The Effect of the American Patent System on Invention: A Historiographic Review

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Often acrimonious debates over the United States patent system have raged since soon after it was established in 1790. Despite several revampings, its critics have continued to make their voices heard, while supporters defend its role in the American research and economic community. The chief question has been whether the system is a force for good or ill: does it promote progress by encouraging and rewarding innovation, or does it hinder advancement by granting monopolies where none are warranted?

The United States Constitution states, "The Congress shall have Power To... promote the Progress of Science and useful Arts, by securing for limited Times to Authors and Inventors the exclusive Right to their respective Writings and Discoveries."[1] Patents are a form of bribery: the inventor is given a monopoly over his invention in return for fully disclosing it so that all of society may profit from it. This conception of patents is very different from the European one, where patent rights are often viewed as natural rights; in America, social utility is the final motivation. The Congress is free to revoke the patent and copyright acts, if it feels they are not effectively promoting the progress of science and technology (the "useful Arts"). There are numerous other points of departure of the American patent system from the British one, on which it is based; these have presented analysts—from industrialists and economists to political scientists and historians—with a unique set of problems and issues with which to grapple.[2]

This paper will survey and analyze historians' attitudes toward the patent system. While its main focus will be on the effect of the patent system on invention—was it encouraged, discouraged, or unaffected by patent policies?—it is impossible to divorce issues of development from those of research.[3] The use and abuse of patents, economic and other motivations for research by individuals and corporate entities, the history of the patent system, and a few other topics intimately related to the interface between intellectual property law and invention will also necessarily be touched upon; this study would be not just incomplete but misleading without these references. While many texts remark on how patents were used, few investigate the effects of such use or speculate on what might have been, had the laws been different. For this reason most authors' opinions of the effect of the patent system on invention, in the past and present, must be determined through their tone and choice of facts. The paper will begin with a brief history of the patent system, focusing on public attitudes toward it; next historians' viewpoints will be explicated and explanations sought for these attitudes and for the changes in them; and finally the historians' analyses will be critiqued and the author's synthesis stated.[4]

[1]The Constitution of the United States of America, 1787, Article I, Section 8.

[2]The American system permits patenting of much that would be unpatentable in Europe because of its triviality or obviousness; it also does not mandate the working or license of patents. David A. Hounshell and John Kenly Smith, Jr, *Science and Corporate Strategy: Du Pont R&D, 1902–1980*, Studies in economic history and policy: The United States in the twentieth century (Cambridge: Cambridge University Press, 1988), p. 201.

[3]Historians bemoan their inability to do so despite their best efforts. John Jewkes, David Sawers, and Richard Stillerman, *The Sources of Invention*, second edition (London: Macmilian, 1969), p. 152.

[4]It is inevitable that this viewpoint, which is elucidated on page 15, has tinted the interpretation of these writings, which were formative in its creation; nevertheless, objectivity will be striven for.

A Chronology of the U.S. Patent System

On April 10, 1790, three years after the ratification of the Constitution, which gave Congress the discretion to establish a national patent system, it was legislated into existence, primarily because of the pressure of steamboat claims arising from the Fitch-Ramsey competition.[5] Each patent application was examined by the Secretary of State, the Attorney General, and the Secretary of War.[6] Led by Thomas Jefferson, these examiners set high standards of novelty.[7]

Despite their diligence, the three cabinet members were soon relieved of their duties due to their burdensome nature (or because of their stringency in granting patents—only three were given the first year[8]). In 1793 a new system of registration was initiated. For the next 43 years applicants had only to file the proper paperwork and remit their fees in order to be granted a patent. In the case of patent suits or priority claims, the courts were left to sort out the often considerable mess.[9] This registration system encouraged derivative inventions and minor modifications,[10] but the Patent Office's recommendations to withhold letters patent were rarely upheld and a spirit of laxity prevailed.[11] There was a widespread belief—enunciated by thinkers such as Jeremy Bentham and John Stuart Mill as well as by others in all walks of life—that inventions would cease if the patent system was abandoned.[12] Indeed, while the patent office languished, inventors were as active as ever. But by 1836 public opinion had shifted,[13] and a stronger patent office seemed an obvious necessity rather than part of a dangerous scheme of unconstitutional centralization.[14]

In that year the patent office began to examine applications and test demonstration

[5]David P. Billington and Alfonso M. Albano, *Episodes in American Invention: the Steamboat and the Telegraph*, Monograph Series of the New Liberal Arts Program (MIT Press and McGraw Hill, 1990), p. 9.

[6]H. N. Scheiber, "The Impact of Technology on American Legal Development, 1790–1985", in J. Colton and S. Bruchey, editors, *Technology, the Economy, and Society*, pages 83–125 (New York: Columbia University Press, 1987), p. 85.

[7]This would not be the first time that examiners were accused of prejudice because of their superior learning (see below), but another explanation may be found in Jefferson's agrarian inclination: since he considered working with machinery dangerous to the human soul (M. Roe Smith, "Technology, Industrialization, and the Idea of Progress in America," in K. Byrne, editor, *Responsible Science: The Impact of Technology on Society*, pages 1–30 (San Francisco: Harper & Row, 1986), p. 3) he may have been less than eager to encourage American industry.

[8]Henry M. Paynter, "The First U.S. Patent", *American Heritage of Invention & Technology*, 5(3):18–22, Fall 1990.

[9]Robert C. Post, *Physics, Patents, and Politics: a Biography of Charles Grafton Page* (New York: Science History Publications, 1976), p. 48.

[10]Scheiber, "Impact of Technology on Legal Development", p. 85. Many businessmen found the system a hindrance rather than a help. A. Hunter Dupree, *Science in the Federal Government: a History of Policies and Activities to 1940* (Cambridge, Mass.: The Belknap Press of Harvard University Press, 1957), p. 13.

[11]Post, *Physics, Patents, and Politics*, p. 48.

[12]Arnold Plant, "Economic Theory Concerning Patents", *Economica*, 1 (new series), February 1934, pp. 39–40; Steven Lubar, "'New, useful, and nonobvious'", *American Heritage of Invention & Technology*, 6(1):9–16, Spring/Summer 1990, p. 11.

[13]The acceptance of central authority in the patent system and other parts of the national government is probably tied as much to events like steamboat explosions as to a widespread recognition of a need for a new patent system. J. G. Burke, "Bursting Boilers and the Federal Power", *Technology and Culture*, 7:1–23, 1966.

[14]Dupree, *Science in the Federal Government*, pp. 43, 46.

apparatus; Henry Ellsworth, the first of the modern-day Patent Commissioners (the patent system has not been significantly changed since the act of 1836, though the Patent Office's policies have varied), also wanted to channel government sponsorship of private research through his office, but this never came to pass.[15] These changes did not immediately produce any highly visible effect (the legal system still encouraged patent litigation and most patents were still granted[16]) except to incite agitation both for more change and for less. As the patent office, which hired some of the country's leading scientific for the highly sought after positions of examiner, strengthened its criteria in the 1840s, and as the courts became skeptical of patent claims, sentiment against the system grew. The scientific examiners were considered to lack sympathy for the subtleties of technological innovation and to dismiss the validity of far too many patent applications. While lawyers and patent agents were by far the strongest advocates of of a liberal patent policy, manufacturers, engineers, and even politicians also agitated for reform or abolition.[17]

While the abolitionists agitating for a return to a simple registry received little support, by 1850 the reform and liberalization campaign was in full swing. *Scientific American*, which had spoken lauditorily of the Patent Office as late as 1848, became the standard-bearer, criticizing examiners for viewing applicants as "rogues or fools" and declaring that inventions which were not patented were lost to the world.[18] In addition to working for policy changes, the reformers attempted the removal of patent clerks viewed as especially illiberal; a decade and a half earlier the examiners were revered as the cream of the scientific crop, but now the job was portrayed as one anyone could do, and less cerebral people better than critical, highly skilled intellectuals. In the late 1850s, the pressure was rewarded with mass resignations from the Patent Office, which was transformed and liberalized with the politicization of the office of Commissioner of Patents. Examiners were relegated to a *de facto* advisory role; they helped applicants to word their claims and disclosures for maximum effect and were much more closely supervised, and had much less discretionary authority, than before. The low pay, low morale, and heavy workload also led to liberality, since it was easier to pass an application than to explain why it was being rejected. The percentage of applications granted more than doubled in a period of five years.[19]

While there were some dissenters who remarked on the cheapness of invention (especially with respect to the cost of development) and the disproportionate patent reward, most people were pleased with these improvements to the patent process.[20] In 1860 Abraham Lincoln

[15]Post, *Physics, Patents, and Politics*, p. 40.

[16]Scheiber, "Impact of Technology on Legal Development", p. 86.

[17]Post, *Physics, Patents, and Politics*, pp. 11, 57, 58, 65, 106, 127; Plant, "Economic Theory Concerning Patents", pp. 40, 47; Lubar, "'New, Useful, and Nonobvious'", p. 10. Prominent engineers such as I. K. Brunel and Sir William Armstrong felt the patent system interfered with their work and over-rewarded inventors for what were merely improvements or adaptations of existing knowledge. Politicians, on the other hand, hoped that the Patent Office could become self-supporting if it granted enough applications. Post, *Physics, Patents, and Politics*, p. 152; Jewkes, Sawers, and Stillerman, *Sources of Invention*, p. 39. In England, journalists, academics, and a Royal commission joined politicians and industrialists in agitating for abolition. Plant, "Economic Theory Concerning Patents", p. 47.

[18]Post, *Physics, Patents, and Politics*, pp. 110, 120, 136. Holland did repeal its patent law in 1869. Plant, "Economic Theory Concerning Patents", p. 47.

[19]Post, *Physics, Patents, and Politics*, pp. 51, 53, 133, 137, 151.

[20]Jewkes, Sawers, and Stillerman, *Sources of Invention*, p. 154. The authors note on page 117 that research probably accounts for 4.1% of the total R&D expenditure and conclude that the patent monopoly is essential

remarked in a speech, "The Patent Office added the fuel of interest to the fire of genius."[21] The crest of public approbation for the patent system came in 1968 when Charles Page was granted, by special Congressional act and on the weight of public outcry against a Frenchman who had received a French prize for a similar mechanism, a patent (which covered much more than his original research) for his decades-old discovery of the Ruhmkorff coil. The egregious misuse of this extraordinarily powerful patent did much to sour the public on the virtues of patenting.[22]

The next decades were, for the most part, quiet, business-as-usual ones in the patent system. In 1885 only 12% of patents were assigned to companies, though this number was to change soon. While some voices of dissent were heard (in 1909 Baekeland cried that the system placed the "inventor at the mercy of a legalized system of piracy," and some observers considered the patent system a handicap to business, more because of jurisdictional hassles in court cases and inefficient or red-tape-laden administration on the national level than because of ideological difficulties), most of its clients approved of the system's operation. Patents were not particularly hard to come by, and corporations successfully pursued minor reforms for their convenience. There was a disregard or approval of patent monopolies, which became more prevalent with the establishment of research labs and aggressive patent policies by corporations. The one critically important (legal) innovation of this era was the development of the defensive patent tactics that would come to dominate the patent arena.[23]

The patent came to be viewed by corporations as simply another weapon in the commercial battle, and it was used for the commercially expedient retardation, as well as promotion, of invention. Patent portfolios became very important to strategy, and companies amassed huge ones. Their patent positions were aided by the establishment of research and development organizations and industrial labs, whose secondary (and sometimes primary) motivation for research was to produce patents for the company and which often carried on uninteresting or unfruitful research which was likely to yield secondary patents or patents on alternate approaches to a problem.[24] Concerns over patents often led to the delay of research results in applied fields.[25] Companies also aggressively pursued and acquired outside patents. These patent portfolios were then used as bargaining chips in negotiations with their competitors; often the patents were pooled. It became difficult for competitors, even those with new and innovative products, to gain a foothold in the market, so their motivation to innovate was lowered; another contributing factor was the licenses on basic technology which

for the introduction of the technology but not necessarily for its discovery.

[21]David F. Noble, *America by Design: Science, Technology, and the Rise of Corporate Capitalism* (New York: Alfred A. Knopf, 1977), p. 84; Lincoln was himself a patentee.

[22]Post, *Physics, Patents, and Politics*, pp. 176–181. There was rejoicing in the profession when this patent finally ran out. While the patent's owners never won a major infringement suit, it was nevertheless highly effective when used for extortion against, and later as a bludgeon by, Western Union. It is possible that Page knew what he was doing and colluded with his heirs to enrich them through this stratagem; on his deathbed (shortly after the patent grant) he remarked, "I have neglected and abused many privileges."

[23]Noble, *America by Design*, pp. 85–90, 102–105.

[24]George Wise, *Willis R. Whitney, General Electric, and the Origins of U.S. Industrial Research* (New York, Columbia University Press, 1985), p. 273; Noble, *America by Design*, p. 92; Hounshell and Smith, *Science and Corporate Strategy*, pp. 177, 200, 221; Leonard S. Reich, *The Making of American Industrial Research: Science and Business at GE and Bell, 1876–1926* (Cambridge: Cambridge University Press, 1985), pp. 4, 191, 193, 231, 235, 237, 238, 245.

[25]Wise, *Willis R. Whitney*, pp. 106, 112, 119.

required them to turn over results of their research to the patent licensor.[26] Monopolists often had little motivation to improve their services or provide a superior product, especially when retooling and other capital costs were high.[27]

Corporations' other costs were also high: in the early stages of the development of nylon for commercial production, for example, 230 experts were involved in the project. Advanced technological research was so expensive that few companies were willing to engage in it without the expectation of a large payback on their successful innovations. Blocking patents encouraged competitors to work around them to new results that might not otherwise have been obtained. While strict patent laws prevented the theft of intellectual property, liberal licensing policies provided companies with the opportunity to use new inventions without infringement. Competitive techniques not involving patents (for instance, price-cutting and lead times) were used, especially when patent protection proved weak, and new products did appear and new companies enter the marketplace, if slower than they might have otherwise.[28]

An anticorporate patent environment developed starting in the 1930s. In 1937 the idea, previously a minority position, that the Depression had been caused at least in part by corporate monopolies, began to gain ground. In lieu of patent law reform, beginning in the 1940s the federal government began aggressive antitrust action. This was in some respects a success—it caused companies to think twice about entering combinations, trusts, and mergers—but it had little effect on many patent monopolies, which remained a legally sanctioned form of monopoly maintained by large companies which had dug in to solid patent positions in the previous decades. One of the attempts to tighten controls on patent monopolies, the judge-made "flash of genius" test, was legislated away in 1952.[29]

While capitalistic economists were opposed to monopolies, which spelled stagnation for them, the public again reversed its position, in part because of the conception that while the 19th century had been the heyday of the individual inventor, 20th century research was the province of the institution. By this time companies were being awarded between half and two thirds of all patents. The patent system, rooted in the economic and political history of the United States, unchanged in any significant aspect for decades, and still holding the general form it had been given in 1836, came to be seen more as a national institution than an economic device. Suggestions to do away with it (or to liberalize or strengthen the patent criteria) met with emotional as well as rational resistance. The heady economic climate made the public less eager to find a scapegoat; there seemed little reason to tamper with America's economic system.[30]

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[26]Reich, *Making of American Industrial Research*, pp. 4, 235; Wise, *Willis R. Whitney*, p. 221; Eric von Hippel, *The Sources of Innovation* (New York: Oxford University Press, 1988), p. 47.

[27]Noble, *America by Design*, p. 99; Reich, *Making of American Industrial Research*, pp. 137, 192, 235–238.

[28]Wise, *Willis R. Whitney*, p. 275; Hounshell and Smith, *Science and Corporate Strategy*, pp. 4, 7, 172; von Hippel, *Sources of Innovation*, pp. 48–66

[29]Jacob Schmookler, *Invention and Economic Growth* (Cambridge, Mass.: Harvard University Press, 1966), pp. 36, 52; Plant, "Economic Theory Concerning Patents"; Hounshell and Smith, *Science and Corporate Strategy*, p. 346; Noble, *America by Design*, p. 88; Reich, *Making of American Industrial Research*, p. 81.

[30]Jewkes, Sawers, and Stillerman, *Sources of Invention*, pp. 23, 37, 134, 135; Lubar, "'New, Useful, and Nonobvious'". It could be written in 1958, "Not long ago it was a common enough doctrine that...firms would try to maintain the status quo by sterilizing patents and suppressing inventions. The popular view now seems almost the opposite one." Jewkes, Sawers, and Stillerman, *Sources of Invention*, pp. 106; this appeared

The late 60s and early 70s brought a new antiestablishment attitude and a new willingness to criticize the status quo; this resulted in "darkside" histories and less sympathy for corporate patent monopolies. It is too early to appraise the most recent decade of changes, but the trend seems to be back toward stronger protection of intellectual property. While the Supreme Court has historically tended to apply strict standards of patentability, it has not hesitated to overturn Patent Commissioners' denials of patents; the creation of the Court of Appeals for the Federal Circuit in 1982 centralized patent appeals in a court which is increasingly favorable to patent claims. In the past a patentee had difficulty upholding his rights in courts which ruled 70% of all patents brought before them invalid, but the Court of Appeals has been much more protective of patent holders, reversing these odds.[31]

Historiographical Attitudes

The primary question for historians of intellectual property is whether it has successfully done its job. Has the Patent Office fostered invention, and when has it been most successful at this task? First the broad brushstrokes of the debate will be painted; an overview of the influences that may have encouraged or reinforced these viewpoints will be presented; and then the positions of particular authors will be examined in more detail.

One group of commentators notes that the patent system ensured that recognition and economic rewards were given to those who deserved them. This monetary motivation was necessary to divert talented individuals from other, conceivably more lucrative fields in which their talents would not serve society as well. Even successful inventors would fail to disclose their products and processes to the public in the absence of a reward for doing so and an assurance that they would not be ripped off by imitators who hadn't put any effort (except that required for craven copying) into their enterprises. The patent system helped to educate everyone. Economic assistance was necessary to offset the high development expenses incurred by innovators introducing new products. The very success of American inventors and technology-oriented industries is evidence that the patent system did its work

in the book's first edition. It is interesting to note that complaints about the administration of the patent system are chronic; the literature is liberally sprinkled with a litany of laments against: long application processing times; insufficient liberality; delays in publishing granted patents; lack of manpower in the patent office; under- or overqualified patent examiners; insufficient funds; poor filing system; inadequate storage and display facilities; tedious forms; lack of mandatory licensing or working of patents; and a hundred other administrative complaints. While suggestions for reform are common—everyone seems to have a pet scheme for reorganizing the office to make it just what a patent office should be—attacks against the rationale of the patent system are much less frequent. But see the following footnote.

[31]Brooke Hindle, *Technology in Early America: Needs and Opportunities for Study*, Needs and Opportunities for Study Series (Chapel Hill: University of North Carolina Press, 1966), p. 239; Patrick Kelly and Melvin Kranzberg, *Technological Innovation: a Critical Review of Current Knowledge* (San Francisco: San Francisco Press, 1978), p. 34; Lubar, "'New, Useful, and Nonobvious'", p. 16; Scheiber, "Impact of Technology on Legal Development", p. 100. This trend is not absolute, of course: voices for changes are still heard, particularly in high-tech industries where change is fastest and patents most powerful. The Australian government recently sponsored a study (T. D. Mandeville, D. M. Lamberton, and E. J. Bishop, *Economic Effects of the Australian Patent System: A Commisioned Report to the Industrial Property Advisory Committee* (Canberra: Australian Government Publishing Service, 1982)) which concluded that its patent system was causing a net drain on its economy and that the country would be better off without it, but this study has provoked little comment and no legislative action.

well, and abuses of the patent system have been rare and in any event have had little effect, they conclude.

Of those who answer in the negative, some argue that the patent system was extraneous and, despite its occasional high profile in political and commercial wrangling, it had little effect on the American rate of invention. It is impossible to plan for chance occurrences like invention, and most truly talented individuals would follow their line of interests regardless of the economic rewards. Many patents proved useless or were overturned in court battles; others were circumvented or ignored. Patents came to have a primarily economic significance as companies used them like any other asset; this use of patents was not even particularly important to most companies. Creative individuals were untouched by this, and many inventions continued to come from outsiders.

The majority of the patent system's critics, however, see it not as a benign agency but as a negative force that threatened to stifle that which it was designed to protect, though they disagree about which aspects of the system were the harmful ones; most cite one or more of the following features. Patents were a drain on the economy and especially on the creators: most inventors never made any money off their patented inventions, even when they pursued successful lawsuits. The patent system was used as a political football, and the examiners' approval rates had more to do with the appointee who was the Commissioner than with technical criteria. The patent system rewarded only one individual, the last link in a chain of investigators who was not solely responsible for the final invention and who probably had collaborated in his research; and it rewarded him with a long period of exclusivity (eventually set at 17 years, but originally as many as 24; the Patent Office had the power to extend the 14-year patents by an additional ten-year term if it felt that the inventor had not been sufficiently compensated during the first period of protection; in practice this rule was arbitrarily applied[32]). Improvements languished in the shadow of basic patents. The lack of mandatory working of patents permitted owners to withhold their inventions from the public even after they had been disclosed, and they encouraged companies to spend resources on ventures doomed to failure but hoped to yield subsidiary patents with which to lock out competitors. Patent monopolies permitted companies to take no interest in innovation or quality in their assurance that no competitor could challenge them.

Other attitudes exist, of course; some historians critique different periods differently, and others argue that the patent system has a positive effect on some groups and a negative one on others. Even many of those who favor the patent system (that is, who argue that it has and does promote innovation) agree that it is in deep-seated need of revision, though without any consensus about what sort of revisions are called for. Probably a majority accept it as flawed but workable and superior to other schemes.

A number of historiographical and social factors may have influenced writers' perceptions of the patent system's effect on invention.[33] The most pernicious of these is the "great man"

[32]Post, *Physics, Patents, and Politics*, p. 165.

[33]That hidden agendas may drastically affect treatment of a subject goes without saying; see Noble, *America by Design* for an example of a treatment colored by Marxism and its attendant prejudices against corporations, etc. This section skips over such influences (though they will be noted in the next, which deals with authors on an individual basis) in order to treat more subtle factors that may influence a historian attempting to be dispassionate; our attempt is to reconcile apparently conflicting views of the subject made in good-faith attempts at objectivity.

hypothesis. Those who subscribe to it tend to report favorably upon the patent system; their criticism is leveled at those who would make its standards unduly high. This attitude meshes well with the imperative to cherish our noble inventors and protect them from the villainies of those who would steal the fruits of their intellectual labors (viz., corporations). Proponents of the great man hypothesis postulate that there is no inexorable or inevitable progress;[34] it depends on the efforts of heroic individuals, who should be protected and rewarded. Biographers may also exhibit some resistance to the mention of baser (for instance, monetary) motives when interpreting their studies' actions, for such could reduce the protagonist to the quotidian sphere of other men. It comes as no surprise that most historians have positive attitudes toward their fields—they study, after all, what interests them—but historians of technology are less negative toward fields related to theirs (such as government, science, business, and the technological/scientific elite) than scholars in many other areas.[35] More simplistic studies tend to be more approving of the past in their Whiggish justification of what has come to be.[36] Technological determinism and internalism can contribute to the opposite interpretation. The idea of autonomous progress implies that patents and other economic influences are not really necessary to facilitate the technological progress that is certain to come anyway. An internalist is likely to see social, economic, and other factors as superfluous not only in directing the scientific mind—which is likely to investigate only what interests it—but also in determining what inventions and discoveries are made: pressures within the field (or serendipitous happenstances) have more effect on a field's progress than external factors.

Social conditions also affect historical views. There was little serious historical attention the interplay of economics and innovation before the middle of the 20th century,[37] but 19th century accounts do reflect its infatuation with technology and lionizing of scientific and technical men.[38] At the beginning of this century, and especially during the Great Depression, monopolies were viewed with increasing suspicion and their tools (such as the patent system) were treated with increasing harshness as historians and economists speculated on the causes of the economic downturn. At the beginning of the Depression, commentators had praised the patent system because monopolies seemed more efficient than a system of competing manufacturers, all spending their money to similar ends (the upsurge of socialism doubtless had something to do with this viewpoint), but when business failed to pull the country out of its slump, its former friends turned upon it. The improved economic climate of the post-war years had a salubrious effect on the patent system's reputation, but the backlash against communism (which had theretofore been mild, if discernible) somewhat

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[34]See, for example, Jewkes, Sawers, and Stillerman, *Sources of Invention*, p. 30. An example of great-man history, full of commendation for the patent system, is Billington and Albano, *Episodes in American Invention*.

[35]Hindle, *Technology in Early America*, pp. 238-239.

[36]Henry Paynter approves of the patent system in glowing terms and states unambiguously that the first U.S. patent "saved what was then America's leading export industry," but he presents no evidence that this was so, or even that many potash manufacturers used it, under license or otherwise. Samuel Hopkins, the patentee, should have been made rich if it had received much lawful adoption. Paynter, "First U.S. Patent", pp. 18, 22.

[37]Jewkes, Sawers, and Stillerman, *Sources of Invention*, p. 19.

[38]As noted above on page 4, particular events like the granting of Charles Page's coil patent soured contemporary writers to a greater or lesser degree.

negated these gains. Patent apologists softened their tone because the granting of monopolies seemed akin to communism and therefore un-American, despite its long history in this country. Another trend taking effect was the great excitement over technology and progress, and the eagerness to continue the advance. The backlash against authority of the late 1960s and early 1970s ushered in a new style of critical ("darkside"[39]) histories which were unstinting in their reprobation of traditional practices; the "repressive" and well-established patent system was a good target. It seems unlikely that historians will ever settle upon an established interpretation of the patent system's effects.

Analysis and Criticism

This section relates selected authors to the above-mentioned groups and trends, describes their arguments in closer detail, and critiques those arguments. All in all, historians have paid relatively little attention to economic influence on inventors; this omission, indicative that they suppose it to have been of minor importance, speaks as expressively as those authors who address the topic, whether to dismiss it with the same conclusion or to call fro closer inspection. Nevertheless, we can find some authors who have considered the influence of patent protection on the promotion of invention, either directly or indirectly.

Arnold Plant finds that the patent system has "no basis of justification;" he finds non-simultaneous invention unlikely, and it is inequitable to give a monopoly to the last link in a long chain of researchers. Monopolies have a negative influence; departing from competition, which ensures that inferior products do not survive in the marketplace, is unlikely to achieve greater efficiency. In the mid-19$^{\text{th}}$ century one of the reasons that manufacturers opposed the patent system was that it encouraged workers to waste their time seeking improvements instead of laboring diligently at their jobs; Plant echoes this attitude by noting that the encouragement of invention is not without cost and voicing fears that "scarce human effort" would be diverted to invention from other jobs (typically managerial) where they could be more profitably employed.[40] The country's exigency demanded immediate attention, and inessential tasks like research could not be spared any of the capable elite. The patent system also encourages obsolescence via the continual introduction of new equipment. Plant's arguments against invention evidence a short-range attitude which is insufficiently supported, and his fear of improved machinery replacing older models is naive at best, since manufacturers will continue to use older versions until it is cheaper to buy the new ones; marketplace Darwinism seems a foregone conclusion. Plant's cavalier attitude toward the inventor reflects a frustration with the economy; he suggests that the obsolescence of old equipment and the displacement of ability from more immediate tasks may be responsible for the Depression.[41]

Jacob Schmookler discusses the economic efficacy of patents more directly, and from a different angle, than most other historians. He bases his work on patent statistics, about which he is sometimes confident and sometimes apologetic. His main argument is that patent

[39] Hindle, *Technology in Early America*, p. 239.

[40] Given the high unemployment rate in 1934, Plant must refer to a scarcity of intelligence. He remarks elsewhere than an able man can easily switch jobs, so training is not the issue.

[41] Plant, "Economic Theory Concerning Patents".

statistics are a good index of the number of inventions made in a particular field, but he also discusses the system in general. Society puts more effort into the dissemination and development of ideas than into their discovery, and more yet into production and implementation. Economic motivations strong for the inventor are not strong.[42] Abuse of the patent system has been minimal: few valuable inventions remain unpatented, and there are few attempts to patent inventions without real commercial potential (half of all patents are actually used). Big firms tend to test their inventions first and then patent only the successful experiments. In fact, the patent system, while still essential to the individual, small company, or company struggling to enter a new field, is largely ignored by large companies, which are capable of commercializing their own inventions. The advantage of lead time is much greater than that of a patent in the anticorporate patent environment; in any event, patents are inefficacious in protecting against alternative means to production. Schmookler sees the patent system as inert for the big corporation but a boon for everyone else. His far-ranging claims, however, are undercut by contradictory evidence presented by himself (he notes that many results of corporate research are not patented[43] after claiming that most inventions are patented) or by other historians, the vast majority of whom have interpreted the facts differently. Even Simon Kuznets, Schmookler's teacher and friend, remarked on the "apparent meagerness" of his results.[44] His method is mechanistic, quantified, and highly suspect: he uses numbers for everything from "gross and net rates of replication" to a society's "inventive potential" and "technological capacity." Serious statistical errors are evident on the most superficial reading, as when he overexcitedly reports the mean and median of a sample of five values.[45]

A volume edited by Patrick Kelly and Melvin Kranzberg also finds that the patent system helps individuals but hinders firms. The courts' antimonopolistic stance discouraged patenting by corporations[46] and inventing around patents was common, especially in the drug industry.[47] They make the usual suggestions for reform; however, they realize that

[42]In a long discussion of the sources of invention he never mentions profits or patents.

[43]This point is supported on page 89 of Jewkes, Sawers, and Stillerman, *Sources of Invention*, which also (page 198) remarks that by 1969 patent statistics were thought more useful than they had been before—though it still disparages overreliance on them—and criticizes Schmookler for overstating the importance of economic demand on the flow of inventions (page 210).

[44]Jacob Schmookler, *Patents, Invention, and Economic Change: Data and Selected Essays* (Cambridge, Mass.: Harvard University Press, 1972). Edited by Zvi Griliches and Leonid Hurwicz, p. viii. Others found the number of patents to be a better measure of research expenditure than of the number of inventions. Kelly and Kranzberg, *Technological Innovation*, p. 34. But most historians use these statistics under protest, only because there are no better sources available. Jewkes, Sawers, and Stillerman, *Sources of Invention*, p. 89 calls their relation to what is really happening in the field of invention very obscure. Also see Reich, *Making of American Industrial Research*pp. 192–193; no other historian treats these statistics with the respect which Schmookler accords them.

[45]Schmookler, *Invention and Economic Growth*; Schmookler, *Patents, Invention, and Economic Change*.

[46]Jewkes, Sawers, and Stillerman, *Sources of Invention*, p. 95 also notes that the underdog was preferred in such suits.

[47]Other authors come to different conclusions. The chemical product patent could cover millions of compounds in a single application and was not invalidated even if many of the chemicals did not perform as the disclosure claimed. In the chemical industry, where compounds' properties were not very well understood, it was hard to concoct one with a particular set of properties. The mechanical and electrical industries had better-developed foundations, so device design to fit a specification was relatively easier, and it was in those industries that patents were less strong. von Hippel, *Sources of Innovation*, p. 53; Noble, *America by Design*, p. 105.

such proposals have little likelihood of adoption. They also note the conflicts inherent in patent-producing government-supported research and remark that for one-time inventors, who make up a significant proportion of the population (of inventors), the patent system is all wrong in terms of both motivation and reward. Like most other writers, however, they endorse it despite its flaws.[48]

A recurrent theme, highlighted by Stefan Dupré and Sanford Lakoff, is that of the need for inquiry into the continuing viability of a system that had served the nation well for a time. A typical remark is "While the patent system has long proved useful in providing an incentive for industrial innovation, it deserves careful reexamination."[49] The patent system, though is a necessary aid to technological expansion, which is at once so expensive that governmental aid (in the form of research funds, patent grants, or both) is necessary and so essential to the nation's well-being that it would be negligent to ignore it. Numerous problems are cited by this "loyal opposition." Unlike those in England, United States patents need not be worked in order to remain in force; thus, many inventions are withheld from the public by owners with ulterior motives. The patent system encourages a wasteful duplication of R&D funds by competing firms pursuing similar lines of research.[50]

John Jewkes, David Sawers, and Richard Stillerman present one of the best overviews of the motivation of inventors. Their conclusion lectures that the interactions between science, technology, and economic growth are "more complicated than prominent voices admit;" too careful to be caught in such folly themselves, they end up waffling on the issue. The book reads like a series of often contradictory facts in search of a theme, and it never succeeds in finding its voice or unifying the various chapters into a clear-cut assessment. It states that the patent system is economically essential and has had a positive effect overall, but the evidence is far from lopsidedly weighted in this direction. The authors recite a litany of problems with the patent system, including difficulties in administration (determining priority was impractical because inventors worked closely with scientists and with one another; their work contained much commonality and liberal borrowing, not to mention chance similarities), legislation (producers, fond of blocking development, used patents restrictively to slow public adoption of technologies), and conception (competition is the best stimulus for innovation, which is slowed by the existence of monopolies). Their case in patents' defense is almost as strong: the Patent Office was a great help in educating individual inventors;[51] patents stimulate work on non-infringing parallel lines of development; and the financial inducements for invention have been and remain considerable. This last point is difficult to believe, however: they are interested in comparing the work of independent inventors with those associated with laboratories, the output of teams with that of individuals, the relative efficacy

[48]Kelly and Kranzberg, *Technological Innovation.*

[49]These authors are generally favorable toward the patent system's effect on invention and innovation. In stark contrast stands the argument that "in these days" (1958 and 1969), there is a good chance of newer inventions superseding older ones, so the patent system is actually weaker than ever and encouraging new developments more than ever. Jewkes, Sawers, and Stillerman, *Sources of Invention*, p. 106.

[50]J. Stefan Dupré and Sanford A. Lakoff, *Science and the Nation: Policy and Politics* (Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1962).

[51]For support of this position, also see Kelly and Kranzberg, *Technological Innovation*, p. vii; most commentators and contemporaries, however, found the Patent Office's dissemination of information to be virtually useless. Post, *Physics, Patents, and Politics*, p. 111; Wise, *Willis R. Whitney*, p. 119; Hounshell and Smith, *Science and Corporate Strategy*, pp. 169, 200.

of directed and undirected research, and science-based with technology-based investigation, but they make no mention of motivation in their checklist. In seventy case histories, there are no significant references to patents. They later admit that they consider economic motives secondary to the inventor: after all, only one or two percent of them make money from their inventions; Edison remarked that he'd spent more than he'd earned on his 1180 patents.[52] The authors consider knowledge and renown to be more important motivators than personal gain, though they consider the latter a right of the inventor and it dismays them to see inventors disappointed in becoming rich, whether because of business failure or patent infringement. Their suggestion—rewarding inventors from the public purse in order to relieve them of the burden of commercial enterprise—is a fairly commonly suggested one,[53] but it presents even more difficulties than the current system of permitting the market to determine the value of an invention. Two obvious ones are the lessening of motivation to make a product a commercial success and the difficulty of setting the inventor's reward. Like a number of other authors, they seem resigned to living with the present system, which, while flawed, appears superior to the alternatives; it is regrettable that they do not derive any other conclusions from their work.[54]

Robert Post, too, approves of the patent system with reservations, but he is more successful in pinpointing its weaknesses. Post does not belabor the advantages of the patent system (while he notes that individuals were loathe to disclose their inventions before they'd secured their patent rights, he doesn't speculate on whether or not they would have revealed them in the absence of such rights), but it is clear that he views the system as sound in principle. He notes two minor flaws: far too many trivial and unwarranted patents were granted, and patent searches were too difficult.[55] He found the system of the mid-19$^{\text{th}}$ century even more susceptible to a greater danger, however: that of politicization. This started in earnest in 1845, when the commissionership began to change with each election (sometimes the purges reached down even further, to employees with incorrect philosophies), but even earlier political pull had been a requirement, along with scientific excellence, for obtaining a post as a patent examiner. The examiners were far from impartial, disinterested judges; morale was low and few cared at all about due credit, truth, or equitableness, and the Patent Office was rocked by public scandal. Its acceptance rates depended heavily on the examiner and the commissioner, especially when the political appointees exercised their power over the examiners. Patent agents sometimes advised clients to hold their applications until after the next inauguration. Post's well-documented conclusions are convincing and difficult to contradict.[56]

David Noble, who approaches the patent system from a Marxist, anticorporate viewpoint, finds that while at times in the past it has been effective in encouraging inventors, it has now fallen prey to monopoly interests and acts as a net drain on the American economy. He

[52]The costs of obtaining and defending patent protection was greater than most inventors could afford and was unlikely to produce a fiscal profit in any case. Noble, *America by Design*, p. 98; von Hippel, *Sources of Innovation*, p. 47.

[53]See, for example, Kelly and Kranzberg, *Technological Innovation*, p. 42.

[54]Jewkes, Sawers, and Stillerman, *Sources of Invention.*

[55]Patent searches have been difficult from the first, and they still are today: each one costs thousands of dollars. See the footnote above for references on the inadequacy of the Patent Office's attempts at education and the dissemination of technical knowledge found in patent disclosures.

[56]Post, *Physics, Patents, and Politics.*

places heavy emphasis on the new corporate uses of patent protection which originated in the late 19th century. The ability to not work patents permits them to be used for suppressing competition; subsidiary blocking patents depend on this feature of the American patent system. Noble also notes, along with other analysts, that larger corporations seem worse at innovation than smaller ones: while they spend most of the money and get most of the patents, they spend more per patent (despite their subsidiary patenting efforts) and they are unlikely to come up with the breakthrough inventions, which arise more often from individuals or from outside the field.[57] The corporations' patent-assisted stranglehold over industry forced lone inventors to seek safety and security in the big labs, which had a negative effect on their output, not to mention personal well-being.[58]

Leonard Reich finds that while patents do have their uses, they are more often abused. Patent law encouraged monopolies and combinations, which came to dominate industry. These patents provided both a positive and a negative impetus to innovation; they could be used to hold back an industry, and often were.[59] Secondary and blocking patents prevented progress from being made or introduced to practice. There was even a negative effect on research, which became focussed on the production of bargaining chips rather than on real innovations; in some cases it was discontinued altogether because of the need to license basic technology in order to use the inventions and because agreements required a license to turn over research results to the licensor (or to a patent pool). The research that was carried out tended to be extensive, leading to many patents (especially those outside the corporation's field of interest, since those patents tended to be most useful defensively), rather than in-depth, which tended to change manufacturing methods and apparatus too quickly. While patents were among the most important fruits of the research labs, they were not being used as they'd been intended but had been turned to new, wholly commercial uses. Antitrust rulings tended to be circumvented with the aid of the legally mandated patent monopoly. Reich presents a set of examples of the abuses of the system that are convincing and would be difficult to rebut; he concludes that the patent system has not been a progressive force.[60]

George Wise concludes that the patent system has worked well overall. Wise notes that individuals were intimidated into giving up their research results (by threats or the inability to work them) and that even AT&T was frightened away from the radio business in the course of a 12-year patent battle which it eventually won. He also points out that patents run counter to the scientific tradition.[61] He concludes, however, that patents did not permit

[57]This thesis is well-supported in the literature. Wise, *Willis R. Whitney*, pp. 243, 273, Schmookler, *Invention and Economic Growth*, p. 27.

[58]Noble, *America by Design*; compare this to Kelly and Kranzberg, *Technological Innovation* and Schmookler, *Invention and Economic Growth*, who come to the opposite conclusion—that patents help the individual and hinder the firm—but make their case much less persuasively. Noble's contentions that the individual suffered are supported by other authors, but they focus more on the lack of acceptance of inventions and the lack of widespread recognition, or on strong-arm tactics employed against them, than on lack of enrichment. Wise, *Willis R. Whitney*, pp. 99–100.

[59]The principal uses of patent-oriented research were threefold: to prevent competition from entering the market; to prevent competitors from themselves gaining strong patent positions; and for trading. Only rarely did such research produce new products.

[60]Reich, *Making of American Industrial Research*.

[61]Joseph Henry remarked, "I partook of the feeling common to men of science, which disinclines them to secure to themselves the advantages of their discoveries by a patent." Since that time—when only a few scientists disagreed with him—this view has lost its supremacy. Post, *Physics, Patents, and Politics*, p. 133;

complete control and that competition took place, and inventing around occurred, despite the corporations' best efforts; patent monopolies existed only in fields where one corporation was already unusually strong and so cannot be wholly attributed to the patents' power. The patent was just one more weapon in the armories of corporate rivalry, and one which was not even particularly efficacious. This conclusion comes as a bit of a surprise after the earlier evidence and so fails to convince.[62]

David Hounshell and John Smith are even more approving: like Wise, they recite a set of apparent abuses of the patent system, but they, too, find grounds on which to excuse it and conclude that the system's effect was in fact positive. Patents prevented economic thievery and also provided a convenient method for accumulating profits, when they worked. Frequently, however, patents were not even considered, since many were too narrow and revealed too much, and other mechanisms by which to attack contenders for market share were available. Hounshell and Smith mention various typical actions of questionable morality (attempts to steal or block existing patents, failure to abide by agreements to exchange research, patenting of others' inventions) but treat them in a perfectly matter-of-fact way: in big industry, these are business as usual and require no special comment. Likewise, if patents were utilized in ways not expected by the writers of the laws, all companies were free to use them in those ways, and so patents became part of the ordinary process of capitalist enterprise. While the use of patents wasn't always pretty, it was, in the end, for good.[63]

Steven Lubar concurs in Hounshell and Smith's tacit acceptance of the adaptation of patent protection to meet new ends in changing conditions. Political, not technical, factors dominate in treatment of patent claims, he notes.[64] While Lubar disapproves of strict standards of novelty[65] and criticizes antimonopoly patent-smashing, he implicitly accepts all variations of patent policy, as if political control of the patent system is unnoteworthy and no particular patent policy is superior to another, but the economy should be expected to adapt to whichever one is in force at the time. He seems to have lost sight of the fact that the Patent Office was established with a charter more directed than to simply exist.[66]

Eric von Hippel similarly finds that patents are relatively unimportant to business.[67] Patent licensing is used not to earn money but to limit licensees' market share or to get control over their patent portfolios or research;[68] informal know-how trading works better than license agreements or selling technical knowledge, however, except when the value of the information is extremely high. Only the naive honored patents; more effective for excluding competitors were response time (the single most important factor in establishing control of a market) and trade secrets (hiding was critical for the extension of a monopoly). Patents

Wise, *Willis R. Whitney*, p. 106.

[62]Wise, *Willis R. Whitney*.

[63]Hounshell and Smith, *Science and Corporate Strategy*. Hounshell and Smith are extremely sympathetic to big business (they treat antitrust workers as misguided zealots), and it is worthwhile to note that their research was sponsored by Du Pont.

[64]Post is especially emphatic on this point. Post, *Physics, Patents, and Politics*, pp. 54, 109.

[65]He errs in calling them unprecedented in the 1850s.

[66]Lubar, "'New, Useful, and Nonobvious'".

[67]Even if von Hippel's work does not draw on that of Schmookler, the two emphasize many of the same themes.

[68]For support, see Reich, *Making of American Industrial Research*, p. 235; Noble, *America by Design*, p. 98.

are not very valuable to the holder because they are expensive to obtain, their use requires the license of other patents, lawsuits are risky and expensive, and inventing around is easy (except in plastics and chemicals). Few executives called patents "very important" and the lack of patent protection would have a negligible effect (less than 5% would be discontinued) on research outlays.[69]

Conclusion

Historians have come to no clear consensus about whether the American patent system, with its award of a limited monopoly, has had a positive or negative impact on the rate of invention. While mentions of the abuses (or innovative uses) of the system are ubiquitous, most writers agree that the system as it stands is theoretically sound, then suggest how it could be improved. I find these positions persuasive—the idea of rewarding inventors for coming forward with their discoveries is a reasonable one— but its implementation is highly suboptimal. The patent system would work better if it were depoliticized, obstructive patents were disallowed, the standard of patentability rose to a higher level, and mandatory working (or license) of patents was initiated. I am not convinced that the effect on invention has been uniformly positive; not infrequently it seems to have had the opposite effect.

Arguments that patents have been insignificant to companies or that they have been ineffectual tools are weak: if patents were unimportant, companies would not have spent so much time, money, and effort on collecting them.[70] In fact, the patent grant was often more powerful than its justification called for, and patents served to block progress more often than they encouraged it. Since patents did not have to be worked, improvements could legally be kept out of the marketplace for decades; "master" patents, which covered basic processes which could not be invented around also served to prevent access to the field when they were not licensed. Innovators were at the mercy of larger companies whose extensive patent portfolios prevented entry or made it prohibitively expensive. The difficulty of entry and the large failure rate of individual inventors (even when they won the expensive, protracted legal battles that were forced on them) indicates that patents did not well serve the individual inventor, examples where the system did work notwithstanding. These overly-strong patents were caused in large degree by the excessive laxity of the patent office. Instead of a critical examining body, it has often become little more than a rubber-stamp organization, leaving final decisions to the less well qualified courts and permitting abuses of patents (for instance, for intimidation and blocking competitors) to proliferate. Its poor track record of patents upheld in court, and the use of patents to control whole industries or to protect trivial changes and gadgets, are indicative of its inadequate scrutiny. Policy decisions have often been made by political appointees whose heavy-handed administration has prevented the Patent Office from finding its own voice; after all, that voice might not be the liking of the vested minorities that see it only as a means of profit for themselves, not as an institution for fostering economic growth. The original justification of the patent office—the promotion of science and technology—should neither be forgotten nor subordinated to secondary motives

[69]von Hippel, *Sources of Innovation.*

[70]GE spent considerably less money on research than it did on purchasing patents, even though the patents weren't all that valuable. Reich, *Making of American Industrial Research*, p. 80.

like the enrichment of inventors and investors which, while they might be worthwhile goals, are not part of its charter. If these suggestions, expressed often enough before, were followed, the Patent Office could come closer to achieving its potential for encouraging innovation, rather than serving as a stumbling block or an unwitting tool of profit-seekers.

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