



Did the British Patent System Retard the Industrial Revolution?

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In his work on institutions and economic performance, Nobel laureate Douglass North examined the potential role of patenting in the development of technology during England's industrial revolution. He argued that although the societal rate of return to invention has always been high, the vast majority of economies have failed to engage in inventive activities to an optimal extent; it is the very nature of new technology which explains this failure. First, inventions are non-rivalrous, meaning that one's use of an invention will not diminish another's capacity to use it. Second, the costs of invention are infinitely greater than the costs of imitation (which are assumed to be zero). This means that although inventions are costly to develop, they can be duplicated at no trouble or cost to the copier. Without protection from competitors who have not shared in the costs of invention, the original inventor cannot appropriate a return above the market rate to recoup those costs. Consequently, inventive activities will be spurned.¹

It is with the introduction of property rights in invention that these problems can be circumvented. By providing an inventor the temporary right to exclude others from using his invention, patents increase the rate of return to inventive activities. Although prizes and awards offer comparable incentives, North argued that they fail to provide a secure legal basis for ownership of intellectual property: only developing statute and common

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¹ DOUGLASS C. NORTH, *STRUCTURE AND CHANGE IN ECONOMIC HISTORY* 164 (W. W. Norton & Co. 1981). North's treatment of new technology is essentially the same as Kenneth Arrow's. See Kenneth Arrow, *Economic Welfare and the Allocation of Resources for Invention*, in *THE RATE AND DIRECTION OF INVENTIVE ACTIVITY: ECONOMIC AND SOCIAL FACTORS* 609 (Princeton Univ. Press 1962).

law applicable to patenting provides suitable protection.² In England, the property rights of inventors were supposedly guaranteed with the passing of the Statute of Monopolies in 1624, which removed the power of awarding patents for invention from the Crown and embedded the patent system in common law.³ This precocious development raised the private rate of return to invention, contributing to England's technological lead over Europe in the years immediately preceding the Industrial Revolution.⁴

North's treatment of the English patent system was a largely theoretical one, there being a relative sparsity of empirical work on the subject at the time. That sparsity changed during the 1980s, when Harold Dutton and Christine MacLeod produced two monographs covering the period from 1660 to 1852.⁵ Both agreed that the administration of the patent system was extremely inefficient, even by contemporary standards. For example, the petition procedure for a patent was essentially unchanged for over three hundred years between the passing of the Clerks of the Signet and Privy Seal Act in 1535⁶ until reform in 1852. The primary reason for passing the Privy Seal Act (as acknowledged in its preamble) was to institute a procedure wherein the petitioner was obliged to pass through as many offices as possible, so that non-salaried government staff could be supported by the fees levied on them.⁷ This meant that obtaining a patent was not only arduous and time consuming, but also tremendously expensive; MacLeod emphasizes how "[t]he major deterrent to patenting was the expense"⁸ reducing the number of patents that would have been otherwise obtained and that, even after

² DOUGLASS NORTH & ROBERT THOMAS, *THE RISE OF THE WESTERN WORLD: A NEW ECONOMIC HISTORY* 155 (Cambridge Univ. Press 1973).

³ *Id.* at 154. Ostensibly, the Statute disallowed the Crown from awarding monopolies (via the legal instrument of the patent) and reserving related disputes for the common law courts. An exception was made for the general prohibition on patents awarded for new inventions. However, the Crown disregarded the terms of the Statute. In the first related court case after the Statute had been passed, *Mansell v. Bunge* [1626] 41 Acts of the Privy Council 9, 394–95, 410–12 (Eng.) (on file with author), at the direct intervention of Charles I, the Privy Council upheld Mansell's monopoly (for glass manufacture) and declined to transfer the case to the common law courts. See Sean Bottomley, *Mansell v. Bunge (1626)*, in *LANDMARK CASES IN INTELLECTUAL PROPERTY* (Jose Bellido ed., Hart forthcoming 2017) (manuscript on file with author).

⁴ DOUGLASS C. NORTH, *INSTITUTIONS, INSTITUTIONAL CHANGE AND ECONOMIC PERFORMANCE* 114 (Cambridge Univ. Press 2d ed. 1990) (concluding that "patent law encouraged the growth of innovative activity" in England).

⁵ HAROLD DUTTON, *THE PATENT SYSTEM AND INVENTIVE ACTIVITY DURING THE INDUSTRIAL REVOLUTION, 1750–1852* (Manchester Univ. Press 1984); CHRISTINE MACLEOD, *INVENTING THE INDUSTRIAL REVOLUTION: THE ENGLISH PATENT SYSTEM, 1660–1800* (Cambridge Univ. Press 1988). MacLeod has also worked extensively on the patent system after 1800. See Christine MacLeod, *The Paradoxes of Patenting: Invention and Its Diffusion in 18th- and 19th-Century Britain, France, and North America*, 32 *TECH. & CULTURE* 885 (1991); Christine MacLeod, *Strategies for Innovation: The Diffusion of New Technology in Nineteenth-Century British Industry*, 45 *ECON. HIST. REV.* 285 (1992); CHRISTINE MACLEOD, *HEROES OF INVENTION: TECHNOLOGY, LIBERALISM AND BRITISH IDENTITY, 1750–1914* (Cambridge Univ. Press 2007).

⁶ Clerks of the Signet and Privy Seal Act 1534, 27 Hen. VIII c. 11 (Eng.), reprinted in *LAWS AND PRACTICE OF ALL NATIONS AND GOVERNMENTS RELATING TO PATENTS FOR INVENTIONS* 66 (New York, John L. Kingsley & Joseph P. Pirson eds., 1848).

⁷ MACLEOD, *INVENTING THE INDUSTRIAL REVOLUTION*, *supra* note 5, at 40

⁸ *Id.* at 76.

“statutory reforms in 1852 and 1883, [the patent system] remained barely fit for purpose.”⁹

To compound matters, the petition was ostensibly pro forma and patents issued as a matter of course. Without any examination of the proposed patent, the legal cachet of the eventual grant was necessarily undermined and “the market value of a patent depended upon a successful case at law.”¹⁰ Unfortunately for patentees, that success was supposed to be exceedingly difficult to obtain, especially before 1830. The judiciary was apparently hostile toward patentees, a hostility manifested as an unfeasibly strict interpretation of the law, “allowing no error, however immaterial.”¹¹ Under these circumstances, the development of a substantive body of case law was impossible, and such were the supposed difficulties involved with enforcing patents that they were rarely “worth the parchment [they were] written on.”¹² This situation also prevented patentees from assigning or licensing their rights to others. It was only around 1830, when there was an apparent “sea change” in attitudes, that judicial hostility was replaced by a growing appreciation of patenting’s role in encouraging invention and the law courts began to place patent rights on a more secure legal footing.¹³ Ultimately, MacLeod concludes that, certainly before the nineteenth-century, “[w]ithout a patent system, it is doubtful that . . . Britain would have seen significantly less inventive activity.”¹⁴

This article assesses each of those claims in turn. Part I examines the issue of judicial hostility in the law courts. Contrary to Dutton’s and MacLeod’s conclusion, this part shows that the judiciary clearly understood the role of patents in creating an incentive to develop new technology. Moreover, beginning in the middle of the eighteenth century, the patent came to be conceived contractually: in return for his patent, the inventor had to publish his invention in the form of a specification, facilitating the diffusion of new technology as well. However, if the judiciary were not hostile toward patent rights, this would imply that there should have been substantive developments in patent law before 1830. Part II analyzes the development of law in one particular area—the assigning and licensing of patents. It establishes that there were indeed important developments in this law, actively facilitating

⁹ Christine MacLeod & Alessandro Nuvolari, *Patents and Industrialisation: An Historical Overview of the British Case, 1624–1907*, at 4 (Paper for the Strategic Advisory Board on Intellectual Property Policy, 2010), http://www.merit.unu.edu/wp-content/docs/25years/presentations/mcleod_nuvolari.pdf.

¹⁰ DUTTON, *supra* note 5, at 179.

¹¹ *Id.* at 77.

¹² MACLEOD, *INVENTING THE INDUSTRIAL REVOLUTION*, *supra* note 5, at 69.

¹³ MacLeod, *The Paradoxes of Patenting*, *supra* note 5, at 905.

¹⁴ MacLeod & Nuvolari, *supra* note 9, at 11. Dutton is more optimistic, arguing that, for all its faults, patenting still offered a degree of protection in excess of the next-best alternative (secret working) for the large majority of industries and that, consequently, it did provide a significant incentive to inventive activity. DUTTON, *supra* note 5, at 110. MacLeod dismisses this argument as “Panglossian.” MacLeod, *The Paradoxes of Patenting*, *supra* note 5, at 906.

these types of transactions. Finally, it establishes that inventors frequently transacted their patents, and that many were able to profit significantly from doing so.

I. JUDICIAL BIAS IN THE LAW COURTS

Let us now examine the issue of judicial hostility in the law courts and the conception of the patent in contractual terms.

A. The Early Political-Economic Rationale for Awarding Patents to Inventors

The early political economists advocated a familiar rationale for awarding patents to inventors: it encouraged the development of new technology. It was also seen as a superior policy tool to cash grants and other *post hoc* rewards. Adam Smith, for example, had a horror of almost any monopoly: “the cruellest of our revenue laws . . . are mild and gentle, in comparison of some of those which the clamour of our merchants and manufacturers has extorted from the legislature, for the support of their own absurd and oppressive monopolies. Like the laws of Draco, these laws may be said to be all written in blood.”¹⁵ However, in 1763 Smith noted that

the inventor of a new machine or any other invention has the exclusive privilege of making and vending that invention for the space of 14 years by the law of this country, as a reward for his ingenuity, and it is probable that this is as equall an one as could be fallen upon. For if the legislature should appoint pecuniary rewards for the inventors of new machines, etc., they would hardly ever be so precisely proportiond to the merit of the invention as this is. For here, if the invention be good and such as is profitable to mankind, he will probably make a fortune by it; but if it be of no value he also will reap no benefit.¹⁶

Later, in 1795, Jeremy Bentham expressed himself in similar terms:

A patent considered as a recompense for the encrease given to the general stock of wealth by an invention, as a recompense for industry and genius and ingenuity, is proportionate and essentially just. No other mode of recompense can merit either the one or the other epithet.

The only mode of bestowing upon an inventor a recompense for his invention otherwise than by a patent, is by giving him a sum . . . Is the reward [given] in this [form] proportionable to the service? It may be so: but against its being so there is infinity to one.¹⁷

¹⁵ ADAM SMITH, *AN INQUIRY INTO THE NATURE AND CAUSES OF THE WEALTH OF NATIONS* bk. 4, at 165 (Edwin Cannan ed., Modern Library 1937) (1776).

¹⁶ 5 ADAM SMITH, *LECTURES ON JURISPRUDENCE: THE GLASGOW EDITION OF THE WORKS AND CORRESPONDENCE OF ADAM SMITH* 116 (Ronald Meek, David Raphael & Peter Stein eds., Liberty Fund 1982) (citation omitted).

¹⁷ 1 WERNER STARK, *JEREMY BENTHAM'S ECONOMIC WRITINGS* 263–64 (George Allen & Unwin 1952) (alterations in original).

Across the Channel in France, Britain's industrial success was often attributed to the provision of patent rights. In 1803, Jean-Baptiste Say wrote:

In England, when a private individual invents a new product, or discovers an unknown process, he obtains an exclusive privilege for making this product or to use this process. As he has no competition in this production, he can raise prices above what would be necessary to repay his advances with interest, and to pay profits . . . and in a country as prodigiously productive as England . . . this reward is often very considerable.¹⁸

This naturally raises the question: was the judiciary really so hidebound that it disregarded the shared view of contemporary political economists?¹⁹

B. The Judiciary's Attitude Toward Patents

Dutton does quote an instance in 1799 in *Hornblower v. Boulton & Watt* where Lord Kenyon pronounced himself “not one of those who greatly favour patents.”²⁰ Kenyon continued that, “though, in many instances, and particularly in this, the public are benefited by them, yet on striking the balance upon this subject, I think that great oppression is practised on inferior mechanics.”²¹ Such sentiments, however, did not prevent Kenyon from deciding “that this is a patent for a manufacture” and, like the three other judges, he found in favor of Watt.²²

The Boulton & Watt cases also indicate that Kenyon was in a minority of one in harboring such reservations about whether it was politic to award patents.²³ For example, Justice Grose observed that “[t]he aim of the

¹⁸ “En Angleterre, quand un particulier invente un produit nouveau, ou bien découvre un procédé inconnu, il obtient un privilège exclusif de fabriquer ce produit, ou de se servir de ce procédé. Comme il n'a point de concurrents dans cette production, il peut en porter le prix fort au-dessus de ce qui serait nécessaire pour le rembourser de ses avances avec intérêts, et pour payer les profits . . . et dans un pays aussi prodigieusement productif que l'Angleterre . . . cette récompense est souvent très-considérable.” JEAN-BAPTISTE SAY, TRAITÉ D'ÉCONOMIE POLITIQUE, OU SIMPLE EXPOSITION DE LA MANIÈRE DONE SE FORMENT, SE DISTRIBUENT ET SE CONSOMMENT LES RICHESSES 262 (Paris, Deterville 1803).

¹⁹ The “patent controversy” arose later in the mid-nineteenth century. Before then, such was the degree of unanimity concerning patents that even the prototype anarchist Pierre-Joseph Proudhon (“*La propriété, c'est le vol!*”) considered temporary protection for inventors to be a social “necessity.” Fritz Machlup & Edith Penrose, *The Patent Controversy in the Nineteenth Century*, 10 J. ECON. HIST. 1, 9 (1950).

²⁰ *Hornblower v. Boulton & Watt* (1799) 101 Eng. Rep. 1285, 1287, 8 T.R. 95, 98 (Opinion of Lord Kenyon, C.J.), quoted in DUTTON, *supra* note 5, at 77. Dutton also produces quantitative evidence indicating that patentees only won about one-third of cases before 1830. Unfortunately, this cannot be read simply as evidence of judicial hostility. The majority of disputes were settled before they came to court, often with the patentee agreeing to license the use of the patent to the defendant(s) in return for their dropping the case. Ordinarily, these license fees would have cost less than legal fees which, with the possibility of paying damages, meant that only those defendants with the strongest cases would persist in going to court, potentially skewing the percentage of cases found in their favor. By contrast, the patentee was likely to have much more at stake financially, and would have had a stronger motivation to pursue more marginal cases. Even so, quantitative work using a wider range of cases indicates that the success rate of patentees was nearer to 50 percent. SEAN BOTTOMLEY, *THE BRITISH PATENT SYSTEM DURING THE INDUSTRIAL REVOLUTION* 82 (Cambridge Univ. Press 2014).

²¹ *Hornblower*, 101 Eng. Rep. at 1287–88, 8 T.R. at 98.

²² *Id.* at 1288, 8 T.R. at 99.

²³ MacLeod also notes that, “[p]rior to the mid-eighteenth century, there is no evidence that judges held any anti-patent prejudices.” MACLEOD, *INVENTING THE INDUSTRIAL REVOLUTION*, *supra* note 5, at 58.

Legislature is obvious; . . . it was to encourage ingenious artificers and able and studious men to invent and bring forward for the use of the public new manufactures, the produce of their ingenuity, by holding out to them the reward of the 14 years' monopoly."²⁴ Further, the judiciary recognized the commercial importance of new technology. As Chief Justice Eyre stated in *Boulton & Watt v. Bull*, "[t]he advantages to the public from improvements of this kind [methods of manufacture], are beyond all calculation important to a commercial country, and the ingenuity of artists who turn their thoughts toward such improvements is in itself, deserving of encouragement."²⁵ Similarly, in *Hornblower v. Boulton & Watt*, Justice Ashhurst noted that "[e]very new invention is of importance to the wealth and convenience of the public."²⁶ It is finally worth mentioning that these sentiments were not peculiar to the Boulton & Watt cases. In 1785 in *Arkwright v. Nightingale*, for example, Lord Loughborough stated that "the law has established the right of patents for new inventions; that law is extremely wise and just."²⁷

However, grants of monopoly (temporary or otherwise) were antithetical to the fundamental tenets of common law; if the judiciary were not biased against patenting, there must have been some legal rationale with which they justified patents for invention. Although notions of "natural rights" were influential in contemporary debates concerning copyright, there was no judicial support for natural rights in invention. During *Donaldson v. Beckett* in 1774, when the House of Lords decided that copyright could not be held in perpetuity because natural rights ceased on publication, it was universally assumed that there were no equivalent rights in patents either.²⁸ Rather, the patent was conceived as embodying a social contract between the inventor-patentee and the public. In this schema, the public awarded the patent in return for a detailed description of the patented invention, in the form of a specification, a copy of which was deposited at the Court of Chancery. Beginning in the 1780s, when the legal record starts to improve, this contractual conceptualization of the patent grant was ubiquitous—although its origins can be traced back to the beginning of the eighteenth century.²⁹ In 1785 in *Rex v. Arkwright*, Justice Buller stated that "it is clearly settled as law,

²⁴ *Hornblower*, 101 Eng. Rep. at 1288, 9 T.R. at 100 (Grose, J.).

²⁵ *Boulton & Watt v. Bull* (1795) 126 Eng. Rep. 651, 667, 2 H. Bl. 463, 494 (Eyre, C.J.).

²⁶ *Hornblower*, 101 Eng. Rep. at 1288, 9 T.R. at 99 (Ashhurst, J.).

²⁷ *Arkwright v. Nightingale* (1785) 1 Hayward's Patent Cases 221, 239, 1 Carpmael's Patent Cases 38, 49 (Loughborough, L.).

²⁸ See MACLEOD, *INVENTING THE INDUSTRIAL REVOLUTION*, *supra* note 5, at 198; see also *Millar v. Taylor* (1769) 98 Eng. Rep. 201, 4 Burr. 2303 (Aston, J.).

²⁹ For example, in a bill of complaint entered at the Court of Chancery in 1716, the ironmaster Abraham Darby I, listed the conditions on which his patent had been granted. One of the conditions reads: "it was granted to your orator . . . that the said letters patent or the inrollment thereof should be in and by all things good, firm, valid, sufficient and effectual in the law . . . notwithstanding the not full and certain describing the nature and quality of the said invention or of the materials." *Darby v. Bartlett* (1716) C 11/1721/15, 1 (National Archives in London (NAL)) (on file with author); see also *BOTTOMLEY*, *supra* note 20, at 46–50, 89–95.

that a man, to entitle himself to the benefit of a patent for a monopoly, must disclose his secret, and specify his invention in such a way, that others may be taught by it,”³⁰ and this *raison d'être* was consistently invoked throughout the period. Later, in 1835 in *Derosne v. Fairie*, Lord Abinger summed up, “the law requires, that a man, as the price of the monopoly which he obtains for fourteen years for any invention, shall enable the public, after the monopoly has ceased, to have a full and distinct account of the whole of that invention.”³¹

C. *The Early Codification and Diffusion of Technical Knowledge*

This social contract was not some convenient legal fiction—if the specification was found to be inadequate in court, then the patent would be annulled (and this happened frequently); testimony provided in various parliamentary select committees shows that inventors responded logically to these demands, going to great lengths to prepare accurate specifications. James Watt, for example, corresponded extensively with friends when preparing his specification for the separate condenser (an invention which radically improved the fuel efficiency of steam engines). A 1769 letter to Dr. William Small makes Watt’s motivation clear: “as I have been informed that some patents have been defeated because the specification was not clear enough to enable other people to execute the scheme, I have added descriptions of the machines with drawings.”³² Inventors also invested significant sums of money hiring draughtsmen to prepare the drawings and legal assistance for the precise wording. In 1829, it was reported that the charges for preparing the specification could be as high as £200, although the average was nearer £20 (which was still twice the average annual wage, however).³³

Consequently, patent specifications came to fill an important gap in the supply of technical information. Although there had been a boom in scientific publishing during the eighteenth century, very little of this literature dealt directly with the technical problems encountered in the early stages of the Industrial Revolution.³⁴ This is probably because there was little incentive for practitioners of industrial technology to codify and set down their technical knowledge: the benefits were uncertain, and if it informed the efforts of would-be competitors, it could well undermine the author’s private rate of return.³⁵ Specifications, of course, as a reliable and up-to-date

³⁰ R. v. Arkwright (1785) 1 Hayward’s Patent Cases 245, 286, 1 Carpmael’s Patent Cases 53, 78.

³¹ *Derosne v. Fairie* (1835) 2 Hayward’s Patent Cases 589, 613, 1 Carpmael’s Patent Cases 664, 683–84.

³² MATTHEW BOULTON & JAMES WATT, 1 INDUSTRIAL REVOLUTION: SERIES 1, THE BOULTON AND WATT ARCHIVE AND THE MATTHEW BOULTON PAPERS FROM THE BIRMINGHAM CENTRAL LIBRARY 4 (Adam Matthew 1993).

³³ 3 Report from the Select Committee on State of Law and Practice Relative to Patents for Inventions 17 (House of Commons 1829) [hereinafter 1829 Committee Report] (on file with author).

³⁴ Joel Mokyr, *The Intellectual Origins of Modern Economic Growth*, 65 J. ECON. HIST. 285, 300 (2005).

³⁵ One scenario where practitioners did choose to codify and reveal their expertise in writing was when the resultant pamphlet or book could be used as a means of advertising their talents, perhaps in the hope of

source of technical information, were ideally suited to compensating for this shortage. In the eighteenth century, specifications were entered at the Court of Chancery in London where, for a small fee, anyone could consult them—including foreigners, much to the ire of British manufacturers. In 1785, for example, Matthew Boulton (James Watt’s business partner) complained to the Board of Trade that “specifications are accessible to all foreigners and the facility with which the secrets of our new inventions are there disclosed . . . has induced them to carry these inventions to other countries, where the secret of such inventions is better kept.”³⁶ Several measures were introduced to Parliament in an effort to retain national possession of patented technology, but as this would have entailed a fundamental restructuring of how the patent grant was conceived, all failed.

Later, in the first half of the nineteenth century, specifications were frequently printed in contemporary journals and magazines, some of which had large circulations. At its peak in the 1830s, the *Mechanics Magazine* was selling 16,000 copies a week at 3 pence, enough for the printer Charles Timperley to include it in his list of the seven best-selling weekly journals of the day.³⁷ He also included *The Repertory of Arts* in his list of the twelve “principal periodicals” (magazines sold on a monthly basis).³⁸ By publishing patent specifications, these magazines provided a large proportion of the manufacturing and laboring population with cheap and convenient access to the latest technical information—much cheaper and easier than if the technology had remained in tacit form or worked in secret, a plausible scenario in the absence of patent protection or the social contract.³⁹

Finally, these publications were in great demand abroad and played a critical role in the international diffusion of British industrial technology. They certainly highlighted the futility of the British government’s ban on the migration of skilled workers and the export of machinery in the first quarter of the nineteenth century. For example, the testimony of Henry Maudslay (a celebrated machinist) made a particular impression on an 1825

employment or to sell their wares, and this has been shown to have happened in the brewing industry during the eighteenth century. Alessandro Nuvolari & James Sumner, *Inventors, Patents, and Inventive Activities in the English Brewing Industry, 1634–1850*, 87 *BUS. HIST. REV.* 95–110 (2013).

³⁶ Board of Trade, Commercial Treaty with France, BT 6/114, 185–86 (NAL) (on file with author).

³⁷ CHARLES TIMPERLEY, *A DICTIONARY OF PRINTERS AND PRINTING* 952 (London, H. Johnson 1839).

³⁸ *Id.* at 75.

³⁹ The situation can be compared with France, where the social contract conceptualization of patents was slower to emerge. Inventors complained bitterly about the availability of specifications and, from at least 1811, they could only be accessed with the permission of the *Ministre du Commerce*. This permission was not guaranteed and, unless patentees chose to publicize their invention themselves, specifications were effectively unobtainable until the patent expired. Gabriel Galvez-Behar, *Was the French Patent System Democratic?* 9 (Dec. 8, 2010) (unpublished manuscript), <https://halshs.archives-ouvertes.fr/halshs-00544730/document>. For a longer discussion on the French system at this time, see Jérôme Baudry, *Une histoire de la propriété intellectuelle. Les brevets d’invention en France, 1791-1844: acteurs, catégories, pratiques* (2014) (unpublished Ph.D. thesis, *L’école des hautes études en sciences sociales*) (on file with author); GABRIEL GALVEZ-BEHAR, *LA RÉPUBLIQUE DES INVENTEURS: PROPRIÉTÉ ET ORGANISATION DE L’INNOVATION EN FRANCE, 1791-1922* (Presses Universitaires des Rennes 2008).

Select Committee established to investigate the export of tools and machinery. Their final report contained a long verbatim extract of Maudslay's testimony, containing his response to the question of whether it was "within his knowledge that the French are in possession of drawings and plans of almost every patent as soon as they are published in England":

Yes, I know from circumstances that have come to my own knowledge. On the first of every month, books are packed off to Hamburg, and sent through Holland and all parts of the Continent This is a copy of the French *Repertory of Arts* [alluding to a book produced by the witness], and this is a drawing of a machine, and is as good a plan as a man need to work from, and I know this machine was not at work in our Mint when this book was published in France.⁴⁰

II. TRANSACTING PATENT RIGHTS

The previous part demonstrated that there is little evidence to indicate that the judiciary harbored hostile attitudes toward patents and inventors. Instead, political economists and the judiciary recognized the benefits of encouraging the development of new technology, and especially the role of patents in incentivizing innovation. This insight does, however, raise further problems with the historiography. In particular, Dutton attributed the slow development of legal precedent until the 1830s to the uncertain legal status of the patent and judicial hostility. If patents were founded on solid jurisprudential foundations, one would expect to see a more thorough judicial elucidation of patent law at an earlier period than previously thought. Although there is not space for an exhaustive survey of English patent law, this part will focus instead on developments in one area of particular importance—the assignment and licensing of patents.

A. The Assignment and Licensing of Patents

To begin, some definitions. An assignment occurred when the patentee sold the patent. When the patent was assigned in its entirety, the original patentee surrendered all interest in it to the assignee. Partial assignments, however, were when a patentee assigned only a share of the patent to another party. This was normally made as part of a wider agreement to work the patent in

⁴⁰ 5 Report from the Select Committee on the Laws Relating to the Export of Tools and Machinery 17 (House of Commons 1825) (on file with author). The evidence of Maudslay and others led the Committee to the following conclusion: "[I]n regard to the ease with which all plans, models, and drawings of new inventions in machinery are conveyed to the Continent, and the facility with which some engineers assert that good workmen can construct machinery from them, it is probable that if the present prohibitory policy is persisted in, foreign nations will be obliged to establish manufactories (as has already partly done in France, the United States, &c.) for those articles with which we refuse to furnish them, and which a liberal course of policy would entirely prevent." *Id.* at 16.

partnership (although to work the patent in partnership did not necessarily require any assignment of the patent). Partnerships were often formed between an inventor and a manufacturer. Perhaps the best-known example of this type of firm was Boulton & Watt, addressed later. In contrast to assignments, licenses conferred no legal or financial interest on the patent. Rather, they constituted an agreement by the patentee to waive the right of exclusivity to the invention in return for some form of consideration, normally a royalty.⁴¹

Such transactions could encourage the development and diffusion of technology in four ways. First, not all inventors are able or willing to commercialize their inventions themselves. Instead, by selling or licensing their patent, inventors can appropriate a return on inventive activities without incurring the risk and trouble of going into business. This also extends the incentive to engage in inventive activities beyond those who have the capacity to implement an invention themselves. Second, by selling a portion of the patent as part of a partnership agreement, an inventor can secure investment capital or access to a manufacturing plant to help commercialize the invention. Without sufficient capital, it is difficult to turn an invention to profit. Third, patents, by defining and delineating property rights in an invention, facilitate their exchange with other users. Consequently, the ability to sell and license patent rights can have an important role in the physical dissemination of technology. Finally, licenses also assist the development of technology. When patented technology is improved upon, any subsequent improvements cannot be implemented without the license of the patent holder of the original invention. Where licenses are unlikely to be acquired, the incentive for other parties to improve on patented technology will be diminished for the duration of the original patent.

It is then of direct technological and economic significance that there was an active market for patent rights. It would have provided inventors during the English industrial revolution the means to make returns from their inventions, to secure capital, and to obtain access to the inventive output of others. However, it has been argued that the nascent market in patent rights was smothered by a hostile legal environment before 1830. In particular, MacLeod argues that the insecurity of patent rights often made them impossible to transfer: “the lack of support offered patentees by the courts was chiefly responsible for the defensive way in which they managed

⁴¹ Purchasing a machine that was covered by patent protection did not endue the right to use it as well; a license from the patent holder(s) was always necessary. In 1833 in *Haworth v. Hardcastle*, defense counsel sought to argue that “that the circumstances of the defendants having purchased the patented machinery, was, of itself, an answer to the case. The machinery was put up by the patentee, he failed, and his machinery was sold; any person purchasing such machinery was entitled to use the invention.” *Haworth v. Hardcastle* (1834) 2 *Hayward’s Patent Cases* 373, 383, 1 *Carpmael’s Patent Cases* 597, 604. The argument was overruled by Justice Alderson. *See id.*

their patents.⁴² Some firms apparently refused all licensing offers to avoid implicitly confirming the validity of the patent, preferring instead to retain the option of challenging the patent's validity in court. It was only with changes in judicial attitudes toward patents, and the concomitant development of case law after 1830, that the legal footing of patents became sufficiently secure to facilitate these types of exchanges—but even then, in many industries, the “habits of secrecy had become . . . ingrained.”⁴³

Thus, examining the market in patent rights can test the argument made in the preceding part. Insecure and ill-defined patent rights would be very complicated to exchange. If these types of transactions were unusual, it might imply that they were precluded by the legal difficulties involved (or that they were not valuable enough for parties to go to the trouble of exchanging them). Alternatively, if there was such a market, it would corroborate the argument made here.

1. *Contract and Property Law as the Basis of Patent Rights*

There were two legal instruments by which patent rights could be licensed—deed or contract—whereas an assignment had to be made by deed.⁴⁴ The primary difference between deeds and contracts was that for a contract to be valid, both sides were required to exchange something in “consideration” (in effect, anything of value). In contrast, deeds are a legal instrument by which rights are granted and do not require consideration from the grantee (although in practice something is normally exchanged). Regarding patents, the only other significant difference between contract and deed was the applicability of estoppel to the latter. Estoppel means that when an agreement is transacted by deed, both sides verify the pertinent facts on which the deed is founded. In so doing, neither side can subsequently deny the veracity of these facts.

The applicability of estoppel to deeds assigning patent rights was expressly decided in 1789 in *Oldham v. Langmead*, where Lord Kenyon held that the original patentee, in signing the deed by which he assigned the plaintiff the patent, was estopped from later disputing the validity of the patent.⁴⁵ *Oldham v. Langmead* was subsequently cited in 1834 in *Bowman v. Taylor*, where it was confirmed that, when a license was transacted by deed,

⁴² MacLeod, *The Paradoxes of Patenting*, *supra* note 5, at 906.

⁴³ MacLeod, *Strategies for Innovation*, *supra* note 5, at 300, 304.

⁴⁴ WILLIAM HINDMARCH, *THE LAW AND PRACTICE OF LETTERS PATENT FOR INVENTION* 234 (London, Stevens 1846).

⁴⁵ *Oldham v. Langmead* (1789) 1 Hayward's Patent Cases 351, 352. This early application of estoppel was significant not only for securing the rights of both sides to any agreement made by deed, but also because, as a doctrine, estoppel was regularly used in dealing with land law, and this importation of principles from real property supports the argument made earlier that patents were treated analogously to other forms of property.

licensees were also estopped from disputing the validity of the patent.⁴⁶ The principle of estoppel, however, only applied to transfers made by deed. In 1839 in *Chanter v. Leese*, the plaintiff sought to demonstrate that the defendant was estopped from challenging the validity of a patent that had been licensed to him.⁴⁷ Chief Justice Tindal quashed this argument: “There is no assignment of the patents by deed . . . [T]he whole matter rests in contract. The defendant is not . . . estopped from shewing . . . that one of the six patents is void.”⁴⁸

2. *Patent Validity*

It was possible, however, to make it an express term of the contract that the licensee could not impeach the validity of the patent, and these were reportedly common.⁴⁹ It was then a relatively simple matter for a patentee to protect himself from subsequent challenges to the validity of his patent from licensees. He could either grant the license by deed, or with a contract containing a no-challenge clause. But it is also difficult to account for the behavior of those firms that reportedly refrained from entering license agreements, to avoid affirming the legality of the patent. If the patentee assented to a contract that omitted the no-challenge clause, these firms could have acquired a license while retaining the option of challenging the patent later.

Possibly their concern related to the recovery of license fees paid for a patent that was subsequently found to be invalid. In *Taylor v. Hare* in 1805, the plaintiff had sought to effect precisely this kind of recovery, but his claim was rejected, Justice Heath stating that “[t]here never has been a case . . . in which a Plaintiff, having received benefit from a thing which has afterwards been recovered from him, has been allowed to maintain an action for the consideration originally paid.”⁵⁰ Significantly, the license contract was enforced independently of the validity of the patent. Later, in *Neilson v. Fothergill* in 1841, the defendant had withheld a year’s license fee, claiming that the patent was invalid.⁵¹ Lord Cottenham rejected these arguments: “I find that you owe a year’s rent, as to which you can have no defence, because it is not due by virtue of the patent right, but by virtue of the contract.”⁵² That in the event of the patent’s being declared void they could never recover their royalties must have acted as a discouragement to potential licensees.

⁴⁶ *Bowman v. Taylor* (1834) 2 *Hayward’s Patent Cases* 359, 359. Later in *Neilson v. Fothergill*, Lord Cottenham declared, “the authority of *Bowman v. Taylor* is a settled principle of law, and proceeds on the same footing as that of landlord and tenant.” *Neilson v. Fothergill* (1841) 4 *Hayward’s Patent Cases* 385, 388.

⁴⁷ *Chanter v. Leese* (1839) 151 *Eng. Rep.* 296, 5 *M. & W.* 698.

⁴⁸ *Chanter v. Leese*, 151 *Eng. Rep.* at 297, 5 *M. & W.* at 700–01.

⁴⁹ See HINDMARCH, *supra* note 44, at 243.

⁵⁰ *Taylor v. Hare* (1805) 127 *Eng. Rep.* 461, 462, 1 *Bos. & Pul. (N. R.)* 260, 262 (Heath, J.).

⁵¹ *Neilson v. Fothergill* (1841) 4 *Hayward’s Patent Cases* 385, 385.

⁵² *Id.* at 386–87 (Cottenham, L.C.).

If, however, the court had held the reverse to be true, that a licensee could dispute the legality of the patent and recover his license fees, such an outcome could have set a more obstructive precedent.⁵³ Where a large royalty had been paid, the prospect of recovery would have offered a powerful incentive for a licensee to challenge the validity of the patent (where, of course, the terms of the contract allowed him to do so).

3. *Royalty Structures and Exclusivity in Patent Licensing*

There were then no significant legal restrictions imposed on the assignment or licensing of patents, yielding a huge range of license and assignment agreements that could be tailored to the nature of the technology or the business requirements of the contracting parties. When licensing, the simplest arrangement was for patentees to charge a flat annual rate. Richard Hare, for example, charged an annual royalty of £100 for the use of his 1791 patent for “preserving the essential oil of hops in brewing.”⁵⁴ For “product” inventions it was common to vary the license fee according to the output produced under license. Samuel Wright, for example, licensed production of his encaustic tile, patented in 1830, at the rate of 2 shillings per square yard. Similar calculations could be made for “process” inventions, varying the license according to the size or number of machines to which the process was applied. In the textile industry, Thomas Turner observed that “a quarterly rent is common where the patent is for a process or machinery as for each loom or each spindle.”⁵⁵ Similarly, for his screw propeller, Bennet Woodcroft charged a royalty of 5 shillings per horsepower of the engine which turned the propeller.⁵⁶

Patent holders also enjoyed great latitude in negotiating other facets of a license or assignment. For example, it was possible to grant “exclusive” licenses, where the licensee enjoyed the sole right to exercise the patented invention. These exclusive licenses had two important uses. First, there was a proviso entered in every patent that if more than five persons obtained a share, it would be automatically voided. Exclusive licenses, however, when contracted for with a friendly patentee, allowed companies with six or more owners to enjoy exclusive rights to inventions (and to sub-license others).⁵⁷ As a consequence, this potentially restrictive proviso had no practical effect. Second, it was possible to grant exclusive licenses that were limited to a

⁵³ This scenario does not apply to transfers made by deed, as the licensee would have been estopped from pursuing this course of action.

⁵⁴ *Taylor v. Hare* (1805) 1 *Hayward's Patent Cases* 529, 531.

⁵⁵ THOMAS TURNER, *THE LAW OF PATENTS AND REGISTRATION OF INVENTION AND DESIGN IN MANUFACTURE* 68 (London, J. Crockford 1851).

⁵⁶ *Woodcroft v. Reyner* (1844) 4 *Hayward's Patent Cases* 1015, 1016.

⁵⁷ This proviso could also be circumvented by allowing partners to hold shares as trustees for others. 1829 Committee Report, *supra* note 33, at 12.

particular location. This practice was common for patents for consumer products, providing each license holder a monopoly within his own locality.

4. *Partnerships and Patents*

Partnerships involved a much closer professional relationship than between patent holder and licensee. Most important, each partner was personally liable for the entirety of the debts incurred by the partnership, a substantial commitment. Indeed, because it was not always clear where the interests (and debts) of an individual ended and those of the partnership began, this commitment could be larger than implied by the immediate activities of the enterprise. Neither was it easy to extricate oneself from a partnership; ownership was transferable only with the unanimous consent of all the other partners. Manufacturing, however, was perceived to be an activity that required the financial commitment of its managers, and so partnerships were a common business form in the working of patents.⁵⁸ Usually, these partnerships involved the patentee, who provided access to the patent (and technical expertise in the invention), with one or more manufacturers who provided capital and a manufacturing base with which to implement the invention.

There is not, however, a significant amount of case law regarding partnerships and patents, probably because partnerships were usually formed by contract whereas patents had to be assigned by deed. Consequently, there could be no “implicit” assignment of shares in the patent made by the partnership contract. In the absence of any explicit assignment, the patent remained the sole property of the original patentee, insulating it from subsequent legal action involving the partnership. For example, in *Birch v. Wood* in 1843, the defendants tried to avoid paying damages for infringing a patent.⁵⁹ The defense demonstrated that Birch (the patentee) had been in partnership when he obtained the patent in 1837 and that the expense of obtaining the patent was borne by partnership funds. In 1839 Birch had left the partnership and assigned to his partners his share of the business. After this assignment, the partnership continued to receive royalties from licensing the patent to other users. On this basis the defendants argued the patent had been assigned to the partnership. The partnership had subsequently gone bankrupt and been dissolved. Consequently, the defendants argued, they were no longer liable for damages. Justice Cresswell, however, noted that the patent had never been explicitly assigned by Birch to any of his partners and that therefore the defendants were still accountable for the infringement payments, but to Birch.⁶⁰

⁵⁸ PHILLIP COTTRELL, *INDUSTRIAL FINANCE, 1830–1914: THE FINANCE AND ORGANISATION OF ENGLISH MANUFACTURING INDUSTRY* 34 (Methuen 1980).

⁵⁹ *Birch v. Wood* (1843) 4 *Hayward's Patent Cases* 651, 652–54.

⁶⁰ *Id.*

B. The Development of the Law Concerning the Licensing and Assignment of Patents

The law concerning the licensing and assignment of patents was permissive, providing patentees and other parties the freedom to tailor their licenses in accordance with their business requirements and the nature of the technology. The law also provided reasonable protection for patentees in these agreements. In transactions made by deed, other parties were estopped from challenging the validity of the patent, and no-challenge clauses entered into contracts were enforceable in court. Similarly, without a specific instrument of assignment, none could be implied by a partnership contract.

Consequently, qualitative evidence from the nineteenth century indicates that assignments and licenses were commonplace. In particular, the engineer John Farey observed that “in general patentees are very eager to grant licenses to anyone who applies for them at any sort of fair price.”⁶¹ There was a sound reason for this practice. Farey continued that, if a patentee did refuse a license and the suitor subsequently used the invention anyway, “the patentee would I believe get only nominal damages.”⁶² Accordingly, it was rare for patentees to refuse licenses. One lawyer wrote that “it is almost universal for patentees to grant licenses to persons desirous of using the invention” and “the terms of course may be indefinitely varied.”⁶³ Quantitative evidence corroborates this picture. Between 1770 and 1845, around one in three patents was assigned in full at some point over its fourteen-year term (with little variation over the whole period) and another one in four was either assigned in part or licensed as well.⁶⁴

C. The Rewards of Invention

It is more difficult to show that these transactions were commensurate with the “value” or “quality” of the inventions involved, not least because such judgments are inherently subjective. Many inventors, though, failed to reap any reward for their efforts and ended their days in poverty: John Kay, James Hargreaves, and Richard Trevithick to name but three. Moreover, Kay, Hargreaves, and Trevithick all chose to patent their most important inventions (the flying shuttle, the spinning jenny, and the first high-pressure steam locomotive, respectively), but to no avail. Understandably, cases such as these have led many to query whether patents ever helped inventors appropriate returns from inventive activity: in the words of Gregory Clark, “patents mostly provided poor protection, the major gains to innovators coming through appeals post hoc to public beneficence through Parliament

⁶¹ 1829 Committee Report, *supra* note 33, at 143.

⁶² *Id.*

⁶³ ROBERT RANKIN, AN ANALYSIS OF THE LAW OF PATENTS 98 (London, J. & W.T. Clarke 1824).

⁶⁴ For full details of this exercise, see BOTTOMLEY, *supra* note 20, at 220–27.

. . . . [T]he Industrial Revolution economy was spectacularly bad at rewarding innovation.”⁶⁵

This account, however, overlooks two important points. First, possessing a patent for an invention, even one that posterity might recognize as “revolutionary” or “ground-breaking,” does not necessarily mean that profits will automatically ensue. Inventors required at least some degree of business acumen (or a business partner with business acumen) if they wanted to introduce and commercialize new technology in what was still, relative to today, a technologically conservative society. Second, and more important still, it overlooks what was unique about England in the eighteenth and early nineteenth centuries. It is not that inventors sometimes failed to profit from patenting their inventions but that others were able to do so at all: this was the first time and place where inventors were frequently able to appropriate large returns from new technology via patenting.

An early example is provided by Thomas Newcomen, who introduced his atmospheric engine (the first commercially viable steam engine), with the co-founders of the “Proprietors of the Invention for Raising Water by Fire,” under the auspices of a pre-existing patent. Newcomen earned about £10,000 from dividends, share sales, and consultancy fees.⁶⁶ Even more profitable was the silk-winding machinery patented by Thomas Lombe in 1718. When the patent expired in 1732, Thomas had reputedly made £80,000, and this is probably true: after his death in 1739, his estate was valued at £118,000, an enormous sum.⁶⁷ Moving on to the period of the industrial revolution proper, there were a multitude of inventors who made their fortunes with patented technology, often working in partnership. Perhaps the most famous example was the partnership between James Watt (a steam engineer who left behind an estate worth approximately £80,000⁶⁸) and Matthew Boulton, although one could also mention Strutt, Need & Arkwright (cotton spinners) or Neilson, MacIntosh & Wilson (iron founders). These men often came from humble backgrounds. Richard Arkwright began working life as a barber’s apprentice, Thomas Lombe’s father had been a Norwich worsted weaver. It is difficult to envisage how Lombe *et al.* could have accumulated

⁶⁵ Gregory Clark, *The Great Escape: The Industrial Revolution in Theory and History* 21–22 (Sept. 2003) (unpublished manuscript), <http://faculty.econ.ucdavis.edu/faculty/gclark/papers/IR2003.pdf>. Recent quantitative work indicates that, to the contrary, inventors were actually very remunerated during the Industrial Revolution. Inventors, for example, left behind significantly more wealth at death than the general adult male population and than their (non-inventive) adult brothers. See Sean Bottomley, *The Returns to Invention During the Industrial Revolution* (Paper Presentation at the World Economic History Congress, Aug. 5, 2015) (on file with author).

⁶⁶ BOTTOMLEY, *supra* note 20, at 247.

⁶⁷ Will of Sir Thomas Lombe, Alderman of City of London, PROB 11/694/54, NAL (on file with author).

⁶⁸ James Watt left behind two wills, one for his English goods (valued at between £60,000 and £70,000) and another for his Scottish goods (valued at £11,774). Will of Doctor James Watt, Doctor of Laws of Handsworth, PROB 11/1621/182, NAL. Watt, James, SC70/1/21, National Archives of Scotland (on file with author).

such wealth over the course of their lifetimes without proprietary rights in the technology they developed, re-establishing the point that it was possible for inventors, with luck, to make their fortunes with patented technology.

D. Technological Advancement

The active market in patent rights also reduced the likelihood that patents would frustrate the sequential development of technology.⁶⁹ Indeed, the “pyramidal principle” of patents—where, if an inventor developed an improvement to a product or process for which a patent was in force, the improvement could be used under license—was long established.⁷⁰ In 1764, for example, John Morris patented an improvement to Jedediah Strutt’s stocking frame (used for knitting ribbed stockings and itself patented in 1759), which he was able to work under license from Strutt.

Nevertheless, Michele Boldrin and David Levine have argued that James Watt could have used his patent for the separate condenser to stymie subsequent developments in steam engineering, ultimately “delay[ing] the industrial revolution by a couple of decades.”⁷¹ Parking their naively reductionist view of the industrial revolution (a much more complex and variegated event than simply the development of the steam engine), their argument is founded on three premises, all mistaken. First, Boldrin and Levine suggest that Watt wielded a virtual monopoly over the construction of steam engines during the course of his patent term (from 1769 to 1800). However, Watt and his business partner Matthew Boulton (B&W) were responsible for less than a quarter of steam engine erections during this period (although they were by some distance the largest steam engineering firm at the time).⁷² Consequently, there was no change in the growth trend of steam engine installation during Watt’s patent term—and it did not confer that degree of market power. Second, Boldrin and Levine assert that “it is only after their patents expired that B&W really started to manufacture steam engines.”⁷³ Their accounts suggest otherwise. Ten years before the expiration of their patent, the

⁶⁹ This was a concern for contemporaries, prompting *The Economist* to come out in favor of the abolition of patents in 1851. “On all inventors it is especially a prohibition to exercise their faculties; and in proportion as they are more numerous than one, it is an impediment to the general advancement, with which it is the duty of the Legislature not to interfere.” *The Right of Property in Inventions*, 12 *ECONOMIST*, Feb. 1, 1851, at 113, 114.

⁷⁰ William Cornish, *Personality Rights and Intellectual Property*, in WILLIAM CORNISH, STUART ANDERSON, RAY COCKS, MICHAEL LOBBAN, PATRICK POLDEN & KEITH SMITH, 13 *THE OXFORD HISTORY OF THE LAWS OF ENGLAND 1820–1914: FIELDS OF DEVELOPMENT* 948 (Oxford Univ. Press 2010).

⁷¹ Michele Boldrin & David Levine, *What’s Intellectual Property Good For?*, 64 *REVUE ÉCONOMIQUE* 38 (2013).

⁷² John Kanefsky & John Robey, *Steam Engines in 18th-Century Britain: A Quantitative Assessment*, 21 *TECH. & CULTURE* 161, 169, 175 (1980).

⁷³ MICHELE BOLDRIN & DAVID LEVINE, *AGAINST INTELLECTUAL MONOPOLY 2* (Cambridge Univ. Press 2008).

partnership were manufacturing goods to the value of over £10,000 per annum and, in the last full year of their patent term, this figure stood at £28,617.⁷⁴

Finally, Boldrin and Levine argue that Watt used his patent “as a legal cudgel with which to smash competition.”⁷⁵ In particular, Watt was supposed to have used his patent to prevent those such as Jonathan Hornblower, who were beginning to use high-pressure steam to actively “push” against the piston, rather than using the pressure exerted by the atmosphere to “pull” the piston down. This advancement was significant because high-pressure compound engines became the predominant design during the nineteenth century. However, until the 1790s, Hornblower’s engines worked poorly and the partnership decided to ignore him: “As to the trumpeting if anybody is wicked enough to erect one of their Engines let them, and when we can do no better lett us try the law.”⁷⁶ Matters degenerated so much that Hornblower’s “engine man” at the Radstock colliery was feeding information to Watt in the hope of gaining employment with him instead. When eventually Hornblower’s engine did become a viable alternative, B&W refrained from enjoining the use of Hornblower’s engine for the simple reason that B&W was able to obtain royalties from those who were using Hornblower’s engine—precisely in accordance with the pyramidal principle outlined above. Those facts indicate that a much more measured assessment of Watt’s patent is in order: although these royalties increased the price of a Hornblower engine, discouraging its adoption by potential users, his patent did not constitute an impassable obstruction to using high-pressure steam.

III. CONCLUSION

Although prizes and awards offer incentives to innovate, Nobel laureate Douglass North concluded that those mechanisms fail to provide a secure legal basis for ownership of intellectual property, reasoning that only developing statute and common law applicable to patenting provides proper protection. In contrast, the empirical research of Dutton and MacLeod seemed to indicate that, until a change in judicial attitudes circa 1830, most patents were “not worth the parchment [they were] written on.”⁷⁷ Commentators have also suggested that the supposedly minimal worth of patents in Britain before the mid-nineteenth century forestalled attempts by inventors to license or

⁷⁴ Accounts and Balance sheets 1783 to 1797, *The Industrial Revolution: A Documentary History*, Reel 75, Item 1 (British Library) (on file with author).

⁷⁵ Boldrin & Levine, *supra* note 73, at 2.

⁷⁶ Letter from James Watt to Matthew Boulton (Sept. 23, 1786), *The Industrial Revolution: A Documentary History*, Reel 4, Item 71 (British Library) (on file with author), *quoted in* BOTTOMLEY, *supra* note 20, at 260.

⁷⁷ MACLEOD, *INVENTING THE INDUSTRIAL REVOLUTION*, *supra* note 5, at 69.

assign their patents. Those commentators conclude that, before 1830, secret working was a widely practiced alternative to patenting, even in technological sectors where such secrecy was costly to maintain—the implication being that patents did little to provide an incentive to develop technology during the industrial revolution.

A reevaluation of the empirical and qualitative data and the case law reveals that, contrary to those commentators' conclusion, patents in Britain during the industrial revolution were not conflated with "monopolies." In fact, there is little evidence of routine judicial hostility toward patenting before 1830. Instead, the patent was conceived as a contract between the inventor and the public. In return for his patent, the inventor was supposed to provide the public with a written statement of the patented invention, in the form of the specification. Specifications were diligently prepared; if they were inadequate, the patent was annulled. Consequently, during a period when accurate and technical information was often unavailable, specifications constituted a uniquely reliable source of cutting-edge technology, and their value is evident from their extensive circulation, both in Britain and abroad.

The permissive laws concerning the licensing and assignment of patents gave patentees the freedom to draft licenses consistent with their business requirements and the nature of the invention's technology. Qualitative evidence from the nineteenth century indicates that assignments and licenses were commonplace. Moreover, enforcement of patent rights in Britain in the nineteenth century enabled inventors to profit from inventive activities—some spectacularly so. Others, possessing a patent but little business acumen, failed to monetize their inventions almost as spectacularly as those who succeeded. Thus, the active market in patent rights, whose sophisticated rationale had jurisprudential antecedents from the beginning of the eighteenth century, reduced the likelihood that patents would frustrate the sequential development of technology and enabled inventors to earn substantial profits from licensing and assigning those patent rights.