

JAMES KEIR

(1735-1820)

A RENAISSANCE MAN OF THE INDUSTRIAL REVOLUTION

Kristen M. Schranz

James Keir is best remembered as a chemist and industrialist, but he was also an author, translator, geologist, metallurgist, and military captain. He was born in Stirlingshire, Scotland on 29 September 1735 and the last of eighteen children born to John Keir (1686-1743) and Magdaline Lind (1691-1775). Both the Keir and Lind families had considerable wealth and were influential in Edinburgh politics. John served in various capacities on the Town Council before he died in 1743 and Magdaline sold the family estates of Muirton and Queenshaugh to care for her large family, including James who was just eight years old.

After studying at the High School in Edinburgh (1742-8), Keir took classes in medicine and chemistry at the University of Edinburgh (1754-7), where Andrew Plummer probably instructed him in practical chemistry. During his tenure at university, Keir also became acquainted with Erasmus Darwin. Their friendship flourished through correspondence, even when Keir left Edinburgh without finishing his degree to join the West Indies militia in 1757.

Military Career

During his service abroad, Keir maintained his scholarly pursuits. He awoke early each morning to read from the classics and to translate the Greek military historian, Polybius. In 1790, he published *An Essay on the Martial Character of Nations*. Another forthcoming text, *A Dictionary of the Art of War*, was advertised that same year but was unfortunately burned at the publisher's shop. When England was under threat by Napoleon Bonaparte in 1803, Keir again took up his pen to write *Reflexions on the Invasion of Great-Britain by the French Armies*. Whilst in the military, Keir met another like-minded Scot, Alexander Blair, who would become a partner in the Tipton chemical works. In 1766, Keir was posted to Bandon, Ireland, and by 1768 he had sold his captain's commission to pursue chemistry and philosophy.



JAMES KEIR, ESQ^R F.R.S. &c.

Engraving of James Keir after a portrait by L de Longastre (no date).

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Keir and Macquer's Chemistry

Keir's first task was to translate Pierre-Joseph Macquer's 1766 *Dictionnaire de chymie*. He completed much of the work while he resided in Ireland with the writer and inventor Richard Lovell Edgeworth. Keir's *Dictionary of Chemistry* of 1771 was accompanied by considerable annotations and further applications of chemistry to everyday life. Throughout the 1770s, Macquer and Keir corresponded several times about improving their first editions.¹ The French chemist even sent revisions to Keir from Paris as they were printed. Keir's second dictionary of 1777, along with the appended *Treatise on the Various Kinds of Permanently Elastic Fluids or Gases*, and Macquer's updated dictionary of 1778 are a testament to this cross-Channel collaboration.

Metallurgy and Glassmaking

Around 1770, Keir partnered with his cousin to produce metal ship parts for the British Navy. In 1771, Commissioners tested plates and nails from Messrs. Archibald and James Keir on a ship bound for Antigua.² The pieces were probably made of copper-plated iron, a material that the Birmingham physician William Small described in a 1771 letter to James Watt.³ On 10 October 1771, Keir married Susanna Harvey (1747-1802) at St. Philip's Cathedral, Birmingham. The Harvey family had been ironmasters in Birmingham for several generations,⁴ so his in-laws may have influenced Keir's foray into metallurgy at this time.

In the early 1770s, intellectual and industrial opportunities brought Keir to settle in the West Midlands. His long-time friend

Darwin, who worked as a physician at Lichfield, catalysed Keir's friendship with various members of the Lunar Society of Birmingham.

In October 1771, Keir leased Holloway End Glasshouse in Amblecote, near Stourbridge.⁵ A year later, in December 1772, he took on John Taylor and Samuel Skey as partners in the business.⁶ According to extant letters, Holloway End supplied a variety of products to consumers: window glass to Londoners;⁷ chemical wares to Boulton;⁸ and decanters and wine glasses to Robert Small in Dundee, Scotland.⁹ The glassworks also assisted his work on the nature of crystallisation. Keir's 'Observations on the Crystallization of Glass' was published in the Royal Society's *Philosophical Transactions* in 1776, accompanied by detailed engravings of specimens. He was elected as Fellow of the Royal Society in 1785, after which he published two additional papers in the *Philosophical Transactions*.¹⁰

During his glasshouse operations between 1771 and 1778, Keir also pursued chemical experiments. One desirable commodity of the eighteenth century was alkali for bleaching, dyeing and soap making. Keir, Watt, and the Scottish chemist, Joseph Black, attempted for many years to produce alkali by decomposing sea salt. Although a patent was considered between 1780 and 1781, the plan never materialised.¹¹ At his Tipton works, Keir eventually converted waste sulphates of potash and soda into alkali for soap boiling.



Courtesy of The Lewis Walpole Library, Yale University

Egyptian Hall, Mansion House, London by Augustus Pugin and Thomas Rowlandson for *Microcosm of London* (1808). In 1796, Eldorado metal was used in the large eastern and western windows, and in the enclosure for the second level Music Gallery.

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Work with Boulton and Watt

Glass manufacturing was not as lucrative as it first appeared and by 1778 Keir looked elsewhere to employ his chemical and organisational expertise. Matthew Boulton suggested he move closer to the Soho manufactory—an invitation that Keir embraced. Keir moved to Winson Green and offered advice for Boulton's manufacturing and marketing practices. It has been assumed that Keir managed Soho between 1778 and 1780, while Boulton and Watt were away on steam engine business in Cornwall. However, upon Boulton's death in 1809, Keir wrote to Boulton's son, Matthew Robinson, that he did not want his brief stint at Soho to be on the historical record because his time there had been 'awkward and unpleasant'.¹² The only official managerial role Keir took on was the brief supervision of the second order of East India silk reels.

Despite his negative experience at Soho, several innovations resulted from Keir's time there. In late 1779, Watt patented his letter copying press. Keir and Watt applied their chemical expertise to find the best paper and ink combinations for the apparatus. In 1780, Watt took in Boulton and Keir each as quarter partners in the venture.¹³

Eldorado Metal

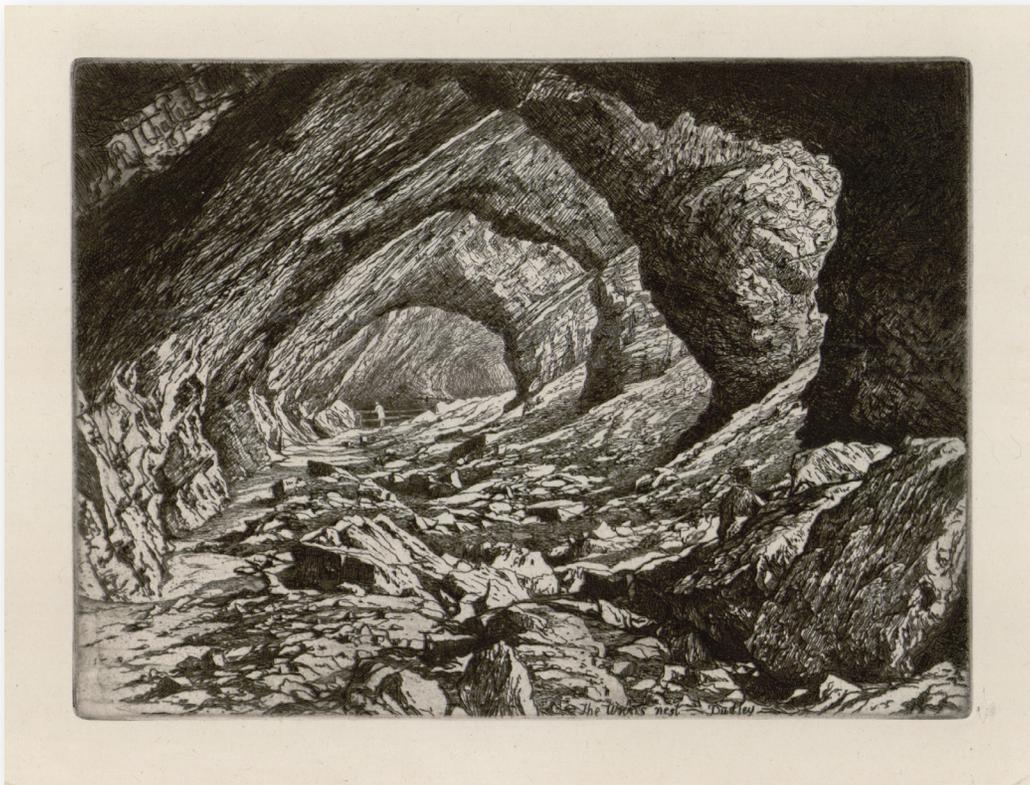
At some point during their collaboration at Soho, Boulton and Keir also developed a golden-coloured metallic alloy (consisting of copper, zinc, and iron in a 100 : 75 : 10 proportion). Keir took out a sole patent for the compound metal in 1779, citing its

ability to be forged when hot or cold.¹⁴ Boulton and Keir presented the material to the Navy in the form of ship bolts, nails, and sheathing. Several trials were made on the metal and it was employed in a few frigates.¹⁵ When he left Soho around late 1780, Keir engaged the London-based coppersmith William Forbes to help him scale up the production of the alloy.¹⁶ Although Forbes secured another trial for the metal in 1783, the Navy did not choose to employ the alloy further.

Under the direction of the Scottish polymath William Playfair, whom Keir had befriended at Soho, the alloy was rechristened 'Eldorado-metal' and marketed as elegant glazing bars for windows.¹⁷ After a falling-out with Playfair, probably over the patent for the Eldorado sashes, Keir took over production of the metal and used it to make fanlights, sash windows and skylights. Through the work of architects like Robert Adam and John Soane, the Eldorado material was incorporated into many fashionable public and private buildings throughout the kingdom.¹⁸

The Tipton Chemical Works and Tividale Colliery

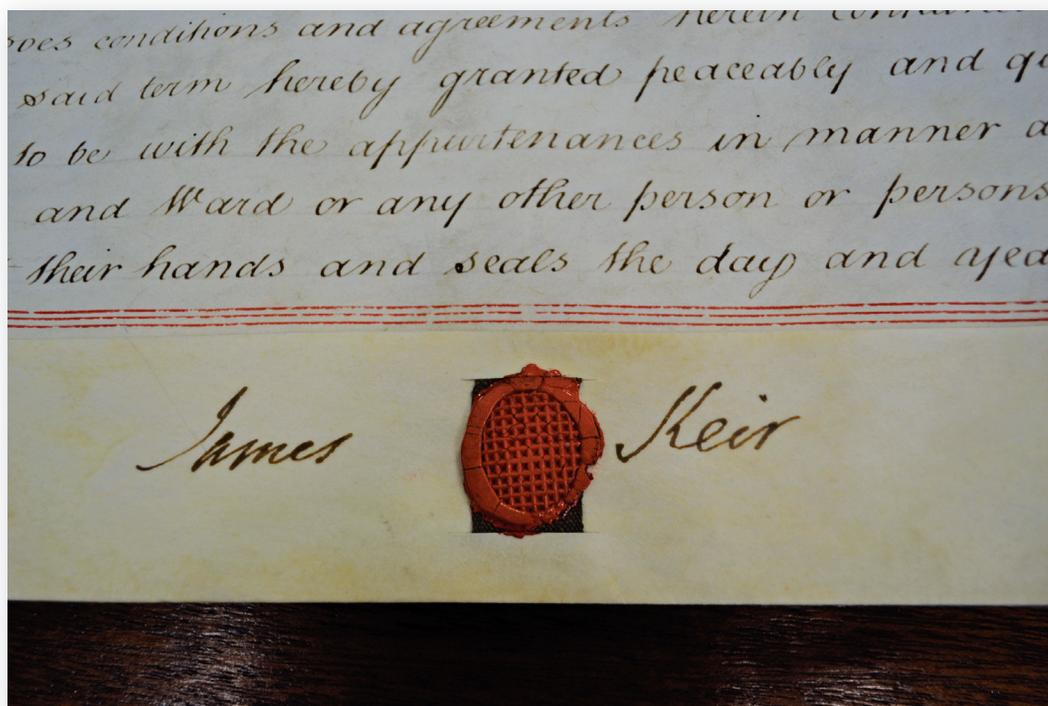
Around 1780, Keir joined with his army friend Blair to begin an alkali manufactory along the Birmingham Canal in Tipton. Taking over the former site of Bloomsmithy Mill, the chemical works eventually produced alkali, soap, white and red lead, and Eldorado and iron window sashes.¹⁹ The scale of operations at the Tipton works was considered second only to Soho in the late



The Library of Birmingham

The Wren's nest, Dudley, a source of geological interest for Keir. From *The Black Country – Sixteen Etchings of Scenes in the Coal and Iron District of South Staffordshire* (1887) by Richard S Chattock.

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Dudley Archives and Local History, DE/4/7/1234

Signature of James Keir on the lease of the New Pool at Tipton, March 1805.

Chemical Reputation

On several occasions, Keir also acted as a chemical consultant. Although the field of professional chemistry was not fully defined until the nineteenth century, by the late eighteenth-century chemists testified on various topics using their expertise. In 1786, Keir was charged by the Society of Arts to analyse a sample of Indian fossil alkali submitted by the physician Helenus Scott. Keir tested the properties of the specimen and advised the Society on its potential uses in English manufactures.²⁷ On another occasion in 1803, Keir was asked by a House of Commons Committee headed by William Wilberforce to confirm the priority and safety of Dr James Carmichael Smyth's nitrous acid fumigations for contagious fevers.²⁸

Darwin, Priestley and Day

From the time he settled in the West Midlands to well into the 1800s, Keir was intimately connected with the Lunar Society of Birmingham. His intellectual and innovative pursuits need to be framed within the relationships forged by these unique gatherings. Society members including Boulton, Darwin, Watt and Joseph Priestley supported each other's personal and entrepreneurial pursuits. In 1787, Keir advised Darwin on corrections for 'The Loves of the Plants', the second poem of *The Botanic Garden*. Keir was also a sounding board for Priestley's ongoing chemical study of airs.²⁹ On 14 July 1791, Keir presided

over a Birmingham dinner commemorating the start of the French Revolution, an event that precipitated the Priestley Riots. Keir was quick to justify the premise of the dinner³⁰ and aided Priestley when rioters destroyed his house. In keeping with his spirit of benevolence, in 1791 Keir composed a eulogy, *An Account of the Life and Writings of Thomas Day*, to honour a fellow Society member who passed away at age forty-one.

Final Years

In his advancing years, Keir turned over the Tipton operations to Blair in 1811.³¹ On 3 June 1815, the partnership of Blair and his sons also dissolved and the soap and lead manufactory ceased to be associated with their names.³² In the last couple of decades of his life, Keir suffered much from rheumatism. His main joy was derived from his growing number of grandchildren. Keir passed away on 11 October 1820 at the age of 85. He was buried a week later at All Saints Church, West Bromwich. Unfortunately, household fires at Hill Top in 1807 and Abberley Hall in 1845 destroyed many of Keir's letters and manuscripts. Between published works and scattered archival records, however, much still remains to discover about the life and work of this innovative polymath of the Industrial Revolution. ●

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References

- 1 James Keir to Pierre-Joseph Macquer, 23 March 1776; Keir to Macquer, 4 March 1778; in *Correspondance du chimiste P.-J. MACQUER (1784)*. I, Gallica <<http://gallica.bnf.fr>> Macquer to Keir, 28 March 1776, in Amelia Moilliet and James Keir Moilliet, eds., *Sketch of the Life of James Keir, Esq., F.R.S., with a Selection from his Correspondence* (London, 1868), 54-56.
- 2 The National Archives (TNA), ADM 106/1198/141, 'Commissioner Thomas Hanway, Chatham. Receipt of warrant', 23 April 1771. For the results of the trial: TNA, ADM 106/1218/15, 'Andrew Anderson and Henry Topham, English Harbour, Antigua', 20 August 1773.
- 3 Birmingham Archives and Heritage (BA&H), MS 3782/12/76/135, William Small to James Watt, 14 February 1771[?].
- 4 Yvonne Solomon, 'James Keir', 5 September 2016, personal email (14 June 2017).
- 5 BA&H, MS 3782/12/76/136, William Small to Watt, 19 October 1771.
- 6 Keir claims his glass was preferred in London over the Newcastle variety. See BA&H, MS 3219/4/73/2, Keir to Watt, 27 February 1772.
- 7 BA&H, MS 3782/12/65/3, Keir to Matthew Boulton, 2 October 1772.
- 8 BA&H, MS 3782/12/24/116, Robert Small to Keir, 7 August 1777.
- 9 James Keir, 'Experiments on the Congelation of the Vitriolic Acid', *Philosophical Transactions of the Royal Society of London* 77 (3 May 1787): 267-281; James Keir, 'Experiments and Observations on the Dissolution of Metals in Acids, and their Precipitations', *Philosophical Transactions of the Royal Society of London* 80 (20 May 1790): 359-384.
- 10 Watt and Black discussed Keir's proposed alkali patent in a series of letters. See Robert G.W. Anderson and Jean Jones, eds., *The Correspondence of Joseph Black*, vol. 1 (Surrey, England, 2012): Watt to Joseph Black, 30 May 1780; Black to Watt, 3 June 1780; Watt to Black, 9 June 1780; Watt to Black, 15 October 1780; Watt to Black, 8 March 1781; Watt to Black, 9 April 1781; Black to Watt, 1 May 1781.
- 11 BA&H, MS 3782/13/37/101, Keir to Matthew Robinson Boulton, 3 December 1809.
- 12 BA&H, MS 3147/18/3, Deed of Partnership, 1780.
- 13 *A.D. 1779 No 1240. Specification of James Keir: Producing Compound Metals* (London 1876).
- 14 See BA&H, MS 3782/12/65/40, Keir to Boulton, 3 November 1779.
- 15 For the Keir-Forbes correspondence, search 'Keir' under '01 - William Forbes', *Finding aid: Forbes of Callendar Paper*, 15 September 2016, <<http://www.falkirkcommunitytrust.org/heritage/archives/finding-aids/forbes.aspx>>.
- 16 'Eldorado Manufactory', *The Times* (London, England), 12 April 1785.
- 17 See John Sambrook, *Fanlights* (London, 1989), p. 21. Entries for the Eldorado in The Soane Archive at Sir John Soane's Museum, Bill Books 3, 5, and 6. The Bill Books also contain entries for Keir's wrought iron products.
- 18 Stebbing Shaw, *The History and Antiquities of Staffordshire*, vol. 2 (London, 1798-1801), 136-137.
- 19 For the visit of American chemist Thomas Peters Smith, see BA&H, B&W/Misc/4, Record of meeting with James Watt and Matthew Boulton in Birmingham and to James Keir, including a visit to his coal mines, c. 1965. (From American Philosophical Society, Mss.914.Sm6, Thomas P. Smith journal in Europe, 1800-1802.)
- 20 For example, see V&A/Wedgwood Collection, MS No. E1-678, Keir to Josiah Wedgwood, 26 December 1787.
- 21 Keir only finished the entry for 'Acids (Vegetable)'.
- 22 For example, see BA&H, MS 3147/3/(504), Keir to James Watt, Jr., 5 December 1790 and 4 August 1808.
- 23 See BA&H, MS 3147/3/(504), Keir to James Watt, Jr., 20 November 1789.
- 24 James and Susanna had lost their young son, Francis, c. 1776.
- 25 Private collection of the Moilliet family.
- 26 Keir to Society of Arts, 26 April 1786, in 'Paper in Chemistry', *Transactions of the Society, Instituted at London for the Encouragement of Arts, Manufactures and Commerce* 6 (1788), 133-148.
- 27 Keir to William Wilberforce, 13 June 1802, in Appendix for 'Report from the Committee on Dr. Smyth's Petition, respecting his Discovery of Nitrous Fumigation', *Reports from Committees of the House of Commons (1793-1802)* 14 (1803), 228.
- 28 Keir to Joseph Priestley, 26 March 1788, in Joseph Priestley, 'Additional Experiments and Observations relating to the Principle of Acidity, the Decomposition of Water, and Phlogiston', *Philosophical Transactions of the Royal Society of London* 78 (1 May 1788), 323-330.
- 29 See 'J. Keir, Esq., to the Printer of the Birmingham and Stafford Chronicle, 20 July 1791'; 'J. Keir, Esq., to the Printer of the Birmingham Gazette, 24 July 1791 in *An Authentic Account of the Riots in Birmingham*' (Birmingham; London, 1791), 29-37.
- 30 'Partnerships Dissolved', *Morning Post* (London, England), 23 December 1811.
- 31 *The London Gazette*, 10 June 1815, issue 17022, p. 1113.

Secondary Sources and Further Reading

- L. Gittins, 'The Alkali Experiments of James Watt and James Keir, 1765-1780', *Transactions of the Newcomen Society*, 68, 1997: 217-230.
- John R. Harris, 'Copper and Shipping in the Eighteenth Century', *The Economic History Review*, 19, 3, 1966: 550-568.
- Amelia Moilliet and James Keir Moilliet (eds), *Sketch of the Life of James Keir, Esq., F.R.S., with a Selection from his Correspondence* (Robert Edmund Taylor, 1868).
- J.L. Moilliet and Barbara M.D. Smith, *A Mighty Chemist: James Keir of the Lunar Society* (Privately printed, 1982).
- J.L. Moilliet, 'Keir's Caustic Soda Process—an Attempted Reconstruction', *Chemistry and Industry* (5 March 1966), 405-408.
- Robert Schofield, *The Lunar Society of Birmingham: A Social History of Provincial Science and Industry in Eighteenth-Century England* (Clarendon Press, 1963).
- Jenny Uglow, *The Lunar Men* (Farrar, Straus, and Giroux/ Faber and Faber Ltd., 2002).
- Barbara M.D. Smith, 'Keir, James (1735-1820)', *Oxford Dictionary of National Biography* (Oxford University Press, 2004); online edn, Sept 2013 [<http://www.oxforddnb.com/view/article/15259>, accessed 31 Aug 2017]



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