1 Introduction: inventors and other heroes

The inventor was an improbable hero. Neither his conceptual pedigree nor his personal attributes marked him out as a transparently heroic figure. Long distrusted as a monopolist and 'projector', he toiled in an anonymous workshop, far from the glorious field of battle, or the terrors of the ice floes, the desert, or the jungle. Yet, in a century remarkable for its celebration of heroes, the inventor too had his pedestal and his laurel wreath. Notoriously, in the essays of Samuel Smiles, he took centre stage, the epitome of 'self help', but this was only one facet of a cult whose origins preceded Smiles' worthy gospel by several decades and whose significance ran much deeper. The intrusion of inventors amidst the warriors, monarchs and statesmen who dominated the pantheon of early nineteenth-century Britain represented a challenge to aristocratic society. As astute observers recognized, the 'colossal' statue of James Watt, installed in Westminster Abbey in 1834, was the harbinger of a new age; it was the cultural counterpart of the Reform Act of 1832.[1]

The politics of invention

James Watt was posthumously fashioned into the standard-bearer of the rising industrial classes. He personified their claim that it was not military prowess that made Great Britain great, but the ingenuity and enterprise of its 'industrious' citizens: the country's strength and global influence rested on the prosperity generated by manufacturing and trade; peaceful competition was a more secure route than war to individual happiness and national supremacy. Never was this claim in greater jeopardy than during the Napoleonic wars and their aftermath: Nelson's victory at Trafalgar in 1805 and Wellington's at Waterloo, ten years later, appeared

[1] Christine MacLeod, 'James Watt, heroic invention, and the idea of the industrial revolution', in Maxine Berg and Kristine Bruland (eds.), *Technological revolutions in Europe: historical perspectives* (Cheltenham and Northampton, MA: Edward Elgar, 1998), pp. 96–7; James Fentress and Chris Wickham, *Social memory* (Oxford: Blackwell, 1992), p. 127.

to confirm the fitness of an aristocratic military caste for government. It fed a swelling tide of nationalism and triggered a cult of hero worship, which found its most visible expression in the erection of large-scale public monuments to the victors of the battlefield.[2] It threatened to suppress the demands for political representation and fiscal justice that the excluded classes had been advancing for over half a century – with mounting confidence since the American and French revolutions. In this bellicose climate, it became necessary to advance that campaign by redefining the nation and the nation's heroes: they would be men of peaceful conquest. The death of James Watt in 1819 provided the reformers' first opportunity to subvert the dominant heroic image.

Eulogistic obituaries lauded Watt's inventive genius and exaggerated the role of his improved steam engine in creating Britain's wealth and defeating Napoleon. The efforts of influential friends to commemorate his memory culminated in a grandiose public meeting at Westminster in 1824, chaired by the prime minister, Lord Liverpool, which launched the national appeal for his monument. There, a glittering array of leading politicians, men of science, literary figures and manufacturers promoted Watt's reputation as a saviour of his country and a benefactor of humanity: thanks to him, they proclaimed, steam power promised a future of peace and prosperity, British naval supremacy, and the extension of Christian civilization around the globe. In effect, a significant element of the governing class was endorsing the growth of industry and opening a dialogue with the men whose business ventures had promoted it. Across the country, manufacturers and their workers responded enthusiastically to the opportunity to install 'one of their own' in the national pantheon. Alarmed by this new alliance, however, radical politicians sought to reclaim Watt for their own cause; simultaneously they opened a debate about the nature of invention. The press started to show a new respect for inventors, and cartoonists lampooned the prospect of a steam-powered future, paying tribute thereby to the new-found significance of technology.

Gradually, during the 1830s and 40s, this new regard for technical achievements expanded, fuelled by the daring feats of the civil engineers, as they propelled railways across the landscape, bridged estuaries and gorges, and tunnelled (not without terrifying mishaps) beneath the River Thames. In a highly visible way they were taming nature. The leading

[2] Linda Colley, *Britons: forging the nation, 1707–1837* (New Haven and London: Yale University Press, 1992); Alison W. Yarrington, *The commemoration of the hero, 1800–1864: monuments to the British victors of the Napoleonic wars* (New York and London: Garland, 1988).

civil engineers – George and Robert Stephenson, Marc and Isambard Kingdom Brunel, in particular – became celebrities in their lifetimes. Explanations of Britain's extraordinary growth in prosperity since the eighteenth century were increasingly couched in terms of technological change, often by reference to particular inventors. Historians and social commentators began to chronicle the rise of manufacturing industry (not always favourably): authors as disparate as Lord Macaulay and Friedrich Engels credited the importance of Watt, Richard Arkwright and other industrial pioneers. Inventors received sympathetic treatment from Charles Dickens and Mrs Gaskell, not to mention the mixed attentions of a bevy of minor novelists, poetasters and *Mr Punch*; their lives were sanctioned by obituaries in *The Times*.

The popular celebration of inventors reached its zenith in the third quarter of the nineteenth century. The Great Exhibition of 1851 played a pivotal role, orchestrating a sense of national pride in British manufacturing supremacy and an ethos of peaceful international competitiveness. From the revolutionary design of the Crystal Palace, to the power and ingenuity on display in the machinery hall, everything put new technology in a positive light and excited curiosity about its creators. Less ostentatiously, the Patent Law Amendment Act of 1852, the first major reform of the patent system in over 200 years, stirred up a ferment of controversy. Not only did its passage through Parliament stimulate debate over the inventor's role in the creation of national wealth, but it also sparked the 'patent controversy', which threatened the patent system with abolition and kept the issue in the public eye for another three decades. Prompted perhaps by this threat, Bennet Woodcroft, at the head of the new Patent Office, made enormous efforts to preserve and publicize the achievements of inventive men, both living and dead. He supplied Samuel Smiles and other biographers with information, and began to rescue machinery that marked 'the great steps in every invention' for the new Patent Office Museum at South Kensington.

Controversy of a different kind was provoked in 1854 by the outbreak of war in the Crimea and, a few years later, in India. Pacifists and others who had believed that war was an anachronism, doomed to extinction as modern nations engaged in mutually beneficial free trade, were shocked to find inventors supplying the state with new technologies of destruction. In more conservative eyes, however, this was further cause to celebrate the contribution that inventors and manufacturing industry made to Britain's international predominance: the heroes of the battlefield were impotent without the support of ingenious men on the home front, both directly in the production of weapons and indirectly in filling the nation's coffers, thanks to its booming industries. Few were prouder of their place

in 'the workshop of the world' than the skilled men whose trades were at the forefront of industrialization, and many of them identified with the inventors who had been instrumental in their success. In the heavy industries and mechanized textile trades, in particular, they drank toasts to the memory of their heroes and celebrated them on their trade-union insignia. Just as in 1832 the manufacturers had staked their claim to enfranchisement under the banner of Watt and steam-powered industry, so at mid-century skilled working man campaigned for equal political rights by reference to the ingenious artisans' role in the nation's greatness.

As hero-worshipping Britain went 'statue mad' during Victoria's reign and embellished the country's squares, parks and buildings with the images of great men (only rarely women), inventors too were ostentatiously commemorated.[3] Towns and cities, universities and professional bodies paid public tribute to men with whose inventive achievements they wished to be identified. They launched public subscriptions in order to honour, in bronze or marble, both those recently deceased and others long dead. While the contributors of guineas headed the lists of subscribers, often the most striking feature was the preponderance of working men who donated their shillings and pence. Occasionally, it was skilled workers who took the initiative, as they did in Bolton (Lancs.) and Penzance (Cornwall), where the statues of Samuel Crompton and Sir Humphry Davy, respectively, still bear testimony to their campaigns. These were bold, symbolic, statements about the contribution of working people to Britain's industrial supremacy. Soon, the most prominent inventors could expect official recognition in their lifetimes, as the state became more liberal in its award of honours to professional men and industrialists. A few inventors were even elevated to the peerage: by 1900, engineering, physics and surgery were all represented in the House of Lords, as was the textile industry.[4]

It was a dizzy ascent, from 'projector' to peer, in scarcely a century. But it proved to be a brief interlude of glory: the inventor would soon return to the obscurity from which he had emerged. The twentieth century's energies were turned inevitably to honouring the dead of the Great War,

[3] Benedict Read, *Victorian sculpture* (New York and London: Yale University Press, 1982), pp. 3–24, 67; Ludmilla Jordanova, *Defining features: scientific and medical portraits, 1660–2000* (London: Reaktion Books, with the National Portrait Gallery, 2000), pp. 86–137.

[4] F. M. L. Thompson, *Gentrification and the enterprise culture, Britain 1780–1980* (Oxford: Oxford University Press, 2001), pp. 45–74; R. Angus Buchanan, *The engineers: a history of the engineering profession in Britain, 1750–1914* (London: Jessica Kingsley, 1989), pp. 192–3.

and simultaneously public art ceased to favour the individual statue.[5] Already, however, the independent inventor's star was dimming, as more powerful groups became attuned to the value of commemorative activity and laid claim to his glory. Professional scientists, campaigning for the public funding of research, were redefining invention as 'applied science': the hard intellectual work, they often implied, lay in the discovery of natural phenomena; the application of such new knowledge to practical ends was a straightforward, virtually automatic procedure that scarcely merited notice, let alone reward. Better organized, in the Royal Society, new university laboratories, and specialist institutions, they reclaimed the space around the monument to Sir Isaac Newton in Westminster Abbey, establishing there a 'scientists' corner' – its most triumphant (and ironic) moment being the burial in 1882 of that ultimate threat to Christianity, Charles Darwin.[6] At considerable expense, the engineers' equally assertive professional bodies maintained their presence close to the same site, with a series of commemorative windows. Devoid of such support in death as in life, the heterogeneous ranks of 'mere' inventors faded from public view.[7] Simultaneously, the publishing industry was redirecting its focus from the biographies of inventors towards the technologies themselves, while academics in the new social sciences elaborated deterministic theories of invention at the expense of the heroic inventor.[8] In a grand final flourish, the showmanship of Thomas Edison and Gulielmo Marconi and the daring feats of the Wright Brothers made them transatlantic household names, the epitome of inventive modernism at the dawn of the twentieth century – none of them available, however, to become British heroes. The inventor, increasingly taken for granted by the British public, came to be seen as an eccentric individualist: he reverted into a benign version of the 'projector', not least in the cartoons of William Heath Robinson and films such as *The Man in the White Suit* (1951).[9]

[5] Thomas W. Laqueur, 'Memory and naming in the Great War', in John R. Gillis (ed.), *Commemorations: the politics of national identity* (Princeton, NJ: Princeton University Press, 1994), pp. 150–67; Rosalind Krauss, 'Sculpture in the expanded field', in Hal Foster (ed.), *Postmodern culture* (London: Pluto Press, 1985), pp. 33–4; Read, *Victorian sculpture*, pp. 3–4.

[6] James Moore, 'Charles Darwin lies in Westminster Abbey', *Biological Journal of the Linnean Society* 17 (1982), 97–113.

[7] Buchanan, *Engineers*, pp. 194–5.

[8] David McGee, 'Making up mind: the early sociology of invention', *T&C* 36 (1995), 773–801.

[9] Simon Heneage, 'Robinson, William Heath (1872–1944)', *Oxford Dictionary of National Biography*, Oxford University Press, 2004, www.oxforddnb.com/view/article/35803, accessed 12 September 2006; Jon Agar, 'Technology and British cartoonists in the twentieth century', *TNS* 74 (2004), 191–3; www.screenonline.org.uk/film/id/441408/index.html, accessed 12 September 2006.

As the tide of celebration ebbed, it stranded the reputations of a famous few above the high-water mark. Watt, Stephenson, Trevithick, Arkwright, Crompton and Davy headed the list of names secured in the grand narrative of Britain's Industrial Revolution (Brunel's is a later revival); those of Lords Armstrong, Kelvin and Lister remain familiar to people with a specialist interest in the history of engineering, science and medicine. They all lived at the right time to be swept up into the Victorian hero-worshippers' net and preserved for posterity. If we recognize the names of their inventive predecessors (Thomas Newcomen, William Lee, John Kay, for example), it is also largely thanks to the historical and commemorative efforts of the Victorians. Their twentieth-century successors, lacking such champions, have fared relatively badly. Securing a place in another grand narrative – that of British victory in the Second World War – appears to provide their strongest suit. The names, for example, of Sir Barnes Wallis and Sir Frank Whittle are remembered (and celebrated on film) thanks to the former's invention of the dam-busting 'bouncing bomb' and the latter's struggle to convince the Air Ministry of the strategic value of his jet engine. Belatedly, Alan Turing's vital contribution to wartime code breaking is receiving public recognition. Other twentieth-century inventors, such as Laszlo Biro, Henry Ford and Sir James Dyson have succeeded in branding their names on the consumer goods that they invented or redesigned, because they became manufacturers.[10] Name recognition, however, is not the same as popular celebration: the hero-worship of inventors is one nineteenth-century 'tradition' that has not survived.[11]

Inventing culture

This book explores the inventor's rise and fall, from several perspectives. At one level, it can be read as a study in 'the social history of remembering'.[12] Peter Burke recommends close scrutiny of 'the process by which the remembered past turns into myth', here using the term 'myth' to mean 'a story with a symbolic meaning, made up of stereotyped incidents

[10] See Sir James Dyson's profile on his company's web site: www.dyson.co.uk/jd/profile/default.asp?sinavtype=pagelink, accessed 12 September 2006.

[11] Eric Hobsbawm, 'Introduction: inventing traditions', in Eric Hobsbawm and Terence Ranger (eds.), *The invention of tradition* (Cambridge: Cambridge University Press, 1983), pp. 1–14.

[12] Peter Burke, 'History as social memory', in Thomas Butler (ed.), *Memory: history, culture and the mind* (Oxford: Basil Blackwell, 1989), p. 100. For an extended study of heroic myth-making, see Graeme Morton, *William Wallace, man and myth* (Stroud: Sutton Publishing, 2001).

and involving characters who are larger than life, whether they are heroes or villains'. Why, he ponders, do only a few monarchs 'become heroes in popular memory', only a few pious individuals become saints?[13] Similarly, I wish to know why so few British inventors are famous today, and why those particular ones (mostly males, born in the eighteenth and early nineteenth centuries)? This is not, however, a systematic analysis of the myths or stories that are woven around many inventors, though such an undertaking could prove very fruitful: as Carolyn Cooper has suggested, they 'may be able to tell us truths about basic human experience, such as "how inventive minds work".'[14] Nonetheless, as Cooper and others appreciate, historians of technology put considerable effort into exposing the inaccuracies in popular myths surrounding inventors – often to little avail.[15] If the mythologizing of inventors has hitherto attracted little attention, scientists have fared better.[16] Not only have historians of science problematized the notion of the scientific hero and offered valuable insights into the making of individual and collective reputations, but they have pursued the philosophical implications of celebrity and myth for the way that scientists see themselves and science itself is understood.[17] In particular, the strategic process by which the credit for scientific 'discoveries' is attributed to particular individuals has become an

[13] Burke, 'History as social memory', pp. 103–104; Fentress and Wickham, *Social memory*, pp. x–xii, 73–4, 88.

[14] Carolyn C. Cooper, 'Myth, rumor, and history: the Yankee whittling boy as hero and villain', *T&C* 44 (2003), 85; also 94–6.

[15] Ibid., 82–4, 90–4. See also Eric Robinson, 'James Watt and the tea kettle: a myth justified', *History Today* (April 1956), 261–5; David Philip Miller, 'True myths: James Watt's kettle, his condenser, and his chemistry', *History of Science* 42 (2004), 333–60; D. A. Farnie, 'Kay, John (1704–1780/81)', *ODNB*, www.oxforddnb.com/view/article/15194, accessed 27 October 2006.

[16] See, however, Patrick O'Brien, 'The micro foundations of macro invention: the case of the Reverend Edmund Cartwright', *Textile History* 28 (1997), 201–33; MacLeod, 'James Watt'; Christine MacLeod and Alessandro Nuvolari, 'The pitfalls of prosopography: inventors in the *Dictionary of National Biography*', *T&C* 48 (2006), 757–76; Christine MacLeod and Jennifer Tann, 'From engineer to scientist: re-inventing invention in the Watt and Faraday centenaries, 1919–1931', *BJHS* 40 (2007), 389–411.

[17] Pnina G. Abir-Am, 'Essay review: how scientists view their heroes: some remarks on the mechanism of myth construction', *Journal of the History of Biology* 15 (1982), 281–315; Pnina G. Abir-Am, 'Introduction', in Pnina G. Abir-Am and C. A. Eliot (eds.), *Commemorative practices in science*, *Osiris* 14 (2000), 1–14; Alan J. Friedman and Carol C. Donley, *Einstein as myth and muse* (Cambridge: Cambridge University Press, 1985); Ludmilla Jordanova, 'Presidential address: remembrance of science past', *BJHS* 33 (2000), 387–406; Patricia Fara, 'Isaac Newton lived here: sites of memory and scientific heritage', ibid., 407–26; Patricia Fara, *Newton: The making of genius* (Basingstoke: Macmillan, 2002); Steven Shapin, 'The image of the man of science', in Roy Porter (ed.), *The Cambridge history of science, Volume 4: eighteenth century science* (Cambridge: Cambridge University Press, 2003), pp. 159–83; Janet Browne 'Presidential address: commemorating Darwin', *BJHS* 38 (2005), 251–74.

important field of study and prompted debate about the very concept of 'discovery' itself.[18]

My interest in the popular memory of the inventor was sparked by astonishment at the turn-round in his reputation. Having begun my research in the seventeenth century, when the 'patentee' was frequently viewed as the comrade-in-arms of the pickpocket and fraudster, it intrigued me that his descendants should be offered to Victorian working men as models of good character. Even more startling was the discovery that, not only had Westminster Abbey opened its doors to Watt's monument, but the king, at the instigation of his prime minister, had headed the list of subscribers. In parallel, the research of Harry Dutton was revealing a growing regard for patentees during the second quarter of the nineteenth century: judges and juries were becoming more sympathetic and finding more often in their favour; Parliament held its first enquiry into the operation of the patent system and, in 1852, finally legislated to make it more transparent and accessible to inventors.[19] Given that it is generally much easier to lose a good reputation than to overcome a bad one, how, against the odds, had the nineteenth-century inventor become a reformed character, even a hero?

Furthermore, what part had this cultural development played in the history of the patent system – in its modernization in 1852 and its subsequent survival through three decades of sustained campaigning for its abolition? How did it affect the conception of invention and technological change? Did those who wished to abolish the patent system conceive of

[18] Augustine Brannigan, *The social basis of scientific discoveries* (Cambridge: Cambridge University Press, 1981); Barry Barnes, *T. S. Kuhn and social science* (London: Macmillan, 1982); Simon Schaffer, 'Scientific discoveries and the end of natural philosophy', *Social Studies of Science* 16 (1986), 387–420; Robert Bud, 'Penicillin and the new Elizabethans', *BJHS* 31 (1998), 305–33; Thomas Nickles, 'Discovery', in R. C. Olby *et al.* (eds.), *Companion to the history of modern science* (London: Routledge, 1990), pp. 148–65; Richard Yeo, *Defining science: William Whewell, natural knowledge, and public debate in early Victorian Britain* (Cambridge: Cambridge University Press, 1993); Simon Schaffer, 'Making up discovery', in Margaret A. Boden (ed.), *Dimensions of creativity* (Cambridge, MA, and London: MIT Press, 1994), pp. 13–51; Michael Shortland and Richard Yeo, 'Introduction' to Michael Shortland and Richard Yeo (eds.), *Telling lives in science: essays on scientific biography* (Cambridge: Cambridge University Press, 1996), pp. 1–44; Geoffrey Cantor, 'The scientist as hero: public images of Michael Faraday', in ibid., pp. 171–94; Thomas F. Gieryn, *Cultural boundaries of science: credibility on the line* (Chicago: Chicago University Press, 1999); David Philip Miller, *Discovering Water: James Watt, Henry Cavendish and the nineteenth-century 'water controversy'* (Aldershot: Ashgate, 2004), esp. pp. 11–26; Marsha L. Richmond, 'The 1909 Darwin celebration: re-examining evolution in the light of Mendel, mutation, and meiosis', *Isis* 97 (2006), 447–84.

[19] H. I. Dutton, *The patent system and inventive activity during the industrial revolution, 1750–1852* (Manchester: Manchester University Press, 1984), pp. 42–6, 59–64, 76–81.

invention and the role played by the individual inventor differently from its supporters? Clearly, the providential theory of invention current before 1800 offered neither scope for heroic action, nor justification for the rewarding of individuals with patents, so what had replaced it?[20] How invention was understood had important ramifications for the nascent 'invention industry' and its clients, prompting both the elaboration of heroic notions of 'genius' and also a reaction against them, which elicited more deterministic and democratic explanations. These competing accounts of invention provide a theoretical framework to the politics of reputation.

The significance of the inventor's construction as a hero extends much further than the development of the patent system and nineteenth-century philosophies of invention. It offers a novel perspective on nineteenth-century British culture more generally, one that chimes with recent challenges by historians to the discourses of 'decline' and aristocratic hegemony. Quantitative demonstrations of Britain's economic robustness in the twentieth century tend to be vitiated by a national myth that its industry, in tandem with its science and technology, has been in decline for over a century. As one of this myth's most cogent critics, David Edgerton, remarks, 'this declinist historiography of British science and technology has been primarily cultural'.[21] In the late nineteenth century, profound anxieties about the loss of international leadership, as other countries began to industrialize energetically, coalesced with the opportunistic propaganda of scientists and engineers campaigning for state sponsorship. Together they launched an influential discourse of 'decline'. This has obscured the evidence of positive attitudes towards innovation and the burgeoning provision of scientific and technical education in late-Victorian and Edwardian Britain.[22]

As for inventors, the discourse of 'decline' has ignored the Victorians' fervent celebration of them as heroes. Instead, it has privileged the complaints of campaigners for reform of the patent system, who portrayed inventors as the pitiable victims of ruthless capitalists unrestrained by a negligent state, and later of scientists, who argued that only well-funded

[20] Christine MacLeod, *Inventing the industrial revolution: the English patent system, 1660–1800* (Cambridge: Cambridge University Press, 1988), pp. 202–4.

[21] David Edgerton, *Science, technology and the British industrial 'decline', 1870–1970* (Cambridge: Cambridge University Press for the Economic History Society, 1996), p. 68.

[22] Ibid., pp. 5–29, and passim; David Edgerton, 'The prophet militant and industrial: the peculiarities of Correlli Barnett', *Twentieth Century British History* 2 (1991), 360–79; Frank Turner, 'Public science in Britain', *Isis* 71 (1980), 360–79; David Cannadine, 'Engineering history, or the history of engineering? Re-writing the technological past', *TNS* 74 (2004), 174–5.

laboratory research could save the nation from foreign competition. It is such cultural shifts, rather than an actual change in the nature of invention and innovation, that accounts for the inventor's eclipse at the start of the twentieth century. Present-day ignorance of the names and achievements of the successors of the industrial revolution's 'heroes' should not be excused – as it regularly is – by reference to their absorption into the anonymous routine of corporate research laboratories, which, in any case, remained scarce before 1914.[23] We have been culturally programmed simultaneously to underrate the one and overrate the other, and seem unable to strike an accurate balance that values creativity without putting it on a false pedestal.[24]

This study is also intended, therefore, as a corrective to the common misconception that, beyond Samuel Smiles' now unfashionable pages, British inventors and engineers have always suffered from opprobrium or neglect – the victims of Luddite mobs, grasping capitalists, cynical politicians and high-minded critics of industrial society. Their nineteenth-century interlude of glory casts a relatively unfamiliar gleam on the cultural history of the period. Although the precise term 'the Industrial Revolution' was not in common usage until the 1880s, the preceding century witnessed a growing awareness and analysis of the revolutionary developments that were transforming the British economy. We are more familiar with the voices of those who deplored industrialization's harmful effects than of those who welcomed its benefits and hymned its achievements. By no means is it my intention to silence the former, but lack of attention to the latter has produced an unbalanced picture of nineteenth-century popular culture, which is only starting to be remedied. This is especially true of the century's second half, as the visible excitement of early railway construction and the triumphalism of the Great Exhibition in 1851 appear to fade, submerged beneath the anxieties generated by Britain's supposedly faltering international competitiveness.

In part, this simply reflects the focus of much historical literature. As its title indicates, *Iron Bridge to Crystal Palace*, Asa Briggs' anthology of visual sources – many of them celebrating heroic technical achievements – terminates in 1851; Klingender's *Art and the industrial revolution* covers a similar period.[25] The familiar names of the early canal and railway engineers present publishers and television producers with easier options than

[23] Edgerton, *Science*, pp. 31–2.
[24] For a critique of today's 'ideology of creativity', see Thomas Osborne, 'Against "creativity": a philistine rant', *Economy and Society* 32 (2003), 507–25.
[25] Asa Briggs, *Iron Bridge to Crystal Palace: impact and images of the industrial revolution* (London: Thames & Hudson, 1979); Francis D. Klingender, *Art and the industrial revolution*, ed. Arthur Elton (London: Evelyn, Adams & Mackay, 1968).