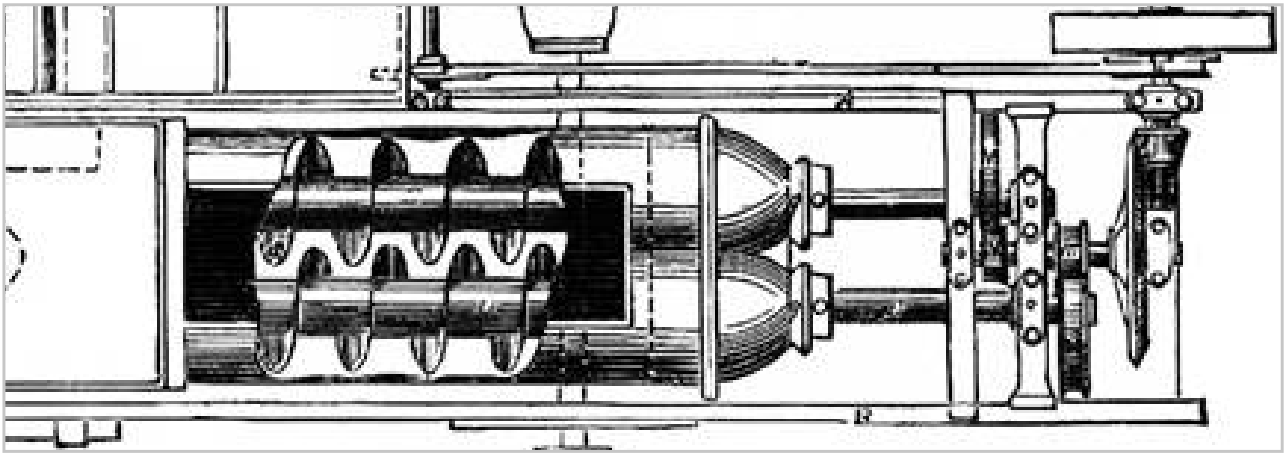
NEWCOMEN Links



NEWCOMEN
The International Society for the History of Engineering and Technology

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Notes on Contributors

Jonathan Aylen was joint organiser of the Newcomen Society Tour of Teesside with fellow member Dr Fred Starr. Jonathan has long-standing connections with Teesside through his research on steel technology and on process plant. He is currently Vice-President of the Newcomen Society.

John Brightling, is Ammonia Commercial Manger for Johnson Matthey. He started out as a Mechanical Engineer, graduating from Leicester University, but got drawn into chemical production at Olefins 6, the ethylene cracker on the South Bank of the Tees. For the past 18 years he has worked in the catalyst business.

David Eaton studied mechanical engineering at UMIST graduating with a masters degree. His industrial experience has been at British Rail research, Rolls Royce Derby and Davy McKee Sheffield. From 1994 to 2003 David was Director of the School of Engineering at Sheffield Hallam University. He has an interest in the history of precision measurement and is a trustee of, and responsible for the metrology collection at, the Ken Hawley Tool Collection, in Sheffield and is chairman of Newcomen South Yorkshire

John Howat qualified in Medicine at Manchester in 1969 and after completing a research degree and specialist training, was appointed Consultant General Surgeon in North Manchester in 1982. Retirement, in 2010, has given him more time to pursue his wide ranging interests in Industrial History.

Stephen K Jones has a particular interest in the study of engineering history, especially relating Brunel and has published 3 volumes on Brunel in South Wales. He is a member of the ICE Panel for Historical Engineering Works (PHEW).

Sue Parker BSc(Dunelm), CPhys., FIMMM is Technical Events Officer at Cleveland Institution of Engineers

Peter Reed is an independent researcher based in Carmichael, California. But his research material is based on extensive work in archives located in the North-West of England.

Dr Fred Starr is a Metallurgist who has specialised in gas manufacture and electric power generation.

Geoff Wallis is a Past President of the Newcomen Society. He is founder and former managing director of Dorothea Restorations Ltd and has over 30 years of experience as a contractor.

Writing for Newcomen Links

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

Articles should be about 1000 words and sent in Word format by email. Short pieces are also welcome. Longer articles may be submitted after discussion with the editor.
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.
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It is not possible to receive photographs/scans of images in books etc if they are still in copyright.

The copy date for the next issue is 1 February 2019
Please submit articles, information, details of events etc to:
The Editor,
Deborah Jaffé at: editor.links@newcomen.com
Tel: 07798 603000

From the President, Robert Taylor

As I come the end of my presidential term, we are moving closer to the centenary of the foundation of our Society. This both gives an opportunity to look back at the contributions that we have made to the study of the history of technology and engineering and consider the role that we would like for our society in the future. Over the last hundred years engineering and technology has changed with the development of new disciplines and professions. The pace of change continues to increase with emerging technologies in a number areas including robotics, artificial intelligence, autonomous vehicles, nanotechnology, quantum computing, biotechnology, and 3D printing. In future years many of these technologies will begin to play an important part of our everyday lives. Our Society must also change with the times and continue to meet the wishes of members, provide value for money and be a society that people with an interest in our subjects would wish to join. As part of this process we are redesigning our website to make it mobile and tablet friendly, reflecting the way that many of our members access information these days. The new website design will also provide new features and make it easier and quicker to upload information for members.

We are also beginning the process of considering what sort of society we would like to be in the future. Our centenary will be a significant occasion for the Society when we aim to engage more people with our work and hopefully attract more new members. Therefore, your Society's Council has begun to consider what we want our centenary activities to deliver for members and the wider public. This will feed into the development of a new strategy for the Society which will set out our key objectives for the coming years. We have already begun consultations with representatives of our Regions to seek their views on the future and we would aim to have a new strategy in place next year in readiness for our centenary.

From the Editor, Deborah Jaffé

There are many 'follow ups' in this issue. Some relate to the Summer Conference on Teesside, which has prompted three further articles. The others include further information on: William Menelaus; the history of mechanical mixers; more boilers and memorials. All follow from pieces in previous issues. For an editor 'follow ups' are a welcome indication that the publication is being read! But they are also a dialogue between members.

Importantly, in this issue, are the conferences and workshops planned for 2019, and there will be more to come. The Society's 2019 Summer Conference will be held in Birmingham to coincide with the many James Watt 2019 events. Also included are pieces on Steam Punk in New Zealand; the ingenious model making of Bodys Isek Kingelez, in the Democratic Republic of Congo; the history of Moore and Wright, manufacturers of precision instruments and two articles on chemical engineering.

I hope, that in the next issue, I can bring you news of some of the events being planned for the Newcomen Society's Centenary year in 2020. In the meantime, please keep reading, observing and sending in your contributions.

The next copy date is 1 February.

Newcomen Matters

Newcomen Society
AGM
13 February at 17.45

The Dana Studio
Wellcome Wolfson Building
165 Queens Gate
London SW7 5HD

followed by
Robert Taylor's
Presidential Address
FROM THE FIRST
TO THE THIRD
INDUSTRIAL REVOLUTION

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The International Society for the History of Engineering and Technology

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NEWCOMEN **Links**

Copy dates for Newcomen Links

1 February
1 May
1 August
1 November

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

Honours

The Society congratulates Malcolm Dick and Ian Blatchford on their New Year Honours. Dr Malcolm Dick is Director of the Centre for West Midlands History at Birmingham University and is closely involved in the forthcoming 2019 James Watt events. He has been awarded an OBE for services to history. Ian Blatchford is Director of the Science Museum Group and has been awarded a knighthood for his services to cultural education.

Condolences

The Socety offers condolences to the family of Lawrance Hurst, who died in November. Lawrance Hurst was a renowned engineer with a vast knowledge of 19th and 20th century engineering history. An obituary, by Andrew Smith, will be published in the next edition of Newcomen Links.

New website

Over the last few months we have been working on the new website. This is now in the final testing phase and almost ready to be launched. The new site will be easy to read and use across all platforms - phone, tablet, laptop and computer. During the change from old to new access to the website will be down for a day whilst we do the transfer. Access to the Archive and Members' Area have been simplified on the new site. There is an on-line shop for publications and many other new features.

Diary Dates

The complete Newcomen diary and information on conferences are published on pages 21-24 and include details on the following:

- 13 February Newcomen Society AGM, followed by the Presidential Address, in London
- 10-11 May Call for Papers & Workshop - The Changing Role of Consultants in Industry 1850–2000, to be held in Oxford
- 21 May Visit to Rhydymwyn Valley Works
- 28 - 30 August, the Newcomen Society Summer Conference to coincide with Watt 2019 in Birmingham.

We now have a clothing line - the hi-vis, Newcomen waistcoat in yellow with reflective stripes, logo and strap line

- The Newcomen logo is printed on the front and back of the bright yellow waistcoat.
- The strap line on the back, reads 'NEWCOMEN working for engineering history www.newcomen.com'.
- The two reflective stripes around it increase visibility.
- The waistcoat is in one size - L/XL - so that it may be worn comfortably over a jacket or anorak.
- It is ideal for group visits to sites or for an individual wearer.
- Wearing one will promote the Society and engineering history to a wide audience.

Price:
£10 plus £1.50 P&P in UK (postage to other destinations available on application)

To order:
Please send a cheque for the appropriate amount, made payable to The Newcomen Society and send it with your name, address and a note of how many tabards you want to:
The Administrator,
The Newcomen Society,
The Science Museum,
Blythe House,
23 Blythe Road,
London W14 0QX

James Watt
1736-1819

2019

Portrait of James Watt by Henry Howard c1797. Wiki Commons

James Watt died on 25 August 2019. A number of events, to mark this, will take place during the year in Birmingham, Scotland and elsewhere. They include:

- The Newcomen Society's Summer Conference 28 - 30 August in Birmingham.
- The James Watt Conference, Rethinking Innovation: James Watt's Networks and their Legacy, 30 August and 1 September at the University of Birmingham
- James Watt Exhibition 12 July - early November, Library of Birmingham:

Further details will be advertised to Newcomen Society members

See also:

- James Watt 2019: https://www.jameswatt2019.org/
- James Watt: Engineer, Inventor, Great Scot: https://jameswatt.scot/
- History West Midlands: https://historywm.com/

Call for Papers
Rethinking Innovation: James Watt's Networks and their Legacy
30 August - 1 September 2019, University of Birmingham

The 200th anniversary of the death of James Watt, on 25 August, provides an opportunity to revisit his personal and public life, relationships, context and legacy. By looking beyond his role in improving steam-engine technologies. This conference seeks to consider the diverse influences that shaped Watt's experiences in Scotland and Birmingham. One underlying theme is to look at Watt the innovator in new ways and explore the idea of innovation at different times and in different localities – an issue that will be explored by a panel of historians and scientists. Other areas that papers might explore include:

- Watt's inventions;
- Watt as an Enlightenment figure;
- Watt's relationship with his workers;
- Watt the politician;
- Watt's family;
- The steam engine and plantation slavery;
- Watt and the environment;
- Watt's legacy.

We also encourage presentations which consider relevant archival, visual, printed or artefactual primary material. Watt is frequently conceived as a heroic genius, but the conference encourages papers that look critically at his work and impact and consider how others helped to shape his inventions.

This conference will bring together academics in different disciplines, including scientists and engineers – the Newcomen Society and Birmingham Centre for Railway Research and Education are involved – as well as historians; heritage professionals working in archives, libraries and museums and researchers at all stages of their careers inside and outside universities. Alongside the conference, there will be a major Watt exhibition at the Library of Birmingham and the oldest surviving Watt working steam engine, the Smethwick Engine, will be operating at Thinktank, Birmingham Science Museum.

Book launches

David P. Miller (University of New South Wales), The Life and Legend of James Watt: Collaboration, Natural Philosophy and the Improvement of the Steam Engine (University of Pittsburgh Press)

Malcolm Dick and Kate Croft (eds), James Watt: his life and Legacy in 50 objects (History West Midlands Ltd.)

Malcolm Dick and Caroline Archer-Parré (eds), James Watt (1736-1819): Culture, Innovation and Enlightenment (Liverpool University Press)

Confirmed Papers

Kate Croft (University of Birmingham), 'Of Material Service to Him: Women in the Life of James Watt'

David P. Miller (University of New South Wales), 'The Life and Legend of James Watt: Collaboration, Natural Philosophy and the Improvement of the Steam Engine'

Leslie Tomory (McGill University). 'James Watt & Co: Industrializing Gas Technology'

Seen

Steam Punk in New Zealand

The Steam Punk movement has developed its own areas of academic study, not only in engineering but also in literature and future studies. Geoff Wallis found a recent visist to the Steam Punk HQ in Oamaru, New Zealand fascinating and has supplied these phototgarohs. The unique locomotive is on display outside the Steam Punk HQ - manufacturer unknown! Whilst the moa, flightless birds foudn in New Zealand, are now extinct, a different form of rare 'moa' is still extant in this hybrid bicycle and mower.

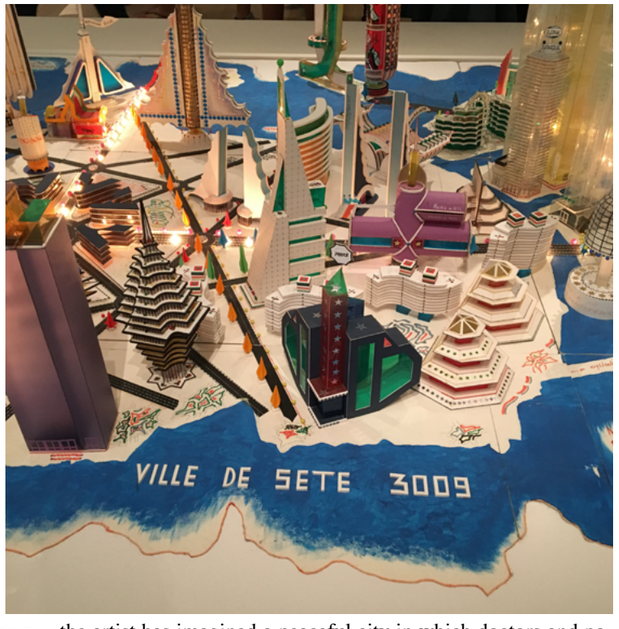
'Steampunk is a quirky and fun genre of science fiction that features steam-powered technology.

'It is often set in an alternate, futuristic version of 19th century Victorian England steam powered devices – the 'world gone mad' as Victorian people may have imagined it. Examples are machines like those in the writing of H. G. Wells and Jules Verne, and in television shows such as Dr. Who.'

www.steampunkoamaru.co.nz

Bodys Isek Kingelez, model maker

"Without a model, you are nowhere. A nation that can't make models is a nation that doesn't understand things, a nation that doesn't live," said visionary artist Bodys Isek Kingelez (1948–2015). Based in then-Zaire (now the Democratic Republic of Congo), following its independence from Belgium, Kingelez made sculptures of imagined buildings and cities that reflected dreams for his country, his continent, and the world. Kingelez's "extreme maquettes" offer fantastic, utopian models for a more harmonious society of the future. An optimistic alternative to his own experience of urban life in his home city of Kinshasa, which grew exponentially and organically with urban planning and infrastructure often unable to keep step, his work explores urgent questions around urban growth, economic inequity, how communities and societies function, and the rehabilitative power of architecture—issues that resonate profoundly today.



Kingelez's vibrant, ambitious sculptures are created from an incredible range of everyday materials and found objects—colored paper, commercial packaging, plastic, soda cans, and bottle caps—all meticulously repurposed and arranged. While he didn't travel outside of Zaire until 1989, he was highly attuned to world events and deeply concerned with social issues. The Scientific Center of Hospitalisation the SIDA (1991), for example, references the AIDS crisis; Palais d'Hirochima (1991) addresses the condition of postwar Japan; and U.N. (1995) attests to the organization's global peacekeeping efforts and the artist's own sense of civic responsibility. In the complex multi-building cityscape Kimbembele Ihunga (1994), the artist reimagines his agricultural home village complete with a soccer stadium, banks, restaurants, and skyscrapers. In Ville Fantôme (1996), which will be accompanied by a Virtual Reality experience for visitors, the artist has imagined a peaceful city in which doctors and police are not needed.'

Extract from the catalogue of the exhibition of Kingelez's fantastical world held at MOMA, the Museum of Modern Art, New York in 2018. DJ

Mechanical Mixers

Miles Lewis responds to Bruce Comfort's item in the March 2018 issue, about the concrete mixer used at the Oamaru breakwater, New Zealand, in 1874. Was this 'the first or a very very early mechanised device?'

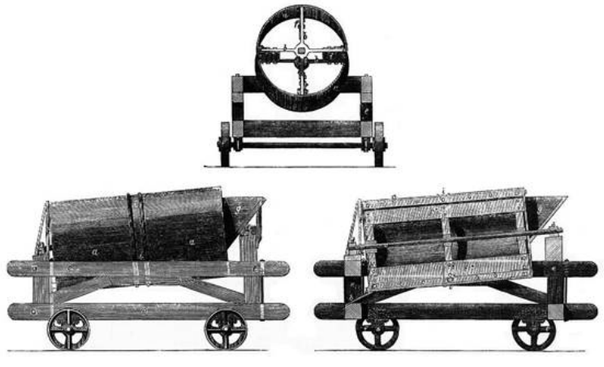
In 1857 Louis Cezanne had invented the first mechanical mixer, a cylinder 3.9m long by 1.2m in diameter, inclined at an angle between 6º and 8º, and made to rotate at 20 revolutions per minute.[1] Something very similar was later used at Birkenhead Docks in England, and was claimed to be the invention of the resident engineer, Le Mesurier.[2] A mixer patented by Ridley in 1865 seems to have been very similar, in that it was a cylindrical drum (or alternatively a cone) tilted at a small angle and rotating. The difference was that the drum contained four 'shelves' or planks running lengthwise along the perimeter in radial planes, so that the mixture would be picked up and dropped off the shelves as the drum rotated.[3]

In France Coignet devised a special machine called the 'malaxator' for preparing his *béton aggloméré*. It had a chamber like a pair of cylinders overlapping in parallel, with no division between them. Each contained an Archimidean screw turning simultaneously in the same direction, so that they overlapped but did not clash. The whole was placed at an angle of about 25º and the raw materials fed through hoppers at the lower end, while the mixed concrete was drawn off at the top.[4] Another machine was the 'Greyveldinger mortar mill', a rather simpler device on the same basic principle. It consisted of a cylindrical trough containing a single Archimidean screw, the whole again angled at about 25º, with the raw materials fed in at the lower end.[5]

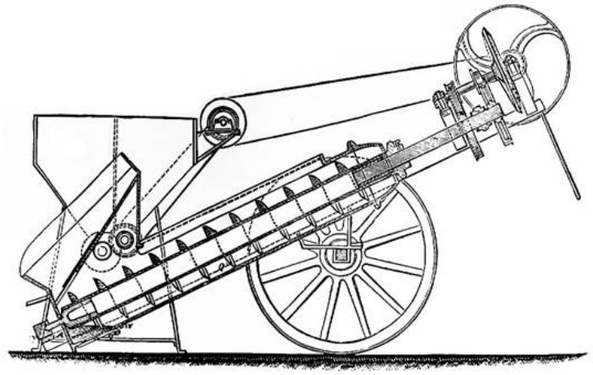
By 1868, something more akin to the vertical pugmill of the brickmaker was being used for *béton coignet*, as described by L F Beckwith in 1868. The basis of it was a mixing cylinder, which was essentially a pugmill, consisting of a vertical metal tube within which a vertical spindle revolved, carrying projecting arms in a helical arrangement. Other short arms projected in from the side of the tube, doubtless counteracting the tendency of the mix to move around as a solid spiral. The materials were carried up at an angle by means of a bucket elevator, and discharged through a chute into the top of the cylinder.[6]

References

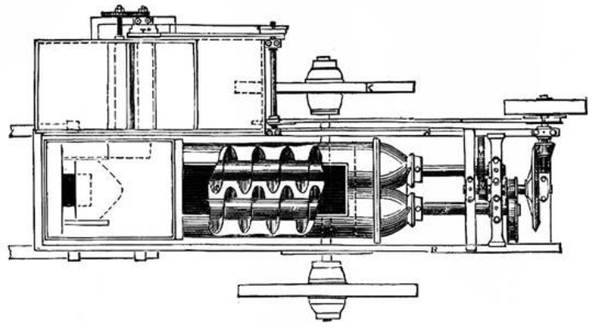
1. *Henry Reid, A Practical Treatise on Natural and Artificial Concrete (London 1879), p 93; Hans Straub [translated E Rockwell], A History of Civil Engineering (Leonard Hill 1970), § 268; Kenneth Hudson, Building Materials (Longman, London, 1972), p 60.*
2. *Reid, Treatise on Concrete, pp 301-3.*
3. *Illustrated Builder's Journal, 4 July 1865,p 53; 22 August 1865, p 15.*
4. *Reid, Treatise on Concrete, pp 164-6.*
5. *Reid, Treatise on Concrete, pp 177-8.*
6. *Leonard Beckwith, Report On Béton-Coignet, Its Fabrication And Uses, &c [in the series W P Blake [ed], Reports of the United States Commissioners to the Paris Universal Exhibition, 1867] (Government Printing Office, Washington 1868), pp 7-9 & pl 1*



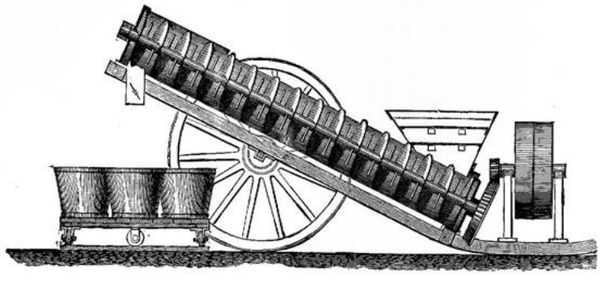
Ridley's concrete mixer: *Illustrated Builder's Journal*, 22 August 1865, p 157.



The Malaxator, elevation: Henry Reid, *A Practical Treatise on Natural and Artificial Concrete: its Varieties and Constructive Adaptations* (Spon, London 1879 [1868]), p 165.



The Malaxator, plan: Henry Reid, *A Practical Treatise on Natural and Artificial Concrete: its Varieties and Constructive Adaptations* (Spon, London 1879 [1868]), p 166.



The Greyveldinger mortar mill: Henry Reid, *A Practical Treatise on Natural and Artificial Concrete: its Varieties and Constructive Adaptations* (Spon, London 1879 [1868]), p 179.

William Menelaus 1818-1882

Stephen K Jones follws up on William Menelaus.

With regard to Leslie Shore's article on William Menelaus I would just like to add that the engineering institute he founded in Merthyr Tydfil, the South Wales Institute of Engineers, is not strictly defunct as it was re-constituted in 2007 . Now the South Wales Institute of Engineers Educational Trust (SWIEET2007), it has the aim of encouraging and developing interest in engineering and related works to a wider society, particularly the young, and providing support to those in engineering education and training. A tradition continued is the William Menelaus Memorial Lecture, first hosted in 1927, in association with the Learned Society of Wales. More recently it has initiated and sponsors the Menelaus Medal, awarded for excellence in any field of engineering and technology. SWIE would retain its original title for 150 years and was the third such body to be formed in the country. It was formed following a meeting held at the Castle Hotel in Merthyr Tydfil on 29 September 1857 and at the first official meeting on 29 October 1857 Menelaus was elected as its first president.

In the following years meetings were held at Merthyr, Cardiff, Newport and Swansea, in 1893 a purpose built headquarters was built in Cardiff. The building still stands but in 1987 SWIE moved out and the building was converted into a restaurant and bar. To return to Menelaus and steel it is interesting to note that in 1876 the resident trustee at Dowlais, George Thomas Clark, made the following comment on the changes made by Menelaus in rolling steel rails, '…so far as we can see, no great railway company will again lay down iron rails …The iron rail trade is a thing of the past.' Prior to his pioneering work Menelaus was instrumental in carrying out numerous improvements in wrought iron making technology, inventing several mechanical handling devices, puddling processes and designing the two-directional 'Goat Mill' at Dowlais for iron rolling which was the most powerful mill of that time. A number of factors would change the dynamics of steelmaking at Dowlais, changes that resulted in a new integrated steelworks being built alongside the docks at Cardiff but this would take place after Menelaus's death.

http://swieet2007.org/
Joe England, Merthyr: The Crucible of Modern Wales, (Parthian, 2017), p 198

More on Boilers

Robert Protheroe Jones has further information on boilers.

The photo query in Newcomen Links 244, p24 is an egg-ended boiler, once exceedingly common but now a relatively scarce survivor. Such boilers were externally heated by a firebox beneath one end, the products of combustion being routed through longitudinal brick flues that typically passed first along the base of the boiler, and then along the sides, before exiting to a chimney stack, though there were variations to this basic layout. The large projections are on the upper surface and enabled attachment of a pressure gauge and a safety valve, and one of them at least would have been a manhole to enable entry for periodic cleaning of scale and sediment deposits. The smaller triangular projections are along its sides and supported the boiler within its brickwork setting, their form permitting movement due to thermal expansion and contraction. Although egg-ended boilers were less efficient than boilers with internal flues (first single-flued wagon and Cornish boilers and then the double-flued Lancashire boiler), their simplicity, relative ease of manufacture, and robustness, kept them in use in locations where coal was cheap, notably collieries. Examples survived in use after the second world war. Being un-obstructed by internal flues, life-expired egg-ended boilers sometimes found a subsequent use as unpressurised storage tanks for water, oil and other liquids. In such secondary use, the upper surface projections usually had blanking plates applied in place of gauges and valves. Where inaccessible to the scrapman, a few remain, such as this example.

K-Class Submarines, the Memorials in Anstruther, Fife

John Howat enjoyed the recent article in the September edition of NLinks and the report of the lecture by Geoff Horseman on the K-Class Submarines. He writes about the memorials to the 104 men who died in the Battle of May Island and who are not forgotten. There are two memorials to them on the sea front in Anstuther, Fife, the closest harbour to the Isle of May and the site of the disaster in the Firth of Forth. The memorials are situated opposite the Fisheries Museum, close to the Lifeboat House.

The "Battle' of May Island

On the night of January 31st 1918, a disaster took place just a few miles off Anstruther when the British Grand Fleet left Rosyth for exercises in the North sea. With wartime news restrictions in force, few if any people onshore were aware of this. At speed and without navigation lights and in radio silence, the leading column of submarines encountered two minesweepers also operating without lights and completely unaware of the Fleet's movements.

In the ensuing confusion two submarines, the K4 and K17, were rammed and sunk with the loss of 108 lives. Four other submarines and a cruiser were severely damaged. Relatives were merely informed that their loved ones were lost on active service.

The Submariners Association and Fife Council
www.submarinersassociation.co.uk
Fife Council
www.fifedirect.org.uk

Contribute to Seen

Contributions to Seen are always welcome. They should be of 'things seen' and not extracts from archives, books etc. Pieces should be a maximum of 300 words, with up to two images. Images should be sent separately and be a minimum of 300 dpi.

Please send contributions to the editor at: editor.links@newcomen.com

Billingham Branch Bridge

One of the 48 ft spans of the bridge. Charles Morris is in the centre of the picture. Image: Fred Starr

Arrangement of the columns and deck beams. Apart from the inevitable graffiti, the bridge seems to be in very good condition. Image: Fred Starr

Fred Starr

On the way back from Hartlepool, we stopped off at the historic Billingham Branch Bridge, dating from 1932, where we were joined by Charles Morris, who through his talks and his ICE brochure on the "Bridges of the River Tees", was the original inspiration for the Newcomen Tour. Charles was our guide on the visit to the bridge, and I have chatted with him since. However, much of the content of this article comes from ICE Paper 5017 by Haldane and Roberts, published in 1935.

The bridge name originates from one of the last branch lines to be built in the Teesside area. The track has been lifted, but it ran from just north of Stockton Station through to marshalling yards at Port Clarence, where it joined the original Clarence Railway. Both the branch line, the bridge, and the new north-south road, over the bridge, running from Billingham Bottoms and then across the nearby Tees over the Newport Bridge, would have been built to serve ICI Billingham and the ship building and power stations on the north side of the river. As such, the Billingham Branch Bridge is reputed to take a dead load of 450 tons.

The historic importance of the bridge comes from its all-welded construction, the first time this technique had been used in Britain. Although welded bridges had been built on the Continent, serious failures had occurred, often in cold weather, with steel quality being an issue. The durability of the bridge is a testimony to efforts made by Dorman Long Ltd, one of the big Middlesbrough steelmakers. Not only did they supply the steel but were also responsible for the welding. Numerous load tests were made on the types of weld configurations that were to be used. The ICE paper contains details. Total bridge length is 216 ft (c.67m) and the centre span is 64 ft (19.5m).

The bridge is of a five-span type, each arch being reminiscent of a sophisticated portal frame, the probable loads being reflected in the width and depth of the webs. Since the stresses change in a uniform manner from the bottom of the columns to the centre of the spans, this results in a smooth widening or narrowing through the arches, as appropriate, giving the bridge a modernist "art nouveau" look.

The five spans were insisted upon to ensure that the railway track would not be disrupted by earth movement caused by pressure from the embankments or from piling. The ground here is very soft, the first test pile sinking 24 feet under its own weight! In addition to the piling, a reinforced concrete underframe was needed to give stability to the piers. The Rotinoff piling technique was another innovation that was used.

Charles himself had to do some restorative work in the 1990s, following cracking of the beams on part of the underframe. He told me that the foundation problems come from the last Ice Age, when the Tees was flowing through a gorge 70 feet deep (sea level was 100ft lower at that time). The piles go down to that depth. During the work, he noted that the movement of the embankments could be measured in feet. I suggested to him that this seems to confirm the integrity of the structure, given that the shifting of the ground and embankments must have put new loads on the bridge, these coming from some unusual directions. There is no obvious distortion or cracking.

The bridge cost a laughable £28,226.5s.11d, the odd shillings and pennies equating to about 33 pence. In the ICE discussion to the paper on the subject, a Mr Gribble stated that it cost three times as much as a riveted example. But it appears that much of the expense went on the piling, and the cost of the steel was coming out at £2.25 per square foot, to use modern currency, about a third less than usual. Furthermore, the actual bridge weight was 70% of that of a riveted design. Charles left me with the thought that despite the use of welding as a fabrication technique, which gives new design possibilities, there was little interest by the British ship building community until after WWII.

The bridge still stands, although like much else on Teesside, bulldozing was a threat. Local activists helped in its rescue, but it was really saved by the cost of renewing the electrical services that cross the spans. One hopes that now the Newcomen Society has been fully alerted to the importance of bridge, our members will give support to its continued existence.

Grave findings on the Founders of the CIE

Sue Parker

In 2014, the Cleveland Institution of Engineers (CIE) celebrated its 150th anniversary. The then President, Dr Graham Hillier, said to me that it would be nice to know where the Founders were born and buried, and would I like to find out! Never being one to pass up a challenge I agreed to do this and the results are fascinating.

It is widely acknowledged that there were three Founders of the CIE, although there were seven people present at the inaugural meeting. The principal three are:-

- Jeremiah Head – Newport Rolling Mills, Fox, Head & Co.
- Thomas Wrightson – partner in Head Wrightson, later Sir Thomas, and Stockton's MP
- Thomas Whitwell – partner in W Whitwell & Co. with his brother.

Others present at the meeting were

- David Joy (Chair) - Steam Hammer Works,Middlesbrough,
- Thomas Howard Head - Teesdale Ironworks,Stockton, (brother of Jeremiah)
- Ernest Hutchinson - Skerne Ironworks,Darlington,
- Alfred Clayton Hill - Clay Lane and South Bank Ironworks,

Jeremiah Head (1835 – 1899)

Jeremiah Head was born in Ipswich in 1835, and married Rebecca Wrightson (Thomas' sister). He did much to develop the demand for malleable iron, and develop use of Cleveland Iron Ore. He worked with Robert Stephenson in Newcastle in his early years, where he was entrusted with the design and installation of a huge pair of compound condensing engines for Messrs Pease and Partners, Darlington. Still at Stephenson's he was resident engineer for a new bridge built over the river Wear at Sunderland. For several years he resided in Swindon, Wiltshire working on improving the design of steam ploughs. He moved to Middlesbrough, convinced that there was money to be made in the rolling of steel plates and sheets for the manufacture of boilers and ships, where he formed Fox, Head and Co with Sir Joseph Pease, Mr Theodor Fox, Mr Joseph Dodds and others. Thus the Newport Rolling Mills were built. He lived in Marske, then Kirkleatham before moving to London in 1895 to set up a consulting engineer's business with his son, Archibald. He frequently visited America to advise on engineering matters.

Jeremiah Head died in Hastings, and I spent a lot of time trying to find where he had been buried. I did not know if he had been brought back to London (or even Middlesbrough) or buried in Hastings. He was a Quaker, like many ironmasters, (eg the Pease family) and I spent some time searching Quaker graveyards. After much squinting at microfiche in Middlesbrough Library, I eventually I found this extract in The Times, Monday March 13th, 1899.

Highgate Cemetery, in north London, contains the

HEAD.—On the 10th inst., at Hastings, in his 64th year, JEREMIAH HEAD, of London. Funeral at Highgate Cemetery, on Tuesday, at 3 30 o'clock. Friends, kindly accept this intimation.

graves of many famous people, including Michael Faraday, Karl Marx, and 170,000 other people in 56,000 graves! So it wasn't a case of going to London and wandering round the cemetery to find him. However, four years on, I had the kind offer via Deborah Jaffé (editor of Newcomen Links) and Elizabeth Duff (NLinks proof reader and Guide at Highgate Cemetery) to locate and photograph the now overgrown grave. So now I have a location, and a photograph, and next time I am in London, I will go and visit Jeremiah.

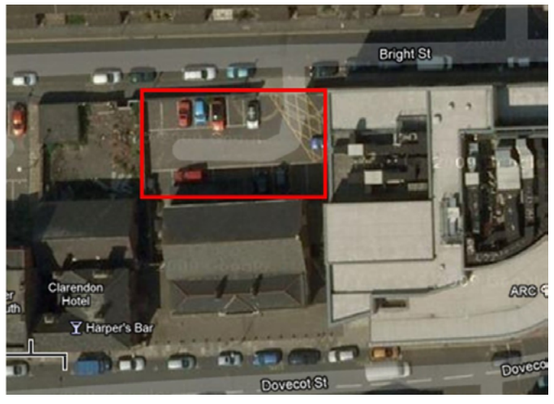
Thomas Whitwell (1839 – 1878)

Thomas Whitwell was born in 1837 at Kendal, in Westmoreland, and as a Quaker, completed his school studies at the Society of Friends' School in York in 1853. At the age of 16 he was apprenticed to Mr Alfred Kitching, locomotive builder, at Darlington. After two years spent at Darlington he went to the well-known engineering establishment of Mr. Robert. Stephenson and Co., Newcastle, to complete his apprenticeship. After having finished his apprenticeship, he joined his brother William and others in starting an iron smelting business at Thornaby in 1859. Initially there were three blast-furnaces and the company was called Messrs Whitwell and Co. Here Thomas Whitwell took a prominent position as an able businessman and an authority on various questions connected with blast-furnace practice. In particular, he developed the heating stove for blast, which he patented in 1865, as an improvement upon Siemens and Cowper's regenerative brick stove. His stove was adopted in many places in the UK, and even more extensively in America and Europe. In 1873 he patented an improved fire-grate, and in 1876 he patented a continuous brick-burning kiln.

The founding meeting of the Cleveland Institution of Engineers was held at his house at 8 Church Row, Stockton-on-Tees, alas no longer there. His untimely death was as a result of an explosion and fire in the pit of a coal-fired reheating furnace

at his own works, where he and a colleague (who also died) were investigating a problem with the furnace. A detailed account is contained in The Engineer, Aug 9th 1878, p 91.

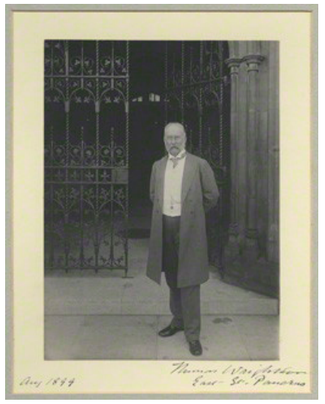
Again I was looking for Thomas Whitwell's grave in a Quaker cemetery, and since there was a large one in Darlington, initially I spent some time searching that via the Internet. I later found out from Stockton Library Heritage Officer, that Thomas had been buried at the rear of the Stockton Friends Meeting House on Dovecot Street. The Historic Buildings officer said that this became a solicitor's office in 1978, and the gravestones at the rear of the property were torn up and destroyed, and the ground became a car park. The graves are still there under the car park, so Thomas Whitwell is in good company with Richard III!



Sir Thomas Wrightson (1839 – 1921)

Sir Thomas Wrightson, Bart., was born at Haughton-le-Skerne, near Darlington, and was educated at private schools and at King's College, London. He served his apprenticeship with his cousin, Lord Armstrong, at Elswick, and then went to Westminster to study civil engineering. At the age of 25 he entered the employment of Head, Ashby, and Co., of South Stockton and shortly afterwards joined the firm, which became known as Head, Wrightson, and Co., subsequently converted into a limited company in 1890. For many years he was vice-chairman, and latterly chairman of the company, one of the largest bridge-building businesses in the country. He was also a director at one time of the North-Eastern Steel Co., Middlesbrough, and was chairman of the Cramlington Colliery Co., in Northumberland.

For upwards of 30 years he was closely identified with the public life of Stockton and Thornaby, and was an active member of the Tees Conservancy Commission. He was Member of Parliament for Stockton from 1892 to 1895, and for St. Pancras East from 1899 to 1906, when he was defeated. A Baronetcy was conferred on him in 1900. He was deeply interested in problems outside engineering, and was the author of a new theory of hearing, which he expressed in a work entitled "An Inquiry into the Analytical Mechanism of the Internal Ear."



He lived at Neasham Hall, on the banks of the river Tees (demolished in 1970 alas), where his death took place on 18 June 1921, at the age of eighty-two. Finding his grave was relatively easy. Google came up with a photo, I looked on Google Maps to find out where it was, and went there! He is buried in Erryholme churchyard, with Elizabeth, his wife. Erryholme, a small hamlet with a 13th century church is situated to the south west of Darlington.

It is joined to where Neasham Hall used to stand, by a private bridge, built by Sir Thomas in 1909, presumably as a short cut to church!

So, eventually, I found where all three Founders were born and buried, and more about them all: a task made much

easier by the existence of the Internet. I'm sure it would have been much more difficult and time-consuming, if not impossible, 54 years ago at the time of the CIE centenary.

Highgate Cemetery: https://highgatecemetery.org/

We are grateful to Dr Ian Dungavell, chief executive of Highgate Cemetery, for enabling the research and photography of Jeremiah Head's grave

Ammonia Synthesis and Fertiliser Manufacture at Billingham

A building block of peace and war as John Brightling explained to the Newcomen Annual Conference and Jonathan Aylen reports

Ammonia is a basic building block of peace and war. It is both a precursor to fertiliser and a key component of explosives through its role in making nitric acid. It is, of course, a compound of nitrogen and hydrogen which are fundamental components of air and water. Ammonia is a route to almost all nitrogen compounds, including Urea used to clean up diesel exhausts. As a result of its many uses, it is one of the most widely produced inorganic chemicals worldwide.

Billingham, on the north bank of the River Tees, has played a major role in ammonia production since the end of World War I. In a superb paper to the Newcomen Annual Conference at the University of Teesside, John Brightling of Johnson Matthey outlined the 100 year history of ammonia and the fertiliser industry at Billingham - a history of sustained innovation right up to the present day. Johnson Matthey is a world leading catalyst supplier. Catalysts are involved at almost every stage in the production of nitrogen compounds from ammonia.

John Brightling is Ammonia Commercial Manger for Johnson Matthey, so he was well placed to survey the development of the global industry up to the present. [1] He started out as a Mechanical Engineer, graduating from Leicester University, but got drawn into chemical production at Olefins 6, the ethylene cracker on the South Bank of the Tees seen by the Newcomen Society during the Annnual Tour visit to the Wilton site. For the past 18 years he has worked in the catalyst business.

Overcoming the Malthusian Dilemma

John's talk began with the Malthusian Dilemma: the idea proposed by Parson Thomas Malthus in his Essay on the Principle of Population 1798 that the world was condemned to starvation and poverty because population growth would outstrip food production. He foresaw population growing geometrically while food production would only grow at an arithmetic rate. Parson Malthus did not foresee the rise of synthetic fertilisers. Some 85% of world nitrogen production now goes into agriculture. Half of the world's food production now depends upon fertilisers derived from ammonia.

The great breakthrough in ammonia production was the Haber-Bosch process, pioneered in Germany and commercialised in 1913. This allowed ammonia synthesis from atmospheric nitrogen. Today, ammonia production worldwide is still largely based on modifications of the Haber-Bosch process. Ammonia (NH_3) is synthesised from a 3:1 mixture by volume of H_2:N_2 at elevated temperature and very high pressure in the presence of an iron catalyst. The nitrogen used is readily obtained from the air, but John Brightling explained the hydrogen has been obtained from a variety of process routes over the years.

During World War I, nitrates were required for the war effort and Britain's "Great Shell Scandal" gave a strong impetus to exploring new routes to making synthetic ammonia for explosives. A government owned nitrate factory was set up at Billingham on North Teesside. The site was chosen because of readily available supplies of coal and the presence of the new North Tees electricity generating station nearby. At the end of the war, the factory was sold off to Brunner Mond (later to become part of ICI) and it was apparent that the plant needed to adopt the Haber-Bosch process used at Opau in Germany.

Adopting Haber-Bosch in the UK

The 2015 Newcomen Conference *Swords into Ploughshares*, on the changes in British industry during and after the World War I, heard a paper from Barry Tate showing how the British set out to learn the secrets of the Haber-Bosch process after the war ended.[2] In principle, the British had access to the German plant at Opau as part of reparations agreed under the terms of the Peace Settlement. Naturally, BASF were less than cooperative and obstructed the fact-finding mission sent to learn details of the high pressure process. Instrument dials were concealed and the detailed British blue-prints stolen on their way back to the UK.

Nevertheless, Brunner-Mond persisted with reverse engineering of the new process, helped by building their own small scale pilot plant and construction of extensive chemical engineering facilities to support development of the high pressure process. In this way, Teesside built up capabilities in chemical plant design and construction. A chemical engineering cluster began to evolve on Teesside with firms such as Power Gas Corporation at Stockton and Ashmore, Benson and Pease.

The first Haber-Bosch synthetic ammonia plant came on stream at Billingham in December 1924. This "number 2 unit" made just 24 tons a day. But the plant was soon extended by 1926 and further units were added in 1928 (no.3) and 1929 (nos. 4 and 5 units.) By 1930, Billingham was making 400 tons of ammonia a day.

The role of coke

John illustrated the nature of the early ammonia process with a short ICI film called "It's in the Air". The film showed gas being produced by first passing steam and then air across hot coke. This made alternately water gas rich in hydrogen and then producer gas rich in nitrogen. The black-and-white documentary showed how hydrogen sulphide contaminants were removed from the hydrogen using iron oxides. A shift converter turned carbon monoxide into CO_2 and added to the hydrogen. The carbon dioxide was subsequently washed out with water scrubbers under pressure and further purified with copper liquor. The initial syngas production took place at atmospheric pressure, but subsequent processes took place at higher and higher pressures as the gas was compressed by a sequence of compressors. Eventually the clean hydrogen and nitrogen were forced to merge at 265 times atmospheric pressure in a bank of parallel converter vessels.

The coke was produced on the Billingham site using good quality Durham coking coal. The use of coke was very inefficient and maintenance costs were high. Only 40% of the energy in the coking coal turned up in the syngas. But the process persisted into the 1950s when the rising price of coking coal forced a search for a more efficient process route. Even so, by 1951, ammonia production at Billingham had climbed to 746 tons a day. It is a measure of the importance of coal that the ICI Billingham site continued to use 2 million tons of coal a year up until the 1960s for power plant, steam raising and as a chemical feedstock.

One alternative route to a syngas feedstock was to use high pressure oil gasification. A Texaco gasifier working at 30 bar was used to react hydrocarbon with steam and oxygen. This had the added advantage that the syngas emerged at high pressure as a feedstock for the Haber-Bosch conversion stage, saving on low-pressure compressors. The disadvantage was that the process needed an oxygen supply. To this end an air separation plant was installed. But air separation plants were temperamental in those early days and an explosion in 1959 called a halt to high pressure oil gasification.

Steam Reforming Technology

ICI developed a process for making syngas from hydrocarbons in place of coke using steam reforming technology. [3] Early research had taken place at Billingham since 1928 and the first steam reformer was built at ICI Billingham in 1935 to use the waste hydro-carbon by-products from an oil-from-coal plant. The plant was successfully replicated at another petrol-from coal-plant at Heysham in Lancashire during the war and the early technology was also sold in the USA. After the war, the ready availability of naphtha from the growing petroleum industry made steam reforming an attractive low cost route to hydrogen production.

Steam reforming began to be used for ammonia feedstock at Billingham from 1962 onwards. This was to replace all the coal units at Billingham, with four steam reforming plants built by the mid-1960s. ICI were to go on and license the process around the world. By the mid- 1960s ICI had sold licences for over a hundred steam reforming plants via British, American and German process plant contractors.

Steam reforming of hydrocarbons was to prove a much cheaper process. Using a nickel catalyst, a hydro-carbon and steam can be persuaded to break down into carbon monoxide and hydrogen at a temperature in the range 700-800° C. These syngas plants operate at very high pressure, compatible with the adjacent ammonia synthesis stage. One breakthrough was to clean the sulphur out of the feedstocks using various catalysts and a zinc oxide absorbent. New types of catalyst were also required to stop carbon formation on the catalyst without using excess steam. The new plants were far more compact in terms of space. Use of chemical absorbents to remove $C0_2$ also saved on the high operating and capital costs of the old high pressure water scrubbing stages. Development of sulphur free syngas also opened up a new range of catalysts.

Scale-up

Once steam reforming had become established as the best route to syngas production for ammonia, the next step was to scale up plants to higher and higher output levels. In the early 1960s, 300 tonnes of ammonia a day was a large throughput. By the end of the 1960s Billingham had three 900 tonne plants built by the process plant contractor M.W. Kellog. These were the largest in the world at the time, though it was surpassed by the Ammonia 4 plant started up in 1978 designed by ICI which made 1125 tonnes a day with ease. This single stream plant is still running at Billingham under new ownership.

By the 1970s North Sea Gas was becoming readily available and was cheap if bought on an "interruptible supply basis". If gas supplies were cut, for instance at times of peak domestic demand in the winter, propane stored in underground salt caverns near the Billingham site was used instead. This meant of course that all catalysts on the plant had to be tolerant to both natural gas and liquefied petroleum gas feedstocks.

Billingham continued to be the centre of expertise in ammonia plant design for ICI, although the Ammonia V design meant for Billingham was built instead in Canada. John Brightling also outlined the continuing improvements in catalysts, especially in terms of reducing unwanted methanol by-products in the process. There have also been improvements in the shape of catalysts, helped by the application of modern computer based techniques such as finite-element analysis to help the geometric design. There have also been further improvements in overall ammonia plant design with the dual pressure process allowing a 3,300 tonne per day plant to be built in Saudi Arabia in 2006. This is a far cry from the initial 24 tonnes a day at Billingham in 1924.

The global ammonia industry has grown massively over time. In 1945, ammonia production was less than 5 million tonnes a year, despite the wartime effort. By 2010 it exceeded 160 million tonnes. Around half the world's population now rely on the Haber-Bosch process for their food supplies. But over that time both energy efficient and environmental emissions have improved dramatically.

1. *The full version of John Brightling's paper on "Ammonia and the Fertiliser Industry: The Development of Ammonia at Billingham", is published in Johnson Matthey Technology Review, 2018, volume 62, no.1, pp. 32–4 which can be found at https://www.technology.matthey.com/ or at https://doi.org/10.1595/205651318X696341. Also see www.jmprotech.com*
2. *Jonathan Aylen, "Swords into Ploughshares – the technical legacy of the First World War for industry - Report on a Newcomen Conference, 24th October 2015, Newcomen Links,*
3. *N.R. Gard, "Thirty years of steam-reforming—a review of ICI developments and experience" Nitrogen, the Journal of World Nitrogen, 1966, no. 39, Jan-Feb., pp.25-29*

Further reading:
Anthony S. Travis, Nitrogen Capture: The Growth of an International Industry (1900–1940), Springer, 2018

P.W.B. Semmens, "Chemical process engineering at I.C.I. Billingham", Transactions of the Newcomen Society, vol.55, 1983-4, pp.52-59

Declaration of interest, Jonathan Aylen is a shareholder in Johnson Matthey

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Moore and Wright of Sheffield

David Eaton

In 1906 Frank Moore began to make engineers' hand tools in a one-room workshop in Reed Street before moving to larger premises on Trafalgar Street, Sheffield. A 1910 catalogue shows the wide range of tools made that included: feeler gauges, firm joint and spring calipers, nail and centre punches, scribers and tap wrenches along with factored goods such as brass blow lamps and leak proof oil cans. Moore and Wright (M&W) was to become a British competitor to L.S. Starrett, Brown and Sharpe and Lufkin of the USA. The Wright in the title is said to be the maiden name of Mrs Moore which was no doubt added to make the company sound substantial.

Above: Frank Moore
Below: Cover of a 1910 catalogue showing the works in Reed Street and Trafalgar Street, Sheffield.

During the 1920s M&W factored many UK and imported tools to sell alongside their own products. These were sold under the trade mark of AVIA. Included in these factored tools was a small range of micrometers with that name but made in Switzerland by a firm called Aureole and similar in style to those produced by Starrett.

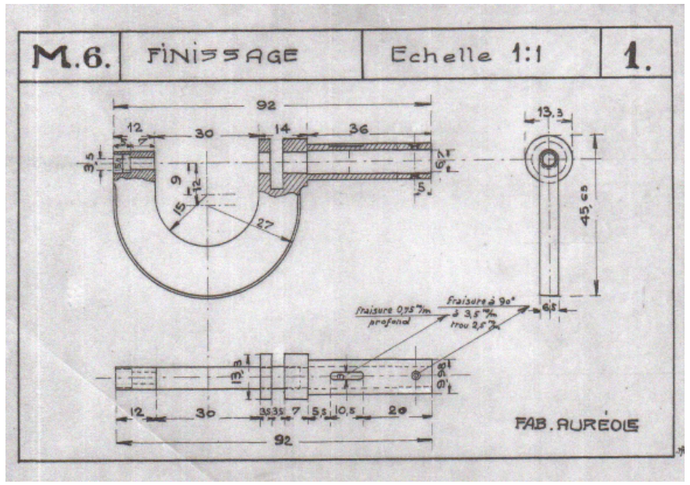
In 1924 the British Government commissioned M&W to look into the possibility of producing micrometers on a large scale. The government was, at that time, cautious in the event of another war, and did not want to be caught out as it had been in run up to World War I. Britain needed its own capability for fine measurement using home produced tools instead of relying on tools from the USA, Germany and Switzerland. With the Aureole connection in Switzerland, M&W asked for their assistance with engineering drawings of micrometers and the machine tools needed to produce them. Aureole responded positively although the drawings provided were in metric had to be converted into imperial measurements by the M&W draughtsmen.

Using these drawings and machine tools the first M&W micrometers were made in 1930 and retailed in 1931. In the catalogue of that time is a copy of an NPL certificate dated January 1932 which verifies that M&W micrometers were made to a "Class A" standard. To improve the micrometers some design and manufacturing details were changed at an early stage. For example, the earliest ones had a spindle diameter of 0.25in which was soon increased to 0.268in. The early spindles were made of hardened silver steel and fitted to a mild steel screw which was cut on an Aureole thread milling machine and finished with a single point lathe tool, the thread being picked up with the aid of a microscope. The screw was left in a soft state and only the spindle was hardened with the two parts being shrunk together.

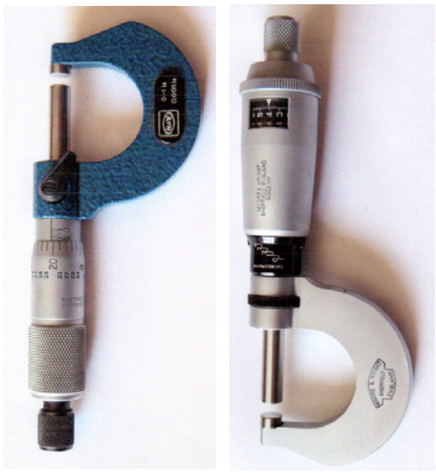
In 1932 a one-piece spindle/screw was made for better accuracy using Kyser Ellison KE637 non-distorting steel with the threads being ground. This process was made possible by major developments in machine tool technology. Machines for grinding precision threads onto hardened steel were developed by Coventry Tool and Gauge Ltd and John Holroyd and Company of Milnrow, Lancashire. M&W used thread grinding machines purchased from these two companies to become the first in the world to mass produce micrometers with hardened and ground screw threads. The Coventry Tool and Gauge machine employed a diamond cut ribbed wheel which gave a pitch accuracy within 0.0001" which was the best in the world at that time.

M&W quickly extended their range of precision measuring tools in the build up to WWII. Under the Emergency Powers (Defence) Act, the government instructed M&W to concentrate on the manufacture of micrometers. At the same time it requested J.Chesterman of Sheffield to focus on Vernier calipers and height gauges. By this time M&W was well established on Trafalgar Street in the centre of Sheffield only a short distance away from the main shopping area. This area was bombed in December 1940 during the blitz in mistake for the Sheffield steelworks. Although M&W's factory was not damaged they realised that they had had a close call and decided to build a shadow factory in Dronfield. They also established a factory in Nottingham and a warehouse at Meadowhead, Sheffield. The company expanded and produced an enormous range of micrometers from 0-1/4" to 6 ft capacity together with their metric equivalents, becoming one of the largest manufacturers of micrometers in the world.

In 1945, the company was acquired by John Shaw & Sons, Wolverhampton, Ltd. At that time Britool Ltd was a well-established subsidiary of John Shaw and together with M&W they formed a powerful UK tool manufacturing group producing high quality precision tools for markets in the UK and across the world. During this period M&W designed and produced some innovative products the most notable being a Braille micrometer,



The Aureole metric drawings were converted into imperial measurements by the M&W draughtsmen.



Left: Braille micrometer, a micrometer for left handed inspectors. Right: A 1969 direct reading micrometer

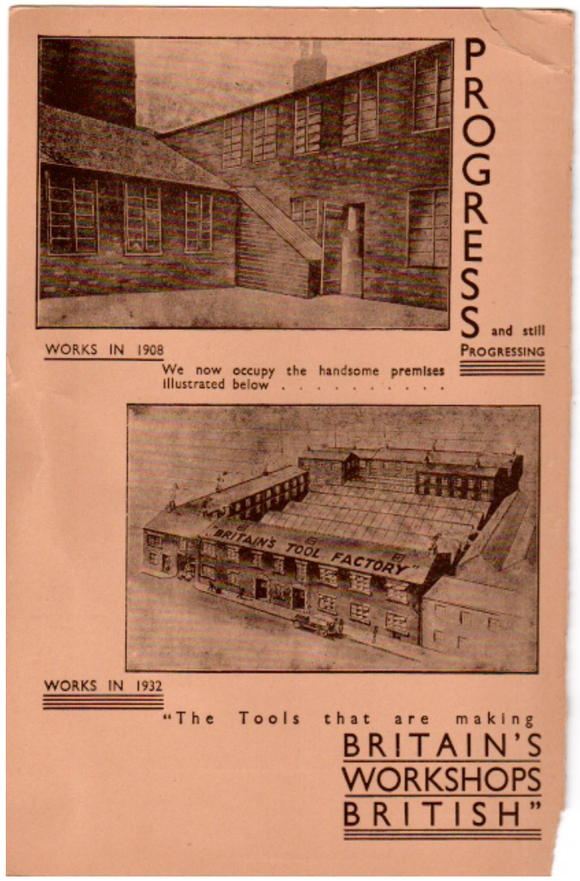
a micrometer for left handed inspectors and, in 1969, a direct reading micrometer. The direct reading micrometer was acclaimed by industry and Apprentice Training Schools in particular. John Shaw strongly supported M&W and realised that to successfully compete in the quality measuring tool market they would need to invest in more modern engineering and manufacturing facilities. To achieve this aim in 1959 the whole company moved into a large new purpose-built factory and offices at Handsworth, on the outskirts of Sheffield.

John Shaw was acquired by James Neill Holdings Limited in 1970 and M&W became a subsidiary of British Tool Manufacturers Limited following a re-organisation within the Neill Group. The follwoing year the M&W range of measuring tools was extended when James Neill acquired Benson Verniers Ltd of Bradford and G.K.N. Shardlow Metrology Ltd. Shardlow produced a direct reading micrometer known as the Mizzy. M&W produced it for a short time but as it did not fit with their manufacturing strategy and as they found it too costly to manufacture production was discontinued. During this period M&W re-engineered its range of micrometers to improve manufacturability and hence reduce manufacturing costs. For example, the standard micrometer range was developed with the measuring head being manufactured as a common and complete unit and bonded into the frames using Locktite 638. Fine blanking was used for making the frames for standard micrometers to ensure accurate profiles and dimensions. This was the time when a rationalised range of micrometers was introduced using dedicated line production methods achieving output levels of 2000 to 2500 per week. M&W also invented, developed and produced the first electronic micrometer in the world which was known as Micro 2000. This appeared for the first time in the 1979 catalogue. However, by this time precision measurement was going electronic. So, together with foreign imports, M&W, like many other British companies, was in for a lean time and needed to downsize in order to survive.

In the 1990s James Neill, which by this time had absorbed M&W, even though the products were still labelled M&W, moved yet again. ASDA, the supermarket at Handsworth, on the adjoining site, needed to expand its carpark , and made James Neill an offer that could not be refused. In turn James Neill relocated to the site of a large, redundant steelworks in the Don Valley in Sheffield, where a new factory was built. But once again production further downsized.

In 2000 M&W was sold to Bower Metrology UK which is owned by SNH Global Holdings. It is interesting to note that M&W labelled products continue to be made. The Bower catalogue shows a wide range of M&W micrometers although most are now made in China except for the three-point internal bore gauges which I understand are still made in Bradford. Thus after 69 years micrometer manufacture ceased in Sheffield.

In the 1920s M&W sold UK made and imported tools under the AVIA trademark.



George E Davis and the Dawning of Chemical Engineering in Britain

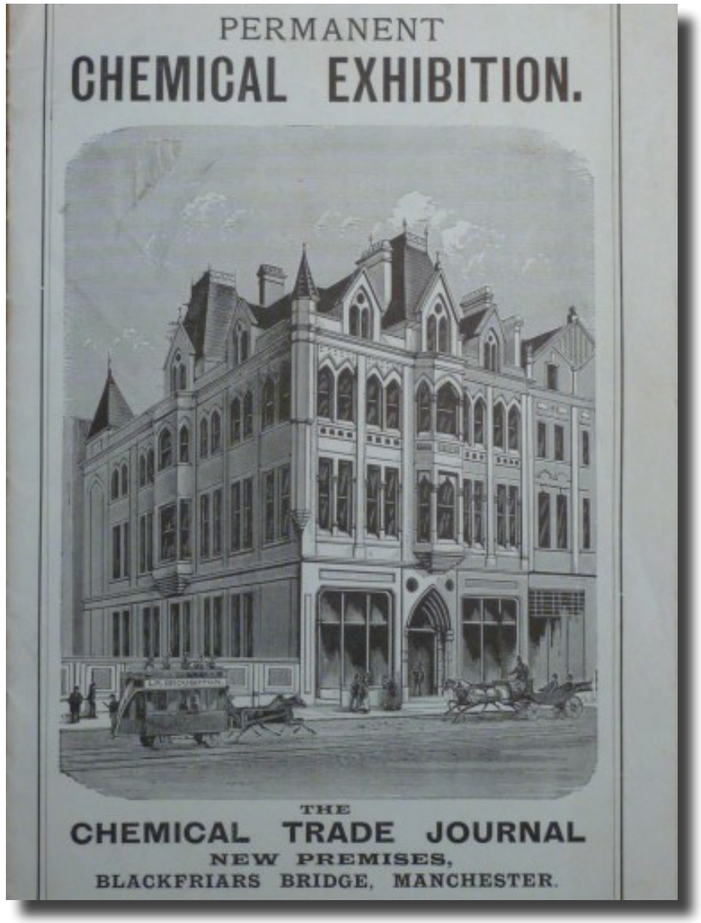
A talk by Peter Reed to Newcomen North West

Jonathan Aylen

It is not often someone can claim to have started an engineering discipline. Arguably, George E Davis was the founder of Chemical Engineering as a university discipline in the UK. Working at Manchester Technical School (later to become UMIST), George Davis taught a pioneering course that was the basis of chemical engineering in Britain. This was soon emulated by other novel courses at Battersea Polytechnic (now University of Surrey) and Imperial College.

Chemical engineering is fundamental to all areas of life. Chemical plants supply the raw materials for a wide range of consumer goods, packaging, food and drink. But the emergence of chemical engineering as a subject in its own right was a hesitant and drawn out process in Britain.

Peter Reed spoke to Newcomen North West - appropriately in Manchester – in September 2018 about the life and work of George E Davis and how he fostered both the development of chemical engineering as an academic discipline and the formation of the Institution of Chemical Engineers.



George Davis studied part-time at Slough Mechanics Institute, having abandoned an apprenticeship as a bookbinder in favour of a job in the local gasworks. He went on to study for a year at the Royal School of Mines in London before moving north to gain experience working for a number of chemical related businesses in Manchester, St. Helens and Runcorn. All the while he was lecturing part-time and publishing scientific papers. At this early stage in his career he was already designing chemical plant, always with an eye on their potential efficiency.

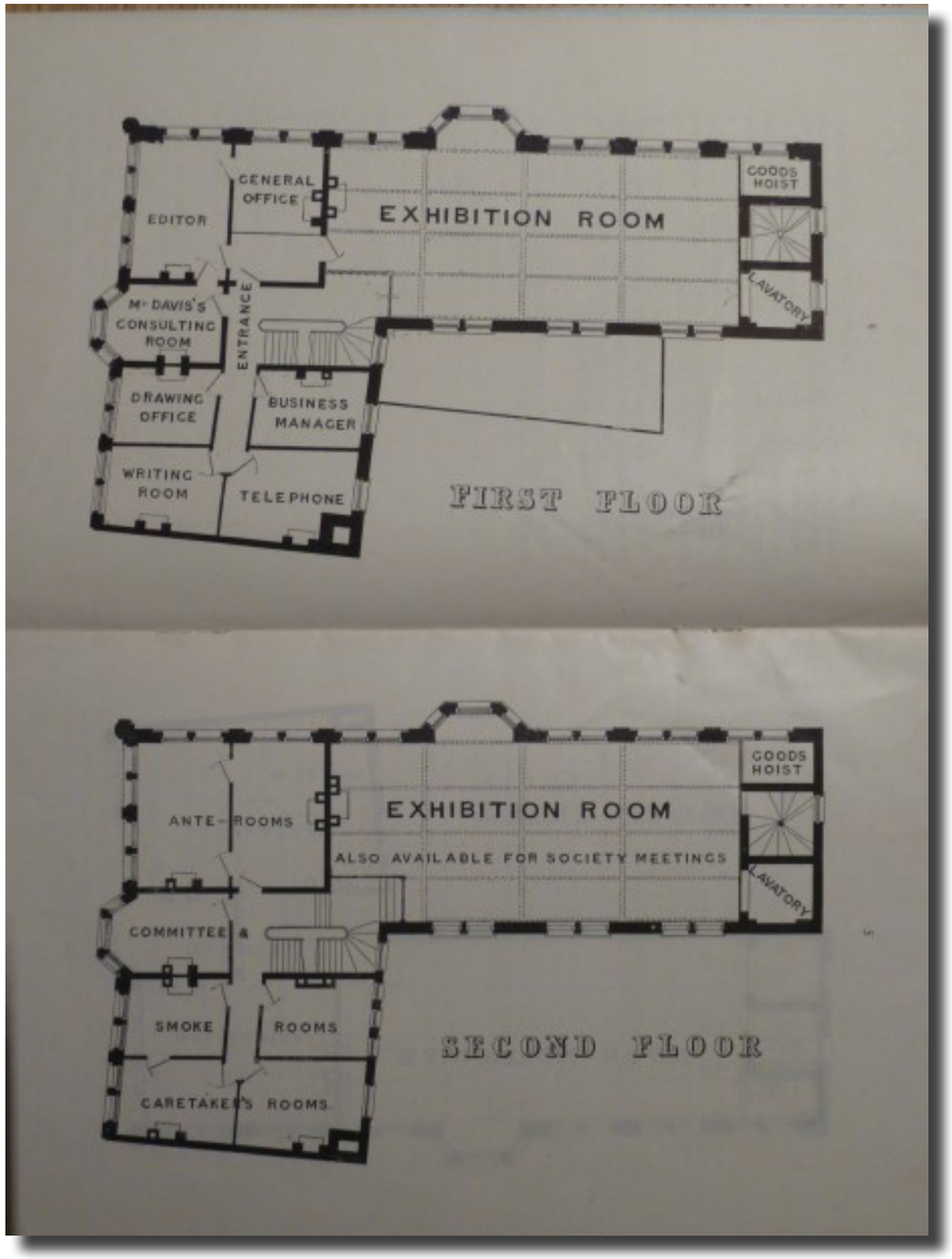
In 1878 Davis was appointed a sub-inspector in the Alkali Inspectorate, to work with Robert Angus Smith their Chief Inspector. At this time chemical plant operation was largely a craft process, managed by a foreman or charge-hand using *rules of thumb*. Owners were typically entrepreneurs and few qualified chemists were employed. Davis became frustrated and disillusioned with the inefficient way manufacturers operated their plant. In 1884 he resigned from the Alkali Inspectorate to form a consulting business in partnership with his brother, a partnership which was to last 21 years.

The consultancy flourished, although the brothers were less successful as bleach manufacturers. George worked on various topics, including: water and sewage analysis; a refuse destructor; and sulphuric acid. He also advised the Cochrane Chemical Co. across the Atlantic in Boston'.

The brothers had a flair for public relations, opening a "Permanent Chemical Exhibition" at Blackfriars Bridge in Manchester to promote the industry. In 1887, Davis founded and edited the Chemical Trade Journal which not only encouraged best practice across the industry, but was also a vehicle to advertise their consultancy, George's lectures and his views on chemical engineering. At the time, the North-West of England was the heartland of Britian's chemical industry with its strong reliance on coal and salt as raw materials.

In 1887, George Davis also began to give lectures at Manchester Technical School. Attendance for the series of a dozen lectures was by ticket only, price 10 shillings. Although the lectures were full of examples, George Davis emphasised common concepts such as distillation; crystallisation; evaporation; transporting solids, liquids and gases; electrolysis and utilisation of waste products, which were common principles across many sectors of the chemical industry.

These themes were to form the basis of his Handbook of Chemical Engineering published in 1901, quickly followed by a second (and updated) edition in 1904. The emerging discipline of chemical engineering now had a textbook. So, for example, John W. Hinchley established a course in chemical engineering at Battersea Polytechnic in 1909. Hinchley probably drew on Davis's work, but he was also studying the performance of different component parts of chemical plant with a view to improving

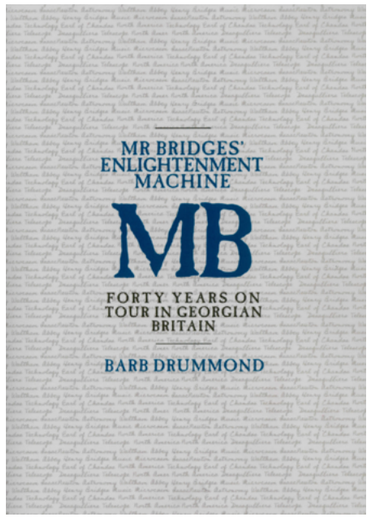


plant design. Then, in 1910 Hinchley was appointed to teach a chemical engineering course at the newly formed Imperial College.

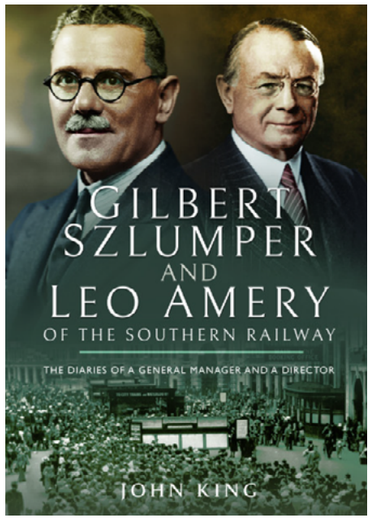
Davis was also an energetic collaborator in forming a professional organisation for the discipline. The South Lancashire Chemical Society was formed in 1879 for those working in the chemical industry. The movement spread nation-wide. Davis wanted the society for those working in the chemical industry to be called the Society of Chemical Engineers but the name did not get sufficient support and it became the Chemical Industry in 1881. He continued to promote the idea of a Society of Chemical Engineers and after his death the Institution of Chemical Engineers was formed in 1922, with John Hinchley as the leading figure. In 1881, the Society of Chemical Industry, with Henry Roscoe as President and George Davis as one of the Secretaries, was formed in London with local branches around the country.

Gradually, the notion of chemical engineering began to spread. In 1893 the Institute of Chemistry briefly offered an examination in General Chemical Engineering for their Fellowship membership to attract those working in industry. By 1906 the Institute of Chemistry included an examination in Chemical Technology for their Fellowship membership. The slow path to recognition of Chemical Engineering begun by George Davis was gathering pace. But it would take World War I with all its demands to accelerate professionalisation.

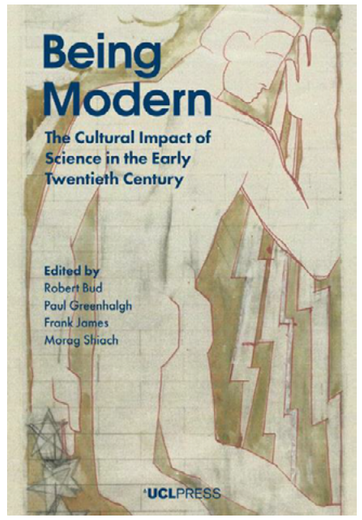
Books received.....



Mr Bridges' Enlightenment Machine: Forty years on tour in Georgian Britain by Barb Drummond.
Barb Drummond £16.99
ISBN 9761912829019
Henry Bridges was a carpenter and, in 1733, the maker of a clock, which had complex displays that could be adapted to discoveries in astronomy. It became a focus of entertainment as well as its more serious purpose on its travels across Britain and North America. The book is the result of Barb Drummond's extensive research.

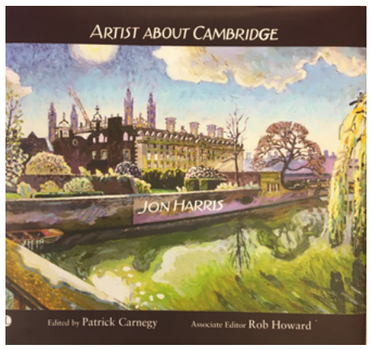


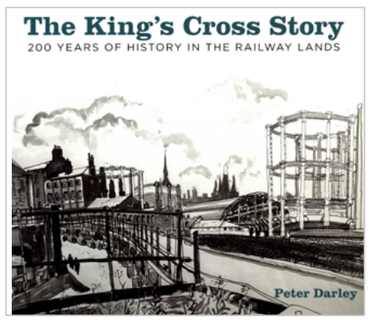
Gilbert Szlumper and Leo Amery of the Southern Railway: The Diaries of a General Manager and a Director.
by John King. Pen & Sword Books £25
ISBN: 9781473835276
Few diaries of senior managers of the Big Four railways have survived to enter the public domain. The remarkable diaries of Southern Railway general manager Gilbert Szlumper and director Leopold Amery are available and addressed in this book. They are a welcome contrast to more formal company histories.



Being Modern, the Cultural Impact of Science in the early Twentieth Century. Eds: Robert Bud, Paul Greenhalgh, Frank James, Morag Shiach
UCL Press £30
ISBN: 178735394X
In the early decades of the 20th century, engagement with science was commonly used as an emblem of modernity. This phenomenon is now attracting increased attention in different historical specialties. This book builds on this interest to explore engagements with science across culture from the end of the 19th century to approximately 1940.

Artist about Cambridge
by Jon Harris. eds: Patrick Carnegy, Rob Howard.
Lutterworth Press
ISBN 0718895320
Jon Harris career as Professor of IT in Construction at the Danish University of Technology informs his painting. His architect's sense of structure and fabric, his draughtsman's eye and vigorous use of pen and brush have produced an outstanding body of work. Jon Harris's text describes how his images of the workings of buildings in Cambridge and his fascination with unregarded vistas, back streets, crucial buildings lost to the wrecking ball, factories and workshops.





The King's Cross Story, 200 years of history in the Railway Lands
by Peter Darley
The History Press £20
ISBN 9780750985796
The arrival of the Great Northern Railway at King's Cross connected London to the north and this book traces that rich history up to the rpsnet. Peter Darley uses photographs, drawings, plans and diagrams to describe and illustrate the constant changes of the area. He describes the once busy, steamy transport hub for people, animals and freight; the area of post war dereliction; the recent transformation into an international and national transport hub and the area of urban regeneration, that has preserved many of those early buildings.

The Changing Role of Consultants in Industry 1850–2000

Call for Papers & Workshop in Oxford on 10-11 May 2019

Consultants – a neglected group
Consultants have been neglected by historians of engineering and technology. They are one professional group that is overlooked when discussing innovations. With few exceptions, only passing reference is made to their background and training, the circumstances of their engagement, the nature of the work and its success.

Yet it is clear that consultants were often a key resource in knowledge management for firms, especially in emerging sectors making the transition from craft-based traditions to use of scientific knowledge.

As the modern corporation arose during the late 19th century, firms faced a growing problem of managing knowledge. They set up in-house laboratories and began to develop R&D programmes. But, at the same time, consultants played a key role in spreading new technologies across firms, improving operating practices within factories, establishing standards and helping develop key supply industries.

A widely supported conference
To help explore these issues, the Newcomen Society has agreed to support a Conference in 2019 on the "Changing Role of Consultants in Industry, 1850 to 2000. Other supporters include: the British Society for the History of Science, Oxford Brookes University and the Society for the History of Alchemy and Chemistry. The Workshop is to held in Oxford on 10-11 May 2019. The Society would welcome papers on a range of issues.

This workshop will address the role of consultants in various industrial sectors across Europe and in the United States, and attempt to establish evidence on who the consultants were, the market for consultants and their impact. Questions that arise include:

Who are the consultants? Studies of individuals or consultancy firms which illustrate the role of consultants.
Shifting definitions of consultants over time: how has this changed and how has the profession evolved?

What of the emergence of professional service firms and process plant contractors who bundle consultancy with the supply of design, plant or buildings, commissioning, training and start-up?

How did someone become a consultant?
What gave consultants the expertise (and standing) to undertake such work? What networks did consultants operate in to sustain their work? What levels of remuneration were available?

The market for consultants
Who employed consultants? What are the challenges for a business in defining a consultant's project? How readily is the consultant's report utilised by the business? What kind of consultancy work was undertaken? Did it vary over time? At what point was the consultant's work taken inside the business? Did any conflicts arise? If so, how were they resolved? To what extent were patents involved? What about the use of industrial consultants by banks, stockholders, financiers and/or government departments or agencies to evaluate capital schemes and projects?

The impact of consultants
How did consultants contribute to innovation and diffusion of technology? What types of knowledge were transferred? What was their relationship to formal in-house R&D – complement or substitute? Has their influence shifted over time? How has their technical advice influenced government industrial policies?

Organisation of the Workshop on 10-11 May 2019
- The workshop will be based on pre-circulated papers, approx. 5,000 words, with deadline of 30 March 2019. A selection of workshop contributions will be published in an edited volume.
- Workshop to be held at the Maison Française d'Oxford, 2-10 Norham Road, Oxford OX2 6SE, United Kingdom.
- Submission deadline for proposals: 30 January
- Please send proposals (max 300 words) and a short CV to: peterreed.42@gmail.com.
- Organisers: Peter Reed (Independent Researcher), Jonathan Aylen (University of Manchester and the Newcomen Society) and Viviane Quirke (Oxford Brookes University).

The workshop is supported by grants from the British Society for the History of Science, the Newcomen Society, Oxford Brookes University and the Society for the History of Alchemy and Chemistry.

The Newcomen Society Calendar

2019

Please check the Events pages on the website for updated information: www.newcomen.com

London @NewcomenSoc
Lectures are held in the The Dana Studio, Wellcome Wolfson Building, 165 Queens Gate, London SW7 5HD, unless specified otherwise. Time 17.45. Visitors welcome, admission free.

9 January Bernard Espion: The 'Vergniais' bridges
13 February Robert Taylor: Presidential Address
13 March Ben Marsden: W J Macquorn Rankine's early years
10 April Simon Jump: From Peenemunde to Dortmund via Korea: A history of the Corporal Missile
8 May Richard Byrom: Fairbairn

Midlands @Newcomen_Mid
Meetings are held in the Thinktank Lecture Theatre, Level 2, Birmingham Science Museum, Millennium Point, Curzon Street, Birmingham, B4 7XG (for Sat Nav, use postcode B4 7AP) Time 19.00. Visitors welcome, admission free
2 January Jim Andrew: The Cobb Land Speed Record Car
6 February Dr Elizabeth Bruton: Opportunities for Women in Wireless Telegraphy during World War One
6 March Russell Thomas: The History of Gas Manufacture in the U.K.
3 April Mike Potts: The Early History of the Newcomen Engine

North East
Meetings in the Carpathia Room, Tyne & Wear Discovery Museum, Blanford Street, Newcastle upon Tyne NE1 4JA Times vary. Paid parking available on site.
12 February, 14.00 Joint Meeting with the Institution of Civil Engineers NE Region. Dr Miles Oglethorpe: Sir William Arrol & Co Ltd
9 April, 18.00 Jonathan Aylen: Cold War to Coal Trains - TOPS, British Railways' First Computer Based Train Operating System

Links NEWCOMEN

Copy dates

1 February
1 May
1 August
1 November

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

North West
Meetings are usually held at the Museum of Science and Industry (MOSI), Liverpool Road, Manchester M3 4FP at 18.30-20.15 unless specified otherwise. Visitors welcome, admission free. Members meet at a nearby restaurant from 17.00.
29 January 18.30, MOSI. Bob Bowden: It's not just about the robot! The development of automated welding
26 February 18.30, MOSI Joint Meeting with the Stephenson Locomotive Society. Dr Michael Bailey and Peter Davidson: Learning Through Archaeology: Killingworth Billy
26 March 18.30, MOSI Joint with the Institution of Structural Engineers. Dr Ralph Harrington, Bulldozers
30 April 18.30, MOSI Dr Victoria Owens: Lady Charlotte Guest at Dowlais, 1833-55: how a pioneering Victorian businesswoman came to head the world's largest ironworks

South Yorkshire @NewcomenSY
Meetings usually held at Kelham Island Museum, Alma Road, Sheffield S3 8RY at 18.30-20.15, unless otherwise indicated. Visitors are welcome and lectures are free. Free parking at Kelham Island Museum for up to 40 vehicles. This is split between the onsite parking and the Museum car park next to the Fat Cat pub. There are 3 accessible spaces at Kelham Island Museum.
28 January Dr Phil Judkins: Convoy - the untold story of the contribution made by Sheffield to the development of radar and to the winning of the Battle of the Atlantic
25 February Dr Gillian Cookson: The Age of Machinery – Engineering in the Industrial Revolution
Tbc March Holiday Inn Royal Victoria, Sheffield (Date and speaker to be confirmed). The Ken Barraclough Memorial Lecture
22April Region AGM followed by Chris Hodrien: Steam below sea- the Royal Navy K Class steam turbine submarines of WW1

Newcomen Society Presidential Address by Robert Taylor From the first to the third industrial revolution

Thomas Newcomen was in the vanguard of the first industrial revolution, which has been well recorded in museums and archives. Indeed, our Society was founded in 1919 to help prevent the loss of significant records and information. We are now in an era where, although people are more dependent on technology, they understand it less and many people have no link with engineering or industry. With the increasing pace of change and technological sophistication, how can we ensure significant items and evidence can be collected and preserved?

NEWCOMEN The International Society for the History of Engineering and Technology

Southern
The meetings are planned to be held at the University of Portsmouth at 18.30. Toom and building tbc
15 January Dr Fred Starr: Steam Reforming - The Technology that Saved the Gas Industry, with special emphasis on Portsmouth Gas Works
19 February Tim Shaw: HMS Warrior 1860
19 March Martin Gregory: Twyford Water Works 'Return to Steam' Project
April / May Robert Taylor: Presidential Address

Western
Meetings are usually held in Room 1, BAWA, 589 Southmead Road, Bristol, BS34 7RG, 7:30-9:30 pm.
10 January at **Royal British Legion Hall, Charlton Road, Keynsham, BS31 2JA** joint meeting with BIAS. Presentation of four short papers, two by Newcomen members and two by members of BIAS.
21 February John Burrows: Chepstow Bridge (1816) and John Rastrick
21 March Stephen Jones: Rise and Fall-Steam and the Suspension Bridge
18 April Don Hillman: Severn Bridge
16 May John Anning: SS Xantho and the Penn Engine

Newcomen Society AGM
13 February at 17.45

The Dana Studio
Wellcome Wolfson Building
165 Queens Gate
London SW7 5HD

followed by
Robert Taylor's
Presidential Address
From the first
to the third
industrial revolution

Visit to Rhydymwyn Valley Works

Tuesday 21 May

In WW II and the years after, few places in Britain were as secret as the Valley Works at Rhydymwyn, near Mold.

Set up in 1939 as a *Shadow Factory* to produce poison gas, the site had extensive underground storage facilities to keep mustard gas and related materials safe from bombing.

Visits to these tunnels are strictly limited by DEFRA, the site landlord.

The Newcomen Society has been able to book a party visit on the morning of Tuesday 21st May.
If you are interested in joining the party, please e-mail:
meetings.north.western@newcomen.com.
There will be a small charge to include a buffet lunch on site.

There will be an opportunity during the visit to learn about the site's even more secret role in the development of the atom bomb.

For further information about the Valley Works including how to find the site, see https://rhydymwynvalleyhistory.co.uk

NEWCOMEN The International Society for the History of Engineering and Technology

The Newcomen Society Summer Conference 28 - 30 August in Birmingham

to coincide with Watt 2019

Information to Follow

NEWCOMEN The International Society for the History of Engineering and Technology

Newcomen Society
2019 Summer Conference
28 - 30 August
Birmingham

James Watt
1736-1819

2019

Portrait of James Watt by Henry Howard c1797. Wiki Commons

James Watt died on 25 August 2019. A number of events, to mark this, will take place during the year in Birmingham, Scotland and elsewhere. They include:

- The Newcomen Society's Summer Conference 28 - 30 August in Birmingham.
- The James Watt Conference, Rethinking Innovation: James Watt's Networks and their Legacy, 30 August and 1 September at the University of Birmingham
- James Watt Exhibition 12 July - early November, Library of Birmingham:

Members will be notified of further details

NEWCOMEN
The International Society for the History of Engineering and Technology

Newcomen Society
AGM
13 February at 17.45

The Dana Studio
Wellcome Wolfson Building
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followed by
Robert Taylor's
Presidential Address

From the First
to the Third
Industrial Revolution

NEWCOMEN
The International Society for the History of Engineering and Technology