

PATENTLY IMPOSSIBLE

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The quest to achieve the impossible fuels creativity, spawns new fields of inquiry, illuminates old ones, and extends the frontiers of knowledge. It is difficult, however, to obtain a patent for an invention which seems impossible, incredible, or conflicts with well-established scientific principles. The principal patentability hurdle is operability, which an inventor cannot overcome if there is reason to doubt that the invention can really achieve the intended result. Despite its laudable gatekeeping role, this Article identifies two problems with the law of operability. First, though objective in theory, the operability analysis rests on subjective credibility assessments. They can introduce a bias toward unpatentability; with inventions emerging from new, poorly understood, and paradigm-shifting technologies as well as those from fields with a poor track record of success as the most vulnerable. Second, what happens when the impossible becomes possible? History reveals that the Patent Office and the courts will continue to deny patents for a long time thereafter.

This Article argues that the mishandling of seemingly impossible inventions vitiates the presumption of patentability, prevents the patent system from sitting at the cutting edge of technology, and frustrates the patent system's overarching goal to promote scientific and technological progress. In an effort to resolve these problems and fill a gap in patent scholarship, this Article offers a new framework for gauging the patentability of seemingly impossible inventions. Briefly, it contends that a more robust enforcement of patent law's enablement requirement can and should perform the gatekeeping role because it can resolve whether an invention works by weighing objective, technical factors. This approach would quickly reveal technical merit for inventions which really work or, alternatively, the fatal flaw for inventions which are truly impossible. Its implementation would not only eliminate the need for the operability requirement, but would also streamline patent examination, improve the disclosure function of the patent system, promote scientific and technological progress, and ultimately foster innovation.

"The difficult, the dangerous, and the impossible have always had a strange fascination for the human mind."¹

INTRODUCTION

The growing backlog of patent applications in the U.S. Patent and Trademark Office (Patent Office) and concerns about patent quality have

¹ JOHN PHIN, THE SEVEN FOLLIES OF SCIENCE 1 (1906).

led to calls for patent reform.² Legal commentators argue that both the backlog and quality problems stem, at least in part, from a large number of patent applications which disclose worthless inventions.³

Perhaps the best solution would be to ferret out these applications at an early stage of patent examination. To some extent this already happens. Applications disclosing perpetual motion machines,⁴ cold fusion processes,⁵ and other inventions which either claim seemingly unachievable results, challenge well-established scientific principles, or simply appear impossible on their face raise red flags in the Patent Office.⁶ The oft-cited statutory basis for rejecting them is § 101 of the Patent Act, which only permits

² See, e.g., Mark A. Lemley, *Rational Ignorance at the Patent Office*, 95 Nw. U. L. REV. 1495, 1500 (2001) [hereinafter Lemley, *Rational Ignorance*] (arguing that inadequate examination leads the Patent Office to issue a large percentage of invalid patents); Doug Lichtman & Mark A. Lemley, *Rethinking Patent Law's Presumption of Validity*, 60 STAN. L. REV. 45, 53-56 (2007) (exploring limitations on the extent and quality of Patent Office review). One cause for the backlog is an increase in the number of patent application filings over time while the time available for examiners to review applications has remained constant. See John L. King, *Patent Examination Procedures and Patent Quality*, in PATENTS IN THE KNOWLEDGE-BASED ECONOMY 54, 63 (Wesley M. Cohen & Stephen A. Merrill eds., 2003) (presenting an empirical study). Reform efforts began after reports surfaced in the early 2000s "that documented important failings in the patent system, including laxity in the [patent] examination process that let a number of bad patents issue . . ." DAN L. BURK & MARK A. LEMLEY, THE PATENT CRISIS AND HOW THE COURTS CAN SOLVE IT 100 (2009).

³ See, e.g., Lemley, *Rational Ignorance*, *supra* note 2, at 1511 (finding that few patents are litigated or licensed and 95% of patents are never used); ADAM B. JAFFE & JOSH LERNER, INNOVATION AND ITS DISCONTENTS 173 (2004) (contending that most patents are worthless). Wacky and absurd patents have received considerable attention in the popular media. See generally TED VANCELEAVE, TOTALLY ABSURD INVENTIONS (2001); James Gleick, *Patently Absurd*, N.Y. TIMES, Mar. 12, 2000 (Magazine), at SM44.

⁴ A perpetual motion machine can run forever without any input of external power; meaning that it can do work without consuming energy. The oft-cited technical objection is that perpetual motion violates the Second Law of Thermodynamics, which holds that a machine cannot be 100% efficient because it can only use a fraction of the energy it receives for work and must lose a significant portion to the environment as heat; usually through friction. See discussion *infra* note 225; Dimitris Tsaousis, *Perpetual Motion Machine*, 1 J. ENG'G SCI. & TECH. REV. 53, 53-58 (2008).

⁵ See *In re Swartz*, 232 F.3d 862, 864 (Fed. Cir. 2000) (per curiam) (affirming the Patent Office's rejection of a cold fusion device). Cold fusion describes a nuclear fusion reaction with hydrogen that occurs at room temperature. Given that the fuel comes from water, a cold fusion apparatus could provide a limitless and nonpolluting source of energy. See ERIC G. SWEDIN, SCIENCE IN THE CONTEMPORARY WORLD 57-58 (2005). Critics contend that cold fusion is incompatible with nuclear physics, which holds that hydrogen fusion requires temperatures on the order of millions of degrees Fahrenheit, which is the condition at the Sun's core. *Id.*

⁶ See *infra* Part II.A.

patents for “useful” inventions.⁷ In patent law, an invention is not useful if it cannot operate to produce the intended result.⁸ The test for operability is whether a person having ordinary skill in the art (PHOSITA)⁹ has reason to doubt the objective truth of the applicant’s assertions.¹⁰

However, using the operability requirement of § 101 as a gatekeeper has several drawbacks. First, elucidating what a PHOSITA would believe can devolve into a subjective judgment about the subject matter. The Patent Office and the courts can develop a bias toward unpatentability; with inventions emerging from new, poorly understood, and paradigm-shifting technologies as well as those from fields with a poor track record of success as the most vulnerable.¹¹ Second and relatedly, since the Patent Office and the courts are probably unaware of what is happening at the cutting edge of science and technology, what happens when the impossible becomes possible? History reveals that the Patent Office and the courts will continue

⁷ “Whoever invents or discovers any new and *useful* process, machine, manufacture, or composition of matter . . . may obtain a patent . . .” 35 U.S.C. § 101 (emphasis added). Aside from utility, an invention must be novel (§ 102), nonobvious (§ 103), and directed to patentable subject matter (§ 101). In addition, § 112 ¶ 1 requires that the application adequately disclose the invention and § 112 ¶ 2 requires that the application conclude with claims which delineate the invention with particularity.

⁸ See *Process Control Corp. v. HydReclaim Corp.*, 190 F.3d 1350, 1358 (Fed. Cir. 1999) (“The utility requirement of 35 U.S.C. § 101 mandates that any patentable invention be useful and, accordingly, the subject matter of the claim must be operable.”); *Newman v. Quigg*, 877 F.2d 1575, 1581 (Fed. Cir. 1989) (“[A] device lacks utility [if] it does not operate to produce what the [inventor] claims that it does.” (citation omitted)); cf. *In re Perrigo*, 48 F.2d 965, 966 (C.C.P.A. 1931) (“It is fundamental in patent law that an alleged invention . . . must appear capable of doing the things claimed . . .”). The U.S. Court of Customs and Patent Appeals (C.C.P.A.) was a predecessor to the Federal Circuit. The Federal Courts Improvement Act of 1982 abolished the C.C.P.A. See Pub. L. No. 97-164, 96 Stat. 25 (codified as amended in scattered sections of 28 U.S.C.). Soon after its creation, the Federal Circuit adopted the C.C.P.A. decisional law as binding precedent. See *South Corp. v. United States*, 690 F.2d 1368, 1370 (Fed. Cir. 1982) (en banc).

⁹ The PHOSITA is a hypothetical construct of patent law akin to the reasonably prudent person in torts. See *Panduit Corp. v. Dennison Mfg. Co.*, 810 F.2d 1561, 1566 (Fed. Cir. 1987) (explaining that a PHOSITA “is not unlike the ‘reasonable man’ and other ghosts in the law.”). Factors relevant to constructing the PHOSITA in a particular technical field include the sophistication of the technology, the educational level of the inventor, the educational level of active workers in the field, the types of problems encountered in the art, prior art solutions to those problems, and the rapidity with which innovations are made. *Envtl. Designs, Ltd. v. Union Oil Co.*, 713 F.2d 693, 697 (Fed. Cir. 1983) (listing the factors).

¹⁰ The Patent Office can establish reasonable doubt if the applicant’s disclosure “suggest[s] an inherently unbelievable undertaking or involve[s] implausible scientific principles.” *In re Cortright*, 165 F.3d 1353, 1357 (Fed. Cir. 1999) (quoting *In re Brana*, 51 F.3d 1560, 1566 (Fed. Cir. 1995)).

¹¹ See *infra* Part II.B.1.

to deny patents under § 101 for a long time thereafter.¹² This time lag between technical possibility and legal recognition is unsettling since “the very purpose of the patent system is to encourage the attainment of previously unachievable results.”¹³ The current § 101 regime frustrates this purpose as well as the patent system’s broader mission to extend the frontiers of knowledge.

This Article offers a new framework for gauging the patentability of seemingly impossible inventions. Briefly, it contends that a more robust enforcement of the enablement requirement of § 112 ¶1—which obliges a patent applicant to disclose how to make an use the invention without undue experimentation—can effectively ferret out truly impossible inventions *by itself* with no need for or help from its § 101 statutory cousin. Importantly, § 112 ¶1 can perform the gatekeeping role by weighing objective, technical factors rather than through subjective credibility assessments which lie at the heart of the § 101 analysis. This enablement-based approach would eliminate the need for the § 101 operability requirement. It would also streamline patent examination, improve patent quality, yield more technically robust patents, and ultimately foster innovation.

The issue addressed in this Article—how to deal with seemingly impossible inventions—has received almost no attention in the academic literature.¹⁴ This Article fills a gap in patent scholarship and will contribute to ongoing debates over patent reform. It is part of a larger project to bridge the disconnect between patent law and the norms of science.¹⁵

¹² See *infra* Part II.B.2.

¹³ *In re Ferens*, 417 F.2d 1072, 1074 (C.C.P.A. 1969).

¹⁴ This is the first article to comprehensively explore incredible inventions and to seriously challenge operability as a patentability requirement. There are only a handful of articles which have explored operability. See Daniel C. Rislove, Comment, *A Case Study of Inoperable Inventions: Why is the USPTO Patenting Pseudoscience?*, 2006 WIS. L. REV. 1275 (2006); Robert Ederer, *On Operability as an Aspect of Patent Law*, 42 J. PAT. OFF. SOC’Y 398 (1960).

¹⁵ See Sean B. Seymore, *Heightened Enablement in the Unpredictable Arts*, 56 UCLA L. REV. 127 (2008) [hereinafter Seymore, *Heightened Enablement*] (proposing a new approach for examining patent applications in unpredictable technologies which, by requiring applicants to disclose actual experimental results, resolves a striking incongruity between patent law and the experimental sciences); Sean B. Seymore, *Serendipity*, 88 N.C. L. REV. 185 (2009) (arguing that although accidental discoveries pervade science, inventors who invent by accident can be unjustly deprived of patents because such discoveries do not mesh with the substantive law of invention); Sean B. Seymore, *The Teaching Function of Patents*, 85 NOTRE DAME L. REV. 621 (2010) [hereinafter Seymore, *Teaching Function*] (proposing a disclosure regime that would allow patents to compete with other forms of technical literature as a source of substantive technical information); Sean B. Seymore, *Rethinking Novelty in Patent Law*, 60 DUKE L.J. 919 (2011) [hereinafter Seymore, *Rethinking Novelty*] (arguing that current novelty doctrine can produce paradoxical outcomes for complex inventions and is seemingly incongruous with basic

The remainder of the Article proceeds as follows. Part I introduces impossibility from a scientific perspective and divides seemingly impossible quests into three broad categories. Part II addresses how the patent system currently handles seemingly impossible inventions. This Part takes issue with the subjective nature of the inquiry and explores its ill-effects on innovation. It concludes that the current regime leads to credibility lags which prevent the patent system from sitting at the cutting edge of science and technology. To solve this problem, Part III offers an enablement-based approach for handling seemingly impossible inventions. This approach replaces the subjective credibility assessment with an objective, fact-intensive analytical framework. This Part concludes by exploring the policy tradeoffs in adopting the new framework and explains how it fulfills several broad goals of the patent system.

I. ACHIEVING THE IMPOSSIBLE

A. *Impossibility as a Driving Force*

The quest to achieve the impossible is a strong driving force in scientific research.¹⁶ Scientists who succeed in doing so are unique because they understand nature and all of its complexity, know what is happening at the forefront of theory and experiment, and are “capable of selecting the new tools that make it possible to achieve today what was impossible yesterday and that will be powerful but routine tomorrow.”¹⁷ But the path to success is not always smoothly paved—it is often rife with skepticism (“*It’ll never work!*”) or disparagement (“*You’re an idiot!*”) from the scientific community.¹⁸ Aside from vindication,¹⁹ success spawns new

principles of patent law).

¹⁶ “Scientists like to show that things widely held to be impossible are in fact entirely possible” JOHN D. BARROW, *IMPOSSIBILITY*, at vii (1998). For instance, K. C. Nicolaou—a prolific organic chemist who is the author or coauthor of over 700 scientific publications and an inventor on more than 60 patents—admits that his favorite synthetic targets are ones that “look impossible at first glance” and “provide an opportunity to discover or invent new science.” 2005 [*American Chemical Society*] *National Award Winners*, CHEMICAL & ENG’G NEWS, Feb. 14, 2005, at 60-61.

¹⁷ Gustaf Arrhenius, *Presentation of the Roebling Medal of the Mineralogy Society of America for 1976*, 62 AM. MINERALOGIST 603, 603 (1977).

¹⁸ This has even been the case for many Nobel Prize-winning achievements. For instance, Barbara McClintock, recipient of the 1971 National Medal of Science and the 1983 Nobel Prize in Physiology or Medicine for her pioneering work in cytogenetics, recounted that “[fellow scientists] called me crazy, absolutely mad at times.” *Jumping Genes*, TIME, Nov. 30, 1981, at 106. Although McClintock published her findings in 1951, it took the scientific community over thirty years to overcome its skepticism because “the prevailing wisdom was that genetic structure was stable and immutable.” *Id.*

fields of inquiry,²⁰ illuminates old ones,²¹ promotes scientific progress,²² and extends the frontiers of knowledge.²³

B. Types of Impossibility

It is possible to divide seemingly impossible quests into three broad categories.²⁴ The first category, *Type I* impossibilities, encompasses quests where the hoped-for result is *per se* impossible because the methodology conflicts with known scientific principles or basic laws of nature. *Type I* impossibilities are easy to identify because “[t]he incontrovertible evidence

¹⁹ Perhaps the best evidence of vindication is the numerous reports in technical journals of results long considered unachievable. A good example is K. C. Nicholau’s total synthesis of the top-selling anticancer drug Taxol. See K. C. Nicholau et al., *Total Synthesis of Taxol*, 367 NATURE 630, 630-34 (1994). This achievement, “considered as the ‘holy grail’ of synthesis in the late 1980s and early 1990s[,] stands as the quintessential symbol of all natural products molecular complexity, and [is] the single most important milestone of complex molecular construction in recent decades.” Cover Legend [K. C. Nicholau], 34 INT’L J. ONCOLOGY 299, 300 (2009).

²⁰ The most striking example is the field of organic chemistry, which became an area of systematic study in 1828 only after Friedrich Wöhler accidentally synthesized urea from mixing two inorganic salts. See Friedrich Wöhler, *Ueber künstliche Bildung des Harnstoffs [On the Artificial Formation of Urea]*, 88 ANNALEN DER PHYSIK UND CHEMIE 253, 253-56 (1828) (original publication); AARON J. IHDE, THE DEVELOPMENT OF MODERN CHEMISTRY 163-65 (1964) (presenting a historical account). This event, heralded as the first organic synthesis, shattered the prevailing belief that man could never make any substance extracted from living things. See *id.* at 163-64 (discussing vitalism).

²¹ For example, chemists long believed that it was impossible for carbon to form fewer than four bonds when it occurred in an organic compound. See, e.g., AUGUST BERNTHSEN, A TEXTBOOK OF ORGANIC CHEMISTRY 14-16 (1891) (describing carbon’s bonding tendencies). In 1900, a chemistry professor at the University of Michigan published a paper describing an organic molecule in which carbon only formed three bonds. See Moses Gomberg, *An Instance of Trivalent Carbon: Triphenylmethyl*, 22 J. AM. CHEMICAL SOC’Y 757, 757-71 (1900). The chemistry community did not accept Gomberg’s explanation for his result until decades later. See Aaron J. Ihde, *The History of Free Radicals and Moses Gomberg’s Contributions*, 15 PURE & APPLIED CHEMISTRY 1, 9-14 (1967). Gomberg’s work shed new light on chemical bonding and led scientists to realize that free radicals play a large role in natural phenomena. See generally BARRY HALLIWELL & JOHN M. C. GUTTERIDGE, FREE RADICALS IN BIOLOGY AND MEDICINE (3d ed. 1999).

²² Scientific progress is “the cumulative growth of a system of knowledge over time, in which useful features are retained and nonuseful features are abandoned, based on the rejection or confirmation of testable knowledge.” MICHAEL SHERMER, WHY PEOPLE BELIEVE WEIRD THINGS 31 (2002).

²³ As discussed below, the patent system seeks similar ends. See *infra* Part III.D.2.

²⁴ These categories are somewhat similar to those used by others. See, e.g., *In re Chilowsky*, 229 F.2d 457, 462 (C.C.P.A. 1956) (articulating three categories of inoperable inventions); MICHIO KAKU, PHYSICS OF THE IMPOSSIBLE, at xvii (2009) (dividing impossibilities into three broad categories).

that Nature is governed by reliable ‘laws’ allows us to separate the possible from the [truly] impossible.”²⁵ Perhaps the best example is alchemy, which is loosely defined as the quest to transform a cheap metal like lead into gold.²⁶ One reason why researchers proceed down dead-end paths is because they misunderstand the underlying science.²⁷

Type II impossibilities are pseudoscience, which are quests which appear scientific but lack scientific foundation.²⁸ A good example is the claim that an electrified cage can enhance the extrasensory perception (ESP)²⁹ of a human subject placed inside of it.³⁰ Pseudoscience’s identifying characteristics include widespread skepticism,³¹ the inability of others to reproduce the research claim,³² static or randomly changing

²⁵ BARROW, *supra* note 16, at vii.

²⁶ See 1 A COMPREHENSIVE TREATISE ON INORGANIC AND THEORETICAL CHEMISTRY § 12 (1922) (exploring the history of alchemy). Alchemists believed that “just as the hardness, color, fusibility, and other properties of certain metals can be altered, so must it be possible to change all the properties of one metal into those of another, and thus produce a veritable transmutation.” *Id.* As scientists began to understand nuclear physics, they learned how to transform one element into another with radioactivity. For a description of the first artificial atomic transmutation, see BERNARD JAFFE, CRUCIBLES: THE STORY OF CHEMISTRY FROM ANCIENT ALCHEMY TO NUCLEAR FISSION 214 (4th ed. 1976) (describing Nobel Laureate Ernest Rutherford’s conversion of nitrogen to oxygen in 1919).

²⁷ Were a *Type I* impossibility ever to become possible, “[it] would represent a fundamental shift in our understanding of [science].” KAKU, *supra* note 24, at xvii.

²⁸ GILA G. TILMAN, SCIENCE, PSEUDOSCIENCE, AND MORAL VALUES 20 (2007); see also SHERMER, *supra* note 22, at 33 (defining pseudoscience as “claims presented so that they appear scientific even though they lack supporting evidence and plausibility.”). Commentators differ in their views on the impact of pseudoscience on scientific progress. Compare JOHN GRANT, DISCARDED SCIENCE 9 (2006) (arguing that pseudoscience does not help and often impedes the advance of human knowledge) with RIKI G. A. DOLBY, UNCERTAIN KNOWLEDGE 207 (2002) (noting that chemistry and astronomy have pseudoscientific origins, and that Darwin’s theory of evolution morphed from pseudoscience to orthodoxy).

²⁹ Extrasensory perception, the “sixth sense,” is an awareness beyond the ordinary senses of hearing, sight, smell, taste, and touch. LYNNE KELLY, THE SKEPTIC’S GUIDE TO THE PARANORMAL 125 (2005).

³⁰ See Andrija Puharich, *Electrical Field Reinforcement of ESP*, 9 INT’L J. PARAPSYCHOL. 175, 175-83 (1967) (discussing general principles); ANDRIJA PUHARICH, BEYOND TELEPATHY 211-25 (1973) (describing the construction and operation of the cage and its effect on ESP). Puharich tried to patent his device. See *Puharich v. Brenner*, 415 F.2d 979, 981-83 (D.C. Cir. 1969) (affirming the rejection of a patent application for the device). Aside from doubting the results of the electrified cage experiments, most scientists remain skeptical about ESP. See *infra* note 31.

³¹ See, e.g., BARRY H. KANTOWITZ ET AL., EXPERIMENTAL PSYCHOLOGY 15 (9th ed. 2008) (“ESP cannot be evaluated[] because only believers can be present when it is demonstrated. The scientist takes a dim view of this logic and most scientists, especially psychologists, are skeptical about ESP.”).

³² See ADIL E. SHAMOO & DAVID B. RESNIK, RESPONSIBLE CONDUCT OF RESEARCH 51

ideas,³³ the lack of connectivity with other scientific disciplines,³⁴ and a lack of publications in the mainstream peer-reviewed literature.³⁵

Finally, *Type III* impossibilities includes quests which are technically impossible right now but might become possible at some point in the future.³⁶ A good example is a technique which will allow adults to regrow decayed, worn, or lost teeth.³⁷ In these quests, there is *something* that makes the impossible seem possible; which can range from a promising preliminary research result to a widespread positive vibe about the discipline. Nanotechnology is an excellent example.³⁸

(2d ed. 2009) (“The ability of other investigators to replicate the experiments by following the method in the published report is crucial to the advancement of science.”); SCOTT O. LILIENFELD ET AL., SCIENCE AND PSEUDOSCIENCE IN CLINICAL PSYCHOLOGY 8 (2004) (contending that pseudoscientists over-rely on anecdotal evidence, which is insufficient to justify a claim and is rarely dispositive).

³³ Unlike real science, where old ideas and knowledge evolve in light of new discoveries or growth in understanding, in pseudoscience ideas do not progress because there is no anchor in an established, foundational body of knowledge. GREGORY N. DERRY, WHAT SCIENCE IS AND HOW IT WORKS 159 (1999). Thus, ideas remain static because there no reason to accept one idea over another. *Id.*

³⁴ Given that pseudoscientists often purport to create new frameworks rather than build on existing ones, “they neglect well-established scientific principles or hard-won scientific knowledge.” LILIENFELD, *supra* note 32, at 7. For this reason, mainstream science “must insist on very high standards of evidence before [accepting the claim].” *Id.* at 8.

³⁵ Peer review refers to the screening of research results by colleagues in a particular discipline. Peter Herson & Candy Schwartz, *Peer Review Revisited*, 20 LIBR. & INFO. SCI. RES. 1, 1 (2006). Pseudoscientists may evade peer review because they fear that the process is inherently biased against their claims (particularly if it conflicts with well-established paradigms) or if their research methodologies do not conform to the scientific method. LILIENFELD, *supra* note 32, at 6.

³⁶ Cf. KAKU, *supra* note 24, at xvii (defining “Class I” impossibilities as those which are impossible today but may become possible in the future because they do not violate the laws of physics).

³⁷ See, e.g., Zunyi Zhang et al., *Antagonistic Actions of Msx1 and Osr2 Pattern Mammalian Teeth into a Single Row*, 323 SCIENCE 1232, 1232-34 (2009) (reporting that deleting a specific gene in mice led them to grow extra teeth); Kazuhisa Nakao et al., *The Development of a Bioengineered Organ Germ Methods*, 4 NATURE METHODS 227, 227-30 (2007) (describing a technique where researchers grew a budding tooth in a Petri dish and then transplanted it into the an empty cavity in a mouse’s mouth, where it grew to full size). Both groups believe that their findings will help elucidate how nature makes teeth and, eventually, lead to tooth regeneration in humans.

³⁸ Nanotechnology is a field of applied science based on the fabrication, control, and manipulation of materials on the atomic or molecular scale (one billionth of a meter). CHARLES P. POOLE & FRANK J. OWENS, INTRODUCTION TO NANOTECHNOLOGY 1 (2003). In a famous speech that he delivered to the American Physical Society over five decades ago, Nobel Laureate Richard Feynman predicted that one day scientists would be able to manipulate matter on the atomic or molecular scale. See Richard Feynman, *There’s Plenty of Room at the Bottom* (Dec. 29, 1959), in RICHARD P. FEYNMAN & JEFFREY ROBINS, THE PLEASURE OF FINDING THINGS OUT: THE BEST SHORT WORKS OF RICHARD P. FEYNMAN

These categories are important because it may be that the Patent Office and the courts are too quick to deem something as *per se* impossible (*Type I*) or pseudoscientific (*Type II*) when it is, in fact, possible now or will be at some not-too-distant point in the future (*Type III*).³⁹ When this miscategorization happens, it can result in delayed entry—or perhaps no entry at all—of inventions with true technical merit into the patent system.

II. PATENTING THE IMPOSSIBLE

A. *The Operability Requirement*

The patent system and mainstream science both rely on the dissemination of technical information to promote innovation.⁴⁰ And like mainstream science, the patent system relies on credibility assessments. It seeks to derail inventions that are so speculative or esoteric in nature that operativeness appears unlikely because a PHOSITA would consider the applicant's assertions unbelievable, incredible in light of contemporary knowledge, or factually misleading.⁴¹ At present the patent system relies on § 101 to perform this gatekeeping function.⁴² Specifically, the courts

117-39 (2000). It now appears that nanotechnology has endless possibilities, including nanoscale drug delivery systems, nanosurgery, nanorobots, nanomachines, and nanoelectronics. *See generally* FRITZ ALLHOFF ET AL., WHAT IS NANOTECHNOLOGY AND WHY DOES IT MATTER? (2010). The federal government spent nearly \$1.5 billion on nanotechnology research in 2009, which is up from \$464 million in 2001. *See* National Nanotechnology Initiative, at <http://www.nano.gov> (last visited Jan. 03, 2011).

³⁹ It is important to emphasize that the category depends on the invention, not the problem to be solved. For instance, an invention claiming a method of using milk to whiten skin might be pseudoscientific (a *Type II* impossibility; discussed *infra* notes 131-132); however, skin whitening is a problem that science can solve.

⁴⁰ *See* *Graham v. John Deere Co.*, 383 U.S. 1, 9 (1966) (describing a patent as “an inducement, to bring forth new knowledge”); *Brenner v. Manson*, 383 U.S. 519, 533 (1966) (“It is true, of course, that one of the purposes of the patent system is to encourage dissemination of information concerning discoveries and inventions.”); *Kewanee Oil Co. v. Bicron Corp.*, 416 U.S. 470, 481 (1974) (explaining that the information disclosed in the patent adds to the public storehouse of knowledge).

⁴¹ *In re Gazave*, 379 F.2d 973, 978 (C.C.P.A. 1967).

⁴² *See supra* note 8 and accompanying text. In addition to operability (or “credible” utility), the utility requirement of § 101 has two additional parts. *See generally* United States Patent and Trademark Office Utility Examination Guidelines, 66 Fed. Reg. 1092 (Jan. 5, 2001) (discussing substantial, specific, and credible utility), *cited with approval in In re Fisher*, 421 F.3d 1365, 1372 (Fed. Cir. 2005). Substantial utility requires that the invention provide “a significant and presently available benefit to the public.” *Id.* at 1371. Specific utility requires that the invention provide “a well-defined and particular benefit to the public.” *Id.* Together, these requirements preclude from patentability “mere ideas[,] hypothetical possibilities, objectives which the claimed [invention] . . . could possibly achieve” *In re ‘318 Patent Infringement Litig.*, 583 F.3d 1317, 1324 (Fed. Cir. 2009)

interpret the utility requirement of § 101 to mandate that an invention operate to produce the intended result.⁴³

1. The Examination Rubric

The Patent Office undertakes a two-step analysis to gauge operability. First, the examiner construes the relevant claims to precisely define the invention to be tested for compliance with § 101.⁴⁴ Second, if it appears that the invention cannot operate to produce the intended result, the examiner assesses credibility by asking if a PHOSITA would believe what the applicant asserts in the written description of the invention.⁴⁵ If the examiner determines that a PHOSITA would reasonably doubt the applicant's assertions, the invention is unpatentable under § 101 for lack of utility *and* under § 112 ¶1 for lack of enablement.⁴⁶ This dual rejection makes sense because an applicant cannot possibly enable a PHOSITA to practice an invention that does not work.⁴⁷

(quoting *Fisher*, 421 F.2d at 1373) (emphasis in original)).

⁴³ *Process Control Corp. v. HydReclaim Corp.*, 190 F.3d 1350, 1358 (Fed. Cir. 1999). The operability requirement can be traced back to the nineteenth century. See *Mitchell v. Tilghman*, 86 U.S. (19 Wall.) 287, 396 (1873) (holding that a patentable invention must be “capable of being used to effect the object proposed”). The utility requirement itself “has its origin in [the Intellectual Property Clause of] the Constitution, which indicates that the purpose of empowering Congress to authorize the granting of patents is “to promote the progress of . . . useful arts.” *Stiftung v. Reinshaw PLC*, 945 F.2d 1173, 1180 (Fed. Cir. 1991) (quoting U.S. Const. art. I, § 8, cl. 8) (emphasis in original).

⁴⁴ *Raytheon Co. v. Roper Corp.*, 724 F.2d 951, 956 (Fed. Cir. 1983). During examination the examiner must give claim terms their broadest reasonable interpretation as they would be understood by a PHOSITA yet consistent with the applicant's disclosure. *In re Morris*, 127 F.3d 1048, 1054 (Fed. Cir. 1997).

⁴⁵ *In re Brana*, 51 F.3d 1560, 1566 (Fed. Cir. 1995). The *written description* is the part of the patent (or patent application) that completely describes the invention. 35 U.S.C. § 112. It is often used interchangeably (and mistakenly) with the term *specification*. F. SCOTT KIEFF ET AL., *PRINCIPLES OF PATENT LAW* 73 n.6 (4th ed. 2008).

⁴⁶ See U.S. Patent & Trademark Office, *Manual of Patent Examining Procedure*, § 2107.01 (8th ed. 8th rev. 2010) [hereinafter MPEP] (discussing the dual rejection). Enablement is one of the three disclosure requirements appearing in the first paragraph of 35 U.S.C. § 112:

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 his invention.

35 U.S.C. § 112 ¶1 (emphasis added). A deeper discussion of enablement appears *infra* Part III.A.

⁴⁷ See *Process Control*, 190 F.3d at 1358 (“If a patent claim fails to meet the utility requirement because it is [inoperative], then it also fails to meet the how-to-use aspect of

A rejection triggers an evidentiary burden-shifting process. Initially the applicant's disclosure enjoys a presumption of truth; meaning that the examiner must initially presume that the invention *can* operate to produce the intended result.⁴⁸ This means that the examiner must establish a prima facie case of unpatentability by coming forward with factual evidence of noncredibility.⁴⁹ Evidentiary sources may include peer-reviewed materials, non-peer-reviewed materials, anecdotal information, information from related technologies, and logic.⁵⁰ If the examiner cannot adduce the evidence, the Patent Office must issue a patent if the applicant meets the other requirements for patentability.⁵¹

An applicant faced with an inoperability rejection can either attack or rebut the examiner's prima facie case. An applicant can successfully attack it if the examiner produces no (or insufficient) evidence to support a finding of inoperability.⁵² A good example is when the examiner relies on common knowledge in the field as proof that the invention cannot work.⁵³

the enablement requirement.”); *In re Ziegler*, 992 F.2d 1197, 1200-01 (Fed. Cir. 1993) (“The how-to-use prong of § 112 incorporates as a matter of law the requirement of 35 U.S.C. § 101. . . . If the application fails as a matter of fact to satisfy 35 U.S.C. § 101, then the application also fails as a matter of law to enable one of ordinary skill in the art to use the invention under 35 U.S.C. § 112.” (internal citations omitted)).

⁴⁸ *In re Cortright*, 165 F.3d 1353, 1357 (Fed. Cir. 1999); *see also* MPEP, *supra* note 46, § 2107.02 (instructing examiners not to begin the analysis by assuming that the asserted utility is false). The underpinnings of the presumption trace back to a C.C.P.A. case:

As a matter of Patent Office practice, a [written description] which contains a disclosure of utility which corresponds in scope to the subject matter sought to be patented must be taken as sufficient to satisfy the utility requirement of § 101 for the entire claimed subject matter *unless* there is a reason for [a PHOSITA] to question the objective truth of the statement of utility or its scope.

In re Langer, 503 F.2d 1380, 1391 (C.C.P.A. 1974) (emphasis in original).

⁴⁹ *In re Gaubert*, 524 F.2d 1222, 1224-25 (C.C.P.A. 1975); *see also In re Oetiker*, 977 F.2d 1443, 1445 (Fed. Cir. 1992) (explaining that the examiner bears the initial burden of presenting a prima facie case of unpatentability); *Fregeau v. Mossinghoff*, 776 F.2d 1034, 1038 (Fed. Cir. 1985) (applying the prima facie case to § 101).

⁵⁰ *In re Dash*, 118 F. App'x 488, 491 (Fed. Cir. 2004). The nature of the source “merely go to the weight of the evidence, not whether it can be relied upon at all.” *Id.*

⁵¹ *Oetiker*, 977 F.2d at 1445. The other patentability requirements appear *supra* note 7.

⁵² *See supra* note 49 and accompanying text; MPEP, *supra* note 46, § 2107.02 (encouraging examiners to provide documentary evidence whenever possible).

⁵³ The general rule is that the Patent Office “may take notice of facts beyond the record which . . . are capable of such instant and unquestionable demonstration as to defy dispute.” *In re Ahlert*, 424 F.2d 1088, 1091, C.C.P.A. 1970) (citation omitted). But, there are limits. First, as to core factual findings, the Patent Office “cannot simply reach conclusions based on its own understanding or experience—or on its assessment of what would be basic knowledge or common sense.” *In re Zurko*, 258 F.3d 1379, 1386 (Fed. Cir. 2001). For such facts, the Patent Office should point to concrete evidence in the record to support the rejection. *Id.* Second, if the examiner relies on common knowledge without documentary support, the rejection can survive only if it is based on sound technical

The applicant can also mount a successful attack if the examiner compels the inventor to explain precisely how or why an invention works,⁵⁴ or contends that the invention is partially operable,⁵⁵ performs crudely,⁵⁶ or is inferior to others.⁵⁷ Reliance on any of these is insufficient to establish the Patent Office's initial burden.⁵⁸

An alternative strategy is to concede the prima facie case and rebut it. The burden shifts to the applicant to come forward with persuasive arguments or additional evidence sufficient to convince a PHOSITA to

reasoning and the applicant does not demand that the examiner provide authority for the statement. *In re Chevenard*, 139 F.2d 711, 713 (C.C.P.A. 1943). Third, the Patent Office must give the applicant an opportunity to challenge a fact asserted to be common knowledge. *Id.*; *but see* *KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 418 (2007) (explaining that in the nonobviousness context, reliance on common sense, viewed through PHOSITA's perspective, is appropriate).

⁵⁴ *See* *Diamond Rubber Co. v. Consol. Rubber Tire Co.*, 220 U.S. 428, 435-36 (1911) (explaining that an inventor need not understand the scientific principles underlying the invention); *Newman v. Quigg*, 877 F.2d 1575, 1581 (Fed. Cir. 1989) (“[I]t is not a requirement of patentability that an inventor correctly set forth or even know, how or why the invention works”); *In re Newman*, 782 F.2d 971, 974 (Fed. Cir. 1986) (explaining that the Patent Office should not ask applicants for scientific explanations because the agency “is not a guarantor of scientific theory.” (citation omitted)); *In re Libby*, 255 F.2d 412, 415 (C.C.P.A. 1958) (explaining that enablement does not require an understanding of the underlying science).

⁵⁵ “The threshold [for] utility is not high.” *Juicy Whip, Inc. v. Orange Bang, Inc.*, 185 F.3d 1364, 1366 (Fed. Cir. 1999). An invention is inoperable only if it is “totally incapable of achieving a useful result.” *Brooktree Corp. v. Adv. Micro Devices, Inc.*, 977 F.2d 1555, 1571 (Fed. Cir. 1992); *cf.* *E.I. du Pont De Nemours & Co. v. Berkley & Co.*, 620 F.2d 1247, 1260 n.17 (8th Cir. 1980) (explaining proof of inoperability requires total incapacity), *cited with approval in* *Envirotech Corp. v. Al George, Inc.*, 730 F.2d 753, 762 (Fed. Cir. 1984). Thus, an applicant satisfies § 101 as long as the invention accomplishes at least one stated objective. *Raytheon*, 724 F.2d at 958.

⁵⁶ *Hildreth v. Mastoras*, 257 U.S. 27, 34 (1921) (“The machine patented may be imperfect in its operation; but if it embodies the generic principle and works . . . though only in a crude way . . . it is enough.”); *see also* *Nat'l Recovery Techs., Inc. v. Magnetic Separation Sys., Inc.*, 166 F.3d 1190, 1196 (Fed. Cir. 1999) (explaining that operability still exists even if the invention does not work perfectly under all conditions).

⁵⁷ *See* *Stiftung v. Reinshaw PLC*, 945 F.2d 1173, 1180 (Fed. Cir. 1991) (“An invention need not be the best or the only way to accomplish a certain result, and it need only be useful to some extent and in certain applications.”); *Custom Accessories, Inc. v. Jeffrey-Allan Indus.*, 807 F.2d 955, 960 n.12 (Fed. Cir. 1986) (“It is possible for an invention to be less effective than existing devices but nevertheless meet the statutory requirements for patentability.”); *In re Ratti*, 270 F.2d 810, 814 (C.C.P.A. 1959) (rejecting the Patent Office's contention that an invention “[must] possess some definite advantage over the prior art” in order to be patentable).

⁵⁸ If the examiner does not meet this initial burden, the applicant does not need to provide any additional evidence to substantiate its assertions, which are presumptively correct. *In re Brana*, 51 F.3d 1560, 1566 (Fed. Cir. 1995).

accept the applicant's assertions.⁵⁹ Applicants can rely on affidavits as proof of operability, although those from experts in the field which show a nexus between the intended result and the supporting evidence are most probative.⁶⁰ When the applicant submits rebuttal evidence, the examiner must "start over" and "consider all of the evidence anew."⁶¹ The examiner must determine patentability based on the *entire* record,⁶² with a preponderance of the evidence as the standard of proof.⁶³

Whether an invention is operable under § 101 is a question of fact.⁶⁴ While the type and amount of proof required depends on the nature of the invention, the degree of certainty regarding both the truth of the intended result and the ultimate fact of operativeness or inoperativeness is the same in all cases.⁶⁵ An invention rejected for inoperability under § 101 also faces rejection for lack of enablement under § 112¶1 because the applicant cannot teach a PHOSITA how to use something that does not work.⁶⁶ Whether a disclosure is enabling is a legal conclusion based on underlying factual inquiries.⁶⁷ On appeal,⁶⁸ the Federal Circuit reviews a finding of

⁵⁹ *In re Swartz*, 232 F.3d 862, 864 (Fed. Cir. 2000) (citing *Brana*, 51 F.3d at 1566); see also *In re Ferens*, 417 F.2d 1072, 1074 (C.C.P.A. 1969) (explaining that it is appropriate for the examiner to request evidence to substantiate the applicant's assertions when they appear to be incredible in light of contemporary knowledge in the field). But see *In re Novak*, 306 F.2d 924, 928 (C.C.P.A. 1962) (noting that rebuttal evidence is unnecessary if a PHOSITA would obviously accept the applicant's allegations as true).

⁶⁰ Cf. *In re Payne*, 606 F.2d 303, 315 (C.C.P.A. 1979) (noting that facts set forth in an affidavit from an expert in the field are highly probative); see also *In re Perrigo*, 48 F.2d 965, 966 (C.C.P.A. 1931) (determining that affidavits which were brief and general in character were insufficient to prove operability). Regarding the nexus, the affiant must be able to show that the intended result stems from the invention and not from some other source. See *Ferens*, 417 F.2d at 1075 (finding that affidavits from lay persons attesting to a cure for hair loss were unpersuasive because they evinced no understanding of the written description of the invention and could not show a nexus); *id.* at 1075 (rejecting an affidavit from a doctor who, though highly skilled, was not an expert in the field and thus could not adequately set forth experimental observations about the alleged cure for hair loss).

⁶¹ *In re Piasecki*, 745 F.2d 1468, 1472 (Fed. Cir. 1984) (internal citation omitted).

⁶² See MPEP, *supra* note 46, § 2107.02 (reminding examiners that incredible utility "is a conclusion, not a starting point for analysis" under § 101).

⁶³ *Oetiker*, 977 F.2d at 1445.

⁶⁴ *Raytheon*, 724 F.2d at 956.

⁶⁵ *Ferens*, 417 F.2d at 1075; *In re Chilowsky*, 229 F.2d 457, 462 (C.C.P.A. 1956) (explaining that the patent statutes and case law lead to this rule).

⁶⁶ See cases cited *supra* notes 46-47 and accompanying text.

⁶⁷ *Swartz*, 232 F.3d at 863.

⁶⁸ An applicant whose claims have been twice rejected by the examiner can appeal to an intraoffice tribunal known as the Board of Patent Appeals and Interferences which, among other things, reviews adverse decisions of examiners. See 35 U.S.C. §§ 6(b), 134(a). The Board can affirm a rejection or reverse and remand to the examining corps. 37 C.F.R. § 1.197 (2009). An applicant dissatisfied with a Board decision can appeal to the

(in)operability and the factual issues underlying enablement deferentially.⁶⁹

2. Proof

Gauging operability is easiest when the applicant can point to actual experimental data or a working model to prove that the invention works.⁷⁰ But unlike the rules of mainstream science, which “require actual performance of every experimental detail” as a prerequisite for publication,⁷¹ in patent law an inventor only needs to provide sufficient technical information to teach a PHOSITA how to practice the invention without undue experimentation.⁷² This means that an applicant usually does not need to actually reduce an invention to practice or produce a physical embodiment⁷³ of it in order to obtain a patent.⁷⁴ But even if an inventor

Federal Circuit or file a civil action against the Director in the U.S. District Court for the District of Columbia. 35 U.S.C. §§ 141, 145. In the latter, the parties may submit additional evidence or argue the previous evidence afresh. *Gould v. Quigg*, 822 F.2d 1074, 1076 (Fed. Cir. 1987).

⁶⁹ For appeals from the Patent Office, the Federal Circuit reviews legal conclusions *de novo* and factual findings for substantial evidence. *In re Gartside*, 203 F.3d 1305, 1315 (Fed. Cir. 2000) (clarifying standards of review for Patent Office decisionmaking); *Bruning v. Hirose*, 161 F.3d 681, 686 (Fed. Cir. 1998) (explaining that enablement is subject to *de novo* review). Where operability is at issue in a jury trial, the Federal Circuit determines if substantial evidence exists to support the verdict. *Brooktree Corp. v. Advanced Micro Devices, Inc.*, 977 F.2d 1555, 1571 (Fed. Cir. 1992). As for enablement, the Federal Circuit reviews the trial court’s legal conclusion *de novo* but reviews the underlying factual findings for substantial evidence (jury trial) or clear error (bench trial). *See Moba, B.V. v. Diamond Automation, Inc.*, 325 F.3d 1306, 1321 (Fed. Cir. 2003) (jury factfinding); *Amgen Inc. v. Hoechst Marion Roussel, Inc.*, 314 F.3d 1313, 1334 (Fed. Cir. 2003) (bench trial). While utility and enablement often involve complex scientific principles, the Federal Circuit views them not as “legal abstractions,” but as issues “[which] properly devolve on the trier of fact” who, as for other kinds of evidence, “must make determinations of credibility, reliability, and weight.” *Brooktree*, 977 F.2d at 1573.

⁷⁰ *Cf. Seymore, Teaching Function, supra* note 15, at 652-53 (advocating a working example requirement for complex technologies which would, among other things, simplify the enablement analysis).

⁷¹ *Hoffmann-La Roche, Inc. v. Promega Corp.*, 323 F.3d 1354, 1377 (Fed. Cir. 2003) (Newman, J., dissenting).

⁷² *Id.*

⁷³ An embodiment is a concrete form of an invention (like a chemical compound or a widget) described in a patent application or patent. ROBERT P. MERGES & JOHN F. DUFFY, *PATENT LAW AND POLICY* 26-27 (3d ed. 2002).

⁷⁴ *See Pfaff v. Wells Elecs., Inc.*, 525 U.S. 55, 60 (1998) (explaining that “the word ‘invention’ in the Patent Act unquestionably refers to the inventor’s conception rather than to a physical embodiment of that idea”). Thus, in patent law, an invention can be actually reduced to practice by building a working model or constructively reduced to practice by filing a patent application which describes how to make and use it. *Univ. of Rochester v. G. D. Searle & Co., Inc.*, 358 F.3d 916, 926 (Fed. Cir. 2004). A constructive reduction to

does engage in some pre-filing experimentation, there are practical reasons why it may be *de minimis*.⁷⁵

Thus, the key challenge for the Patent Office is gauging operability without actual proof. And since the Patent Office lacks an experimental testing facility, it has no way to independently verify the applicant's assertions.⁷⁶ Aside from cases involving perpetual motion machines,⁷⁷ where there is a working model requirement,⁷⁸ the Patent Office allows

practice presumptively satisfies the disclosure requirements of § 112 ¶1. *Hybritech Inc. v. Monoclonal Antibodies, Inc.*, 802 F.2d 1367, 1376 (Fed. Cir. 1986).

⁷⁵ See *infra* Part III.D.1.

⁷⁶ See, e.g., *Beckman Instruments, Inc. v. Chemtronics, Inc.*, 439 F.2d 1369, 1379 (5th Cir. 1970) (noting that in the absence of its own testing facilities, the Patent Office must rely on information presented to it); *In re Ziegler*, 833 F.2d 1024, 1987 WL 38838 (Fed. Cir. Oct. 29, 1987) (unpublished) (commenting on the absence of Patent Office laboratory facilities). Curiously, the Patent Act of 1836, ch. 356, § 6, 5 Stat. 117 (amended 1839), required applicants to submit models at the time of filing. See *In re Breslow*, 616 F.2d 516, 522 (C.C.P.A. 1980) (recounting the history of the requirement); Kendall J. Dood, *Patent Models and the Patent Law: 1790-1880 (Part 1)*, 65 J. PAT. OFF. SOC'Y 187, 187-216 (1983) (same). The Patent Act of 1870 made the submission of models discretionary. See Patent Act of 1870 §§ 28-29, ch. 230, §§ 28-29, 16 Stat. 198; *Breslow*, 616 F.2d at 522. The Patent Act of 1952 preserved the ancient authority in its then-existing form. See 35 U.S.C. § 114 (discussed *supra* note 74); *Breslow*, 616 F.2d at 522 (explaining that Congress had little interest in the statute).

⁷⁷ For an explanation of perpetual motion, see *supra* note 4.

⁷⁸ The patent statute permits the examiner to request a working model of an invention. See 35 U.S.C. § 114 ("The Director may require the applicant to furnish a model of convenient size to exhibit advantageously the several parts of his invention."). However, the Patent Office rarely invokes the requirement unless the invention involves perpetual motion. See MPEP, *supra* note 46, § 608.03 (noting the exception). The exception likely stems from Joseph Newman's fight in the Patent Office and the courts over the application he filed in 1979 for an "Energy Generation System Having Higher Energy Output than Input." See *Newman v. Quigg*, 681 F. Supp. 16, 16-17 (D.D.C. 1988) (presenting a chronology). After the Patent Office rejected the perpetual motion machine as inoperable under § 101, Newman sued the Director in district court which ultimately remanded the application for a new examination. See *In re Newman*, 782 F.2d 971, 972 (Fed. Cir. 1986) (summarizing the procedural history). This time the examiner ordered Newman to deliver a working model of his 9,000-pound machine to the National Bureau of Standards (NBS) for testing. *Id.* at 973-74; Ivars Peterson, *A Patent Pursuit: Joe Newman's "Energy Machine,"* SCI. NEWS, Jun. 1, 1985, at 342. On appeal, the Federal Circuit held that while the NBS could not dismantle the device to elucidate *how* it works, the agency could test it to see *if* it works. *Newman*, 782 F.2d at 974; accord *In re Anfhauser*, 399 F.2d 275, 283 (C.C.P.A. 1968). The NBS determined that the device could not produce the intended result, which led the Patent Office to again reject the application. See ROBERT E. HEBNER ET AL., NAT'L BUREAU OF STANDARDS, REPORT OF TESTS ON JOSEPH NEWMAN'S DEVICE 24 (NBSIR 86-3405, 1986) ("[I]n no case did the device's efficiency approach 100 percent."); *Newman*, 681 F. Supp. at 19-23 (describing the tests). The district court agreed with the Patent Office, *id.* at 23-24, as did the Federal Circuit. *Newman v. Quigg*, 877 F.2d 1575, 1582 (Fed. Cir. 1989). Interestingly, some scientists argue that perpetual motion is

applicants to choose their own way of establishing operability when the examiner questions it.⁷⁹

B. Problems

1. The Subjective Credibility Assessment

The test for operability is whether a PHOSITA has reason to doubt the objective truth of the applicant's assertions.⁸⁰ The Patent Office can establish reasonable doubt if the applicant's assertions "suggest an inherently unbelievable undertaking,"⁸¹ "involve implausible scientific principles,"⁸² "appear to run counter to what would be believed would happen by the [PHOSITA],"⁸³ or emerge from fields riddled with fraud or from which "little of a successful nature has been developed."⁸⁴ In each situation the examiner must turn to mainstream science to determine if the applicant's assertions are (in)credible in light of contemporary knowledge in the field.⁸⁵ Thus credibility in mainstream science and operability in patent law are tightly linked. But, in light of certain idiosyncrasies in mainstream science set forth below, one might ask if this should be the case.

a. Scientific Gatekeeping. In its efforts to advance scientific knowledge and maintain communal standards, mainstream science seeks to discourage *Type I* and *Type II* quests⁸⁶ while fostering those in *Type III*.⁸⁷ It

not necessarily impossible; rather, it just does not fit within the present framework of thermodynamics. *See, e.g.,* DOLBY, *supra* note 28, at 75 (exploring plausible scientific theories which are consistent with perpetual motion).

⁷⁹ MPEP, *supra* note 46, § 608.03.

⁸⁰ *See supra* notes 10 and 46 and accompanying text.

⁸¹ *In re Brana*, 51 F.3d 1560, 1566 (Fed. Cir. 1995) (quoting *In re Jolles*, 628 F.2d 1322, 1327 (C.C.P.A. 1980) (reversing the Patent Office's denial of a patent for chemotherapy drugs because the applicant's assertions that they effectively put a particular type of leukemia in remission were no longer incredible)).

⁸² *Id.*

⁸³ *In re Pottier*, 376 F.2d 328, 330 (C.C.P.A. 1967).

⁸⁴ *In re Gazave*, 379 F.2d 973, 978 (C.C.P.A. 1967) (quoting *In re Oberweger*, 115 F.2d 826, 827 (C.C.P.A. 1940) (concluding that treating baldness is impossible)).

⁸⁵ *See supra* note 50 and accompanying text.

⁸⁶ *See* JOHN M. ZIMAN, RELIABLE KNOWLEDGE 132 (1991) ("In order to retain its reliability and credibility, each scientist [must] exercise critical vigilance over his own work and the claims of his contemporaries."). This is not always an easy task. For example, consider cold fusion discussed *supra* note 5. While some scientists believe that it is impossible (first category) or pseudoscientific (second category), a growing number are optimistic and believe that it might be possible in a few decades (third category).

⁸⁷ Of course, this will depend on how "incredible" the quest appears at a particular moment in time. For example, initially the scientific community may reject the quest as truly impossible (*Type I*) or pseudoscientific (*Type II*). But a promising preliminary

does so by assessing credibility, which is the degree of belief scientists attach to a research claim and to the facts presented to support it.⁸⁸

The process begins when a researcher formally presents a claim to the scientific community by submitting a manuscript to a journal for publication.⁸⁹ At this point a legitimization mechanism kicks in with a built-in “knowledge filter” known as peer review at its core;⁹⁰ and with the journal editors and reviewers as the gatekeepers.⁹¹ Their mission is “[t]o promote original ideas, valuable approaches, or new methods[,] and to reject the mediocre ones.”⁹²

The gatekeepers fulfill this task by engaging in “organized skepticism” to ensure that each research claim is reproducible, logical, independent, and satisfies other basic conditions for communal acceptability.⁹³ As Professor Gregory Derry explains:

[A new research claim] must undergo peer review, which means that it’s sent to other scientists for criticism and judgment; only work judged as worthwhile will be published. The norm in science is to subject [research results] to criticism in order to weed out bogus results. The results that survive this process become a well-established consensus, and new results that contradict this consensus are greeted by particularly severe skepticism. [But] even the consensus remains subject to criticism, and that criticism becomes severe if new and contradictory results (having survived their own skeptical scrutiny) start to accumulate. Oddly enough, skepticism keeps open the

research result will shift the quest to *Type III*. See discussion *supra* Part I.B (discussing *Type III* impossibilities).

⁸⁸ JOHN M. ZIMAN, *REAL SCIENCE* 222 (2002) [hereinafter ZIMAN, *REAL SCIENCE*].

⁸⁹ DERRY, *supra* note 33, at 161; see also DARYL E. CHUBIN & EDWARD J. HACKETT, *PEERLESS SCIENCE: PEER REVIEW AND U.S. SCIENCE POLICY* 85 (1990) (explaining that publishing in journals replaced haphazard modes of circulating science and “facilitate[s] communication, allocation of credit, and authentication of research results.”).

⁹⁰ HENRY H. BAUER, *SCIENTIFIC LITERACY AND THE MYTH OF THE SCIENTIFIC METHOD* 44-48 (1992). The mechanics of peer review typically works as follows. First, the researcher submits the work to a journal. Second, the editor sends it to one or more reviewers knowledgeable about the problem to judge its merit (uniqueness, methodology, adequacy of research design, and potential contribution to the field). Third, the editor makes a final publication decision. Hernon & Schwartz, *supra* note 35, at 1.

⁹¹ FREDERICK GRINNELL, *EVERYDAY PRACTICE OF SCIENCE* 75 (2009) (explaining how a scientist with a new research claim must “get by the gatekeepers”).

⁹² Juan M. Campanario, *Have Referees Rejected Some of the Most-Cited Articles of All Times?*, 47 *J. AM. SOC’Y INFO. SCI.* 302, 302 (1996).

⁹³ ZIMAN, *REAL SCIENCE*, *supra* note 88, at 246; see also MARK ERICKSON, *SCIENCE, CULTURE, AND SOCIETY* 44 (2005) (explaining that a journal’s imprimatur validates the research claim and ascribes status to it). Although personal trust is very important in science, scientific communities “do not accept research claims on the mere say-so of their authors.” ZIMAN, *REAL SCIENCE*, *supra*, at 246.

possibility of change even as it tends [to] foster conservatism in science.⁹⁴

Many would agree that the active, systematic exercise of skepticism through peer review facilitates open communication, the interchange of ideas, and is largely responsible for the success of contemporary science.⁹⁵ But aside from publishing, peer review influences other facets of science; including anecdotal information, what constitutes common knowledge, and what scientists view as logical.⁹⁶

b. Credibility Lags in Mainstream Science. Peer review has serious drawbacks that can affect patent law.⁹⁷ Perhaps the major drawback is that the peer review process can delay, hinder, or block the dissemination of novel ideas.⁹⁸ There are several reasons why this is so. First, quantitative studies and anecdotal sources reveal that reviewers resist change.⁹⁹ They will often reject anything that clashes with then-existing ideas and

⁹⁴ DERRY, *supra* note 33, at 161.

⁹⁵ ELIEZER GEISLER, *THE METRICS OF SCIENCE AND TECHNOLOGY* 233 (2000).

⁹⁶ *See id.*; sources cited *supra* notes 86-90. As one commentator puts it, “[p]eer review pervades science from beginning to end.” Alister Scott, *Peer Review and the Relevance of Science*, 39 *FUTURES* 827, 828 (2007) (citation omitted).

⁹⁷ Peer review has also been the subject of considerable criticism from those within and outside of mainstream science. *See, e.g.*, Rustum Roy & James R. Ashburn, *The Perils of Peer Review*, 414 *NATURE* 393, 393-94 (2001) (arguing that peer review hinders good science); GEISLER, *supra* note 95, at 234 (collecting criticisms); Campanario, *supra* note 92, at 302 (same).

⁹⁸ Raymond E. Spier, *Peer Review and Innovation*, 8 *SCI. & ENG’G ETHICS* 99, 102 (2002). For stories and examples of delayed recognition, see Bernard Barber, *Resistance by Scientists to Scientific Discovery*, 134 *SCIENCE* 596, 597-602 (1961) (providing examples dating back to the 19th century); David F. Horrobin, *The Philosophical Bias of Peer Review and the Suppression of Innovation*, 263 *J. AM. MED. ASS’N* 1438, 1440-1441 (1990) [hereinafter Horrobin, *Philosophical Basis*] (18 examples); Moti Nissani, *The Plight of the Obscure Innovator in Science: A Few Reflections on Campanario’s Note*, 25 *SOC. STUD. SCI.* 165, 171-76 (1995) (47 examples).

⁹⁹ As one scientist argues, “[It] is not permissible is to write or say something which contradicts the shared paradigm, and expect it to be tolerated . . . because the shared paradigm, a necessary frame of reference in normal scientific communication, would be undermined.” IVOR CATT, *THE CATT ANOMALY* 31 (2001), at <http://www.ivorcatt.com/28anom.htm> (last visited Jan. 03, 2011). Often it is better for a scientist to “stop[] producing new, and perhaps unsettling, ideas” because “[r]ewriting or extending the best work of others, or one’s best pieces . . . could be easier, more rewarding, and more acceptable.” Graciela Chichilnisky, *Response*, in *REJECTED: LEADING ECONOMISTS PONDER THE PUBLICATION PROCESS* 57 (George B. Shepherd ed. 1995). Peer reviewers have rejected many research claims that ultimately transformed science; including those by future Nobel laureates Enrico Fermi (theory of radioactive decay), Paul Lauterbur (magnetic resonance imaging), and Hans Krebs (citric acid cycle). *See* Juan M. Campanario, *Rejecting and Resisting Nobel Class Discoveries: Accounts by Nobel Laureates*, 81 *SCIENTOMETRICS* 549, 551-58 (2009) (presenting stories from Nobel laureates rejected by scientific journals).

generally-accepted theories.¹⁰⁰ Second, many factors enter into a reviewer's calculus with have little or nothing to do with technical merit. These include: conservatism,¹⁰¹ bias,¹⁰² conflicts of interest,¹⁰³ jealousy,¹⁰⁴ fears of offending the science establishment,¹⁰⁵ an overwhelming interest in quality control,¹⁰⁶ and the inability to recognize brilliance.¹⁰⁷ In sum,

¹⁰⁰ DAVID SHATZ, PEER REVIEW: A CRITICAL INQUIRY 10 (2004); *see also* Chichilnisky, *supra* note 99, at 57 (“In my experience, the more innovative and interesting the paper, the more likely it is to be rejected . . .”); Stephen Lock, *Peer Review at Work*, 290 BRIT. MED. J. 1555, 1560 (1985) (disclosing an editor's admission that peer review “favor[s] unadventurous nibblings at the margin of truth rather than quantum leaps . . .”).

¹⁰¹ *See* THOMAS S. KUHN, THE STRUCTURE OF SCIENTIFIC REVOLUTIONS 64-65 (1962) (explaining that resistance to change will be strong and long-lasting when a new claim challenges well-accepted paradigms); DERRY, *supra* note 33, at 138 (“Very innovative ideas and unexpected results tend to get selectively filtered out, making peer review a force for conservatism in science.”); CHUBIN & HACKETT, *supra* note 89, at 90 (arguing that journal peer review works against innovation and reinforces scientific dogma).

¹⁰² *See generally* SHATZ, *supra* note 100, at 45-48 (explaining how bias operates in peer review). Potential types of bias include specialty bias, nationality bias, gender bias, age bias, and a bias toward positive results. *See* Ann M. Link, *U.S. and Non-U.S. Submissions: An Analysis of Reviewer Bias*, 280 J. AM. MED. ASS'N 246, 246-47 (1998) (concluding that U.S. reviewers have a significant preference for U.S. papers); Richard Smith, *Peer Review: A Flawed Process at the Heart of Science Journals*, 99 J. ROYAL SOC'Y MED. 178, 180 (2006) (describing the bias against work which discloses negative results); STEVE FULLER, *SCIENCE* 73 (1997) (articulating the operation of the “principle of cumulative advantage” where elite scientists form and maintain closed networks, which means that “the rich get richer and the poor get poorer” in the knowledge production business).

¹⁰³ *See* Drummond Rennie et al., *Conflicts of Interest in the Publication of Science*, 266 J. AM. MED. ASS'N 266, 266-67 (1991) (noting that while no one expects editors to serve as “the science police,” they must ensure that authors and reviewers disclose all potential conflicts).

¹⁰⁴ One commentator argues that many reviewers are against innovation unless it is their own because “[i]nnovation from others may . . . diminish[] the importance of the scientist's own work.” Horrobin, *Philosophical Basis*, *supra* note 98, at 1441.

¹⁰⁵ *See* FULLER, *supra* note 102, at 65 (explaining that since each scientific discipline has a few gatekeepers who pass judgment on everyone else, offending one “can be disastrous, much like failure to pay protection money to the local mafia boss”).

¹⁰⁶ *See* Horrobin, *Philosophical Basis*, *supra* note 98, at 1438 (arguing that “[q]uality control is one means of achieving an end, but it is not the end itself.”); *id.* at 1439 (arguing that any marginal improvement gained in research quality from rejecting a manuscript is no gain at all if it's done at the expense of innovation); Sandra Goldbeck-Wood, *Evidence on Peer Review—Scientific Quality Control or Smokescreen*, 318 BRIT. MED. J. 44, 45 (1999) (exploring difficulties with finding a bias-free metric to assess manuscript quality).

¹⁰⁷ *See* David F. Horrobin, *Peer Review: A Philosophically Faulty Concept Which Is Proving Disastrous for Science*, 5 BEHAV. BRAIN SCI. 217, 218 (1982) (arguing that since brilliance is rare, a less-than-brilliant reviewer probably would not recognize it and reject the claim), *reprinted in* PEER COMMENTARY ON PEER REVIEW 34 (Stevan R. Harnard ed. 1983).

whether and when the credibility gate opens is highly subjective and idiosyncratic.

Perhaps the major downside of this credibility lag for patent law is that it can compromise patent rights. The right to obtain a patent is extremely time sensitive. To illustrate, consider an inventor who files a patent application disclosing a seemingly impossible invention at time *X*. The examiner will turn to mainstream science to determine if the applicant's assertions are (in)credible in light of contemporary knowledge in the field.¹⁰⁸ If the gatekeepers do not credit the finding until time *Y*, the applicant will face an inevitable rejection. Importantly, refiling at or beyond time *Y* is often not a viable option because things have happened which probably have compromised patent rights.¹⁰⁹

2. What Happens When the Impossible Becomes Possible?

The history of science teaches that what was impossible yesterday might be possible today.¹¹⁰ Precisely when the impossible becomes possible depends on several factors; including the nature of the technology, the rate at which knowledge grows within a particular field, ingenuity, and serendipity.¹¹¹ But regardless of when this moment occurs, it can still take years for mainstream science to credit the claim.¹¹²

a. The Credibility Lag in Patent Law. The credibility lag in mainstream science has a parallel in patent law. Particularly susceptible to the latter are inventions emerging from nascent technologies; fields in rapid change, in a primitive stage of development, or in the midst of a technological renaissance; and quests which have a poor track record of success.¹¹³ Nevertheless, there will be *some* lag whenever the Patent Office

¹⁰⁸ See *supra* text accompanying note 85.

¹⁰⁹ For example, the Patent Act contains a loss-of-right provision, § 102(b), which precludes patentability for the inventor's own conduct. Particularly relevant here is that an inventor who discloses the invention in a printed publication (including a published patent application) more than one year before filing cannot obtain a patent. 35 U.S.C. § 102(b). In the context of the hypothetical, this means that the application filed at time *X* can defeat patentability at time *Y*. *In re Katz*, 687 F.2d 450, 454 (C.C.P.A. 1982).

¹¹⁰ See *supra* text accompanying note 17; H. LEE MARTIN, *TECHONOMICS* 89 (2006) (“[W]hat was impossible yesterday . . . becomes possible today and commonplace tomorrow.”); CEES J. HAMELINK, *THE TECHNOLOGY GAMBLE*, at x (1988) (arguing that since “the future cannot be seen as the linear extension of the past[,] it is essential to believe that what was impossible yesterday is tomorrow's possibility!”).

¹¹¹ See, e.g., LESLIE A. HORVITZ, *EUREKA!: SCIENTIFIC BREAKTHROUGHS THAT CHANGED THE WORLD* 1-10 (2002) (exploring various factors).

¹¹² See *supra* Part II.B.1.

¹¹³ See, e.g., *In re Swartz*, 232 F.3d 862 (Fed. Cir. 2000) (generating energy with “cold fusion”); *Newman v. Quigg*, 877 F.2d 1575 (Fed. Cir. 1989) (perpetual motion machine);

looks to mainstream science to determine if the applicant's assertions are credible in light of contemporary knowledge because any lag that exists in mainstream science will unavoidably pass through to the patent system.

Yet, the patent system exacerbates and protracts any artifactual lag stemming from mainstream science. Structural and substantive aspects of patent examination cause a technological lag. Given the technical nature of the examiner's job, one might expect this individual to know exactly what is happening at the forefront of theory and experiment in a particular discipline. This is not the case because the examiner is not an active researcher.¹¹⁴ In addition, the current incentive structure for Patent Office personnel combined with the examiner's time pressures and production goals afford little, if any, time for professional development.¹¹⁵ These realities essentially divorce examiners from the frontlines of science.¹¹⁶ The same is true, perhaps even more so, for judges who hear patent cases.¹¹⁷

Fregeau v. Mossinghoff, 776 F.2d 1034 (Fed. Cir. 1985) (using a magnetic field to alter the taste of food); *In re Eltgroth*, 419 F.2d 918 (C.C.P.A. 1970) (claiming a method for controlling the aging process); *In re Ruskin*, 354 F.2d 395 (C.C.P.A. 1966) (increasing the energy output of fossil fuels through exposure to a magnetic field).

¹¹⁴ See *supra* note 76 and accompanying text; David Hricik, *Aerial Boundaries: The Duty of Candor as a Limitation on the Duty of Patent Practitioners to Advocate for Maximum Patent Coverage*, 44 S. TEX. L. REV. 205, 225-26 (2002) (explaining that examiners no research laboratories and limited access to pertinent technical information).

¹¹⁵ See Arti K. Rai, *Growing Pains in the Administrative State: The Patent Office's Troubled Quest for Managerial Control*, 157 U. PA. L. REV. 2051, 2063-67 (2009) (describing examiner compensation and incentives); Joseph Farrell & Robert P. Merges, *Incentives to Challenge and Defend Patents: Why Litigation Won't Reliably Fix Patent Office Errors and Why Administrative Patent Review Might Help*, 19 BERKELEY TECH. L.J. 943, 944-45 (2004) (discussing biased procedures at the Patent Office which favor hasty examiner analysis and skewed incentives). The amount of time the Patent Office allots for an examiner to dispose of a case depends on factors like seniority and the technology involved. See U.S. GOV'T ACCOUNTABILITY OFFICE, U.S. PATENT & TRADEMARK OFFICE: HIRING EFFORTS ARE NOT SUFFICIENT TO REDUCE THE PATENT APPLICATION BACKLOG 7 (2007) (discussing production goals), available at <http://www.gao.gov/new.items/d071102.pdf>.

¹¹⁶ For thoughts on how this technology gap affects patent examination, see JAMES BESSEN & MICHAEL J. MEURER, *PATENT FAILURE* 161 (2008) (suggesting that the examiners' unfamiliarity with new technologies and lack of knowledge may hurt patent examination quality); John R. Allison & Ronald J. Mann, *The Disputed Quality of Software Patents*, 85 WASH. U. L. REV. 297, 315 (2007) (contending that "patent examiners unfamiliar with a cutting-edge technology like software may be less capable of assessing the quality of the disclosure or of the innovation than they are in technological areas with which they are more familiar.").

¹¹⁷ For thoughts on the disconnect between the judicial bench and the laboratory bench and the consequences for patent law, see Seymore, *Rethinking Novelty*, *supra* note 15, at 946-57 (exploring how the judiciary's unfamiliarity and discomfort with complex technologies has impacted the law of novelty); Seymore, *Heightened Enablement*, *supra* note 15, at 148-50 (arguing that the courts misunderstand what constitutes "undue

Consequently, patent law inevitably lags a step or two behind the cutting edge of science and technology.

Compounding this is evidence of bias against seemingly impossible inventions. History reveals that the Patent Office and the courts have approached seemingly impossible claims with skepticism for the sake of the public good. As the argument goes, there is a belief (albeit an incorrect one) among the public and potential investors that the government never issues patents on inoperable inventions.¹¹⁸ Strict policing of incredible claims, therefore, should protect both the public from potentially harmful products that do not work as claimed and potential investors from patentees who might seek to defraud them.¹¹⁹ Judge Giles Rich agreed; arguing that “[i]t is against public policy to place the oblique imprimatur of the Government via the patent grant on incredible or misleading unproven assertions.”¹²⁰ So it appears that elucidating what a PHOSITA would

experimentation”); Arti K. Rai, *Engaging Facts and Policy: A Multi-Institutional Approach to Patent System Reform*, 103 COLUM. L. REV. 1035, 1068 (2003) (highlighting the lack of technical expertise on the Federal Circuit); William D. Noonan, *Patenting Medical Technology*, 11 J. LEGAL MED. 263, 264-69 (1990) (tracing the history of the disconnect to technical and subjective factors).

¹¹⁸ Rislove, *supra* note 14, at 1280.

¹¹⁹ *Id.* For example, there was a time when the Patent Office and several judges believed that clinical evidence or FDA approval should be a prerequisite for patenting drugs which appear unsafe or risky. *Compare In re Hartop*, 311 F.2d 249, 260 (Smith, J., concurring) (criticizing the Patent Office’s position that it was “carrying out its statutory duty when [it] required proof of safety and effectiveness in man.”) *with id.* at 263-66 (Worley, C.J., dissenting) (agreeing with the Patent Office that Congress intended for it to work cooperatively with other agencies to ensure safety and effectiveness). Now it is clear that drug safety is not the Patent Office’s responsibility. *See In re Anthony*, 414 F.2d 1383, 1455-56 (C.C.P.A. 1969) (explaining that § 101 and other provisions of the patent statutes do not establish safety as a patentability criterion); *Scott v. Finney*, 34 F.3d 1058, 1063-64 (Fed. Cir. 1994) (same); *see also In re Sichert*, 566 F.2d 1154, 1160 (C.C.P.A. 1977) (noting that a minimal level of safety will satisfy § 101).

¹²⁰ *In re Citron*, 325 F.2d 248, 253 (C.C.P.A. 1963) (citation omitted); *cf. Isenstead v. Watson*, 157 F. Supp. 7, 9 (D.D.C. 1957) (contenting that the patent grant “gives a kind of official imprimatur to the [invention] in question on which as a moral matter some members of the public are likely to rely.”). The fear is that some might view the patent grant, albeit improperly, as the government’s endorsement of the technology. *See Timothy R. Holbrook, The Expressive Impact of Patents*, 84 WASH. U. L. REV. 573, 599-600 (2006) (explaining that governments may choose to deny patents on certain inventions in order to eliminate the signal of perceived endorsement or encouragement); Cynthia M. Ho, *Splicing Morality and Patent Law: Issues Arising from Mixing Mice and Men*, 2 WASH. U. J.L. & POL’Y 247, 253 n.29 (2000) (noting that issuing patents covering controversial technologies might be viewed as governmental endorsement). It is also true that a patentee “may advertise its patent to convince gullible consumers that a patent represents the government’s endorsement or imprimatur that the advertised product is actually effective.” Christopher R. Leslie, *Patents of Damocles*, 83 IND. L.J. 133, 144 (2008) (citation omitted). For a view contrary to *Citron* and *Isenstead*, *see Hartop*, 311 F.2d at 263 (“[T]he issuance

believe can devolve into a subjective judgment about the subject matter. Thus, for some quests, the Patent Office and the courts may develop a bias against patentability.

b. Example: The Legitimization of Baldness Treatment as a Credible Field. The pursuit of patents related to baldness treatments provides an excellent example of the contours of the credibility lag in patent law. The pervasiveness of hair loss,¹²¹ its social impact,¹²² and the sensitive nature of the topic¹²³ may explain why reversing baldness has been an obsession since ancient times.¹²⁴ History reveals, however, that most purported baldness cures have not worked.¹²⁵ So it is not surprising that inventors who seek patents on purported cures have faced huge credibility hurdles. But, it appears that several meritorious claims fell through the cracks because it took the Patent Office and the courts a long time to

of a patent is not in fact an ‘imprimatur’ as [to] safety and effectiveness . . . [A patent] is no guarantee of anything . . . The public, therefore, is not protected either by the granting or withholding of a patent.”)

¹²¹ See Ron Shapiro & Valerie D. Callender, *Hair Transplantation*, in HAIR AND SCALP DISEASES 175, 175 (Amy J. McMichael & Maria K. Hordinsky eds. 2008) (noting that in modern times, over 50% of men and 25% of women suffer from some degree of hair loss).

¹²² Throughout history, a full head of hair has been viewed as a sign of strength and virility. Perhaps the most famous story is that of Samson and Delilah:

So Delilah said to Samson, “Tell me the secret of your great strength . . .” [S]o he told her everything. “No razor has ever been used on my head,” he said. “[I]f my head were shaved, my strength would leave me, and I would become as weak as any other man.” After putting him to sleep on her lap, she called for someone to shave off the seven braids of his hair, and so began to subdue him. And his strength left him.

Judges 16: 6,17, 19 (New International).

¹²³ The Old Testament probably provides the most famous example. One day the prophet Elisha, who lost most of his hair at a young age, faced mockery from a group of boys while on a journey. See THOMAS J. CRAUGHWELL, *BAD KIDS OF THE BIBLE* 225-30 (2008) (comparing the story to *The Lord of the Flies*). According to Craughwell, “[t]his mockery of his hairless head made Elisha quite peevish.” *Id.* at 228. Indeed, it led to a gruesome result:

[Elisha] went up to Bethel. As he was walking along the road, some boys came out of the town and jeered at him. “Get out of here, baldy!” they said. “Get out of here, baldy!” He turned around, looked at them and called down a curse on them in the name of the Lord. Then two bears came out of the woods and mauled forty-two of the boys. And he went on to Mount Carmel . . .

2 Kings 2:23-25 (New International).

¹²⁴ See generally KERRY SEGRAVE, *BALDNESS: A SOCIAL HISTORY* 32-65 (1996) (exploring various quests and treatments throughout history); *id.* at 3 (discussing the first written medical record from ancient Egypt of recipes for baldness treatment).

¹²⁵ For a brief historical account of the various quests, see CHRISTOPHER WANJECK, *BAD MEDICINE* 48-52 (2003). Contemporary treatments include topical applications, drugs, herbal remedies, massage techniques, and lifestyle changes. See generally DANIEL J. VERRET, *PATIENT GUIDE TO HAIR LOSS AND HAIR RESTORATION* (2009).

recognize that it *is* possible to treat baldness.

The legal saga began with *In re Oberweger*,¹²⁶ a 1940 case where the applicant claimed that treating the scalp with a paste containing bone marrow, clover oil, and alcohol could regrow hair.¹²⁷ Recognizing that the prior art¹²⁸ contained “little of a successful nature,”¹²⁹ the applicant bolstered the claim with testimonials and an affidavit from a medical doctor attesting to the efficacy of the treatment.¹³⁰ Nevertheless, the Patent Office deemed the invention inoperable “since compositions for growing hair on the human scalp have *uniformly* proven unreliable.”¹³¹ The C.C.P.A. agreed and affirmed the rejection:

Certainly there is nothing in this record to show that appellant’s composition *is any better* than the many hundreds of similar concoctions that have been advertised and sold to a *credulous public* since the beginning of recorded history. It is a *matter of common knowledge* that numerous preparations . . . have been advertised and sold for the purpose of producing hair on bald heads . . . which [are] often harmful to the human body [and] generally understood to be a fraud upon the public.¹³²

Aside from the court’s improper comparison of the claimed invention to the prior art¹³³ and its heavy reliance on common knowledge to determine

¹²⁶ 115 F.2d 826 (C.C.P.A. 1940).

¹²⁷ *Id.* at 827.

¹²⁸ Prior art “constitutes documentary sources (patents and publications from anywhere in the world) and non-documentary sources (things known, used or invented in the United States)” that may be used to determine the novelty and nonobviousness of claimed subject matter in a patent application or patent. 1 DONALD S. CHISUM, CHISUM ON PATENTS, GLOSSARY, GI-8 (2010) [hereinafter CHISUM]; *see also* Kimberly-Clark Corp. v. Johnson & Johnson, 745 F.2d 1437, 1453 (Fed. Cir. 1984) (explaining that prior art is accessible technology in the public domain).

¹²⁹ *Oberweger*, 115 F.2d at 827.

¹³⁰ *Id.* When an applicant submits affidavits as proof of operability, they should show a nexus between the intended result and the supporting evidence. *See supra* note 60 and accompanying text.

¹³¹ *Oberweger*, 115 F.2d at 827. That the claimed composition comprised cheap and ordinary substances certainly raised suspicion. Indeed, the *Oberweger* court cited a case where the court invalidated a patent which claimed that a face cream made with whole milk could whiten skin. *See* Hall v. Duart Sales Co., 28 F. Supp. 838, 839 (D.C. Ill. 1939) (invalidating Massage and Cleansing Cream and Method of Preparing the Same, U.S. Pat. No. 1,668,503 (issued May 01, 1928), for a lack of utility because the addition of milk to the cream “d[id] nothing.”).

¹³² *Oberweger*, 115 F.2d at 829 (emphasis added); *cf.* Hall, 28 F. Supp. at 839 (“To pass the cream off as having, by reason of the addition of milk, any effect other than any other cream, would be a fraud.”).

¹³³ An invention need not possess some definite advantage over the prior art in order to be patentable. *See* sources cited *supra* note 57.

truth,¹³⁴ notably absent from the opinion was any discussion of the invention's scientific underpinnings or technical merit. Thus it appears that the court deemed baldness treatment a *Type II* impossibility.¹³⁵

The C.C.P.A. had to contend with baldness again almost thirty years later in *In re Ferens* (1969).¹³⁶ In that case the applicant claimed that applying a lanolin ointment containing the extract of the jaborandi plant to the scalp combined with electric current could regrow hair.¹³⁷ Here too the applicant buttressed the claim with affidavits from a medical doctor and twenty-one laypersons treated with the purported cure.¹³⁸ Although the applicant admittedly could have proffered more probative evidence,¹³⁹ from a technical standpoint the applicant's assertion was not inherently unbelievable because there were numerous reports in the scientific literature that pilocarpine, a pharmacologically active compound found in jaborandi leaves, could stimulate hair (re)growth.¹⁴⁰ This did not matter because the Patent Office and the C.C.P.A. once again deemed the invention impossible without exploring its scientific and technical merit. Thus, baldness treatments remained pigeonholed as a *Type I* or *Type II* quest because it was "a field of endeavor where little of a successful nature ha[d] been developed despite constant effort"¹⁴¹

Eventually the field emerged from the pigeonhole. One decade after *Ferens*, Upjohn obtained a patent for a method of using minoxidil (trade

¹³⁴ See *supra* note 53 (exploring the limits of facts asserted to be common knowledge).

¹³⁵ See *supra* text accompanying note 28.

¹³⁶ 417 F.2d 1072 (C.C.P.A. 1969).

¹³⁷ *Id.* at 1073. Jaborandi is an herbal shrub with small reddish-purple flowers found mainly in Brazil. BEN-ERIK VAN WYK & MICHAEL WINK, *MEDICINAL PLANTS OF THE WORLD* 239 (2004).

¹³⁸ *Ferens*, 417 F.2d at 1074.

¹³⁹ The court found the affidavits unpersuasive because they did not show a nexus between the intended result and the supporting evidence (in other words, that the intended result came from the invention and not from some other source). *Id.* at 1075. The court also doubted that a neuropsychiatrist could credibly opine on hair growth. *Id.*

¹⁴⁰ See, e.g., *Baldness and Its Treatment*, 2 *LANCET* 376, 376 (1892) (noting that the direct injection of either pilocarpine or an alcoholic extract of the jaborandi plant promotes hair growth but is too powerful a remedy for indiscriminate use); HOBART A. HARE, *A TEXTBOOK OF PRACTICAL THERAPEUTICS* 322 (1897) (providing a recipe for making a hair tonic for reversing partial baldness with jaborandi extract which contains an optimal level of pilocarpine); GEORGE T. JACKSON, *A PRACTICAL TREATISE ON THE DISEASES OF THE HAIR AND SCALP* 135 (1898) (reporting successful cases of hair regrowth in patients whose scalps were treated with a jaborandi paste over several weeks). Pilocarpine works by increasing the blood circulation around hair follicles and opening skin pores (which has the added benefit of promoting the uptake of other compounds into the scalp). STEVEN FOSTER & REBECCA L. JOHNSON, *DESK REFERENCE TO NATURE'S MEDICINE* 219 (2006).

¹⁴¹ *Ferens*, 417 F.2d at 1074.

name Rogaine®) to grow hair.¹⁴² The Patent Office subsequently granted hundreds of patents for methods of treating baldness. What is troubling about these patents is that many of them disclose treatments using rudimentary techniques and mundane materials previously frowned upon, including jaborandi.¹⁴³ The Federal Circuit completed the legitimization process in *In re Cortright* (1999),¹⁴⁴ when it proclaimed that treating baldness is “[not] an inherently unbelievable undertaking.”¹⁴⁵

c. Normative Thoughts. The legitimization of baldness treatment as a credible discipline shows that technical merit and good science can ultimately triumph over skepticism and subjective bias.¹⁴⁶ Indeed, this has been the story of other inventions initially (but wrongly) miscategorized by the Patent Office and the courts as impossible.¹⁴⁷ As a normative matter,

¹⁴² See 6-Amino-4-(Substituted Amino)-1,2-Dihydro-1-Hydroxy-2-Iminopyrimidine, Topical Compositions and Process for Hair Growth, U.S. Patent No. 4,139,619 (filed Aug. 19, 1977) (issued Feb. 13, 1979). Interestingly, Upjohn originally developed minoxidil in pill form to treat high blood pressure. See JOHN TOEDT ET AL., CHEMICAL COMPOSITION OF EVERYDAY PRODUCTS 40 (2005). However, the drug had an unexpected side effect: People who took it grew hair in an unexpected manner on their cheeks, foreheads, hands, and in other places. See SPENCER D. KOBREN, THE BALD TRUTH 4 (2000) (telling the minoxidil story). Researchers soon figured that applying minoxidil directly on a balding scalp might regrow hair on it. *Id.* Minoxidil is one of two FDA-approved treatments for treating male pattern baldness. See VERRET, *supra* note 125, at 49.

¹⁴³ See Composition and Method to Promote Human Hair Growth, U.S. Patent No. 7,238,375 (filed Dec. 20, 2004).

¹⁴⁴ 165 F.3d 1353 (Fed. Cir. 1999).

¹⁴⁵ *Id.* at 1357.

¹⁴⁶ But there have been some near misses. See Horrobin, *Philosophical Basis*, *supra* note 98, at 1439 (providing examples).

¹⁴⁷ Perhaps the best example is the quest to effectively treat cancer. For most of the 20th century, the Patent Office and the courts took the position that it was impossible to do so. See, e.g., *Ex parte Moore*, 128 U.S.P.Q. 8, 9-10 (Bd. Pat. App. 1960) (determining that any suggestion that the claimed compounds could treat cancer was incredible and misleading); *In re Citron*, 325 F.2d 248, 253 (C.C.P.A. 1963) (explaining that an effective cure for cancer appeared to be incredible in light of knowledge in the art). Applicants claiming success faced a formidable (if not insurmountable) patentability hurdle because the Patent Office could demand substantiating evidence from the applicant. *In re Novak*, 306 F.2d 924, 928 (C.C.P.A. 1962); *Citron*, 325 F.2d at 253 (determining that this was an appropriate standard for an invention “of as much public importance as the effective treatment of cancer.”). The situation changed in 1980 when the C.C.P.A. determined that successfully treating cancer is not inherently unbelievable. *In re Jolles*, 628 F.2d 1322, 1327 (C.C.P.A. 1980) (reversing a rejection for a drug claiming to effectively induce remission in leukemia patients). The Federal Circuit agreed. See *In re Brana*, 51 F.3d 1560, 1566 (Fed. Cir. 1995) (noting that treating cancer with chemical compounds “does not suggest an inherently unbelievable undertaking or involve implausible scientific principles” because “[m]odern science has previously identified numerous successful chemotherapeutic agents.”). As to the issue of heightened proof for therapeutics, the Federal Circuit has noted that requiring evidence such as FDA approval to satisfy § 101

this regime is unsettling for at least three reasons. First, science has evolved to a point where “the levels of *complexity* and *specialization* make it nearly impossible for [anyone] who is not intimately familiar with the activity to effectively and credibly evaluate it and its outcomes.”¹⁴⁸ Second, given that operability is an objective question (an invention either works or it does not), an applicant who presents a meritorious claim should not face rejection because of subjective credibility assessments. Third, credibility lags prevent the patent system from sitting at the cutting edge of technology;¹⁴⁹ a place where patent protection is often crucial.¹⁵⁰

III. TOWARD OBJECTIVE GATEKEEPING

A. Theoretical Underpinnings of the New Framework

The key technical question for gauging operability under § 101 is whether the invention can achieve the intended result.¹⁵¹ Closely related to operability is the enablement requirement of § 112 ¶1.¹⁵² Aside from policing claim scope,¹⁵³ it ensures that a PHOSITA can actually make and

could “eliminat[e] an incentive to pursue, through research and development, potential cures in many crucial areas such as the treatment of cancer.” *Brana*, 51 F.3d at 1568.

¹⁴⁸ GEISLER, *supra* note 95, at 219 (emphasis in original).

¹⁴⁹ Cf. Robert P. Merges, *Commercial Success and Patent Standards: Economic Perspectives on Innovation*, 76 CAL. L. REV. 803, 876 (1988) (arguing that the patent system should not employ a patentability test which compromises its primary goal to promote technological progress); see also *Bonito Boats, Inc. v. Thunder Craft Boats, Inc.*, 489 U.S. 141, 150-51 (1989) (noting that the patent system seeks to incentivize inventors who in turn provide the public with new and useful advances in technology); COMM’N ON INTELL. PROP. RTS. IN THE KNOWLEDGE-BASED ECON., NAT’L RES. COUNCIL, A PATENT SYSTEM FOR THE 21ST CENTURY 41 (Stephen A. Merrill et al. eds., 2004) (explaining that accommodating new technologies is an important condition for innovation).

¹⁵⁰ See, e.g., Clarisa Long, *Patent Signals*, 69 U. CHI. L. REV. 625, 647-49 (2002) (arguing that firms obtain patents to show their R&D acumen or technological capacity); Lemley, *Rational Ignorance*, *supra* note 2, at 1504-05 (suggesting that a firm may obtain a patent to “stake their claim” in an area of technology to signal to investors and competitors that it operates at the cutting edge).

¹⁵¹ *In re Cortright*, 165 F.3d 1353, 1357 (Fed. Cir. 1999); see also *In re Ruskin*, 354 F.2d 395, 396 (C.C.P.A. 1966) (“A process is operative if it produces its intended result.”).

¹⁵² See *supra* notes 46-48 and accompanying text.

¹⁵³ See *O’Reilly v. Morse*, 56 U.S. (15 How.) 62, 121 (1854) (explaining that a patentee “can lawfully claim only what he has invented and described, and if he claims more his patent is void.”); *Nat’l Recovery Techs., Inc. v. Magnetic Separation Sys., Inc.*, 166 F.3d 1190, 1196 (Fed. Cir. 1999) (explaining that the purpose of the enablement requirement is to “ensure[] that the public knowledge is enriched by the patent specification to a degree at least commensurate with the scope of the claims.”). The scope of enablement is the sum of what is taught in the written description plus what is known by a PHOSITA without undue experimentation. *Id.*

use what the applicant discloses.¹⁵⁴ Thus, operability and enablement both help to safeguard the technical integrity of issued patents by screening out inventions that cannot work.¹⁵⁵

Given the close relationship between the two statutory requirements, one might ask if it is possible to merge the § 101 and § 112 ¶1 analyses into a single issue when operability is contested. Not only can they be merged, but the single issue should be one of enablement.¹⁵⁶ As explained below, a robust enablement analysis can effectively ferret out impossible inventions *by itself* with no need for or help from its statutory cousin.¹⁵⁷ Importantly, § 112 ¶1 can perform the gatekeeping role through an objective, technical analysis rather than through subjective credibility assessments which lie at the heart of the operability paradigm.¹⁵⁸ This enablement-based approach for determining whether an invention works would eliminate the need for the § 101 operability requirement.

Before explaining how § 112 ¶1 can perform the gatekeeping role, it is important to define more precisely what it means for an invention to be enabled. Enablement exists if a PHOSITA, after reading the applicant's disclosure, can practice the full scope of the claimed invention *at the time of*

¹⁵⁴ Bayer AG v. Schein Pharms., Inc., 301 F.3d 1306, 1314 (Fed. Cir. 2002) (“The enablement requirement ensures that that a specification shall disclose an invention in such a manner as will enable one skilled in the art to make and utilize it.”).

¹⁵⁵ As the Federal Circuit recently explained:

Enablement is closely related to the requirement for utility, [which] prevents mere ideas from being patented. As we noted [previously,] “[p]atent protection is granted in return for an enabling disclosure of an invention, not for vague intimations of general ideas that may or may not be workable Tossing out the mere germ of an idea does not constitute enabling disclosure.”

In re ‘318 Patent Infringement Litig., 583 F.3d 1317, 1323-24 (Fed. Cir. 2009) (quoting Genentech, Inc. v. Novo Nordisk A/S, 108 F.3d 1361, 1366 (Fed. Cir. 1997)).

¹⁵⁶ In a nonprecedential opinion dealing with cold fusion, the Federal Circuit seemingly did the opposite; meaning that the court collapsed the two issues into a question of operability. See *In re* Dash, 118 F. App'x 490-92 (Fed. Cir. 2004).

¹⁵⁷ See *infra* Part III.C.

¹⁵⁸ See *infra* notes 162-163 and accompanying text. For references to the objective nature of the enablement requirement, see 2 R. CARL MOY, MOY'S WALKER ON PATENTS § 7:45 (4th ed. 2008) (noting that enablement “address[es] whether the technological quality of the [applicant's disclosure] meets an objective, minimum standard.”); *In re* Marzocchi, 439 F.2d 220, 223 (C.C.P.A. 1971) (explaining that since § 112 ¶1 only requires “objective” enablement, precisely how an applicant complies with it is immaterial); *Glaxo Inc. v. Novopharm Ltd.*, 52 F.3d 1043, 1050 (Fed. Cir. 1995) (“[T]he enablement requirement . . . looks to the objective knowledge of [a PHOSITA.]”); *Bayer AG v. Schein Pharm., Inc.*, 301 F.3d 1306, 1314 (Fed. Cir. 2002) (explaining that “an enabling disclosure by definition turns upon the objective understanding of a [PHOSITA.]”); *Ariad Pharm., Inc. v. Eli Lilly & Co.*, 598 F.3d 1336, 1366 (Fed. Cir. 2010) (Rader, J., concurring-in-part and dissenting-in-part) (noting that enablement is an objective inquiry which focuses on the four corners of the applicant's written description).

*filing*¹⁵⁹ without undue experimentation.¹⁶⁰ Enablement is a legal conclusion which rests on underlying factual inquiries.¹⁶¹

In *In re Wands* (1988), the Federal Circuit set forth several factors relevant to the enablement analysis.¹⁶² They are: (1) the amount of direction or guidance presented in the disclosure; (2) the existence working examples; (3) the nature of the invention; (4) the predictability or unpredictability of the art; (5) the PHOSITA's relative skill; (6) the state of the prior art; (7) the breadth of the claims; and (8) the quantity of experimentation necessary to practice the claimed invention.¹⁶³ While not mandatory,¹⁶⁴ the *Wands* factors are ubiquitous in evaluating enablement,¹⁶⁵ probably because they touch on issues which are important in virtually all enablement determinations.¹⁶⁶ These include issues related to the technical scope and substance of the disclosure (factors one and two),¹⁶⁷ the nature of

¹⁵⁹ *In re Glass*, 492 F.2d 1228, 1232 (C.C.P.A. 1974); accord *In re Hogan*, 559 F.2d 595, 607 (C.C.P.A. 1977) (reaffirming rule); *Enzo Biochem, Inc. v. Calgene, Inc.*, 188 F.3d 1362, 1371-1372 (Fed. Cir. 1999) (explaining that in both patent examination and litigation the enablement determination “is made *retrospectively*, i.e., by looking back to the filing date of the patent application and determining whether undue experimentation would have been required to make and use the claimed invention at that time.” (emphasis in original)).

¹⁶⁰ *Wright*, 999 F.2d at 1561; see also *Sitrick v. Dreamworks, LLC*, 516 F.3d 993, 999 (Fed. Cir. 2008) (reaffirming the standard). If the disclosure lacks sufficient detail, a PHOSITA can presumably rely on knowledge in the field to fill in the missing information. *AK Steel Corp. v. Solloc & Ugine*, 344 F.3d 1234, 1244 (Fed. Cir. 2003). While “undue experimentation” does not appear in the statute, “it is well established that enablement requires that the specification teach those in the art to make and use the invention without undue experimentation.” *In re Wands*, 858 F.2d 731, 737 (Fed. Cir. 1988).

¹⁶¹ *Sitrick*, 516 F.3d at 999. For the applicable standards of review for enablement, see *supra* note 69.

¹⁶² 858 F.2d 731 (Fed. Cir. 1988).

¹⁶³ *Id.* at 737. The list of factors found its roots in the Patent Office. See *Ex parte Forman*, 230 U.S.P.Q. 546, 547 (B.P.A.I. 1986) (articulating eight factors for determining undue experimentation).

¹⁶⁴ See *Amgen, Inc. v. Chugai Pharm. Co.*, 927 F.2d 1200, 1213 (Fed. Cir. 1991) (noting that the *Wands* factors are illustrative and not mandatory).

¹⁶⁵ See 3 CHISUM, *supra* note 128, § 7.03 (collecting cases).

¹⁶⁶ The factors are interrelated. For example, if the PHOSITA is really smart (factor five), an applicant need not disclose what the PHOSITA already knows or can easily figure out (factors one and two). *Webster Loom Co. v. Higgins*, 105 U.S. 580, 586 (1881) (“[A patentee] may begin at the point where his invention begins, and describe what he has made that is new”); *Spectra-Physics, Inc. v. Coherent, Inc.*, 827 F.2d 1524, 1534 (Fed. Cir. 1987) (“A patent need not teach, and preferably omits, what is well known in the art.”).

¹⁶⁷ The technical substance of the disclosure lies at the heart of the enablement analysis. See *supra* notes 153, 154, 160, and accompanying text. The two factors are clustered together because working examples are a form of guidance. Seymore, *Teaching Function*, *supra* note 15, at 641-46.

the technology (factors three and four),¹⁶⁸ the PHOSITA's knowledge and skill (factor five),¹⁶⁹ and the claim scope sought (factor seven).¹⁷⁰

For present purposes the *Wands* factors are useful in two respects. First, they provide the decisionmaker with a list of objective, technical issues to consider in gauging enablement. Second, they are well-suited to handle inventions emerging from new, poorly understood, and paradigm-shifting technologies as well as those from fields with a poor track record of success. Most (if not all) seemingly impossible inventions can be so classified.¹⁷¹ Thus, a decisionmaker can use the factors to readily resolve whether a seemingly impossible invention can achieve the intended result.

B. Formulating a Screen

1. The Challenge

Given that enablement is a fact-intensive inquiry,¹⁷² it stands to reason that certain *Wands* factors can be more relevant than others in a

¹⁶⁸ One way to determine the requisite amount of teaching is whether the underlying technology is “unpredictable” or “predictable.” The experimental sciences are regarded as “unpredictable” because PHOSITAs in these fields often cannot predict if a reaction protocol that works for one embodiment will work for others. *See, e.g., Cedarapids, Inc. v. Nordberg, Inc.*, No. 95-1529, 1997 WL 452801 at *2 (Fed. Cir. Aug. 11, 1997) (explaining that in the chemical arts, “a slight variation . . . can yield an unpredictable result or may not work at all.”). On the other hand, inventions in applied technologies like electrical and mechanical engineering are often regarded as “predictable” arts because they are rooted in well-defined, predictable factors. *In re Vaeck*, 947 F.2d 488, 496 (Fed. Cir. 1991). For a deeper exploration of the predictable-unpredictable dichotomy, see Sean B. Seymore, *The Enablement Pendulum Swings Back*, 6 NW. J. TECH. & INTELL. PROP. 278, 282-84 (2008) [hereinafter Seymore, *Enablement Pendulum*]; Seymore, *Heightened Enablement*, *supra* note 15, at 136-54.

¹⁶⁹ This factor has become increasingly important over the past decade as the Federal Circuit has compelled patentees to enable the full scope of the claimed invention. *See, e.g., AK Steel*, 344 F.3d at 1244 (determining that where the claims covered a Type 1 or a Type 2 aluminum coating, yet the patent only described a Type 2 coating, the claims were nonenabled because a PHOSITA could not fill in the gaps without undue experimentation); *ALZA Corp. v. Andrx Pharms., LLC*, 603 F.3d 935, 941-42 (Fed. Cir. 2010) (holding that the district court properly determined the PHOSITA's level of skill and did not err in giving less weight to a witness analyzed an issue using the wrong level of skill). For commentary on the importance of the PHOSITA in the enablement context, see Seymore, *Enablement Pendulum*, *supra* note 168, at 284-92; Seymore, *Heightened Enablement*, *supra* note 25, at 134-39.

¹⁷⁰ Enablement places an outer limit on claim scope. *Nat'l Recovery Techs.*, 166 F.3d at 1196.

¹⁷¹ *See supra* note 113 and accompanying text.

¹⁷² *See supra* notes 161-164 and accompanying text.

particular case.¹⁷³ It also stands to reason that for inventions which have similar characteristics, the same subset of *Wands* factors are always highly relevant since similar inventions present similar enablement challenges.¹⁷⁴ In the case of seemingly impossible inventions, the most relevant subset of factors are those closely related to the PHOSITA's knowledge and abilities. To explain why, it is helpful to consider the challenges faced by a PHOSITA who wants to practice a seemingly impossible invention. Perhaps the major challenge is what can be called the knowledge deficit. In the technologies from which seemingly impossible inventions emerge, there tends to be little or no helpful knowledge for the PHOSITA to draw from. The knowledge deficit can stem from a poor track record of success, the paradigm-shifting nature of the technology, or other reasons.¹⁷⁵ This means that determining the PHOSITA's level of skill (being careful not to overestimate it)¹⁷⁶ and the technical scope and substance of the disclosure are very important because the PHOSITA must rely heavily, if not

¹⁷³ *Amgen*, 927 F.2d at 1213. Relatedly, a decisionmaker need not evaluate each factor before making an enablement determination. *Id.*

¹⁷⁴ *See, e.g.*, *Chiron Corp. v. Genentech, Inc.*, 363 F.3d 1247, 1254 (Fed. Cir. 2004) (noting that nascent technologies “must be enabled with a ‘specific and useful teaching.’” (quoting *Genentech*, 108 F.3d at 1367-68)); *Vaack*, 947 F.2d at 496 (noting that the requisite level of disclosure for an invention involving predictable mechanical or electrical elements is less than that required for the unpredictable arts).

¹⁷⁵ *See supra* note 171 and accompanying text.

¹⁷⁶ Recall that enablement is always assessed retrospectively. *See supra* note 159. Overestimating the PHOSITA's level of skill typically happens for two reasons. First, the PHOSITA's knowledge and abilities can evolve over time; most notably between the time of filing and the time of the enablement analysis. As Professor Holbrook has explained, “Enablement, while conceptually simple, is legally and factually complex [because] whether a disclosure is enabling can shift over time; as the knowledge of the PHOSITA shifts, an identical disclosure may shift from not being enabled to being enabled.” Timothy R. Holbrook, *Possession in Patent Law*, 59 SMU L. REV. 123, 130 (2006) (internal citation omitted) [hereinafter Holbrook, *Possession*]; Timothy R. Holbrook, *Equivalency and Patent Law's Possession Paradox*, 23 HARV. J.L. TECH. 1, 41-43 (2009) (making a similar argument). Second, there is the problem of hindsight bias. It “will normally lead fact-finders to overestimate the level of skill in the art, since subsequent advances will suggest that the invention could not have been that difficult to do.” Dan L. Burk & Mark A. Lemley, *Is Patent Law Technology-Specific?*, 17 BERKELEY TECH. L.J. 1155, 1199 (2002); *cf.* Gregory N. Mandel, *Patently Non-Obvious: Empirical Demonstration That the Hindsight Bias Renders Patent Decisions Irrational*, 67 OHIO ST. L.J. 1391, 1402 (2006) (“Critical for patent law, once individuals have hindsight information, they consistently exaggerate what could have been anticipated in foresight and not only tend to view what has occurred as having been inevitable, but also as having appeared relatively inevitable beforehand.”); R. Polk Wagner, *Reconsidering Estoppel: Patent Administration and the Failure of Festo*, 151 U. PA. L. REV. 159, 205 (2002) (“[In considering] enablement, which is measured through the lens of the knowledge of the relevant field as of the filing date of the patent application[,] [a]s the filing date becomes distant, the potential for cognitive biases, such as a hindsight bias, increases.”).

exclusively, on the instruction provided within the four corners of the patent document in order to practice the invention.¹⁷⁷

Given the importance of the patent document, it is clear that the patentee needs to provide a disclosure of high technical quality. The best way to do this is with working examples.¹⁷⁸ They show with actual technical detail that the invention can really achieve the intended result.¹⁷⁹ As explained below, it is this technical detail which makes the existence of working examples the most important *Wands* factor for seemingly impossible inventions.

2. The Importance of Working Examples

It is axiomatic that the best way to teach a technical subject is with working examples.¹⁸⁰ They lie at the core of technical publications because they provide the best form of guidance and direction for replicating what is disclosed therein.¹⁸¹ In patent documents their presence “facilitates, if not ensures, enablement of an invention.”¹⁸²

Working examples can perform functions which extend beyond teaching. Of particular importance for present purposes is an evidentiary function. Providing a tangible method for achieving the intended result

¹⁷⁷ Cf. *Chiron*, 363 F.3d at 1254 (making a similar observation for inventions emerging from unpredictable technologies).

¹⁷⁸ Seymore, *Teaching Function*, *supra* note 15, at 642.

¹⁷⁹ *Mazzari v. Rogan*, 323 F.3d 1000, 1005 (Fed. Cir. 2003) (citing *Cooper v. Goldfarb*, 154 F.3d 1321, 1327 (Fed. Cir. 1998)). Of course, working examples vary in technical quality and helpfulness to the PHOSITA. Relevant variables include how the research was performed (and in particular, whether it was done according to the scientific method), the amount of information disclosed, lucidity, logical reasoning, and other factors. See HEATHER SILYN-ROBERTS, *WRITING FOR SCIENCE AND ENGINEERING* 39-44 (2000) (explaining how to disclose experimental results).

¹⁸⁰ See, e.g., George Gore, *On Practical Scientific Instruction*, 7 Q.J. SCI. 215, 228 (1870) (asserting that one who teaches a technical subject must teach with examples which should be full of practical applications and familiar illustrations); Seymore, *Teaching Function*, *supra* note 15, at 641-54 (making a similar argument in the patent law context).

¹⁸¹ See, e.g., SHAMOO & RESNIK, *supra* note 32, at 51 (“The ability of other investigators to replicate the experiments by following the method in the published report is crucial to the advancement of science.”); BERT A. DAY & BARBARA GASTEL, *HOW TO WRITE AND PUBLISH A SCIENTIFIC PAPER* 61 (6th ed. 2006) (noting that disclosing the experimental methods is important because the scientific community must adjudge the results reproducible before attaching scientific merit to the work).

¹⁸² Bratislav Stankovic, *The Use of Examples in Patent Applications*, 18 INTELL. PROP. & TECH. L.J. 9, 10 (2006). But, as with other forms of enablement, the breadth of the teaching provided in a working example must be commensurate with the claim scope sought. See cases cited *supra* note 153. A teaching which lacks specificity or provides inadequate guidance will result in a narrow(ed) claim scope (*Wands* factor eight). BURK & LEMLEY, *supra* note 2, at 115.

establishes credibility by signaling that the underlying research represents good science.¹⁸³ Indeed, working examples distinguish good science from speculative theories by extinguishing the fires of suspicion.¹⁸⁴

The facts in *In re Eltgroth* (1970) illustrate this point.¹⁸⁵ The applicant claimed a method for controlling aging by manipulating the concentration of isotopes of specific elements within an organism.¹⁸⁶ While the scientific literature taught how to manipulate isotope concentrations, the applicant did not explain how doing so could control aging.¹⁸⁷ The failure to provide a tangible method for achieving the intended result led the Patent Office to reject the claim under both § 112 ¶1 and § 101.¹⁸⁸ In affirming the rejection, the C.C.P.A. noted the inadequate teaching and “a conspicuous absence of proof” in the disclosure:

Not one example is given. Not one isotope [affecting] aging is identified Moreover, appellant has . . . failed to show how knowledge available to [PHOSITAs] would enable them to make and use his invention despite the lack of specific disclosure [A]ppellant has provided no more than a speculative theory or hypothesis¹⁸⁹

¹⁸³ See MARGARET CARGILL & PATRICK O’CONNOR, WRITING SCIENTIFIC RESEARCH ARTICLES 35 (2009) (noting that a goal for disclosing experimental procedures is to establish credibility in the work); MARTHA DAVIS, SCIENTIFIC PAPERS AND PRESENTATIONS 61 (2005) (explaining that the experimental section of a scientific paper “is the very foundation of the scientific merit and feasibility of the work.”); DAY & GASTEL, *supra* note 181, at 61 (arguing that working examples are essential for showing that the potential for reproducing the result exists; otherwise the work is not good science).

¹⁸⁴ See David S. Wainwright, *Patenting Around Nuisance Prior Art*, 81 J. PAT. & TRADEMARK OFF. SOC’Y 221, 224 (1999) (explaining that patent applications which lack working examples can raise suspicion because “[i]t can be difficult for one outside the art to know whether a specific item is enabling or not.”); *cf. In re Lorenz*, 305 F.2d 875, 878 (C.C.P.A. 1962) (stating that the strong and comprehensive language of § 112 evinces Congress’s intent for applicants to “make a full and complete disclosure of their invention, leaving nothing to speculation or doubt”).

¹⁸⁵ 419 F.2d 918, 918 (C.C.P.A. 1970).

¹⁸⁶ Isotopes are atoms of a particular element with which differ in the number of neutrons. Importantly, isotopes of a given element differ in chemical properties. See *generally* LINUS PAULING, GENERAL CHEMISTRY (3d ed. 1988).

¹⁸⁷ *Eltgroth*, 419 F.2d at 921.

¹⁸⁸ *Id.* at 919-920. The Patent Office found a statement in Supreme Court opinion particularly appropriate:

[A] patent is not a hunting license. It is not a reward for the search, but compensation for its successful conclusion. “[A] patent system must be related to the world of commerce rather than to the realm of philosophy.”

Brenner v. Manson, 383 U.S. 519, 536 (1966) (quoting *In re Ruschig*, 343 F.2d 965, 970 (C.C.P.A. 1965) (Rich, J.)).

¹⁸⁹ *Eltgroth*, 419 F.2d at 921.

The applicant's inadequate teaching essentially invited a PHOSITA to engage in undue experimentation to achieve the intended result.¹⁹⁰

Working examples also provide the best evidence that what was impossible at one point in time is now possible (a *Type III* impossibility).¹⁹¹ Similarly, the absence of working examples can signal that a putative invention is *per se* impossible (*Type I*) or pseudoscientific (*Type II*). This is why enablement matters because there is no way that an applicant claiming an invention falling into one of these two categories can provide a *working* example which achieves the intended result.¹⁹²

In sum, working examples allow § 112 ¶1 to provide an objective, fact-intensive route to elucidating whether a seemingly impossible invention can achieve the intended result. Given their central role in the enablement analysis, there should be an across-the-board working example requirement in patent law¹⁹³ except for inventions in which enablement “is so apparent as to virtually jump off the page and slap a PHOSITA in the face.”¹⁹⁴

¹⁹⁰ *Id.*

¹⁹¹ In other words, working examples can show that the state of the art has advanced far enough to allow a PHOSITA to achieve the intended result. See discussion *supra* notes 36-38 and accompanying text. For instance, working examples helped convince the Patent Office and the courts that it is possible to successfully treat cancer. Compare *In re Citron*, 325 F.2d 248, 249-53 (C.C.P.A. 1963) (explaining that applicants' invention relating to an alleged effective treatment for cancer, which lacked specific tests, experiments, or clinical data, asserted incredible utility in the light of the knowledge of the art) with *In re Jolles*, 628 F.2d 1322, 1326-28 (C.C.P.A. 1980) (concluding that clinical tests, combined with the close structural similarity of the claimed compounds with chemotherapeutics known in the art, would allow a PHOSITA to accept the claimed utility) and *In re Brana*, 51 F.3d 1560, 1566 (Fed. Cir. 1995) (noting that treating cancer with chemical compounds “does not suggest an inherently unbelievable undertaking or involve implausible scientific principles” because “[m]odern science has previously identified numerous successful chemotherapeutic agents.”).

¹⁹² Cf. Seymore, *Teaching Function*, *supra* note 15, at 653 (arguing that it is easier for an examiner to gauge enablement with actual experimental results than with other types of support).

¹⁹³ See Seymore, *Heightened Enablement*, *supra* note 15, at 156-58; Seymore, *Teaching Function*, *supra* note 15, at 641-54. Professor Cotropia also advocates an actual reduction to practice requirement in patent law. See Christopher A. Cotropia, *The Folly of Early Filing in Patent Law*, 61 HASTINGS L.J. 65, 120-22 (2009) (proposing a framework wherein the Patent Office would defer examination until the applicant submits evidence of actual implementation of the invention).

¹⁹⁴ Seymore, *Heightened Enablement*, *supra* note 15, at 156 n.15 (internal quotation marks and brackets omitted); cf. *Ash v. Tyson Foods, Inc.* 546 U.S. 454, 456-57 (2006) (per curiam) (quoting *Cooper v. Southern Co.*, 390 F.3d 695, 732 (11th Cir. 2004)) (evaluating the “jump off the page” standard in the context of an employment discrimination suit).

C. Applying the Framework

The basic proposition is that the enablement requirement of § 112 ¶1 can effectively ferret out truly impossible inventions *by itself* with no need for or help from its § 101 statutory cousin. The first subsection presents a hypothetical which illustrates the mechanics of the enablement-based framework. The second subsection explores the plausibility of the proposal.

1. Mechanics

The following hypothetical is based on an actual patent case.¹⁹⁵ Suppose that an inventor files a patent application claiming a method of using heat to transform antimony¹⁹⁶ into gold.¹⁹⁷ The application discloses a working example; including the amount of starting material (antimony) used, reaction conditions and temperatures, and the amount of product (gold) isolated.¹⁹⁸

An examiner with expertise in the field reads the application and checks it for compliance with the statutory patentability requirements.¹⁹⁹ Focusing on enablement, the patent application is presumptively enabled as

¹⁹⁵ On May 7, 1897, Edward C. Brice filed a patent application claiming a process for making gold from other elements. See H. Carrington Bolton, *Recent Progress of Alchemy in America*, CHEMICAL NEWS, Aug. 6, 1897, at 61-63 (describing the claimed method); Adolf G. Vogeler, *A Nineteenth Century Gold Factory*, PHARM. J., Feb. 26, 1898, at 189-91 (presenting additional experimental details).

¹⁹⁶ Antimony is a chemical element typically obtained from complex mineral ores containing lead, tin, zinc, silver, and gold. See NICHOLAS C. NORMAN, CHEMISTRY OF ARSENIC, ANTIMONY, AND BISMUTH 43 (1998).

¹⁹⁷ This claim sounds like alchemy: the transmutation of one chemical element into another in a non-radioactive process. See *supra* note 26 and accompanying text.

¹⁹⁸ In the actual case, the inventor shared his theory of transmutation with a news reporter:

[Brice] depends almost entirely upon a decomposition of the atomic properties of the antimony and a radical reconstruction as a new body [using] intense heat and the free admission of oxygen. This is nature's process, and is exemplified in the volcanic action by which most of the gold existing in a natural state was formed. [Some researchers believe] that at some long-ago period tremendous convulsions of subterraneous gas threw up from the earth's interior some metallic substance, which underwent a transmutation into gold. [Brice chose antimony as a starting material] mainly because it is found in considerable quantity [in] gold ores.

Chicago Alchemist Thinks that by Following in Nature's Pathway to Make Gold of Dross, CHI. TRIB., Dec. 12, 1897, at 33. Brice built a gold-making factory in Chicago which processed over 10,000 pounds of crude ore per day. See Vogeler, *supra* note 195, at 189-90 (describing the daily operation of the National Metallurgical Company).

¹⁹⁹ See *supra* note 7 (reciting the conditions for patentability).

filed.²⁰⁰ To establish a prima facie case of nonenablement,²⁰¹ the examiner bears the initial burden of setting forth a reasonable explanation as to why the enablement provided by the applicant is not commensurate with the claim scope sought.²⁰² The examiner must explain any doubts as to the accuracy of any statement with evidence or reasoning rooted in fact.²⁰³

The examiner undertakes a *Wands* analysis by construing the claim (factor seven),²⁰⁴ determining the PHOSITA's knowledge and level of skill (factor five),²⁰⁵ and evaluating the teaching provided in the written description (factors one and two)²⁰⁶ in light of the nature of the technology (factors three and four).²⁰⁷ Almost immediately, the examiner recognizes that information pertaining to the source and purity of the antimony is conspicuously absent from the disclosure. Researchers in the field include this information as a matter of course because impurities in starting materials can lead to irreproducible or spurious results.²⁰⁸ To bolster this reasoning, the examiner consults the "antimony" entry in a chemical encyclopedia. It reveals that "[m]ost of the antimony produced in the United States is from complex antimony deposits found in Idaho, Nevada, Alaska, and Montana [which] consist of [minerals containing] silver or gold."²⁰⁹ Based on the totality of the evidence,²¹⁰ the examiner rejects the

²⁰⁰ *In re Marzocchi*, 439 F.2d 220, 223 (C.C.P.A. 1971).

²⁰¹ An examiner must prove unpatentability by a preponderance of the evidence. *See In re Oetiker*, 977 F.2d 1443, 1445 (Fed. Cir. 1992) (articulating the burden-shifting framework used in patent examination).

²⁰² *In re Wright*, 999 F.2d 1557, 1561-62 (Fed. Cir. 1993).

²⁰³ *Marzocchi*, 439 F.2d at 224; *see also In re Brebner*, 455 F.2d 1402, 1405 (C.C.P.A. 1972) (holding that the Patent Office must provide a factual basis for a lack of enablement rejection, rather than conclusory statements regarding the PHOSITA's level of skill).

²⁰⁴ *See* MPEP, *supra* note 46, § 2164.04 (instructing an examiner who suspects that one or more claims lack enablement to first construe them to determine their scope); *AK Steel Corp. v. Sollac & Ugine*, 344 F.3d 1234, 1241 (Fed. Cir. 2003) (explaining that because a patent's written description must enable the full scope of the claimed invention, the enablement inquiry typically begins with a construction of the claims).

²⁰⁵ *See supra* notes 169 and 176 and accompanying text.

²⁰⁶ *See supra* note 167.

²⁰⁷ *See supra* note 168.

²⁰⁸ *See* MAXINE LINTERN, LABORATORY SKILLS FOR SCIENCE AND MEDICINE 64-65 (2007) (explaining that the methods section should contain information including the commercial supplier from which materials were purchased so that a competent researcher can read the recipe and repeat exactly what was done). Laboratory chemicals vary widely in degrees of purity. *See, e.g.,* CHEMICAL TECHNICIANS' READY REFERENCE HANDBOOK 571 (Gershon J. Shugar & Jack T. Ballinger eds., 4th ed. 1996) (listing grades of purity).

²⁰⁹ 3 KIRK-OTHMER ENCYCLOPEDIA OF CHEMICAL TECHNOLOGY 42 (Arza Seidel ed., 5th ed. 2007) (emphasis added).

²¹⁰ *See* MPEP, *supra* note 46, § 2164.01(a) (reminding examiners that "any conclusion of nonenablement must be based on the evidence as a whole." (citing *In re Wands*, 858 F.2d 731, 737, 740 (Fed. Cir. 1988)).

claim as *prima facie* nonenabled under § 112 ¶1 because a PHOSITA faced with the inadequate guidance vis-à-vis the source and purity of the antimony would have to engage in undue experimentation to achieve the intended result.²¹¹

Next, the examiner sends the rejection to the applicant accompanied with a request for information regarding the source and purity of the antimony.²¹² The applicant responds by disclosing that the antimony is technical grade (lowest purity) obtained from Acme Metals Company in Yellow Pine, Idaho.²¹³ Further research reveals that: (1) Yellow Pine has one of the largest gold-antimony deposits in the nation;²¹⁴ and (2) Acme's technical grade antimony contains ten percent gold by weight. The examiner performs a calculation which reveals that the amount of gold reported in the applicant's working example *is less than* the amount of gold known to be present in the antimony starting material. These facts lead the examiner to conclude that the applicant did not transform antimony into gold but merely recovered a fraction of the gold already present in the starting material.²¹⁵ When presented with this information, the applicant decides to abandon the application.²¹⁶

The foregoing hypothetical illustrates two important points. First, it shows that a *Wands* analysis can ferret out a truly impossible invention by

²¹¹ See *supra* note 163 and accompanying text.

²¹² During the course of patent examination, the examiner may request “[t]echnical information known to [the] applicant concerning . . . the disclosure, the claimed subject matter, other factual information pertinent to patentability, or concerning the accuracy of the examiner's stated interpretation of such item.” 37 C.F.R. § 1.105 (a)(1)(viii) (2009).

²¹³ Technical grade, the lowest chemical grade, “is used industrially, but is generally unsuitable for laboratory [use] because of the presence of many impurities.” REFERENCE HANDBOOK, *supra* note 208, at 571.

²¹⁴ See, e.g., Junius Larsen & William C. Peters, *Idaho*, 45 INDUS. & ENG'G CHEMISTRY 2424, 2424-31 (1953) (describing the deposits).

²¹⁵ The story in the actual case is quite interesting. After receiving two inoperability rejections, Brice asked the Patent Office for permission to demonstrate the claimed process in Washington. See Bolton, *supra* note 195, at 62. Since the Patent Office lacked adequate laboratory facilities, the Secretary of the Treasury allowed Brice to use the spacious facilities at the U.S. Mint. *Id.* The Director of the Mint bought the requisite materials from reputable dealers and directed three experts to carry out the claimed process. After conducting replicate experiments, the experts reported that the claimed process failed to recover the entire amount of gold known to be present in the starting material; leading them to conclude that there was “not the slightest evidence of any ‘creation’ or transmutation.” *Id.* at 62-64 (reproducing the Report to the Honorable R. E. Preston, Director of the Mint, Washington, D.C. (May 22, 1897)). As to the final disposition, Brice argued that the Patent Office rejected his application out of fear of a “monetary panic.” Vogeler, *supra* note 195, at 189.

²¹⁶ Of course, the applicant could try to salvage something and seek a patent claiming a method of separating gold from antimony. However, that claim would be subject to novelty, nonobviousness, and other patentability hurdles. See *supra* note 7.

itself without a subjective credibility assessment. The claimed method in the hypothetical involves alchemy.²¹⁷ Aside from being a *Type I* impossibility,²¹⁸ modern alchemistic claims often conjure up notions of fraud.²¹⁹ Yet, the examiner did not need to venture down the credibility path because obtaining more detail about the working example revealed the applicant's error.

Second, it shows that many incredible claims can be traced to faulty experimental technique.²²⁰ As the late Professor John Ziman explained in his book *Real Science*, experimental researchers must work under “carefully contrived circumstances” where “all other potential disturbing factors are eliminated” so that “the explanation for the observed [result is] something more interesting than, say, an impure chemical reagent”²²¹ In patent law as in other contexts, a careful examination of the examples provided can readily reveal whether an intended result stems from sloppy research.

2. Plausibility

There is some decisional law which supports the proposition that if the case for nonenablement is very strong, that is a sufficient bases to deny patentability notwithstanding deficiencies under § 101. In *In re Speas*,²²² the applicant sought to claim:

“*any and all* devices and systems which operate in such a manner as to violate the [S]econd [L]aw of [T]hermodynamics as it is currently understood and accepted as inviolable by a majority of the worldwide scientific community,” and “*any and all* devices and systems which are adapted for converting thermal energy into other energy forms by contacting a heat source without the necessity of also contacting a thermal medium of lower temperature.”²²³

Two things stand out. First, the “any and all” claim language immediately raises enablement concerns due to its potentially limitless breadth.²²⁴

²¹⁷ See *supra* notes 26 and 197 and accompanying text.

²¹⁸ See *supra* notes 25-27 and accompanying text; *but see* Vogeler, *supra* note 195, at 190 (“No one should presume to pronounce the transmutation of one element into another an impossibility, but it seems an infinite improbability.”).

²¹⁹ WILLIAM R. NEWMAN & LAWRENCE M. PRINCIPLE, *ALCHEMY TRIED IN THE FIRE* 12 (2005); *see also* HERBERT S. REDGROVE, *BYGONE BELIEFS* 102 (1999) (contrasting “genuine” alchemists of ancient times with those who entered the quest in modern times).

²²⁰ ZIMAN, *REAL SCIENCE*, *supra* note 88, at 94.

²²¹ *Id.*

²²² See *In re Speas*, 273 F. App'x 945 (Fed. Cir. 2008) (per curiam) (nonprecedential).

²²³ *Id.* at 946 (emphasis added).

²²⁴ See *In re Wright*, 999 F.2d 1557, 1561-62 (Fed. Cir. 1993) (holding that the applicant failed to enable a claim covering “*any and all* live, non-pathogenic vaccines, and

Second, any device that could continuously convert heat completely to work without any additional energy input would violate the Second Law of Thermodynamics.²²⁵ A closer look at the applicant's description of the invention reveals, however, that the disclosed device does not do so because it actually draws in thermal energy from the surroundings.²²⁶

The examiner rejected the claim independently under § 112 ¶1 and § 101, respectively, after determining that: (1) the enablement provided was not commensurate with the claim scope sought; and (2) the invention could not achieve the intended result.²²⁷ The Board explicitly affirmed each rejection.²²⁸ Although the Patent Office argued both issues in its appeal brief to the Federal Circuit, it contended that the court could resolve the case *solely on enablement grounds* with no need to reach the § 101 issue.²²⁹ This argument makes sense because if the disclosed device did not violate the Second Law of Thermodynamics, it was nonenabled.

The Federal Circuit adopted this reasoning and affirmed on nonenablement grounds. The court held that the Board's rejection was supported by substantial evidence because the applicant's "particularly broad" and "limitless" claim was not enabled by a description which was commensurately broad in its teaching.²³⁰ The important point is that it was possible to screen out this invention solely based on (a lack of) technical merit; thereby avoiding any need to engage in a credibility assessment.²³¹

processes for making these vaccines") (emphasis in original).

²²⁵ The Second Law of Thermodynamics states that it is impossible to convert heat completely to work without some energy loss. R. K. RAJPUT, ENGINEERING THERMODYNAMICS 232 (3d ed. 2010). A machine that could do so would be 100 percent efficient. Such machines are referred to as perpetual motion machines of the second kind. *Id.* Curiously, the term "perpetual motion" does not appear either in the Patent Office documents or in the Federal Circuit opinion.

²²⁶ See *Speas*, 273 F. App'x at 946 ("Thus, the movement of the ferrofluid imparts mechanical energy upon the wheel. *Speas* claims that because this ferrofluid is moved and adds energy to the paddle wheel 'without input into the system other than ambient thermal energy,' it is proof that the second law of thermodynamics is not inviolate—an object of the invention.").

²²⁷ *Speas*, 273 F. App'x at 945-46; see also Brief for Appellee Director of the United States Patent and Trademark Office at 7-8, *In re Speas*, 273 F. App'x 945 (Fed. Cir. 2008) (No. 2008-1076).

²²⁸ Brief for Appellee, *supra* note 227, at 9-10.

²²⁹ *Id.* at 18.

²³⁰ *Speas*, 273 F. App'x at 946.

²³¹ In his commentary on *Speas*, Professor Crouch reached a similar conclusion: "Although this type of case is fun to read, it also provides an interesting lesson—that [there are] tools to reject inadequate patent applications on their merits without resorting to broad exclusions of particular subject matter." Dennis Crouch, *CAFC Rejects Patent on Invention to Overcome the Second Law of Thermodynamics*, PATENTLY-O (May 1, 2008, 2:32 PM), <http://www.patentlyo.com/patent/2008/05/cafc-rejects-pa.html>.

Both *Speas* and the hypothetical presented above show that whether an invention can achieve the intended result is a yes or no question. If the answer is no, § 112 ¶1 alone can resolve the issue because there is no way that the applicant can provide an enabling description for a true impossibility. In other words, a careful examination of the working example will reveal the fatal flaw.²³² Analytically, this means that the decisionmaker can use technical factors like claim breadth and the substantive content of the applicant's disclosure to achieve the same ends as the current operability regime without its pitfalls.

D. Policy Tradeoffs

1. Disclosure

Replacing the § 101 operability regime with an enablement-based framework elevates the role of the disclosure and the PHOSITA's level of skill in resolving the workability question. The key metric for gauging enablement in the proposed framework is the working example. But the idea of ratcheting up enablement,²³³ especially through a working example requirement, implicates a larger debate over the appropriate role of disclosure in patent policy.²³⁴

Clearly the enablement analysis is easiest when the applicant can point to actual experimental results as proof that the invention works. Such results are a prerequisite for communal acceptance in mainstream

²³² See JOHN WALLER, *FABULOUS SCIENCE* 40 (2004) (noting that an experimental result can be "so aberrant that error seems the most reasonable explanation."); ROBERT L. PARK, *VOODOO SCIENCE* 9 (2002) ("Error is a normal part of science, and uncovering flaws in scientific observations or reasoning is the everyday work of scientists.").

²³³ Other commentators have argued for a robust enablement requirement. See, e.g., Mark D. Janis, *On Courts Herding Cats: Contending with the "Written Description" Requirement (And Other Unruly Patent Disclosure Doctrines)*, 2 WASH. U. J.L. & POL'Y 55, 108 (2000) (arguing that a vigorous enablement requirement could lead to the development of more coherent patentability guidelines).

²³⁴ Patent scholars differ in their views on the role of the disclosure. Compare Holbrook, *Possession*, *supra* note 176, at 126, 133-47 (describing the "pervasive" role of disclosure in patent law and policy, including enriching the state of the art contemporaneously with the invention and showing evidence of possession of the invention) and Jeanne C. Fromer, *Patent Disclosure*, 94 IOWA L. REV. 539, 547-54 (2009) (cataloguing the beneficial uses for the disclosure in patent law; including stimulating innovation, preventing duplication, gauging patentability, and signaling R&D strength) with Alan Devlin, *The Misunderstood Function of the Disclosure in Patent Law*, 23 HARV. J.L. & TECH. 401, 412 (2010) (arguing that "disclosure as an objective of patent policy should be discarded in certain circumstances" because it "serves no more than an ancillary role within the larger purpose of the patent regime[.]").

science.²³⁵ Patent law, however, is not so demanding.²³⁶ Actual experimentation is not a prerequisite for patenting.²³⁷

It is understandable why an inventor may choose to file a patent application with minimal teaching. First, most would agree that for simple inventions, there is no need for experimentation if the technology so easy to understand that a PHOSITA can readily figure out the details.²³⁸ Second, sometimes inventors must obtain patents at an early stage of research and development (well before identifying a marketable product) in order to attract investors.²³⁹ Third, applicants must often file early in order to safeguard patent rights both in the United States²⁴⁰ and abroad.²⁴¹

Patent theory posits that early filing facilitates the entry of new technical knowledge into the public domain,²⁴² which in turn serves as building blocks for further innovation.²⁴³ Filing too early, however, can

²³⁵ See *supra* note 181 and accompanying text.

²³⁶ See *supra* Part II.A.2.

²³⁷ See *supra* note 74 and accompanying text.

²³⁸ See discussion *supra* note 168 (noting that the PHOSITA needs less guidance in predictable fields). For a concrete example, see Seymore, *Teaching Function*, *supra* note 15, at 644 (contending that for a patent claiming a broom rake, a PHOSITA would not benefit from a working example because the technology is easily understood).

²³⁹ See, e.g., Mark A. Lemley, *Reconceiving Patents in the Age of Venture Capital*, 4 J. SMALL & EMERGING BUS. L. 137, 144 (2000) (explaining that “one of the reasons people are patenting at a very early stage in the process is precisely in order to attract or appease venture capital”).

²⁴⁰ For example, an applicant must file a patent application within one year of disclosing the invention in a printed publication. 35 U.S.C. § 102(b) (2006). Likewise, if the invention is used in public, sold, or subject to an offer for sale in the United States, the applicant must file within one year of the event. *Id.* A fundamental purpose of § 102(b) is to encourage prompt filing. *Woodland Trust v. Flowertree Nursery, Inc.*, 148 F.3d 1368, 1370 (Fed. Cir. 1998). Similarly, § 102(g) “penaliz[es] the unexcused delay or failure of a first inventor to share the benefit of the knowledge of the invention with the public after the invention has been completed.” *Checkpoint Sys., Inc. v. U.S. Int’l Trade Comm’n*, 54 F.3d 756, 761 (Fed. Cir. 1995) (internal citation and quotation marks omitted).

²⁴¹ The one-year grace period available in the United States is not available in many foreign countries. In fact, most countries have an absolute novelty requirement such that any pre-filing disclosure, including activity by the inventor, is patent-defeating. See, e.g., Convention on the Grant of European Patents, art. 54(2), Oct. 5, 1973, 1065 U.N.T.S. 255, 272. Accordingly, if foreign filing is a possibility, the applicant must take steps to avoid inadvertent or premature disclosure. DAVID A. BURGE, *PATENT & TRADEMARK TACTICS AND PRACTICE* 127-36 (3d ed. 1999).

²⁴² See John F. Duffy, *Rethinking the Prospect Theory of Patents*, 71 U. CHI. L. REV. 439, 445 (2004) (arguing that early filing leads to reduced patent terms; thereby dedicating the invention to the public at an earlier time).

²⁴³ *Bonito Boats, Inc. v. Thunder Craft Boats, Inc.*, 489 U.S. 141, 151 (1989); see also *Aronson v. Quick Point Pencil Co.*, 440 U.S. 257, 262 (1979) (noting that one goal of patent law is “[to] promote [] disclosure of inventions to stimulate further innovation”); *W.L. Gore & Assocs. v. Garlock, Inc.*, 721 F.2d 1540, 1550 (Fed. Cir. 1983) (“Early public

have serious consequences for the patent system.²⁴⁴ Of particular importance for present purposes are two problems which arise from disclosing and patenting an underdeveloped invention. They are: (1) the entry of a feeble, non-technically robust disclosure into the patent literature which provides dubious guidance to the PHOSITA, adds little or nothing to the public storehouse of knowledge, and supplies little technical fodder for follow-on researchers to build upon,²⁴⁵ and (2) the creation of roadblocks for other inventors,²⁴⁶ including the ability to dominate other technological innovations that only subsequent workers in the field can actually enable.²⁴⁷

disclosure the linchpin of the patent system.” (citation omitted)); *Transco Prods. Inc. v. Performance Contracting, Inc.*, 38 F.3d 551, 558 (Fed. Cir. 1994) (rejecting an interpretation of § 112 which would “subvert the patent system’s goal of . . . encouraging early disclosure.”).

²⁴⁴ See, e.g., Seymore, *Teaching Function*, *supra* note 15, at 659 (arguing that the current disclosure framework can thwart innovation); Cotropia, *supra* note 193, at 87-119 (presenting a comprehensive analysis of the costs of early filing on the patent system).

²⁴⁵ In other words, the disclosure probably lacks sufficient technical detail to be helpful. Thus, it does little to advance technological progress, which is commanded by the Constitution. *Graham v. John Deere Co.*, 383 U.S. 1, 6 (1966).

²⁴⁶ A good example is when an early filer strategically drafts claims which cover undeveloped technology. See Michael J. Meurer & Craig Allen Nard, *Invention, Refinement and Patent Claim Scope: A New Perspective on the Doctrine of Equivalents*, 93 GEO. L.J. 1947, 1975 (2005) (exploring the practice); BESSEN & MEURER, *supra* note 116, at 67 (arguing that the practice “penalizes real innovators who operate in the shadow of early, broad claims.”).

²⁴⁷ Seymore, *Teaching Function*, *supra* note 15, at 660. Another commentator elaborates on the scope and consequences of the problem:

The further a patent moves away from a requirement that the inventor actually have a complete and operative invention [at the time of filing], the broader the patent’s scope and the greater potential that the [claims] will protect speculative ideas . . . With just a little time, money, and imagination, one may . . . without inventing anything . . . [obtain a patent with] claims that are broad enough to [encompass] technology developed for the first time years after the inventor first files an application . . . [This can have] an undue chilling effect on the behavior of later scientists [and] researchers . . . who (sometimes many years later) through their own experimentation, hard work, and trial and error[,] succeed in [creating] a bona fide product or process that actually works.

Christopher A. Harkins, *Fending Off Paper Patents and Patent Trolls: A Novel “Cold Fusion” Defense Because Changing Times Demand It*, 17 ALB. L.J. SCI. & TECH. 407, 453 (2007). A good illustration involves *Type III* impossibilities, which were defined earlier as quests which are impossible at time *X* but might become possible at time *Y*. See *supra* Part I.B. Suppose inventor *A* obtains a patent at time *X* and inventor *B* obtains a patent for a new and nonobvious improvement at time *Y*. In order to practice the improvement, *B* must get a license from *A*. See Robert P. Merges & Richard R. Nelson, *On the Complex Economics of Patent Scope*, 90 COLUM. L. REV. 839, 860-61 (1990) (explaining dominant and subservient patents). If *B* wants to avoid a license, *B* must challenge *A*’s patent in court and prove by clear and convincing evidence that *A*’s presumptively valid patent is invalid for nonenablement. *ALZA Corp. v. Andrx Pharms., LLC*, 603 F.3d 935, 940 (Fed.

An across-the-board working example requirement would ameliorate, if not eliminate, each of these problems.²⁴⁸

Although it is perhaps counterintuitive, an enablement-based approach might actually attract inventors to the patent system who would otherwise forego the patenting process under the status quo. To unpack this argument, consider that inventors claiming the impossible (or any invention) want to believe that they will get—and are, in fact, entitled to—a fair shot at getting a patent. However, inventors who believe that the Patent Office and the courts are biased against granting patents for certain types of inventions (which is likely under a regime rooted in subjective credibility assessments) may decide not to waste their time and money pursuing a patent if a denial is inevitable.²⁴⁹ Put simply, “inventors respond to how the Patent Office behaves.”²⁵⁰ Under the proposal, an inventor with a seemingly impossible claim who knows that it will receive an objective, technical examination might decide to try getting a patent. This will give the patent system the benefit of a disclosure that it otherwise would lose.

2. Promoting Scientific and Technological Progress

One question that might arise for any proposed patent reform is how does it align with the patent system’s overarching goal to promote scientific and technological progress.²⁵¹ As explained below, an objective,

Cir. 2010). Also, *B* may have a hard time getting the improvement patent because the Patent Office can assert the disclosure of *A*’s patent as prior art against *B*’s claim; most likely for a lack of nonobviousness. See 35 U.S.C. § 103. To make matters worse for *B*, the Federal Circuit has held that the examiner can *presume* that *A*’s disclosure is enabled; meaning that the examiner need not elucidate if what *A* discloses really works. *Amgen Inc. v. Hoechst Marion Roussel, Inc.*, 314 F.3d 1313, 1355 (Fed. Cir. 2003); Seymore, *Rethinking Novelty*, *supra* note 15, at 940-46 (criticizing this presumption). To win, *B* must rebut the presumption by a preponderance of the evidence. *In re Sasse*, 629 F.2d 675, 681 (C.C.P.A. 1980). The basic point is that in both cases *B* has to prove nonenablement for a patent that never should have issued. Cf. Jay P. Kesan, *Carrots and Sticks to Create a Better Patent System*, 17 BERKELEY TECH. L.J. 763, 765 (2002) (suggesting that concerns related to the Patent Office’s issuance of “facially” invalid patents may stem from the examiner’s inability to accurately determine the scope and content of the prior art).

²⁴⁸ See Seymore, *Teaching Function*, *supra* note 15, at 652-66.

²⁴⁹ This is the case for perpetual motion and cold fusion, which automatically raise red flags in the Patent Office. See *supra* notes 4-6, 77-78 and accompanying text. Again, a working example requirement would eliminate the need for special treatment.

²⁵⁰ JAFFE & LERNER, *supra* note 3, at 175.

²⁵¹ This goal emanates from the Intellectual Property Clause of the Constitution: “To promote the Progress of Science and useful Arts, by securing for limited Times to Authors and Inventors the exclusive Right to their respective Writings and Discoveries.” U.S. Const., Art. I, § 8, cl. 8. See also *Motion Picture Patents Co. v. Universal Film Mfg. Co.*, 243 U.S. 502, 511 (1917) (observing that “the primary purpose of our patent laws . . . is ‘to

enablement-based approach for elucidating whether an invention works is better suited for achieving this goal than the current operability regime.

Recall that at present the examiner turns to mainstream science to answer the workability question.²⁵² Elucidating whether an invention “borders on the incredible in light of contemporary knowledge [in the field],”²⁵³ “suggest[s] an inherently unbelievable undertaking,”²⁵⁴ “involve[s] implausible scientific principles,”²⁵⁵ or “appear[s] to run counter to what would be believed would happen”²⁵⁶ depends on what the scientific community views as credible at a particular moment in time. And it will not give its imprimatur to a research claim unless and until it passes through the knowledge filter. If an inventor seeks a patent before this happens, the credibility lag will lead to a patent denial regardless of the claim’s technical merit.²⁵⁷ Clearly such a regime prevents patent law from sitting at the cutting edge of science and technology.²⁵⁸

This artifact of the operability regime conflicts with the a fundamental goal of the patent system to encourage the rapid dissemination of technical knowledge.²⁵⁹ As soon as a patent document publishes,²⁶⁰ there

promote the progress of science and useful arts.”); *Eldred v. Ashcroft*, 537 U.S. 186, 223 (2003) (noting that the constitutional command is the “ultimate purpose” of the patent system); *Bilski v. Kappos*, 130 S. Ct. 3218, 3236 (2010) (Stevens, J., concurring) (explaining that Intellectual Property Clause empowered Congress “to pass a series of patent laws . . . as a means of encouraging innovation.”). Scholars have sought to clarify the meaning of the constitutional language. *See, e.g.*, EDWARD WALTERSCHEID, *THE NATURE OF THE INTELLECTUAL PROPERTY CLAUSE* 125-26 (2002) (explaining that in the latter part of the eighteenth century, the term “science” was synonymous with “knowledge” and “learning”); Karl B. Lutz, *Patents and Science: A Clarification of the Patent Clause of the U.S. Constitution*, 18 GEO. WASH. L. REV. 50, 54 (1949) (noting that the term “useful arts” is synonymous with the word “technology”).

²⁵² *See supra* Part II.B.1.

²⁵³ *In re Ferens*, 417 F.2d 1072, 1074 (C.C.P.A. 1969).

²⁵⁴ *In re Jolles*, 628 F.2d 1322, 1327 (C.C.P.A. 1980).

²⁵⁵ *In re Brana*, 51 F.3d 1560, 1566 (Fed. Cir. 1995).

²⁵⁶ *In re Pottier*, 376 F.2d 328, 330 (C.C.P.A. 1967).

²⁵⁷ *See supra* Part II.B.2.

²⁵⁸ *See supra* notes 149-150 and accompanying text.

²⁵⁹ *Brenner v. Manson*, 383 U.S. 519, 533 (1966) (“[O]ne of the purposes of the patent system is to encourage dissemination of information concerning discoveries and inventions.”); *see also* Malla Pollack, *What is Congress Supposed to Promote? Defining “Progress” in Article I, Section 8, Clause 8 of the United States Constitution, or Introducing the Progress Clause*, 80 NEB. L. REV. 754, 778-79 (2001) (arguing that the Intellectual Property Clause empowers Congress to create an individual right to exclude through patents only to the extent that those rights promote the dissemination of knowledge). The statutory scheme helps achieve this goal. As discussed above, a fundamental purpose of both § 102(b) and § 102(g) is to encourage prompt filing. *See supra* note 240. In addition, recent amendments to the patent statutes facilitate quicker dissemination. For instance, until 1999, patent applications were kept in secret unless and

is hope that the public will use the technical details disclosed therein to improve upon the invention, to design around it, or to engage in other innovative activities.²⁶¹ This is where enablement enters the picture. It plays the central role in “safeguard[ing] the patent system’s disclosure function by ensuring relatively swift dissemination of technical information from which others . . . can learn.”²⁶² And the knowledge gained will reduce R&D waste,²⁶³ spur creativity,²⁶⁴ and ultimately extend the frontiers of

until the patent issued. Now, most patent applications publish eighteen months after the earliest effective filing date. *See* American Inventors Protection Act of 1999, Pub. L. No. 106-113, 113 Stat. 1501 (codified as 35 U.S.C. § 122(b)(1)(A)).

²⁶⁰ *See supra* note 259 (discussing the pre-grant publication of patent applications).

²⁶¹ Fromer, *supra* note 234, at 541. Importantly, the public can engage in these activities during the patent term. As the late Judge Giles S. Rich once explained:

Another aspect of what we think of as “the patent” which should not be forgotten is that it is not only a grant of right to exclude from the government; simultaneously, it is a publication, making (in principle at least) a full public disclosure of the invention due to § 112 ¶1. So even if it does not go into the public domain during the patent term, the public gets the advantage of knowing what the invention is and how to practice it. (“Literae patentes” = “open letters,” in short form, “patents.”) . . .

Janice M. Mueller, *A Rich Legacy*, 14 BERKELEY TECH. L.J. 895, 900 (1999) (quoting correspondence from Judge Giles S. Rich, Circuit Judge of the United States Court of Appeals for the Federal Circuit to Professor Janice M. Mueller (Aug. 16, 1997). But, Professor Holbrook argues that the Federal Circuit’s evisceration of the common law experimental use exception means that “[o]ne can read the patent but cannot make or use the invention for purposes of exploring its function or the manner in which it works [without risking infringement].” Holbrook, *Possession*, *supra* note 176, at 140; *see also* Ted Hagelin, *The Experimental Use Exemption to Patent Infringement: Information on Ice, Competition on Hold*, 58 FLA. L. REV. 483, 494-504 (2006) (making a similar argument).

²⁶² FED. TRADE COMM’N, TO PROMOTE INNOVATION: THE PROPER BALANCE OF COMPETITION AND PATENT LAW AND POLICY ch. 4, at 3-4 (2003); *see also* LizardTech, Inc. v. Earth Res. Mapping, Inc., 424 F.3d 1336, 1344 (Fed. Cir. 2005) (describing enablement as the essential aspect of the patent bargain); 3 CHISUM, *supra* note 128, § 7.01 (explaining that among the disclosure requirement, enablement has the deepest historical roots and “lies at the heart of the patent bargain”).

²⁶³ Kenneth W. Dam, *The Economic Underpinnings of Patent Law*, 23 J. LEGAL STUD. 247, 267 n.79 (1994); *see also* Anthony Murphy, *Intellectual Property*, in INNOVATION: HARNESSING CREATIVITY FOR BUSINESS GROWTH 87, 92 (Adam Jolly ed., 2003) (arguing that since patent applications contain a complete description of the relevant technology are ready accessible online, “[w]hy struggle to solve a technical problem already solved by another and published in [a patent] application?”). One could argue that any delay of entry into the patent system caused by the need to make working examples could actually set the stage for duplicative research efforts. However, it is probably rare that researchers are working on the identical problem in exactly the same way at the same moment in time.

²⁶⁴ *See* MICHAEL A. GOLLIN, DRIVING INNOVATION 15-19 (2008) (explaining that disclosure adds to the pool of accessible knowledge that other creative individuals can use and improve upon).

science and technology.²⁶⁵

The preceding discussion highlights the related yet dissimilar ways that mainstream science and patent law seek to promote scientific and technological progress. Clearly both patent law and science seek to foster innovative activity through the dissemination of technical knowledge.²⁶⁶ But then the divergence occurs. Whereas mainstream science emphasizes legitimization of technical knowledge through peer review, patent law emphasizes its quick communication to the public. As long as the patentee provides sufficient information about the invention so that others can understand and practice it,²⁶⁷ ancillary details such as the inventor's acumen²⁶⁸ or how or why the invention works are irrelevant.²⁶⁹

²⁶⁵ See ROGER E. SCHECHTER & JOHN R. THOMAS, PRINCIPLES OF PATENT LAW 6 (2004) (noting that patents enrich the public domain and thus support further innovation).

²⁶⁶ In particular, both mainstream science and patent law promote disclosure through publication. Once in the public domain, there is hope that others will build upon those results and engage in further research. See Rebecca S. Eisenberg, *Proprietary Rights and Norms of Science in Biotechnology Research*, 97 YALE L.J. 177, 184 (1987) (exploring the compatibility and conflicts between the norms of science and patent law). But, Professor Eisenberg also points out that to the extent that patent protection "limit[s] the ability of other scientists to use published knowledge, intellectual property law has been perceived within the scientific research community as conflicting with the traditional norms and rewards of science." *Id.*; see also Rebecca S. Eisenberg, *Patents and the Progress of Science: Exclusive Rights and Experimental Use*, 56 U. CHI. L. REV. 1017, 1017 (1989) ("Yet the idea that exclusive rights in new knowledge will promote scientific progress is counterintuitive to many observers of research science, who believe that science advances most rapidly when the community enjoys free access to new discoveries.").

²⁶⁷ See *J.E.M. Ag Supply, Inc. v. Pioneer Hi-Bred Int'l, Inc.*, 534 U.S. 124, 142 (2001) (explaining that to obtain a patent, the applicant "must describe the [invention] with sufficient specificity to enable others to 'make and use' the invention after the patent term expires." (quoting 35 U.S.C. § 112 ¶1)). Here it is worth noting that quests which are *per se* impossible (*Type I*) or pseudoscientific (*Type II*) can nevertheless produce knowledge which promotes scientific and technological progress. As one commentator explains:

The pursuit of the perpetual motion machine . . . has not been fruitless from a scientific point of view. On the contrary, although inventors have never produced a perpetual motion machine, the enormous time and energy invested into building such a fabled machine has led physicists to carefully study the nature of heat engines. (In the same way, the fruitless search of alchemists for [a method to] turn lead into gold[] helped to uncover some of the basic laws of chemistry.)

KAKU, *supra* note 24, at 262-63; see also F. SHERWOOD TAYLOR, *ALCHEMISTS: FOUNDERS OF MODERN CHEMISTRY* 3 (1992) (noting that the alchemists hold an honored position in the history of science because they crafted most contemporary laboratory techniques).

²⁶⁸ See *Eames v. Andrews (The Driven-Well Cases)*, 122 U.S. 40, 56 (1887) (explaining that an inventor's ignorance of the scientific principles is immaterial as long as the patent's disclosure sets forth the "thing" to be done so that it can be reproduced); *Radiator Specialty Co. v. Buhot*, 39 F.2d 373, 376 (3d Cir. 1930) ("It is with the inventive concept, the thing achieved, not with the manner of its achievement or the quality of the mind which gave it birth, that the patent law concerns itself."); *Earle v. Sawyer*, 8 F. Cas.

Some may argue that patent law's indifference to the ancillary details deviates from scientific norms inasmuch as there is an inevitable tradeoff between rapid dissemination and credibility. But herein lies the problem: It is not the province of patent law to determine what constitutes credible science; that task belongs primarily to the scientific community.²⁷⁰ This is why the proposed enablement-based framework is better suited for fulfilling patent law's overarching goal of promoting science and technological progress than what prevails today. And, quite fortuitously, the across-the-board working example requirement advocated herein would ameliorate concerns about credibility.

CONCLUSION

Encouraging the attainment of previously unachievable results is a fundamental facet of the patent system. While success clearly benefits the public through new products and processes, the quest to achieve the impossible itself generates a body of technical knowledge that can spur creative activity, foster innovation, and extend the frontiers of science and technology. Yet, the patent system struggles to achieve these ends due to the subjective facets of the current patent examination framework. By adopting an objective approach to gauging patentability for seemingly impossible inventions based on technical merit, the proposed framework will resolve these problems, promote broader goals of patent policy, and contribute to broader debates about the intersection between patent law and science and technology.

254, 256 (C.C.D. Mass. 1825) (No. 4,247) (Story, J.) (“It is of no consequence, whether the thing be simple or complicated; whether it be by accident, or by long, laborious thought . . . that it is first done [because the] law looks to the fact, and not to the process by which it is accomplished.”).

²⁶⁹ See cases cited *supra* note 54.

²⁷⁰ See, e.g., CHUBIN & HACKETT, *supra* note 89, at 4 (arguing that aside from asserting the autonomy and authority of science, peer review “makes new knowledge claims more credible to the nonscientist because [they] bear the approval of the scientific community.”). *But see* *Brooktree Corp. v. Advanced Micro Devices, Inc.*, 977 F.2d 1555, 1573 (Fed. Cir. 1992) (explaining that “[w]hile utility and enablement often involve complex scientific principles, the Federal Circuit views them not as “legal abstractions,” but as issues “[which] properly devolve on the trier of fact” who, as for other kinds of evidence, “must make determinations of credibility, reliability, and weight.”). Despite the drawbacks in using credibility assessments for patentability purposes, they can be useful in other contexts. See, e.g., *Daubert v. Merrell Dow Pharms.*, 509 U.S. 579, 592-94 (1993) (setting forth a five-part test for U.S. judges to evaluate the credibility of scientific testimony for admissibility purposes).