historians of science and technology, science studies researchers, museum professionals, and public historians working in these areas. The Fellowship period is expected to last for up to three years (considerations for shorter periods will be made) beginning in the Fall of 2014. We welcome applications from researchers of all rank. CHF anticipates hiring 3-5 research fellows to establish this group.

We have a particular interest in the following areas of research:

*The Material Culture of the Laboratory*

We are interested in research that examines, among other potential topics:

- The relationship between tools, equipment, and instrumentation and the work of science
- The effect of new instruments on scientific practice and knowledge making
- The introduction of new materials into the laboratory
- The relationship between the material makeup of the laboratory and the culture of those that populate it

*The Sciences and Technologies of Material Culture*

We are interested in research that examines, among other potential topics:

- The translation of everyday perception into scientific and engineering terms
- The scientific understanding of material performance and functionalities
- The imitation of natural materials by artificial ones
- The driving forces of material innovation
- The development from matter to the molecular to the material

Projects fitting within, or connecting, these areas of study are highly desirable.

Research Fellows joining CHF will be expected to:

- Participate in the overall construction of this new research group through the pursuit of their own original research;
- Coordinate with the research group and CHF professional staff to create networks of collaboration on these topics extending beyond CHF;
- Work with CHF professional staff to identify and co-construct outreach and programming activities building on a utilizing their research;
- Work with CHF professional staff to identify opportunities to grow and maintain the research group beyond its initial phase; and
- Contribute to the overall research community at CHF through regular participation in the activities of our broader community of fellows.

Review of applications will begin immediately. Applicants should submit a cover letter, CV, the names and contact information for 2 references, and a research prospectus of approximately 500 words to:

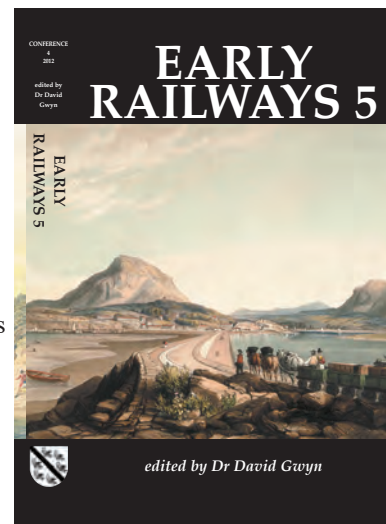
[materials2014@chemheritage.org](mailto:materials2014@chemheritage.org).



## Public Service Broadcasting

Public Service Broadcasting, the intriguing musical duo of J. Willgoose and his drummer Wrigglesworth, have set out to 'inform, educate and entertain' audiences with their distinctive use of old film and sound footage combined with their own music. Their '...uniquely spell-binding live AV Transmissions see them weave samples from old public information films, archive footage and propaganda material around live drums, guitar, banjo and electronics as they teach the lessons of the past through the music of the future - beaming our past back at us through vintage TV sets and state of the art modern video projection devices'. Their albums include: *Inform – Educate – Entertain*; *The War Room*; *Spitfire* and *Everest* and are available as cds and to buy and download through iTunes. Film versions of *Spitfire* and *Everest* can be viewed on You Tube. **Public Service Broadcasting:** [www.publicservicebroadcasting.net](http://www.publicservicebroadcasting.net)

The Fifth International Early Railways Conference, held at Caernarfon in 2012, was a notable success and the Newcomen Society was one of its sponsors. The Proceedings are published by subscription as Early Railways 5 and the list is now open. The volume is, for the first time, in colour, with an editorial by Dr David Gwyn and 21 peer-reviewed papers of new researches. The subscription price is £39 including post and packing worldwide.



**Order forms and full details available at:** [www.earlyrailways.org.uk](http://www.earlyrailways.org.uk).  
**After 1st September 2014 the full publication price will be £55. For further information, please contact:** [early.railways.conference@gmail.com](mailto:early.railways.conference@gmail.com)

## British Library Voices of Science - on line

The *Voices of Science* website draws on the *Oral History of British Science* initiative led by National Life Stories at the British Library. The project set out to collect life story interviews, both audio and video, with those people in Britain who have spent their lives in science and technology. Interviewees talk candidly about their motivations, frustrations and triumphs, as well as their colleagues, families and childhoods. They reflect on how new instruments and techniques have changed the way they work and how fluctuations in government policy and media interest have reshaped how they spend their time. The website presents clips from the first 100 recordings covering the themes of *Made in Britain* and *A Changing Planet*. It also provides links to the full interviews and transcripts available at British Library Sounds. Biographies, photographs and links provide context for each scientist's life and work. All the digital interviews, averaging 10-15 hours in length, have been archived in perpetuity at the British Library. Further information at: [www.bl.uk/historyofscience](http://www.bl.uk/historyofscience)

The screenshot shows the 'Voices of Science' website interface. At the top, there is a search bar and navigation menus for 'Catalogues', 'Collections', 'Discover', 'Services', 'Visiting', 'About', and 'Information for...'. Below the header, a grid of 24 scientist profiles is displayed, each with a small portrait and their name and profession. The scientists listed are:

- Mary Almond (Physicist)
- Eric Ash (Electronics engineer)
- Mike Baillie (Dendrochronologist)
- Rick Battarbee (Palaeolimnologist)
- Nigel Bell (Environmental scientist)
- Mary Lee Berners-Lee (Computer scientist)
- Conway Berners-Lee (Computer scientist)
- Ray Bird (Computer engineer)
- Barbara Bowen (Research and editorial assistant)
- Richard Brett-Knowles (Electronics engineer)
- Ron Bridle (Civil engineer)
- Tony Brooker (Computer scientist)
- David Cartwright (Oceanographer)
- John Charnley (Aeronautical engineer)
- Jenny Constant (Materials scientist)
- Mary Coombs (Computer programmer)
- Russell Coope (Palaeontologist)
- John Coplin (Aeronautical engineer)
- Alan Cottrell (Materials scientist)
- James Crease (Oceanographer)
- David Davies (Geophysicist)
- Ralph Denning (Aeronautical engineer)
- John Dewey (Geologist)
- Bob Dickson (Oceanographer)
- Roy Dommett (Aeronautical engineer)
- Ann Dowling (Aeronautical engineer)
- David 'Dai' Edwards (Computer engineer)
- Stanley Evans (Physicist)
- Joseph Farman (Atmospheric scientist)
- Brian Flowers (Physicist)
- Michael Forrest (Physicist)
- Steve Furber (Computer scientist)

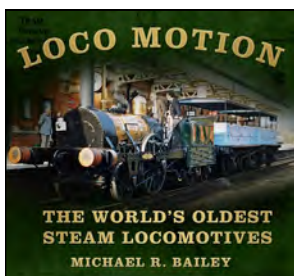
## Loco Motion

The World's Oldest Steam Locomotives

Michael R. Bailey

To be published 7th March 2014, £25 Hardback  
9780752491011

Discover the world's oldest steam locomotives—  
from their enigmatic inventors right down  
to the nuts and bolts



The evolution of the steam locomotive changed the world by bringing a new age of industrial potential. The work of locomotive pioneers such as Richard Trevithick meant that these machines could now be used to transport heavy raw materials and people at speeds and distances never seen before. The steam locomotive laid the foundations for the high-tech world we live in today.

Michael R. Bailey's *Loco Motion: The World's Oldest Steam Locomotives* charts the development of the world's earliest steam locomotives using previously unpublished material, research and illustrations.

- The earliest examples of steam locomotives explored by class and group
- Covers famous examples of early steam engines including Trevithick's *Puffing Devil* and Stephenson's *Billy*
- Outlines the operating and preservation history, design characteristics, components and modifications
- Provides an in-depth list of museums housing each of the surviving locomotives



## Interesting websites

Nigel Hobden, of Random Computing, has given us some interesting web references on aspects of the history of engineering and technology. They include a look inside the IBM Museum at 100 years of technology. This ever growing list of websites is available in the Members' Area of the website where the links are live.

# The Newcomen Society Calendar.....

Please check the Events pages on the website for updated information: [www.newcomen.com](http://www.newcomen.com)

Complete Programme for 2014/15 will appear in the next issue

**LONDON** Meetings held in the Director's Suite, The Science Museum, Exhibition Road, London SW7 2DD. Time: 17.45. Visitors welcome, admission free. Members & guests go to a nearby restaurant afterwards.

**2014**

**8 October** Phil Judkins: German Wartime Radar

**12 November** Cliff Lea: The UK and Oil Exploration

**10 December** Martin Gregory: Sewing Machines

**2015**

**14 January** John Wilson: Woodworking Machinery

**11 February** Geoff Wallis: The Presidential Address - Conservation Ethics in Practice

**11 March** José Luiz Dias: Electric Motor Refurbishment in Brazil tbc

**8 April** Ian Whittle & Fred Starr: Whittle Jet History

**13 May** Chris Barker: Model T Innovations

**MIDLAND BRANCH** Meetings held in the Thinktank Theatre, at the Birmingham Science Museum, at Millennium Point, Curzon Street, Birmingham, B4 7XG.

Time: 18.30 for 19.00. Visitors welcome, admission free. There is a pay-bar in the building which may be serving snacks and drinks before the meeting. A pub across Curzon Street serves meals and afterwards many adjourn there. Parking on-site from Jennens Road is £3 from 6pm or across Jennens Road at £1 from 4.30pm

**2014**

**1 October** Brian Corfield: The Hornblowers, 18<sup>th</sup> Century Steam Pioneers

**5 November** Dr. Bryan Lawton: Tunnelling in the 1740s

**3 December** Dr. Tom Elliott: South Staffordshire Mines Drainage Commission

**2015**

**7 January** David Ensor: History of Instrumentation and Testing

**4 February** John Porter: Engines for the Titanic – insights from a Ship's Engineer

**4 March** Geoff Wallis, The President: Conservation Ethics in Practice

**1 April** Stephen K. Jones: Brunel in South Wales

**NORTH EASTERN BRANCH** Meeting in the Discovery Museum, Newcastle upon Tyne NE1 4JA at 18.00

tbc

**NORTH WEST BRANCH** Meeting at the Museum of Science and Industry, Liverpool Road, Manchester M3 4FP.

Time 18.30, visitors welcome, admission free. Members meet at a nearby restaurant from 17.00. Parking is available on site.

**2014**

**23 September** *With the Manchester Association of Engineers*

Dr David Dulieu (Outokumpu Oy, Sheffield): Harry Brearley and the development of Stainless Steel.

**28 October** *With the Manchester Association of Engineers*

Deborah Jaffé: Frank Hornby and mechanical toys - Britain, Germany and the USA, 1880- 1950

**25 November** Branch AGM

Geoff Wallis (President, the Newcomen Society): Conservation Ethics in Practice

**2015**

**20 January** *With the Computer Conservation Society. Note change of start time 5.30 for 6.00 pm*

Dr Elizabeth Bruton (University of Leeds): 'Radar' of the First World War: B-stations and wireless direction-finding in World War One

**24 February** *With the Institution of Civil Engineers* Richard Byrom: William Fairbairn and the Iron Girder Bridge

**24th March** Julia Elton: The Thames Tunnel

**SOUTHERN BRANCH** Meetings held in a lecture room at the University of Portsmouth 18.30. Some on-street parking is available there is a charge for use of University car parks.

tbc

**WESTERN BRANCH** Meetings held in Room 1 Bristol Aeroplane Welfare Association (BAWA), 589 Southmead Road, Filton, BS34 7RG from 19:30-21:00 Visitors welcome, admission free.

**2014**

**13 August** Visit to various sites related to the Powell Duffryn Coal Mines, South Wales, led by Leslie Shore.

**15,16,17 August**, Western Branch stand and book sale at the Bristol Model Engineering and Hobbies Exhibition, Thornbury, South Gloucestershire

**2 October**, Visit to the Stirling Engine Open day at the Hereford Waterworks Museum, Hereford,

**16 October** John Wilson: Woodworking Machinery, Part 1

**20 November** Derek Hunt: Somerset Coal Canal

**2015**

**15 January** Joint Meeting with BIAS. Four 20 min talks. tbc

**19 February** Geoff Wallis: Presidential Address- Conservation Ethics in Practice

**19 March** Laurence Ince: Neath Abbey Ironworks

**16 April** Philip Hosken: The Oblivion of Trevithick

**21 May** John Porter: Titanic's Engines- Insights from a Ship's Engineer

## VISITS

### 13 AUGUST VISIT TO POWELL DUFFRYN RHYMNEY COLLIERY SITES SOUTH WALES

Tour Guide Leslie Shore (member) and author of the acclaimed book "Peerless Powell Duffryn of the South Wales Coalfield". Numbers limited to 24. Cost per head £16 to include snack lunch and site entries etc. Proposed transport- car share. All day visit starting at 10.30 am Full details available from Dr Bryan Lawton: [bandbalawton@talk.talk.net](mailto:bandbalawton@talk.talk.net) or 01793 7626

John Anning: [john.anning@hotmail.co.uk](mailto:john.anning@hotmail.co.uk) or 01275 846546.

### 10-12 SEPTEMBER CLEVELAND BRIDGE & ENGINEERING + BRIDGES OF THE RIVER TEES TOUR

This tour of the Bridges of Teesside will be combined with a unique opportunity to visit the works of Cleveland Bridge and Engineering Ltd, Darlington. The December issue of NewcomenLinks carried an article by Robin Brooks of the NE on *Bridges of the Tees Estuary* talk by Charles Morris, a well respected member of the ICE, who will be our guide. **If interested, please make contact immediately, as places will be limited, Fred Starr: 020 8764 7837 newcomen.starr@yahoo.com**

### 2 OCTOBER, VISIT TO THE STIRLING ENGINE

Open day at the Hereford Waterworks Museum, Hereford. Further details at:

[western@newcomen.com](mailto:western@newcomen.com)

THE NEWCOMEN SOCIETY IN ASSOCIATION  
WITH THE  
LEARNED SOCIETY OF WALES

RIBBON OF FIRE: HOW US STRIP MILL TECHNOLOGY CAME TO WALES

by Jonathan Aylen

Thursday 30 October 6:45 for 7:00

Robert Recorde Room, Department of Computer Science,  
Faraday Building, Singleton Park,  
Swansea University, Swansea SA2 8PP

The American continuous wide strip mill halved the cost of steel sheets after 1926. This large scale technology was rapidly adopted in the USA to supply a growing market for autobody, canstock and consumer goods. After much controversy, Welsh steelmakers built these new mills in the 1930's under pressure from customers and American technical partners. Once Richard Thomas had bought their Ebbw Vale mill in 1936, Summers at Shotton were tipped into ordering their wide hot strip mill from a rival American supplier. This lively paper based on US and European archive sources considers the personalities, the technical choices, the construction and the impact of these radical schemes on Wales. Marshall Aid funded a third strip mill at Port Talbot after the war, but a fourth private sector mill at Cardiff was abandoned once Llanwern got under way. The paper ends with a reminder of the fiftieth anniversary of direct computer control of the Llanwern wide hot strip mill in 1964.

The Newcomen Society is pleased to be working in conjunction with the Learned Society of Wales to bring a Welsh venue to existing and new members. Wales was an early adopter of the Newcomen engine with two engines erected sometime between April 1714 and December 1715.

The venue of this lecture, at Swansea University, is named after Robert Recorde (c1512–1558) who was a distinguished Welsh Renaissance writer of books on arithmetic, practical calculation, geometry and astronomy.

*Jonathan Aylen of Manchester Institute of Innovation Research, University of Manchester is a joint editor and author of 'Ribbon of Fire: How Europe adopted and developed US strip mill technology (1920-2000)' published by Pendragon, Bologna 2012.*

Proposed Visit to a UK Oil Production Site/Gathering Centre

Cliff Lea will give his his lecture: The Derbyshire Oil Wells of 1918 – Britain's first oilfield, in London on 12 November

As a prelude we are arranging a visit to a current British oil production site/gathering centre and we have the possibility of either Singleton in West Sussex or Welton near Gainsborough in Lincolnshire. The date has yet to be fixed but it is likely to be late July / early August. Numbers will be limited.

If you think that you would like to join us on this visit please register your interest at the address below. In order to assist in deciding which site we visit would you please state your preference for Sussex or Lincolnshire.

Please contact:

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editor.links@newcomen.com

or the Office: +44 (0) 20 7371 4445

AT THE SCIENCE MUSEUM, LONDON

**Unlocking Lovelock: Scientist, Inventor and Maverick** opened in April. This new temporary exhibition showcases the life, work, professional and more personal archive of James Lovelock, one of Britain's most important living scientists and inventors.

**The Exponential Horn: In Search of Perfect Sound** opened in May. This is a new audio installation and events series, curated by Aleksander Kolkowski, featuring the historic 27-foot Denman Horn loudspeaker as its centrepiece. And, following a very successful run at the Science Museum, visitors to the Museum of Science & Industry in Manchester will be able to visit the Collider exhibition and walk the tunnels of CERN, see history being made and step inside the world's greatest experiment.

**Reaktion books will publish, in July, James Watt: Making the world anew.**

In his major new work, Ben Russell, Curator of Mechanical Engineering here, takes James Watt's workshop, displayed in the Science Museum since 1924, as a starting point to recreate a craft history of Britain's industrial revolution and a rich pre-history of the modern engineering profession.

**Information Age, a new major permanent gallery** opening in autumn 2014, will encourage visitors to the Science Museum to explore how history informs our experience of technological change in a digital world. For 200 years, users, as well as innovators, have developed information and communications networks – transforming how we connect with each other and reshaping our lives.

**Cosmonauts: Birth of the Space Age** will open in November. This major temporary exhibition will look at Russia through the prism of a prime collection of space technology and engineering artefacts, some object never before seen, and will offer powerful first-hand encounters with space-flown objects and the story of a nation's commitment to exploring the cosmos.

**The Science Museum**

**Exhibition Road**

**South Kensington**

**London, SW7 2DD**

[www.sciencemuseum.org.uk](http://www.sciencemuseum.org.uk)

STICK - SCOTTISH TECHNOLOGY AND  
INDUSTRY COLLECTIONS AND KNOWLEDGE  
AUTUMN CONFERENCE

STICK is now planning its autumn conference which will explore the Scottish industrial diaspora – the world-wide spread of Scottish engineering products and expertise such as shipbuilding in Japan and Australia, and textile production in Europe. It will be held in October 2014 in Dundee. Further information about this event will be made available soon.

[www.stickssn.org](http://www.stickssn.org)

TWENTIETH  
CENTURY  
SOCIETY



SAVING  
THE EARLY TWENTIETH CENTURY  
LISTED WIND TUNNELS AT FARNBOROUGH  
A TOUR OF THE WIND TUNNEL BUILDINGS,  
THE RE-ERECTED AIRSHIP  
HANGAR, THE SEA PLANE TESTING TANK AND  
THE RESTORED UTILITARIAN LANDSCAPE.  
28 JUNE 2014

The Royal Aircraft Establishment factory site at Farnborough was used for most of the 20<sup>th</sup> century to develop and test aircraft. In 1999 the site was declared redundant and sold to Slough Estates for redevelopment as a business park. The significance of some of the historic factory buildings was recognized and attempts were made to safeguard the aeronautical heritage by retaining a core area of historic factory buildings, which includes three listed wind tunnel buildings and the listed 1912 airship hangar. Julian Harrap Architects worked with Slough Estates for seven years to repair the exterior of the wind tunnel buildings, restore their settings and re-erect the frame of the early airship hangar. Julian Harrap will lead the walking tour of the historic core of the factory site, describing the development of the site and works undertaken to alter and repair the listed buildings and their settings to reflect the factory site's heyday and provide a unique civic area within the new business park.

**For further information and to book contact The 20th Century Society at:**  
[events\(a\)c20society.org.uk](mailto:events(a)c20society.org.uk)  
020 7250 3857

ARTLINER WIND TUNNEL PROJECT

Two of the listed wind tunnel buildings will be open to the public for the first time from 9 June 20 July as part of the Artliner Wind Tunnel Project:

[www.thewindtunnelproject.com](http://www.thewindtunnelproject.com)

THE PORTAL AT DUDLEY CANAL TRUST

Last year Dudley Canal Trust (Trips) Limited took in the region of 65,000 people on a journey into the Dudley Canal Tunnel and Limestone Mines, enabling them to experience a unique part of Dudley's rich industrial heritage. The proposed Portal will be an attractive visitor facility which will not only provide much needed space to support our operation, by creating a venue for interpretation and education and helping to improve the overall trip experience, but will also bring significant benefits to the local community, Castle Hill and the wider Black Country. Planning permission has been obtained for the Portal building, with the majority of funding from the Heritage Lottery Fund, the European Regional Development Fund and the Black Country Local Enterprise Partnership 'Growing Places' Fund is in place, subject to the signing of agreements and we plan to commence construction in the summer of this year. Artist's impressions of the new building can be found on our website

[www.dudleycanaltrust.org.uk](http://www.dudleycanaltrust.org.uk)

501 Birmingham New Road Dudley West Midlands  
DY14SB

Tel: 0121 5576265

Email: [enquiries@dudleycanaltrust.org.uk](mailto:enquiries@dudleycanaltrust.org.uk)

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*The Newcomen Society  
Calendar of Branch meetings  
and listings of other events  
are on pages 26-28*

*The full listing of lectures  
for  
2014/15  
will be published  
in the September issue*

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**NEWCOMEN**

The International Society for the History  
of Engineering and Technology

[www.newcomen.com](http://www.newcomen.com)