One of the most interesting developments in patent law during the last century is the catastrophic collapse of the paper patent doctrine, which had authorized courts to discriminate against patents that were never successfully practiced by their patentees. The doctrine’s demise opened the door for the dramatic and controversial rise in patent litigation by “nonpracticing entities” or “patent trolls”—entities that, in the words of President Obama, “don’t actually produce anything themselves.” This Article undertakes a comprehensive review of this lost doctrine and shows that the doctrine took a balanced approach, hurting patentees who never developed their technologies but helping those who had. The doctrine declined because it could not be reconciled with the theoretically impoverished views about information disclosure embraced by courts of the late twentieth century. With the advent of more sophisticated theories about the value of learning-by-doing and, more generally, about the problems associated with generating and disseminating information, the paper patent doctrine now has what it lacked in the past—a solid theory for favoring patents that were taught not just through paper disclosure but also by real-world practice. This Article concludes that the paper patent doctrine should be revived and that existing case law provides a sufficient foundation for a revival.
INTRODUCTION

Beginning in the last third of the nineteenth century and continuing through the first half of the twentieth century, patent law of this country contained a vibrant, important, and theoretically fascinating doctrine known as the "paper patent" doctrine. The core of this doctrine authorized courts to differentiate among patents based on whether the patentee had ever practiced the patented technology in the real world. Mere paper patents—those never developed and successfully practiced by their patentees—were construed narrowly and were more likely to be held invalid. But the doctrine was not simply an anti-patent doctrine. While uncommercialized patents were disfavored, there was a flip side: patents successfully commercialized by a patentee (or the patentee's licensees) were favored in determining patent scope and validity.

The paper patent doctrine suffered a calamitous fall from favor in the second half of the twentieth century. The intellectual critics of the doctrine included none other than Learned Hand, who in 1951 described "[t]he phrase, 'paper patent'"—he would not even dignify it with the title "doctrine"—as "a mere bit of rhetoric," "a make-weight," and "a meaningless platitude."1 Though the doctrine faced increasing skepticism, still it retained some vitality throughout the 1960s and '70s. Even as late as 1980, the doctrine warranted some mention as part of the canon of patent law, with the concept of a "paper patent" being defined as "a patent for an invention which either is incapable of being put into practice, or, if put into practice, proved not to be commercially feasible, or at least an invention that has not been put into use."2 Yet in the last decades of the twentieth century, the doctrine was plainly in decline, with numerous lower court decisions chipping away at its vitality.3

When Congress created the Federal Circuit in 1982 and centralized all intermediate appellate jurisdiction for patent cases, the new appellate court followed what was then the dominant approach in the lower courts: patents, whether mere paper patents or not, were treated equally.4 In the Federal Circuit, the paper patent doctrine died quietly, without any explicit rejection. Rather, it was simply never employed. In the entire history of the Federal Circuit—encompassing more than the last quarter century of intermediate appellate practice in federal patent law—the concept of a "paper patent" has been mentioned only twice: once in 1984 as part of a quotation from

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1 Frank B. Killian & Co. v. Allied Latex Corp., 188 F.2d 940, 942 (2d Cir. 1951).
3 See discussion infra Part II.B.
4 See, e.g., In re Johnson, 747 F.2d 1456, 1461 (Fed. Cir. 1984).
an earlier precedent and once in 1987 as part of a dissenting opinion. Moreover, those two references did nothing other than to confirm the doctrine's death. The 1984 case emphasized that paper patents could be treated equally with other pieces of prior art "actually used in the real world." In 1987, the dissenting opinion in UMC Electronics Co. chastised the majority opinion for increasing the incentives to seek paper patents, which the dissenter criticized as “contain[ing] untested, speculative details” and as “merely add[ing] to the clutter of unproved patents in the PTO [United States Patent and Trademark Office] and in the courts.” That opinion recognized the possibility of differing treatment for paper patents, but of course it was merely a dissenting opinion. Since 1987, the paper patent doctrine has vanished from even discussion in appellate patent decisions.

There is a reason for the demise of the paper patent doctrine, and it goes to the foundational theory of the patent system. In the last half century, United States courts have increasingly come to embrace a “documentary disclosure” theory, under which the quid pro quo for patent rights is the disclosure required by statute to be provided in the patent document. A good expression of this theory can be found in the Supreme Court’s 2001 decision in J.E.M. Ag Supply, Inc. v. Pioneer Hi-Bred International, Inc., which stated unequivocally that “[t]he disclosure required by the Patent Act is ‘the quid pro quo of the right to exclude.’” Since the disclosure required by statute is only a paper disclosure, an exclusive focus on the statutorily required disclosure is equivalent to a documentary disclosure theory. Yet such a theory is not required by statute, nor has it always been the theory embraced by the Supreme Court.

Earlier Supreme Court precedent emphasized that “[t]he basic quid pro quo contemplated by the Constitution and the Congress for granting a patent monopoly is the benefit derived by the public from an invention with substantial utility.” The difference is subtle but extraordinarily important, both theoretically and practically. If the quid pro quo of a patent is “the benefit derived by the public from an invention,” that public benefit can easily be viewed as including not merely the disclosure required by the statute to be set forth in the patent document but also the benefit flowing from the practical

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6 In re Johnson, 747 F.2d at 1461 (quoting In re Holladay, 584 F.2d 384, 386 (C.C.P.A 1978)).
7 816 F.2d at 665 (Smith, J., dissenting).
10 Id.
knowledge and experience gained from actually building and commercializing the invention. Under this view, the documentary disclosure required by statute is a minimum, but patents that disclose more than the minimum provide a greater public benefit and thus should be valued more.

To be sure, this “public benefit” theory is similar to the documentary disclosure theory in that the public benefit associated with invention and patenting flows primarily or exclusively from the production and disclosure of new information. Thus, the public benefit theory need not deny that the primary justification for the patent system lies in remedying the market failures that arise with respect to certain types of information. The difference between the two theories, however, is that the public benefit theory permits a more capacious, more sophisticated, and more realistic view about how information is produced and disseminated in industry and society in general. This core theoretical difference is starkly illustrated by the “paper patent” doctrine, which can be easily reconciled with the public benefit theory but not with the documentary disclosure theory. Indeed, under the latter theory, a doctrine discriminating against “paper patents” is utterly incoherent because all patent rights are ultimately justified on the statutorily required disclosure, which is merely a paper disclosure.

If the history of the paper patent doctrine had been written a decade or two ago, it might have ended here, with the conclusion being that the doctrine’s ultimate demise was attributable to the deep inconsistency between it and the documentary disclosure theory, which had emerged as the principal theoretical basis for the patent system. Indeed, the fall of the paper patent doctrine might well have been viewed—again, one or two decades ago—as an excellent example of the incremental process by which, in time, legal doctrine improves and becomes more consistent with theory.

In the last few years, however, a new controversy has arisen in the practice and scholarship of patent law: the controversy over patent infringement actions brought by “nonpracticing entities” (NPEs) or, as they are frequently (and derisively) called, “patent trolls.” These

NPEs or patent trolls are patentees who have never themselves commercialized their patented inventions. Rather, their business model involves patenting technology (or purchasing patents from others) and then suing other firms that use the patented technology.\textsuperscript{12} The practices of NPEs are least justifiable where the patents have never been practiced by any entity in the chain of patent ownership and are asserted against entrepreneurial firms that not only developed the technology independently but also took the risks associated with bringing the technology to market. In such situations, the demise of the paper patent doctrine is a true loss to society, for the doctrine's absence means that courts have no doctrinal tool to distinguish between patentees that did, and those that did not, do anything in practical terms to advance the relevant technological art.

The modern controversy over patent trolls has become so prominent that even the President of the United States has publicly criticized patentees who "don't actually produce anything themselves" and announced legislative and executive initiatives directed at curbing the supposed abuses of "patent trolls."\textsuperscript{13} Yet the controversy is really not new; it is merely a continuation of a fundamental controversy about the theoretical basis for patents. Specifically, the controversy concerns the scope of inventive activities that form the basic justification for patents. Are those inventive activities limited to the creation of technical information capable of being fully disclosed in a legal document such as a patent specification? Or can the inventive activities justifying a patent include a much broader range of activities—including the practical development of the invention, the disclosure and teaching of the invention to a workforce, and the marketing of the invention to consumers? The twentieth century's strong tack toward the documentary disclosure theory produced the demise of the paper

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\textsuperscript{12} See Golden, supra note 11, at 2112.

patent doctrine, but it did not end the fundamental controversy over
the meaning and purpose of the patent system.

Two things have changed about the controversy. First, of course,
the terminology has changed, with the lexical locus of controversy
shifting from "paper patent" to "NPEs" and "patent trolls." Yet while
the semantic change may disguise the connection between the old
and new controversies sufficiently so as to avoid detection by a simple
Lexis or Westlaw search, even a moment's reflection makes the con-
nection clear. The old paper patent doctrine encouraged legal dis-
crimination against patents that were never practiced or
commercialized. The modern objection to patent trolls is commonly
stated as hostility to those who have obtained patents, which are of
course merely paper, but who have never built or commercialized any
product or service. In short, "NPEs" and "patent trolls" are often
merely modern monikers for the owners of paper patents.

Second, and more importantly, the status quo has changed. In
the middle of the last century, discrimination against paper patents
was the accepted doctrine, even though it was being steadily under-
mined by the advance of the documentary disclosure theory. Today,
the documentary disclosure theory dominates. Nondiscrimination
against paper patents is the rule, and dissatisfaction with NPEs or pat-
et trolls is the upstart challenge to the status quo. If the documen-
tary disclosure theory is the foundation of the patent system, then any
hostility toward NPEs or trolls is inexplicable. The documentary dis-
losures of patents held by patent trolls must comply with the same
standards as all other patents, and if the disclosures pass those stan-
dards, then the grants of exclusive rights to nonpracticing entities are
no less theoretically justifiable than grants to practicing entities. In-
deed, to the extent that nonpracticing entities purchase patents not
currently being used by their owners, they perform the socially benefi-
cial function of creating liquidity in the market for intellectual prop-
erty rights.14

Establishing the connection between the paper patent doctrine
and the controversy over nonpracticing entities or "patent trolls" is
the descriptive part of this Article. But this Article also aspires to draw
attention to, and to take a position on, the immensely important theo-
retical stakes of this centuries-long controversy, which is manifesting
itself in the rhetoric concerning paper patents and patent trolls. Even
as the paper patent doctrine was declining, scholars outside the legal
profession were developing more sophisticated theories about infor-
mation that took into account the significant costs associated with dis-
seminating and teaching technical information, and the value of

14 This argument is justifiably advanced by many defenders of nonpracticing entities. See, e.g., McDonough, supra note 11, at 223–24.
experiential learning and learning-by-doing in both developing and transferring new information.\textsuperscript{15} This Article demonstrates that, to the extent these modern theorists are correct, the twentieth century's rejection of the paper patent doctrine was a major misstep in the development of patent law.

Part I of this Article provides the historical backdrop necessary to understand the paper patent doctrine. This Part explains why paper patents are allowed to exist at all in our modern patent system. While modern lawyers may accept without question the idea that patent rights may be granted based on nothing more than a paper disclosure, that idea was not always accepted in the patent system. The shift to allowing even some validity of paper patents was a major development of the nineteenth century and required a basic shift toward an "informational" theory of the patent theory—that is, toward a theory that justified the patent system on the basis of generating and disclosing new technological information.

Part II of the Article recounts the history of the paper patent doctrine from its rise during a period in the late nineteenth and early twentieth centuries to its downfall in the second half of the twentieth century. The paper patent doctrine was a theoretical compromise that permitted some paper patents but still valued what might be called real-world inventive activity, including actual reduction to practice, commercialization, and commercial success. The doctrine was, however, never clearly justified as a matter of theory. That theoretical weakness led to the doctrine's decline as the documentary disclosure theory began to dominate judicial thinking. One consequence of the doctrine's disappearance has been that modern courts are perfectly willing to enforce patents obtained by entities that never practiced or commercialized the patented technology. The recent hostility against patent trolls and other nonpracticing entities is a reaction to this modern development, and it presents a striking challenge to the dominant documentary disclosure theory.

Part III of this Article presents the theoretical case for reviving the paper patent doctrine and for rejecting the documentary disclosure theory. Modern theoretical and empirical investigations into the economics of information and information transfer have produced a more realistic and accurate description of how technological information is disclosed within an industrial society. The simplistic theory that information transfer occurs all at once upon publication of a document is no longer tenable. Rather, information transfer is a complex process that demands much more than documentary disclosure; it can require "learning-by-doing" and even geographic proximity. Indeed,

\textsuperscript{15} See infra Part III.
the difficulty in transferring technical information explains (i) why patent citations of other patents demonstrate an otherwise inexplicable geographic correlation; (ii) why a nation's loss of domestic manufacturing capabilities might very well reduce that nation's ability to innovate; and (iii) why public initiatives to locate research centers near centers of population and industry—initiatives exemplified by Cornell's new NYC Tech Campus—are sensible policy responses to the unique economics of information transfer.

The conclusion offers specific doctrinal details of how to revive the paper patent doctrine within modern patent law.

I
THE ORIGINS OF PAPER PATENTS: HISTORY AND THEORY

Any discussion of the paper patent doctrine must begin with a cogent explanation of why the patent system allows any paper patents. After all, inventors are supposed to come to the patent system only after they have achieved their inventions, and at least in popular culture, the act of inventing is seen as being completed by a "eureka" moment in a laboratory or workshop when the inventor's machine or process at last begins to work.

Modern patent lawyers would, however, take a different view. While they would agree that invention must precede patenting, patent lawyers of our era would view making an invention work in the physical world as an "actual reduction to practice," which, they would insist, is one of two possible ways in which an inventor can complete the process of invention. The other way to complete invention is through a "constructive reduction to practice," which means filing a patent application that discloses the conceived invention with all the statutorily required details. The invention disclosed in the patent application must be capable of actually working in the real world if it were built, but the inventor herself need not have yet built it, practiced it, or otherwise made it work in the real world.

This concept of "constructive reduction to practice" is the foundation of all paper patents, and to modern lawyers, it may seem to present an insolvable conflict with the paper patent doctrine. In the parlance of modern patent lawyers, "constructive reduction to practice" is supposed to be every bit as good, for purposes of establishing a date of invention, as an "actual reduction to practice." Given the

17 See id. at 492 (internal quotation marks omitted).
18 See id. (stating that priority of invention is awarded to "the first party to reduce an invention to practice unless the other party can show that it was the first to conceive the invention and that it exercised reasonable diligence in later reducing that invention to
unassailable status of constructive reduction to practice, hostility to paper patents seems anomalous. Why, after all, should the patent system recognize both a doctrine that allows paper patents in the first place (constructive reduction to practice) and a doctrine that disfavors such patents (the paper patent doctrine)? There are two answers to this question.

First, the tension between the paper patent doctrine and constructive reduction to practice is not so great as it first seems, for the paper patent doctrine does not deny that some paper patents might be socially desirable and worthy of enforcement. The paper patent doctrine merely authorizes courts to scrutinize such patents more carefully to ensure that they are socially desirable and that they are interpreted no more broadly than the inventor's actual contribution merited. Since the constructive reduction to practice establishes just the minimum required for filing a valid patent application, constructive reduction to practice is not inconsistent with a doctrine that allows courts to permit paper patents to the extent that they actually advance the relevant art.

Second, and more importantly, the doctrine of constructive reduction to practice is, from a historical perspective, not so unassailable as modern patent lawyers may believe. Rather, the very notion of a "constructive" reduction to practice did not arise until the second half of the nineteenth century and did not become an accepted part of the patent law practice until the early twentieth century. Since paper patents are built on this concept, it is worthwhile to examine the history of this development and the underlying theoretical shifts that explain it.

A. The Transition to Paper Patents: The Rise of “Constructive” Reduction to Practice

The concept of constructive reduction to practice is such a thoroughly modern concept that the leading treatise writer of the late nineteenth century, Yale Law School Professor William Robinson, set forth teachings that are diametrically opposed to it and, thus, opposed to permitting any paper patents. In his treatise, Robinson described the invention necessary to sustain a patent as comprising two necessary components: one “mental,” the other “manual.” The mental component is unsurprising to modern lawyers. It consisted of the “idea conceived by the inventor.” But the idea—the information alone—was insufficient. To qualify as an inventor and to be eligible for a patent, an individual had to complete a physical, “manual” act—“the reduction of the idea to practice,” a “requirement of the law [which] is satisfied by nothing less than the actual practice of some art, or the construction of some article of manufacture.”

The implication of Robinson’s statements are so radically different from current practice that the modern lawyer might be tempted to construe them as requiring merely that the inventor must teach how to apply a general idea in the physical world. Certainly, that is much closer to what would be required under current practice. But Robinson’s treatise clearly forecloses such a modern interpretation. Robinson expressly enumerated what would not constitute a sufficient physical act or reduction to practice for the purposes of completing the inventive act, including “[a] written description of the proposed invention, even when so fully illustrated by drawings that any person skilled in the art could carry out the ideas of the inventor,” “[a] model exhibiting the article in all its parts, disclosing its mode of operation and clearly showing its feasibility,” “[a]n application for a patent, in which description, drawings, and model are combined,” and even “the granting of a patent, after due examination by the proper officers.”

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22 See WILLIAM C. ROBINSON, 1 THE LAW OF PATENTS FOR USEFUL INVENTIONS § 77, at 116 (Boston, Little, Brown & Co. 1890).
23 Id. Elsewhere, Robinson defined the mental part of invention with more particularity, stating that it required “an exercise of the creative faculties, generating an idea which is clearly recognized and comprehended by the inventor, and is both complete in itself and capable of application to a practical result.” Id. § 86, at 132.
24 Id. § 77, at 116.
25 Id. § 126, at 181.
26 See Ariad Pharm., Inc. v. Eli Lilly & Co., 598 F.3d 1336, 1351–52 (Fed. Cir. 2010) ("[T]he test for sufficiency [of a written description claiming constructive reduction] is whether the disclosure of the application relied upon reasonably conveys to those skilled in the art that the inventor had possession of the claimed subject matter as of the filing date. . . . [T]he written description requirement does not demand either examples or an actual reduction to practice . . . . ").
27 ROBINSON, supra note 22, § 126, at 181–83.
Robinson was not anomalous among nineteenth century patent treatise writers. The great Willard Phillips, the first important American treatise writer on patent law, wrote in 1837 that "[t]he subject of a patent must be something that has been reduced to practice; it is not enough that it is merely practicable or possible; it must be something which has been actually done or produced."28 Similarly, writing in 1849, George Ticknor Curtis believed that a patent could "only be for theory reduced to practice," and he stressed that this meant that the subject of a patent had to be "actually put in practice" (for arts) or "actually made" (for manufactured items).29 Not one of these leading nineteenth century treatise writers—Phillips, Curtis, or Robinson—ever mentioned the concept of "constructive reduction to practice."

Moreover, the treatise writers' views were consistent with those of Justice Joseph Story, one of the most influential jurists ever in American patent law. In the 1825 case Earle v. Sawyer, Story famously rejected the position that invention was an "intellectual discovery" and instead maintained that the patent act "looks to the fact" of invention, which Story equated with "a principle put in practice, and applied to some art, machine, manufacture, or composition of matter."30 Story’s comments in Earle were widely quoted in the nineteenth century,31 and even today they remain recognized as a prominent example of a "materialist" approach to invention, in which "it is the physical device, the thing itself, that is of value to society and hence of interest to the law."32

28 WILLARD PHILLIPS, THE LAW OF PATENTS FOR INVENTIONS 110–11 (Boston, Am. Stationers' Co. 1837). Later in his treatise, Phillips also restates that "the law does not regard a mere conception, imagination, or intellectual process, as being the subject of a monopoly, independently of its reduction to use" and that "to lay a foundation for a patent, something must be wrought, done or produced." Id. at 161. Phillips relied on the requirement of reduction to practice as a prerequisite to patenting to explain why the law governing priority of invention favors the first to invent. See id. ("[I]f the patentee is the prior inventor in this sense his patent will not be defeated merely because some other person may before have imagined something of the same sort.").


30 8 F. Cas. 254, 256 (C.C.D. Mass. 1825) (No. 4247); see also White v. Allen, 29 F. Cas. 969, 972 (Clifford, Circuit Justice, C.C.D. Mass. 1863) (No. 17,535) (stating that "in order to constitute an invention, in the sense in which that word is employed in the patent act, the party alleged to have produced it must have proceeded so far as to have reduced his idea to practice, and embodied it in some distinct form").

31 See, e.g., CURTIS, supra note 29, § 6 n.1, at 5 (citing Earle to outline the elements of a patentable invention); PHILLIPS, supra note 28, at 81 (citing Earle to support the claim that the law credits the first inventor and is not concerned with the method of invention); ROBINSON, supra note 22, § 72 & n.1, at 111 (citing Earle to outline "[t]he characteristics of a patentable invention"); id. § 78 n.3, at 120 (citing Earle to note that Justice Story "disputes the doctrine of intellectual [as opposed to actual] creation").

Yet while the position endorsed by Robinson’s 1890 treatise was not anomalous by nineteenth century standards, it was already becoming dated even as the treatise was being published. Robinson himself acknowledged in a footnote the existence of contrary authority holding that “the granting of a patent, in which the invention is so clearly set forth by language and drawings, etc., that it shows itself to be practicable, is sufficient evidence of reduction to practice.” Though that authority directly contradicted the position Robinson took in the text of his treatise, the authority included only decisions of the Commissioner of Patents, not court cases, so perhaps Robinson felt justified in submerging the authority in a footnote. But the administrative practice was in fact on the ascendency.

In the 1890s, the concept of “constructive reduction to practice” began to appear in both treatises and court opinions, which uniformly cite to the Patent Office’s administrative practice as the source of the concept. Administrative necessities probably dictated the Patent Office’s acceptance of constructive reduction to practice. As a centralized bureaucracy that must quickly examine thousands of patent applications, the Patent Office had little or no ability to investigate the underlying physical reality of inventions. For a time in the early and middle part of the nineteenth century, the Patent Office required small-scale models of inventions to be constructed and to be submitted with many patent applications. But submitting models of inventions imposed obvious costs on patent applicants and were of dubious value in assisting the administrative process of patent examination. In the latter half of the nineteenth century, the Patent Office increasingly came to rely solely on written documents, and the constructive reduction to practice concept emerged as the Patent Office shifted to a preference for paper.

Yet the Patent Office’s administrative preferences do not explain why constructive reduction to practice was accepted so readily by the courts. Indeed, the early administrative precedents recognizing constructive reduction to practice were quite modest and could have been limited to the specific administrative proceedings at issue. For exam-

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33 Robinson, supra note 22, § 126 n.5, at 183.
37 See Nard, supra note 36, at 70 n.83 (noting that by 1880, “models were no longer required to be submitted with a patent application”).
ple, many early administrative precedents stated merely that the filing of the patent application would be deemed to be evidence of reduction to practice.\textsuperscript{38} Courts could have limited the constructive reduction to practice concept to a mere evidentiary presumption that could have been overcome in subsequent litigation with proof that the patent applicant had not, in fact, reduced the invention to practice. Courts did not so limit the concept but instead embraced a constructive reduction to practice as fully equivalent to an actual reduction to practice.\textsuperscript{39} Administrative necessities cannot explain why the courts were so willing to accept this development. Rather, constructive reduction to practice triumphed because the concept fit comfortably within the informational theories that were becoming the foundation for the patent system. To that theoretical development we now turn.

B. The Development of an Informational Theory of the Patent System

The rise of constructive reduction to practice and the concomitant entry of paper patents into the legal system corresponds to a fundamental shift toward what we will call an “informational theory” of the patent system—i.e., a theory in which the patent system is justified on the ability of patents to encourage the production and disclosure of information.

A little more than a century before the publication of Robinson’s treatise, constructive reduction to practice and paper patents would have been unthinkable for the simple reason that the then-existing patent system (meaning the English patent system, since the United States did not yet exist) did not require a complete documentary disclosure as a prerequisite to patenting.\textsuperscript{40} The theory of the patent system then has frequently been described as mercantilist in the sense that it was directed toward developing national industry.\textsuperscript{41} Yet al-

\textsuperscript{38} See Automatic Weighing Mach. Co. v. Pneumatic Scale Corp., 166 F. 288, 290 (1st Cir. 1909) (“Under a rule of the Patent Office, the filing of an allowable application is a constructive reduction to practice.”).

\textsuperscript{39} See supra note 35 and accompanying text.

\textsuperscript{40} See, e.g., Merges & Duffy, supra note 32, at 261 (tracing the requirement of an enabling disclosure back to the case of Liardet v. Johnson, (1778) 1 Carmpael’s Patent Cases 35 (K.B.)); Adam Mossoff, Rethinking the Development of Patents: An Intellectual History, 1550–1800, 52 Hastings L.J. 1255, 1294 (2001) (noting that the requirement of an enabling disclosure was not clear until 1795); Edward C. Walterscheid, “Within the Limits of the Constitutional Grant”: Constitutional Limitations on the Patent Power, 9 J. Intell. Prop. L. 291, 334 (2002) (discussing the English inventor James Watt—famous for his steam engine—and noting that, as late as 1769, “it is unlikely that either [Watt] or those he consulted thought that it would have to be fully enabling in the manner set forth by Mansfield nine years later in Liardet v. Johnson”).

though the patent system was deeply intertwined with mercantilist policies, it is perhaps best described as a pragmatic system or, to be less charitable, an under-theorized system. True, certain aspects of the system seemed inspired by mercantilism. For example, the English System permitted patents of importation, which granted mere importers of industrial technology exclusive rights to practice the technology within the realm of England.\textsuperscript{42} Such patents of importation have classically been explained as a means for developing national industry,\textsuperscript{43} a key goal of mercantilist systems. Other aspects of the patent system were, however, structured to spur innovation generally and thereby to increase consumer welfare.\textsuperscript{44} Thus, the patent system at that time might be best described as serving multiple purposes and lacking a single unifying theory.

During the late eighteenth century and throughout the nineteenth century, three important developments signaled patent law’s increasing shift toward an informational theory. First, the law began to place more weight on the need for, and importance of, a patent specification—the part of the document that is supposed to describe the invention, and how to make and use the invention, in sufficient detail so that all relevant knowledge concerning the invention is conveyed to the public. This trend is often dated to the 1778 English case of \textit{Liardet v. Johnson},\textsuperscript{45} though \textit{Liardet} was almost certainly the culmination of earlier legal developments.\textsuperscript{46}

\textsuperscript{42} See Michael A. Glenn & Peter J. Nagle, \textit{Article I and the First Inventor to File: Patent Reform or Doublespeak?}, 50 IDEA 441, 446 (2010) (“These ‘patents on importation’ provided economic incentive to skilled tradesmen, while giving England the benefits of the skilled labor.” (citing Merges & Duffy, supra note 32, at 4–5)).

\textsuperscript{43} See, e.g., id. (“In a time where invention as we know it today was not a driving economic force, it is clear that patents on importation were a valuable way to stimulate local economy and self-sufficiency.”).

\textsuperscript{44} See Mark D. Janis, \textit{Second Tier Patent Protection}, 40 HARV. INT’L L.J. 151, 210 (1999) (explaining the “prospect theory” of patent law, which views patents as “security for the future expenditure of development funds necessary to ‘innovate’, i.e., to transform an invention into a commercial product”).

\textsuperscript{45} Liardet v. Johnson, (1778) 1 Carpmael’s Patent Cases 35 (K.B.).

\textsuperscript{46} John N. Adams and Gwen Averley, \textit{The Patent Specification: The Role of Liardet v Johnson}, 7 J. LEG. Hist. 156, 171 (1986) (concluding that, like most “developments in the law and practice of patents . . . in the eighteenth century,” the changes attributed to \textit{Liardet} “were almost certainly gradual”).
Second, patent law began to allow, indeed eventually to require, patentees to define their inventions through patent "claims."\textsuperscript{47} Prior to the development of patent claims, patent infringement disputes were decided based on a jury's assessment whether the defendant's product or process was "substantially identical" to the patentee's.\textsuperscript{48} That approach to patent infringement tended to emphasize the physical embodiment of the patentee's ideas, and the jury was often invited to compare the target of infringement to a physical embodiment of the invention produced by the patentee.\textsuperscript{49} Patent claims, however, allowed patentees to define their inventions at higher levels of generality so that their exclusive rights could be co-extensive with the "principles" of their inventions.\textsuperscript{50} In other words, claims allowed inventors to obtain rights that were co-extensive with their intellectual contributions to a field. Once again, this development tends to emphasize that patent rights are justified by, and thus tailored to, the informational contribution by the inventor.

Third and finally, nineteenth century patent law began to rely on administrative examination of patent applications rather than a mere administrative registration system.\textsuperscript{51} The examination process itself meant that inventors needed to educate bureaucratic examiners to understand the invention so that its novelty could be evaluated. The practical difficulties associated with bringing physical examples of machines and processes to show to examiners meant that most of the teaching of the examiners had to be done through a paper disclosure. Since the administrative examination system was based on the theory that patent rights should be issued only after the examiners had applied their expertise to determine the validity of the claimed rights,\textsuperscript{52} it was logical both that the documentary description of the invention should be equated with the scope of the patent and that the description of the invention should be disclosed to the public (so that mem-


\textsuperscript{48} See John F. Duffy, The Festo Decision and the Return of the Supreme Court to the Bar of Patents, 2002 \textit{Sup. CT. REV.} 273, 308-09 (describing the "substantial identity" infringement test in the early nineteenth century).

\textsuperscript{49} See id. at 308 (describing that the jury's test for infringement was whether a physical invention was substantially like that described in a patent).

\textsuperscript{50} Id. at 309-10 & nn.115-16 (describing how inventors during the first part of the nineteenth century used early patent claims to identify the broad "principles" of their inventions, for which they were seeking exclusive rights).


\textsuperscript{52} See id. at 237 ("[E]xamination was likely to instill greater confidence in the validity of issued patents, leading to enhanced marketability of these proprietary tools.").
bers of the public could determine the reach of the patent). Moreover, because the patent application was (and had long been) merely a draft of the final patent, the preexisting administrative practice meant that a description of the invention designed to satisfy the examiner would become part of the disclosure made to the public. Thus, "[g]iven the bureaucratic constraints on those administering the system," a trend toward protecting the invention as disclosed in the patent specification was probably not only an "inevitable development" but also "the only way to go." 53

In sum, during the two-hundred-year period prior to the beginning of the twentieth century, the patent system focused increasingly on the information disclosed in the patent specification. By the beginning of the nineteenth century, such documentary disclosure had become a necessary basis for patent validity (under Liardet v. Johnson) 54 and, by the beginning of the twentieth century, it was even a sufficient basis for validity (under the constructive reduction to practice doctrine). Yet documentary disclosure had not yet become the exclusive basis for evaluating the validity and scope of patent rights.

II

PAPER PATENT DOCTRINE

By the beginning of the twentieth century, the law had reached what might be called a compromise position: documentary disclosure was sufficient to sustain the validity of a patent, but the courts favored inventors who had done more. That pragmatic position was, in essence, the paper patent doctrine. It was not a rigid doctrine, and it was based on a simple intuition: if an inventor had made more contributions to the actual practice of the art, then the patent system should be willing to grant greater rights.

The chart below shows the number of federal appellate court decisions per decade that at least mention the doctrine during the period 1890–2010 (the data per decade are reported on a forward-looking basis; thus, the data point for 1890 counts all appellate decisions rendered from 1890–1899). As can be easily seen, the doctrine reached its peak prominence in the 1930s; it was still very much a viable doctrine in the 1950s and '60s; but after the 1980s, it vanished entirely. A total of 144 federal appellate decisions are charted below,

54 See Liardet v. Johnson, (1778) 1 Carpmael's Patent Cases 35, 37 (K.B.) (setting forth Lord Mansfield's instruct to the jury that "[t]he meaning of the specification is, that others may be taught to do the thing for which the patent is granted; and if the specification is false, the patent is void, for after the term the public ought to have the benefit of the discovery").
and each of those decisions was examined to confirm that the decision was at least referring to the paper patent doctrine.

**DISCUSSIONS OF THE "PAPER PATENT" DOCTRINE IN FEDERAL APPELLATE CASES PER DECADE**

Subpart A below details the appellate cases that applied the doctrine, and subpart B discusses the criticisms of the doctrine that led to its demise.

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55 The cases were identified in the following method. First, the Lexis library "US Courts of Appeals Cases, Combined" was searched for the phrase "paper patent" in every case decided before November 2012. That search yielded 218 cases. Many false positives were generated by cases that cited to *The Wood-Paper Patent*, 90 U.S. 566 (1874). Each appellate case citing that decision was examined and excluded unless the case also discussed the paper patent doctrine (one case did discuss the doctrine in addition to citing to the *Wood-Paper Patent* case; the other 17 cases were excluded). The Lexis appellate file also includes cases from the old federal "circuit courts," which were trial courts; those were excluded (44 exclusions). Finally, each of the 157 remaining cases was examined, and all remaining false positives were excluded (13 more exclusions). A good example of an excluded false positive is the recent piece of litigation between the PTO and the examiners' union, *United States Department of Commerce v. Federal Labor Relations Authority*, which discussed the union's complaint that the PTO's switch to a computerized system and elimination of the physical files containing "paper patents" "adversely affects employees by requiring them to spend virtually their entire work day tethered to a computer screen." 672 F.3d 1095, 1098 n.1 (D.C. Cir. 2012). Such discussions of "paper patents" clearly have no relevance to the paper patent doctrine.

The cases were classified into the categories described in Parts II.A and II.B of this Article by two coders, the author and a research assistant. Initial classifications were done independently and were in agreement for 80% of the cases. Final classifications were reached first by each coder reexamining the cases in which there were conflicting classifications and later by agreement. The complete database of paper patent cases, with their classifications, is available upon request from the author.
A. The Heyday of the Paper Patent Doctrine

As mentioned in the introduction to this Article, the paper patent doctrine was not necessarily unfriendly to inventors or to patent holders. In fact, an examination of the 144 appellate opinions on the paper patent doctrine reveals that (as shown in the chart below) the pro-patent side of the doctrine was discussed slightly more frequently by appellate courts, although the split is very close to 50-50.

**Number of Cases in Which the Paper Patent Doctrine Was Discussed**

![Chart showing the distribution of cases discussing the paper patent doctrine]

An excellent example of the pro-patent side of the paper patent doctrine is found in the 1950 Seventh Circuit decision *Hunt v. Armour & Co.* The inventor in that case, George R. Hunt, patented a machine for picking the feathers off of chickens, licensed the patent to one manufacturer, and then brought an infringement action against Armour & Company, a major food processing and distributing company that was using machines made by an unlicensed manufacturer. Armour argued that Hunt's patent was invalid based on two prior patents.

In deciding the validity question, the Seventh Circuit expressly looked to the practical impacts that the patent-in-suit (Hunt's) and the prior art patents had in advancing the art. Prior to Hunt's invention, chickens were picked by hand—a "slow, tedious and expensive process." The machines produced by Hunt's exclusive licensee met

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56 185 F.2d 722 (7th Cir. 1950).
57 See id. at 723–24.
58 See id. at 726.
59 Id. at 723.
“with immediate and widespread acceptance” and with an “impressive” impact on the industry: “Within four years after the Hunt machines were first put on the market, about 85% of the commercially dressed poultry was picked on machines,” and that percentage rose to “about 90%” before the end of ten years. By contrast, the two prior art patents relied upon by the defendant in an attempt to invalidate the patent—prior patents to Bouda and Richards—were nothing more than “paper patents”, as “none of them ever picked a chicken.”

The court then offered separate criticisms for each of the prior art patents. For the Bouda patent, the court noted that, “[i]n spite of the widespread demand for [a good chicken-plucking] machine, Bouda’s ideas did not get much further than his drawing board.”

Similarly, the Richards patent was rejected by the court as being “fantastic and...no better than the Bouda machine.”

A similar case is Reynolds v. Whitin Machine Works, where the Fourth Circuit instructed that “[p]atents for useful inventions ought not be invalidated and held for naught because of such excursions into the boneyard of failures and abandoned experiments.” As in the Hunt case, the court recognized that the patent “undoubtedly marked a great step forward in the art.” The patented machine, a so-called roving machine for preparing cotton to be spun into yarn, “revolutionized roving in textile plants,” “became a pronounced commercial success,” and generated large royalties for the patentee. Nonetheless, the accused infringer attempted to invalidate the patent with no fewer than twenty-one prior art patents. The Fourth Circuit found all of those patents to be “mere paper patents which never went into use and which embody none of the features which have made the [patented invention] successful.” The court recognized that the changes made by the patent “spelled the difference between success and failure” and thus concluded that those successful changes “undoubtedly constituted patentable invention.”

Probably one of the most prominent examples of the paper patent doctrine is found in Lion Fastener, Inc. v. Hookless Fastener Co., which sustained the validity of Gideon Sundback’s famous 1917 patent on the first practical “zipper” mechanism.

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60 Id. at 724.
61 Id. at 725 (quoting Hunt v. Armour & Co., 90 F. Supp. 767, 770 (N.D. Ill. 1950)).
62 Id. at 726.
63 Id. at 727 (internal quotation marks omitted).
64 167 F.2d 78, 84 (4th Cir. 1948).
65 Id. at 81.
66 Id. (quoting district court findings).
67 Id. at 84.
68 Id. at 84–85.
69 72 F.2d 985 (3d Cir. 1934); see U.S. Patent No. 1,219,881 (filed Aug. 27, 1914).
now widely acknowledged to be meritorious, and he has been in-
ducted into the National Inventor’s Hall of Fame. Indeed, Sundback has even received the ultimate accolade of the twenty-first
century—his 132nd birthday was commemorated with a Google Doo-
dle. Yet, Sundback’s patent had a significant prior art problem due
to a 1912 patent issued to Katharina Kuhn-Moos:

Katharina Kuhn-Moos had the idea of a hookless fastener composed
of dual rows of staggered metallic members so spaced apart that on
being drawn through the guideways of a slider and made to con-
verge, the projections of members on one row would fit into re-
ceses of members on the other row, whereby all members would
interlock and the metallic seam be formed.

The disclosure of Kuhn-Moos patent, however, revealed a clunky
mechanism in which the metallic “members are too large and the
locking means too insecure.” It was “a paper patent containing the
kernel of an inventive conception not reduced to actual practice.”
That characterization of the prior art opened the way for the court to
sustain Sundback’s patent as being an “invention” (in modern par-
lance, a nonobvious advance) despite the conceptually similar prior
art.

The paper patent doctrine was, however, not an absolute barrier
to relying on prior uncommercialized patents to invalidate a later pat-
ent. The analysis in United Specialties Co. v. Industrial Wire Cloth Products
Corp. provides a good example. There, the court evaluated the valid-
ity of the patent-in-suit in light of two prior art patents that “were
merely paper patents.” The court did not deny the basic wisdom
underlying the paper patent doctrine and acknowledged that “it may
be true that a patent not commercially exploited must be considered
with caution.” Nevertheless, the court recognized that “there are
frequently reasonable considerations why patents which substantially
advance the art fail to get into commercial use.” Those reasons
could be “economic or financial,” or “[t]he time may not be oppor-

com/doodles/gideon-sundbacks-132nd-birthday (featuring a zipper down the middle of
the Google logo).
72 Lion Fastener, Inc., 72 F.2d at 987.
73 Id.
74 Id.
75 Id. ("[I]t is invention, with limitations.").
76 186 F.2d 426 (6th Cir. 1951).
77 Id. at 429.
78 Id.
79 Id.
tune for the development of a meritorious invention.” Ultimately, the court invalidated the patent because it covered merely a machine “of a well known type with substantially the same or equivalent elements” as found in the prior art, and because the changes made by the new patent resulted in little or no practical differences.

The table below classifies all sixty-eight appellate decisions in which the paper patent doctrine was invoked, or was attempted to be invoked, as a reason for sustaining the validity of a patent against prior art patents that were mere paper patents. The vast majority of appellate decisions accepted the doctrine as a reason to favor the validity of a patent if the prior art patents were mere paper patents, but it was nonetheless only a reason to favor the patent’s validity. Courts frequently (32.35%) held that whatever weight the doctrine had, it was not enough to sustain the patent-in-suit. Only a very small minority of cases—eight decisions (11.76%)—openly disparaged the doctrine. Nevertheless, those criticisms of the doctrine seem to have been highly influential in the long run; they will be discussed in subpart B below.

Table 1: The Pro-Patent Side of the Paper Patent Doctrine (1890-present):
Appellate Cases in Which the Doctrine Was Invoked as Reason for Sustaining the Validity of a Patent Against Prior Art Paper Patents

<table>
<thead>
<tr>
<th>Category</th>
<th>Cases</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Cases relying on the doctrine in sustaining a patent</td>
<td>37</td>
<td>54.41%</td>
</tr>
<tr>
<td>B. Cases rejecting reliance on the doctrine in that case</td>
<td>22</td>
<td>32.35%</td>
</tr>
<tr>
<td>C. Cases criticizing or rejecting the doctrine</td>
<td>8</td>
<td>11.76%</td>
</tr>
<tr>
<td>D. Cases in which the doctrine was invoked only in a dissent</td>
<td>1</td>
<td>1.47%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>68</strong></td>
<td><strong>100.00%</strong></td>
</tr>
</tbody>
</table>

The anti-patent side of the doctrine can be broken into similar categories, as the table below does.

Table 2: The Anti-Patent Side of the Paper Patent Doctrine (1890-present):
Appellate Cases in Which the Doctrine Was Invoked as Reason for Invalidating or Limiting the Scope of a Paper Patent-in-Suit

<table>
<thead>
<tr>
<th>Category</th>
<th>Cases</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Cases using the doctrine to invalidate or limit the scope of a patent</td>
<td>41</td>
<td>66.13%</td>
</tr>
<tr>
<td>B. Cases rejecting reliance on the doctrine in that case</td>
<td>15</td>
<td>24.19%</td>
</tr>
<tr>
<td>C. Cases criticizing or rejecting the doctrine</td>
<td>4</td>
<td>6.45%</td>
</tr>
<tr>
<td>D. Cases in which the doctrine was invoked only in a dissent</td>
<td>2</td>
<td>3.23%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>62</strong></td>
<td><strong>100.00%</strong></td>
</tr>
</tbody>
</table>

80 Id.
81 See id.
The most striking difference lies in the higher frequency of success of the paper patent doctrine when it applied against the patent-in-suit. Where the court was willing to apply the doctrine and the patent-in-suit was determined to be a paper patent (i.e., categories A and B above), the cases show a nearly 3:1 ratio between what might be considered successful versus unsuccessful invocations of the doctrine—that is, the ratio between (i) those cases that invalidated or restricted the rights of the patentee and (ii) those cases that were willing to enforce the patent without regard to its paper-patent status. By contrast, the similar “success ratio” from Table 1 was not even 2:1. The higher success ratio for the anti-patent side of the doctrine suggests that, while the courts were wary of paper patents being used as prior art to invalidate the patents, they were much more hostile to what today would be considered one objectionable troll-type behavior: the assertion of an uncommercialized patent against an entrepreneurial firm that made technology actually work in the real world.

An excellent example is Van Kannel Revolving Door Co. v. General Bronze Corp. The patent-in-suit there, which covered a braking mechanism for a revolving door, was applied for, and issued, in 1924. It was purchased by the plaintiff eight years later “for an undisclosed consideration,” and “no one ever used a [braking mechanism] manufactured in accordance with” the express teachings of the patent. The defendant claimed the patent was “inoperative,” but the plaintiff’s expert witnesses testified that, while the precise mechanism disclosed in the 1924 patent did encounter “difficulties” in actual operation, those difficulties might be overcome with some modifications. To the court, however, the crucial fact was that “no one seized upon [the patented] invention when it appeared in 1924 or has ever used it since.” Thus, the court agreed with the defendant’s argument that the 1924 patent “was an inoperative paper patent which had no effect on the art and was only brought to light by the plaintiff in an effort to monopolize the field after the defendant had already installed, to the plaintiff’s knowledge, a governor of the type now charged to infringe.”

It is interesting to compare the approach of a case like Van Kannel Revolving Door with the approach that would be taken by a modern court. Evidence that a patented invention had never been practiced according to its specific teachings would simply not be enough to

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82 77 F.2d 300 (2d Cir. 1935).
84 Van Kannel Revolving Door, 77 F.2d at 303.
85 See id.
86 Id.
87 Id.
render the patent invalid as inoperative, no matter how serious were
the practical difficulties. Rather, the operability of the patented in-
vention would be judged on the basis of whether the claimed inven-
tion achieved any meaningful amount of the invention’s claimed
goal. Since the 1924 patent’s goal was merely to provide a “governor
mechanism . . . permitting [revolving doors] to rotate freely until a
predetermined speed is reached and then operating [a] brake mecha-


nism,” the practical difficulties in its operation would not be suf-
cient to invalidate the patent provided that the mechanism disclosed
achieved this goal in any meaningful way.

Under the modern approach, the infringement case would then
turn to the claiming “game,” which would compare the accused de-
vice to the claim language used in the patent. If the claim language
were sufficiently broad, the patentee’s inability to overcome any diffi-
culties in making the device practically successful would not matter,
and infringement liability may very well lie against a subsequent entre-
preneur who made a similar, but practically successful, device. Utterly
lost in the modern analysis is the basic intuition that the court stated
in Van Kannel Revolving Door—the patent system should not be grant-
ing rewards to paper patents that “had no effect on the art” and that
are “only brought to light . . . in an effort to monopolize the field”
after other parties independently solved the practical problems associ-
ated with the embryonic technology described in the patent.

Under the anti-patent side of the paper patent doctrine, courts
would not only invalidate paper patents on which suit had been
brought, they would also rely on the patent’s status as mere paper to
restrict the rights associated with the patent in at least three ways: (1)
by interpreting the claims of the patent narrowly; (2) by limiting the
range of equivalents available under the doctrine of equivalents; and
(3) in at least one case, by invoking the equitable doctrine of laches to
dismiss an infringement action. The table below compiles the fre-
quency with which the courts made such uses of the doctrine.

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90 See Giles S. Rich, Extent of Protection and Interpretation of Claims—American Perspectives,
21 Int’l Rev. Indus. Prop. & Copyright L. 497, 499 (1990) (“To coin a phrase, the name
of the game is the claim.” (emphasis omitted)).
91 Van Kannel Revolving Door, 77 F.2d at 303.
Table 3: Categories of Cases Relying on the Anti-Patent Side of the Paper Patent Doctrine:

<table>
<thead>
<tr>
<th>Categories of Appellate Cases in Which the Doctrine Was Successfully Invoked as a Reason for Invalidating or Limiting the Scope of a Paper Patent-in-Suit</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>A (i) Cases using the doctrine in invalidating a patent</td>
<td>14</td>
</tr>
<tr>
<td>A (ii) Cases using the doctrine in construing the patent narrowly</td>
<td>20</td>
</tr>
<tr>
<td>A (iii) Cases using the doctrine in limiting the range of equivalents</td>
<td>6</td>
</tr>
<tr>
<td>A (iv) Cases using the doctrine to justify an invocation of laches to bar suit</td>
<td>1</td>
</tr>
<tr>
<td><strong>Total Cases A (i) – (iv)</strong></td>
<td><strong>41</strong></td>
</tr>
</tbody>
</table>

As with the pro-patent side of the doctrine, the anti-patent side was also not stated in absolute terms. Rather, nonuse of a patent was merely a consideration—a significant consideration—in determining the validity and scope to be afforded a particular patent. The courts recognized that use of a patent was not a legal prerequisite to validity and that a patent holder could have meritorious reasons for nonuse. *Hartford-Empire Co. v. Obear-Nester Glass Co.* provides a good example. The patentee was “the largest manufacturer of glass-producing machinery in the country” and held “a great number of patents pertaining to this art.” The court recognized that, given the patentee’s large portfolio of patents, the patentee had to make a choice as to which patents it would practice—"in fact, a choice has been a rather obvious necessity"—and the choice would be based on “practical” reasons “such as character of the article to be made, simplicity of operation, cost of machine, and other considerations.”

The situation in *Hartford-Empire* is common, and the court’s treatment of it is sensible. Firms engaged in research often produce a portfolio of possible technological alternatives. They will naturally invest and begin to practice in the most promising of those alternatives, and indeed society would want them to practice only the most efficient possible alternatives. If other firms could more easily invalidate the unpracticed patents, then the research firm would have an incentive to try to practice all the possible alternatives—or at least to try to practice them minimally so that they could maintain their exclusive rights. But such practice of less efficient technologies is not in the social interest.

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By the 1930s and ’40s, the paper patent doctrine had evolved into a stable and predictable part of patent law. The doctrine was

92 71 F.2d 539 (8th Cir. 1934).
93 *Id.* at 565.
94 *Id.*
grounded in good intuitions. On its pro-patent side, the doctrine recognized the difficulties in creating practical innovations by cobbling together information from the paper disclosures of failed patents. On its anti-patent side, the doctrine was based on the correct intuition that inventors who practice their innovations in the real world add more social value than those who merely use their patents as weapons against others who undertook the risks of commercialization. The doctrine was not stated in absolutes, and it had nuances to account for special circumstances where the failure to practice a patent was not a significant concern. What the doctrine lacked, however, was a solid theoretical basis.

B. The Demise of the Doctrine and the Consequences

The demise of the paper patent doctrine was not abrupt. No single decision accounts for its fall from favor. Criticism from famous judges, especially Learned Hand, was clearly a significant factor in the doctrine's decline, but such prominent criticism was only part of the story. The more general problem was that the doctrine never had a rigorous theoretical justification. It was an intuition—a correct intuition—but one that could not be grounded in the basic purposes of the patent system as they were understood in the latter half of the twentieth century. The absence of that theoretical justification led to the decline. The final blow to the doctrine was the creation of the Federal Circuit and the centralization of appellate jurisdiction over patent appeals in that court.

(1) Learned Hand and the Assault on the Pro-Patent Side of the Doctrine. On the pro-patent side of the doctrine, Learned Hand was the doctrine's most vociferous critic. Two decisions were especially important. In Western States Machine Co. v. S.S. Hepworth Co., Judge Hand considered whether the patent asserted in the infringement suit should be held invalid as anticipated based on a twenty-one-year-old patent that had not been commercially practiced. He held that the old paper patent did invalidate the newer patent, even though the older patent had "made no impression upon the art." To Hand, the absence of the earlier patent's practical effect in the field was "irrelevant." "True," he wrote, "when courts wish to discredit a reference, and do not quite know how to avoid it, they at times are fond of calling it a 'paper patent'; but that is only rhetoric." Even if the older patent had "lain for years unheeded, as little a contribution to the sum of knowledge as though it had never existed, an idle gesture long..."
since drifted into oblivion," still it would "be as effective to invalidate a new patent, as though it had entered into the very life blood of the industry."\textsuperscript{99}

The powerful denial of the paper patent doctrine in \textit{Western States} was not, however, too much of a departure from the standard case law on the doctrine because the challenge to the existing patent was one of complete anticipation—that the newer patent was \textit{identical} to the older one. Other cases had taken a similar approach in cases of complete anticipation, and Hand expressly recognized that, if there had been any difference between the old and the new, "the lapse of time" might have been "strong evidence that the change was not as simple as it looks."\textsuperscript{100}

Yet if \textit{Western States} left some room for the paper patent doctrine to operate in cases where the new patent was different from the older paper patent, Hand’s decision in \textit{Frank B. Killian \& Co. v. Allied Latex Corp.}\textsuperscript{101} seemed to foreclose that possibility. The patent in \textit{Killian} was not identical to the paper patent in the prior art, and the district judge below had expressly relied on the paper patent doctrine to discriminate in favor of providing a broad scope of validity to the patent-in-suit:

\begin{quote}
[The prior art patent] remained, so far as the record shows, a paper patent. With all the industry needing and calling for [an improved] apparatus, all manufacturers continued for fourteen years using hand labor, wholly uninfluenced by the existence of [the prior art paper patent]. It is apparent that [the prior art] brought to the industry nothing. \ldots [and] did nothing to carry forward the useful arts.\textsuperscript{102}
\end{quote}

This was the core set of facts in which the pro-patent side of the doctrine typically operated, and the district court’s opinion was well within the mainstream in discounting the value of an unpracticed prior art patent that was similar but not identical to the patent being asserted in the case.\textsuperscript{103} Nonetheless, Hand refused to apply the doctrine, and he did not mince words:

\begin{quote}
Countless patents lie in patent offices, in fact unknown either because they were premature, or were not exploited, or because all their uses were not foreseen; yet an inventor is charged with an acquaintance with all of them. So far as they in fact anticipate his invention they stand on precisely the same footing as though he had had them before him. The fact that the art has not profited by them is irrelevant unless it also appears that they were generally
\end{quote}

\textsuperscript{99} Id.
\textsuperscript{100} Id.
\textsuperscript{101} 188 F.2d 940 (2d Cir. 1950).
\textsuperscript{102} Id. at 941 (quoting the district court opinion).
\textsuperscript{103} See, e.g., Hunt v. Armor \& Co., 185 F.2d 722, 725–28 (7th Cir. 1951).
Hand's attack on the paper patent doctrine in Killian all but spelled the end of the doctrine in the Second Circuit. Only two subsequent cases from the circuit ever even mentioned the doctrine. In Ling-Temco-Vought, Inc. v. Kollsman Instrument Corp.—decided sixteen years after Killian—the court afforded the doctrine, at most, only a small amount of weight, and in the second case, the court merely mentioned the doctrine in passing as it was quoting and distinguishing Ling-Temco-Vought. But Hand's influence was not limited to the Second Circuit. Other circuits also cited his skeptical opinions on the paper patent doctrine, and his criticisms are likely a major reason for the decline of the doctrine.

Hand's objection to the doctrine was legally rigorous. The doctrine was "a mere bit of rhetoric," and there was no reason, at least in the text of statute, to distinguish between a paper patent and one that had entered the very lifeblood of the industry. Yet Hand's criticisms were so successful at least in part because there was no theoretical rejoinder to his legal reasoning. The beginnings of that rejoinder were only just emerging in the academic literature on learning, information transfer, and economics. It would be decades before that scholarship would influence law.

(2) The Erosion of the Anti-Patent Side of the Doctrine. Unlike the pro-patent side of the doctrine, the anti-patent side did not attract a vociferous critic like Learned Hand. Instead, the problems for this portion of the doctrine were both (i) the gradual conflation of the paper patent doctrine with the quite distinct rule that patentees are not required to use their patented technology, and (ii) the rise of the

104 Killian, 188 F.2d at 942.
105 See 372 F.2d 263, 266-69 (2d Cir. 1967) (sustaining the patent-in-suit after describing the prior art as merely a paper patent).
107 See, e.g., Siegel v. Watson, 267 F.2d 621, 624 (D.C. Cir. 1959); Coats Loaders & Stackers, Inc. v. Henderson, 233 F.2d 915, 919-20 (6th Cir. 1956); Royal Patent Corp. v. Monarch Tool & Mfg. Co., 203 F.2d 299, 301 (6th Cir. 1953); Holland Co. v. Am. Steel Foundries, 196 F.2d 749, 751-52 (7th Cir. 1952).
As early as 1908, the Supreme Court in *Continental Paper Bag Co. v. Eastern Paper Bag Co.* clearly established that patentees were not legally obligated to use their patented technologies.\(^{109}\) Still, for decades after that decision, the paper patent doctrine thrived. Sophisticated courts were able to distinguish between the lack of any legal requirement to use a patent and the more nuanced goals of the paper patent doctrine.\(^{110}\)

Nonetheless, the distinction between the rule in *Continental Paper Bag* and the paper patent doctrine was a subtle one, and the courts lacked a good theory to help in drawing the distinction. Worse still, the Supreme Court’s 1945 decision in *Special Equipment Co. v. Coe* \(^{111}\) included broad dicta that could be read as prohibiting any consideration of the patentee’s use of the patent in judging the patent’s validity.

*Special Equipment* arose in an unusual procedural posture. The plaintiff was suing the Commissioner of Patents under the predecessor of 35 U.S.C. § 145, which authorizes a civil suit against the head of the Patent Office (then Coe) to obtain a judicial determination as to an inventor’s entitlement to a patent.\(^{112}\) The circuit court below found the invention to be highly meritorious but was concerned that the inventor was claiming only a subcombination of parts that, while meeting the patentability requirements, would never be sold separately from a larger combination that was the commercially viable product.\(^{113}\) As a result of that concern, the court of appeals had ruled against granting the patent on the “ground that a patent on the subcombination should not be granted because of ‘the dangers of approving a principle which permits a patent monopoly to be extended by granting claims on distinct inventions, which the applicant has no intention of exploiting as distinct inventions.’”\(^{114}\)

In reversing the court of appeals, the Supreme Court spent most of its opinion demonstrating that the patent statutes, the settled practice of the Patent Office, and prior judicial decisions allowed patent claims to be directed to both “a combination and also its subcombinations.”\(^{115}\) The Court also, however, addressed the concern that the inventor had “no intention of exploiting” the claims to subcombine-

\(^{109}\) See 210 U.S. 405, 429-30 (1908).
\(^{110}\) See, e.g., *Wire Tie Mach. Co. v. Pac. Box Corp.*, 102 F.2d 543, 556 (9th Cir. 1939) (noting that the Supreme Court’s *Continental Paper Bag* decision did not foreclose the application of the paper patent doctrine to limit the scope of a patent).
\(^{111}\) 324 U.S. 370 (1945).
\(^{112}\) See id. at 371.
\(^{113}\) See id. at 374.
\(^{114}\) Id. (emphasis added) (quoting the lower court decision).
\(^{115}\) See id. at 377.
tion invention. In response, the Court cited *Continental Paper Bag* and paraphrased its holding broadly as being "that failure of the patentee to make use of a patented invention does not affect the validity of the patent." The word "affect" is the most important one in that passage. It is one thing to hold (as *Continental Paper Bag* did) that failure to use does not *invalidate* a patent; it is quite another to state that failure to use does not even *affect* validity. If that latter statement were strictly true, then a good part of the paper patent doctrine could not survive.

Of course, the holding in *Special Equipment* was much narrower, and the procedural posture of the case was quite different from the typical situation in which the paper patent doctrine was invoked. Nevertheless, lower courts soon began citing *Special Equipment* as imposing significant limits on the anti-patent side of the paper patent doctrine. Thus, as early as 1953, the Fifth Circuit in *Southern States Equipment Corp. v. USCO Power Equipment Corp.* relied on *Special Equipment* to rule that "the fact that [one of the patents asserted by plaintiff in the action] was, as [the accused infringers] characterize it, merely a 'paper patent' enjoying no commercial success, does not affect its validity." That reasoning is clearly incorrect under modern law, for lack of commercial success *can* affect a patent's validity. Nonetheless, similar statements began appearing in other cases, which demonstrated that the lower courts were reading the broad dicta in *Special Equipment* as undermining the paper patent doctrine.

Even on their own terms, however, the statements in *Special Equipment* and the lower court decisions invoking those statements were concerned only with the issue of *validity*; they should not have undermined the portion of the paper patent doctrine authorizing courts to construe paper patents narrowly in deciding *infringement*. Indeed, one of the post-*Special Equipment* cases from the Fifth Circuit did try to preserve that portion of the doctrine. In *Edward Valves, Inc. v. Cameron Iron Works, Inc.*, the accused infringers tried to argue that the patent-
in-suit was merely "a 'paper patent' never sold commercially."\textsuperscript{122} Citing \textit{Special Equipment}, the court held that "lack of commercial success does not preclude enforcement or indicate lack of invention."\textsuperscript{123} Interestingly, however, the court tried to preserve a bit of the paper patent doctrine; the court reasoned that "[i]n a close case the existence of a patent only on paper might tip the scale against a holding of infringement."\textsuperscript{124}

Yet it would make no sense to preserve a part of the paper patent doctrine while abandoning the rest, if the courts had no good theoretical foundation for any part of the doctrine, and that was the root problem. The unanswered—and at the time unanswerable—question was why, in light of the Supreme Court's teachings in \textit{Special Equipment}, should the courts continue to consider the patentee's non-use of the patent as an unfavorable factor. \textit{Continental Paper Bag} and \textit{Special Equipment} plainly established that patentees did not have to practice their patents, and from that clear rule it was only a small leap of logic to conclude that the patent system should not discriminate in any way against nonpracticed patents.

That seemingly small but enormously important step was made all the easier because the courts were also making the subtle but significant shift toward a version of disclosure theory that emphasized the documentary disclosure required under the Patent Act.\textsuperscript{125} Thus, in \textit{Universal Oil Products Co. v. Globe Oil & Refining Co.}, the Supreme Court explained that "the quid pro quo" required of the patentee "is disclosure of a process or device in sufficient detail to enable one skilled in the art to practice the invention."\textsuperscript{126} The last part of that sentence is a paraphrase of 35 U.S.C. § 112, which sets forth the disclosure required in a patent specification.\textsuperscript{127} Not surprisingly, the lower courts also began to equate the patentee's quid pro quo as being the specific disclosures required in the statute, all of which are paper disclosures.\textsuperscript{128}

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\begin{itemize}
  \item \textsuperscript{122} 286 F.2d 933, 939 (5th Cir. 1961).
  \item \textsuperscript{123} Id.
  \item \textsuperscript{124} Id. (emphasis added).
  \item \textsuperscript{125} See, e.g., \textit{Universal Oil Prods. Co. v. Globe Oil & Refining Co.}, 322 U.S. 471, 484 (1944).
  \item \textsuperscript{126} Id.
  \item \textsuperscript{127} 35 U.S.C. § 112 (2006) ("The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same, and shall set forth the best mode contemplated by the inventor of carrying out the invention.").
  \item \textsuperscript{128} See, e.g., \textit{Flick-Reedy Corp. v. Hydro-Line Mfg. Co.}, 351 F.2d 546, 550–51 (7th Cir. 1965) (relying on \textit{Universal Oil Products} for the view that disclosure is the quid pro quo for a patent and citing § 112 as establishing the necessary disclosure).
\end{itemize}
While the Supreme Court seemed to take a broader view in its 1966 decision *Brenner v. Manson* (where the Court identified the quid pro quo of a patent as being not disclosure but rather "the benefit derived by the public from an invention with substantial utility"), the Court soon re-embraced disclosure as the necessary quid pro quo demanded by the patent system. The lower courts followed, with the courts increasingly identifying the documentary disclosure required in the statute as the whole of the relevant disclosure. Eventually even the Supreme Court has come to speak in terms of the "disclosure required by the Patent Act" as being "the quid pro quo of the right to exclude."

In such an era—where the courts had no theory to support the paper patent doctrine and the documentary disclosure theory was in ascendancy—the doctrine had no chance of surviving. Ironically, as the paper patent doctrine was withering in the courts, new theories about information and information transfer were establishing a solid theoretical foundation that could justify the doctrine.

III

MODERN INFORMATION THEORIES: A NEW THEORETICAL BASIS FOR THE PAPER PATENT DOCTRINE

One central, intuitive reason provides the fundamental basis for the paper patent doctrine: Information—indeed, especially highly technical information—can be very costly to transfer from one person to another, and it often cannot be done well by anything so simple as writing the information down on paper and passing the paper to another. If it is true that "information wants to be free"—as the technological guru Stewart Brand famously speculated—then its desires often go unfulfilled, for the difficulty of transferring information is not an unusual or insignificant phenomenon. Indeed, it is a point that, as Professor Edmund Kitch has written, "should not be unfamil-

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130 See Kewanee Oil Co. v. Bicron Corp., 416 U.S. 470, 484 (1974) (relying on *Universal Oil* to identify disclosure as being "the quid pro quo of the right to exclude").
131 See, e.g., Standard Oil Co. v. Montedison, S.p.A., 664 F.2d 356, 363 (3d Cir. 1981) (stating that "compliance with the full disclosure requirement of 35 U.S.C. § 112, which facilitates subsequent free public use of the invention, is the quid pro quo for the grant of a limited patent monopoly on a patentable invention" (emphasis omitted)); A.F. Stoddard & Co. v. Dann, 564 F.2d 556, 563–64 (D.C. Cir. 1977) (stating that the "quid pro quo which supports the patent grant is the requirement of a full disclosure regarding the invention" and discussing the requirements of "the patent laws" (emphasis omitted)).
iar to a teacher who has had the experience of teaching a course and then discovering that many of the students did not understand most of the subject matter."1354

Kitch’s example suggests an excellent way to explain the intuition that undergirds the paper patent doctrine. Consider two professors, each of whom is charged with teaching a particular engineering course to a class of students. The first professor—who will be named the paper disclosure professor—comes to class the first day and distributes a textbook, a syllabus with reading assignments, and copies of some PowerPoint slides containing his notes. He announces the date of the exam, encourages students to read the materials, and departs, never to return to class. A second professor—we’ll call her the learning-by-doing professor—comes to class the first day and does exactly the same things as the first professor. But the second professor does not leave. She stays; she goes through lectures; she asks the students questions; she corrects their answers when they are wrong; she helps the students build devices; and she fixes mistakes in students’ devices when they do not work initially. At the end of the semester, which professor should get the better teacher ratings?

Of course, the obvious answer to that rhetorical question is not only intuitive but is also supported by significant market evidence. If the paper disclosure professor were as good as the learning-by-doing professor, schools and universities could be replaced with just libraries. But as the billions of dollars spent annually on teaching demonstrate, our society understands that mere paper disclosure of information is not a particularly effective way of teaching.

The intuition about the high cost of transferring technical information is not limited merely to teaching in the classroom. Consider, for example, the very project that is the catalyst for this symposium—the opening of Cornell University’s New York City technology campus. This project, Cornell NYC Tech, will eventually cost $2 billion.1355

How can such expense possibly be justified in era of extremely reliable, cheap, and high-quality communications? If students who want to take Cornell classes live in Manhattan rather than Ithaca, Cornell could easily stream its classes over the Internet for a fraction of the cost of building a New York City campus. If Cornell’s entrepreneurial engineering professors need access to the New York City labor market to staff startup companies that will exploit experimental technologies,

those professors could easily e-mail the technical specifications of their technologies—indeed, e-mail their patent specifications, which are supposed to be fully enabling of the technologies—to their New York City-based startups, and the workers in those firms could then easily build the technologies given the paper disclosures. Even if the workers need help, it would be readily available with merely a phone call, or rather a Skype or Facetime video link. If a documentary disclosure theory were even close to the truth, Cornell’s NYC Tech project should be scrapped.

Of course, Cornell University is not going to scrap its plans for a New York City campus. The leadership of both Cornell University and New York City have the intuition—again, the correct intuition—that technical information does not spread easily by simply making paper disclosures and that, therefore, physically locating a technology campus in New York City is likely to foster more technology companies within the City and also to enrich academic research with the wisdom gained from practical experience.

Thus, for example, New York City’s original request for proposals for a technology campus stated that one of its goals of the then-planned project would be to “[d]evelop research that will lead to the formation and expansion of companies in the City and the attraction of companies to the City, in industries that demonstrate the most potential for growth.” Yet if research can be easily spread by mere paper disclosure, then why would any rational person believe that research developed in New York City would be more likely to be exploited in New York City rather than in, say, Chicago or Shanghai? Similarly, New York City’s proposal stated that the developer of the technology campus would be expected to “[c]reate links between industry and academia to ensure that research is applied or translated for use in various business sectors and/or the creation of new commercial ventures in the City.” Why cannot such links be created between Cornell’s Ithaca campus and industry in the New York City area? Even without a New York City campus, electronic and even physical communications across the 225 miles that separate Ithaca from New York City cannot possibly be a significant barrier to such links unless it is true that information is so difficult to transport from person to person that effective teaching often requires more than mere paper disclosure. That truth is exactly what underlies Cornell’s NYC Tech Campus; it is exactly what underlies the sense that the hypothetical “paper disclosure” professor has not done a good job of teaching; and it is exactly what underlies the paper patent doctrine.

137 Id. at 4.
That intuitive truth about good teaching also directly links with policy concerns that the courts have repeatedly identified as being at the heart of the patent system, which is to provide inventors with exclusive rights that are commensurate with their contributions to public knowledge—that are commensurate with their teachings. As the Federal Circuit articulated the principle in the famous In re Wands case:

The premise of the patent system is that an inventor, having taught the world something it didn’t know, is encouraged to make the product available for public and commercial benefit, by governmental grant of the right to exclude others from practice of that which the inventor has disclosed. The boundary defining the excludable subject matter must be carefully set: it must protect the inventor, so that commercial development is encouraged; but the claims must be commensurate with the inventor’s contribution.138

It is true that this basic policy concern is frequently stated in terms of ensuring that patent rights must be commensurate not with the contribution or teachings of the inventor, but with the contribution or teachings in the patent (which might suggest merely the contribution made by the documentary disclosure).139 That slightly different phraseology need not, however, be interpreted as rejecting the importance of nondocumentary teachings. It is better viewed as merely recognizing that a single inventor may have several different patents covering different inventions, and that the rights for each patent must be commensurate with the inventor’s teachings with respect to that particular invention, including both documentary and nondocumentary disclosures (such as teaching a workforce how to practice the invention successfully under real industrial conditions).

The wisdom of the paper patent doctrine is that practical implementations of an invention have value in judging the scope and reality of an inventor’s contributions and teachings to an art. That insight dates back to long-established Supreme Court precedent. Thus, for example, the Court in Consolidated Safety-Valve Co. v. Crosby Steam Gauge & Valve Co. needed to judge whether a patent on a steam engine safety valve issued to George Richardson was invalid in light of the prior art.140 The Court recognized that the apparatus of Richardson had “[l]ikeness[ ]” to the prior art, “in physical structure” and “in im-

138 858 F.2d 731, 741 (Fed. Cir. 1988) (emphasis added).
139 See, e.g., MagSil Corp. v. Hitachi Global Storage Techs., Inc., 687 F.3d 1377, 1381 (Fed. Cir. 2012) (stating patent doctrine tries “to ensure that the public knowledge is enriched by the patent specification to a degree at least commensurate with the scope of the claims” (emphasis added) (quoting Sitrick v. Dreamworks, LLC, 516 F.3d 993, 999 (Fed. Cir. 2008))).
140 113 U.S. 157, 159 (1885).
portant particulars.” That similarity was “only as the anatomy of a corpse resembles that of the living being” because “[t]he prior structures never effected the kind of result attained by Richardson’s apparatus.” It would be “not difficult for skilled mechanics to take the prior structures and so arrange and use them as to produce more or less of the beneficial results first made known by Richardson,” but only after those mechanics had been “[t]aught by Richardson, and by the use of his apparatus.” This analysis is precisely correct because it takes a realistic approach to measuring what the difference is between (i) the known teachings of the prior art, with a recognition that some of those pieces of prior art were like corpses, and (ii) the quantum of information taught by the inventor through documentary disclosures and through “use”—that is, real-world practice—of the actual invention.

While the difference between mere “corpse” patents and those actually put in use is quite old as a matter of intuition, now the distinction is also supported by a wealth of scholarship, to which we now turn.

The value of practical implementation in “teaching”—that is, in spreading information—has at least three distinct components, each with its own branch of scholarship. First, and perhaps oldest, is the branch of education literature that is typically viewed as originating with the early twentieth century educational theorist John Dewey. In his 1922 work *Democracy and Education*, Dewey observed that “[t]he knowledge which comes first to persons, and that remains most deeply ingrained, is knowledge of how to do.” From that observation about the importance of “active doing,” Dewey reasoned that education should commence with situations that “involve learning by doing.” The alternative—an education “under the influence of a scholastic conception of knowledge which ignores everything but scientifically formulated facts and truths”—results in “the subject matter of instruction [being] isolated from the needs and purposes of the learner, and so becom[ing] just a something to be memorized and reproduced upon demand.”

Dewey’s conceptions of active learning and learning-by-doing have now spawned entire fields of educational literature directed to-

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141 *Id.* at 171.
142 *Id.*
143 *Id.*
144 JOHN DEWEY, DEMOCRACY AND EDUCATION 217 (1916).
145 *Id.*
146 *Id.*
ward strategies for effective “experiential learning.” \(^\text{147}\) Indeed, that educational literature is so extensive and pervasive that it includes work on implementing experiential learning in the sub-sub-field of experimental behavioral economics.\(^\text{148}\)

While the educational literature on learning-by-doing and experiential learning concerns the process of information distribution, a second and quite different branch of scholarly literature—this one in the economics field—is directed toward learning-by-doing in information creation. Ken Arrow’s famous article *The Economic Implications of Learning by Doing* began by referring to the psychological literature on learning and from that derived “one empirical generalization . . . so clear that all schools of thought must accept it, although they interpret it in different fashions: Learning is the product of experience.” \(^\text{149}\) From that “empirical” observation, Arrow advanced the hypothesis that “technical change in general can be ascribed to experience, that it is the very activity of production which gives rise to problems for which favorable responses are selected over time.” \(^\text{150}\)

Arrow then set forth a formal model demonstrating that, under certain simplifying assumptions,

\[ \text{[T]he presence of learning means that an act of investment benefits future investors, but this benefit is not paid for by the market. Hence, it is to be expected that the aggregate amount of investment under the competitive model of the last section will fall short of the socially optimum level.} \]

That conclusion is important for patent theory because patents are generally thought to be a regulatory device designed to close the gap between the private and social benefits from investing in knowledge creation. Yet, if knowledge is gained from experience in “the very activity of production,” then investment in production itself will fall short of socially optimal. In other words, if the running of production itself—the running of assembly lines and the like—creates knowledge, then the investment in the productive activity itself has a theoretical claim to favorable regulatory treatment similar to the claim for favoring investment in research. Arrow’s thesis soon generated supporting


\[^{148}\text{See, e.g., Henrik Egbert and Vanessa Mertins, Experiential Learning with Experiments, 9 INT’L REV. ECON. EDUC. 59, 59 (2010) (reporting the results of an “implementation of experiential learning techniques in a behavioural economics class” that was designed “to deepen students’ understanding of both behavioural economics and the experimental approach to research”).}\]

\[^{149}\text{Kenneth J. Arrow, The Economic Implications of Learning by Doing, 29 REV. ECON. STUD. 155, 155 (1962).}\]

\[^{150}\text{Id. at 156.}\]

\[^{151}\text{Id. at 168.}\]
empirical evidence, and an entire economic literature on learning-by-doing has grown up around Arrow's article.

The third and final branch of literature is relevant to assessing the merits of the paper patent doctrine. Michael Polanyi pioneered the concept of "tacit" knowledge, which is knowledge that, while possessed by an individual, is extremely difficult to write down or to convey to others. Such tacit knowledge "cannot be given in lectures and it cannot be found in databases, textbooks, manuals or internal newsletters for diffusion" but is instead transferred through "methods like apprenticeship, direct interaction, networking and action learning that include face-to-face social interaction and practical experiences."

The vast literature on tacit knowledge—what is sometimes called "know-how"—now includes several empirical studies suggesting that information about technology is in fact often tightly bound geographically to the place where the information was originally created. Such studies obviously provide a theoretical basis for a project such as the Cornell NYC Tech campus, for if knowledge does remain bound to and limited by geography (even in an era with inexpensive and nearly instantaneous communications), then technology research and development centers do need to be physically located near markets for technology commercialization.

The combination of these three branches of modern scholarship provides precisely what the paper patent doctrine was missing in the years of its demise: a solid theoretical foundation for favoring practiced over paper patents. Holding all else equal, a practiced patent discloses more, teaches more, and contributes more to the sum total of social knowledge than does a mere paper patent. That point holds true even if the disclosures in patents were always accurate, always practical, and always well explained. In fact, of course, patent disclosures rarely meet such a standard. Patent disclosures may include incorrect information; they need not be easy to understand; and they do

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155 The leading article on the subject is Adam B. Jaffe et al., Geographic Localization of Knowledge Spillovers as Evidenced by Patent Citations, 108 Q.J. Econ. 577 (1993).
156 See, e.g., Randomex, Inc. v. Scopus Corp., 849 F.2d 585, 589 (Fed. Cir. 1988) (holding patent to be valid even though the specification included directions that would lead to an explosion); Atlas Powder Co. v. E.I. Du Pont de Nemours & Co., 750 F.2d 1569, 1576 (Fed. Cir. 1984) (holding patent valid even though forty percent of the disclosed species of the invention were inoperative).
157 See, e.g., Star Scientific, Inc. v. R.J. Reynolds Tobacco Co., 537 F.3d 1357, 1371 (Fed. Cir. 2008) (holding patent claims, a part of the specification, are invalid only if they are "insolubly ambiguous"); In re Wands, 858 F.2d 751, 755 (Fed. Cir. 1988) (holding that
not have to be practical. These are all additional reasons for society to value more the efforts of inventors who teach reliably—not merely through their patent disclosures but also by their disclosures through practice.

CONCLUSION

Intellectual battles about the theoretical underpinnings of legal fields are not mere academic exercises. Theory has practical consequences that affect the structure of rights and the process by which those rights are adjudicated. Rarified statements such as the Supreme Court’s apparent embrace of a documentary disclosure theory may seem to have little consequence for the doctrinal rules about paper patents or the modern rhetorical remonstrances against patent trolls. But the consequences are present and significant. The history of the paper patent doctrine shows the real-world effect of the modern drift in patent theory. In advocating for a resurrection of the paper patent doctrine, this Article seeks both to bring immediacy to what has so far been a rarified theoretical debate among academics and to bring theoretical rigor to what has so far been little more than a series of rhetorical flourishes against patent trolls.

The doctrinal mechanisms for this revival are not hard to find. The anti-patent side of the doctrine still has a vestigial remnant in the current doctrine that weighs “commercial success” in favor of holding that a claimed invention meets the nonobviousness requirement of patent validity. Only two adjustments to this doctrine are necessary. First, commercial success of an invention should count in favor of the validity of the claimed invention only if the commercial success can be tied back to the teachings of that patentee. Obviously, where the patentee or its licensees have had practical commercial success, such success should be viewed as a point in favor of sustaining the validity of the patent. The successful commercial practice by those parties typically has a direct connection to the teachings of the patentee and thus the commercial success provides some evidence as to the value of those

158 See, e.g., Ex parte Cheesebrough, 1869 Dec. Comm’r Pat. 18, 19 (finding that impracticality does not negate patentability); In re Brana, 51 F.3d 1560, 1568 (Fed. Cir. 1995) (holding that a patent may be deemed useful, and thus patentable, even with “the expectation of further research and development” and that “[t]he stage at which an invention in [the field of pharmaceuticals] becomes useful is well before it is ready to be administered to humans”). Note that patents may also fail to work entirely. See Process Control Corp. v. Hydreclaim Corp., 190 F.3d 1350, 1359 (Fed. Cir. 1999). Of course, in such cases, the patent is clearly invalid, see id., but the important point here is a person of skill in the art who is trying to learn from patent disclosures would not necessarily know in advance which patents worked, and which did not. Thus, a person of skill would simply devalue patent disclosures as a whole because some are not worth the time it takes to read them.
teachings. Commercial success by firms other than the patentee and the patentee’s licensees might also count in favor of patent validity, but only in limited circumstances. Thus, for example, if the accused infringer began a commercially successful course of infringement after it gained information about the invention from the patentee’s disclosures (documentary or otherwise), then the accused infringer’s commercial success should count in favor of sustaining the validity of the patent because, once again, the practical success is connected to the patentee’s teachings and thus the success might provide evidence of the value of the teachings.

The paper patent doctrine, however, suggests a very clear limit to the use of commercial success in sustaining a patent: an accused infringer’s commercial success should not count in favor of the validity of the patent where that accused infringer’s commercial success is not actually tied to the teachings of the patentee. Thus, for example, where the accused infringer has created a commercially successful product without knowing about the inventor’s teachings, that commercial success should not be weighed in favor of the patent’s validity. Indeed, where the accused infringer was commercially successful and the patentee and its licensees were not, those circumstances concerning commercial success should weigh against patent validity. Such circumstances are very much like those that existed in Van Kannel Revolving Door Co. v. General Bronze Corp., which, as discussed above, is a classic set of circumstances for invoking the paper patent doctrine and limiting or invalidating the asserted patent.

Reviving the pro-patent side of the paper patent doctrine requires little more than litigants invoking and relying upon the Supreme Court’s teaching in Consolidated Safety-Valve Co. v. Crosby Steam Gauge & Valve Co. that courts should be wary of holding invalid patents based on a combination of elements from mere “corpse” patents—those that never were practiced successfully—where actual practitioners in the relevant art were not able to assemble those elements in a successful manner. Consolidated Safety-Valve has never been overruled or limited. Its approach to prior art paper patents—those corpse patents—should be applied fully and faithfully by the courts.

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159 See Graham v. John Deere Co., 383 U.S. 1, 17–18 (1966) (holding that commercial success could be “indicia of obviousness or nonobviousness”—i.e., indicia of either patent invalidity or validity). Factors such as commercial success and other objective indicia are too often used only in support of patent validity, but the Supreme Court’s statements in Graham make clear that such objective factors can be used to support a finding of invalidity. See id.

160 77 F.2d 300 (2d Cir. 1935).

161 113 U.S. 157, 171 (1885).
The right time for a revival of the paper patent doctrine is now. The doctrinal tools necessary are all present; they need merely to be applied with a bit more vision and vigor. The need for a revival is also present, as the concern about nonpracticing entities—those patentees who, in President Obama's words, "don't actually produce anything themselves"—has reached even into the White House. And, most importantly, the theoretical justification for the doctrine is now in our society's grasp. A revival of the paper patent doctrine would do nothing more radical than recognize that real-world achievements should count for something in the patent system.

See supra note 13 and accompanying text.