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INVENTIVE APPLICATION: A HISTORY

Jeffrey A. Lefstin *

Abstract

The Supreme Court’s recent cases on patent-eligible subject matter have struggled to draw the line between unpatentable fundamental principles, such as laws of nature and abstract ideas, and patentable inventions. In *Mayo v. Prometheus*, the Court suggested that only “inventive applications” of fundamental principles fall within the domain of the patent system. Both *Mayo* and its intellectual forebear, *Parker v. Flook*, anchored this doctrine in *Neilson v. Harford*, the famous “hot blast” case decided by the Court of Exchequer in 1841.

But the Supreme Court has founded the inventive application doctrine on a basic misapprehension. Neilson’s patent on the hot blast was sustained not because his application was inventive, but because it was *entirely conventional and obvious*. In both England and the United States, the hot-blast cases taught that inventors could patent any practical application of a new discovery, regardless of the application’s novelty or inventiveness. And for over one hundred years, American authority consistently maintained that practical application distinguished unpatentable discovery from patentable invention.

The inventive application test in fact originated in 1948, in *Funk Brothers v. Kalo Inoculant*, which departed radically from the established standard of patent eligibility. In the wake of *Funk Brothers*, the lower courts struck down a series of patents unquestionably within the technological arts—arguably the precise innovations the patent system sought to promote. This history is largely forgotten today, but it should serve as a cautionary tale of the patents that could be invalidated if the Court maintains inventive application as the test for patent eligibility.

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INTRODUCTION

What is the boundary between an unpatentable principle and a patent-eligible invention? That question, now framed as the doctrine of patent-eligible subject matter under 35 U.S.C. § 101,¹ was not born from the patent system's encounters with new technologies such as software or biotechnology. Courts have struggled with the boundary between principle and invention since the earliest days of the patent system. Yet after four patent-eligibility opinions from the Supreme

1. Patent *eligibility* under § 101 is only a question of whether an invention is even the proper subject matter for a patent—that is, whether such inventions are even within the bounds of the patent system. A patent-eligible invention under § 101 is *patentable* only if it further complies with the statutory requirements of patentability: utility under § 101, novelty under § 102, nonobviousness under § 103, and adequate disclosure and claiming under § 112. *See* 35 U.S.C. § 101 (2012) (stating that inventions in enumerated categories of subject matter may receive patents “subject to the conditions and requirements of this title”).

Court in the span of five years—*Bilski v. Kappos*,² *Mayo Collaborative Services v. Prometheus Laboratories, Inc.*,³ *Association for Molecular Pathology v. Myriad Genetics, Inc.*,⁴ and *Alice Corp. v. CLS Bank International*⁵—that boundary line has rarely been so difficult to discern.

In *Mayo*, the Supreme Court appeared to set forth a universal framework for resolving questions of patent-eligible subject matter. Prior to *Mayo*, the Court had emphasized that a fundamental principle—an abstract idea, law of nature, or natural phenomenon—could not be the subject matter of a patent. But the Court had not provided a clear analytical framework to differentiate between a patent-ineligible fundamental principle and a patent-eligible application of a fundamental principle. In *Mayo*, the Court held that for a process focusing on the use of a natural law or abstract idea to constitute a patent-eligible *application* of that principle, the process must include an additional “inventive concept” sufficient to ensure that the claimed process amounted to something more than a monopoly on the abstract idea or law of nature itself.⁶ Finding that the remaining elements in the challenged invention were nothing more than “well-understood, routine, conventional activity previously engaged in by scientists in the field,” the Court held the claims at issue were not patent-eligible subject matter.⁷

The patent challenged in *Mayo* was for a process supposedly embodying a fundamental “law of nature.”⁸ Yet the Court proposed a unified analysis that would apply as well to a patent attempting to claim a natural phenomenon or an abstract idea.⁹ The Court explained its earlier decisions involving mathematical equations as cases where patent eligibility hinged on whether the patentee had added something more than “conventional” and “obvious” activity to the underlying algorithm.¹⁰ While few might have defended the precise claims at issue in *Mayo*, the potential sweep of *Mayo*’s test prompted particular concern in the biotechnology industry. Some observers saw the decision as a threat to the patentability of advances in personalized medicine,

2. 130 S. Ct. 3218 (2010).

3. 132 S. Ct. 1289 (2012).

4. 133 S. Ct. 2107 (2013).

5. 134 S. Ct. 2347 (2014).

6. *Mayo*, 132 S. Ct. at 1294–95, 1297.

7. *Id.* at 1298.

8. *Id.* at 1294.

9. *Id.* at 1300 (“[S]imply appending conventional steps, specified at a high level of generality, to laws of nature, natural phenomena, and abstract ideas cannot make those laws, phenomena, and ideas patentable.”).

10. *See id.* at 1298–1300.

identification of biomarkers, the use of existing drugs for new indications, and other inventions where implementation is relatively trivial once a discovery has been made.¹¹

Some of those fears have come to pass. For example, in *Ariosa Diagnostics, Inc. v. Sequenom, Inc.*,¹² the U.S. District Court for the Northern District of California invalidated a patent on a method of diagnosing fetal abnormalities by the amplification of cell-free fetal DNA in the maternal bloodstream.¹³ While the patentees first discovered the existence of cell-free fetal DNA in the maternal blood, the means for implementing that discovery in a diagnostic method—amplifying and sequencing the fetal DNA—was routine in the field at the time of the invention.¹⁴ The claims therefore lacked an “inventive concept” that would render them patent eligible under *Mayo*.¹⁵

In the wake of *Mayo*, the U.S. Court of Appeals for the Federal Circuit attempted to clarify the patent eligibility of computer-implemented inventions in *CLS Bank International v. Alice Corp.*¹⁶ However, disagreement over *Mayo*’s import split the court, negating the Federal Circuit’s attempt to provide a coherent test.¹⁷ The court agreed on one thing: When the Supreme Court required an inventive concept, it could not have meant that the patentee’s application of a fundamental principle must itself be novel or nonobvious.¹⁸ Yet the court could not agree on whether an inventive concept required a “genuine human contribution” to the subject matter of the claim¹⁹ or whether an inventive concept was “shorthand” for a requirement that the claim not be coextensive with an underlying fundamental principle.²⁰

11. See, e.g., Laura W. Smalley, *Will Nanotechnology Products Be Impacted by the Federal Courts’ “Product of Nature” Exception to Subject-Matter Eligibility Under 35 U.S.C. 101?*, 13 J. MARSHALL REV. INTELL. PROP. L. 397, 437–39 (2014).

12. 19 F. Supp. 3d 938 (N.D. Cal. 2013).

13. See *id.* at 954.

14. See *id.* at 953 (“The evidence shows that [it] was well-understood, routine, and conventional activity to combine these steps to detect DNA in serum or plasma.”).

15. See *id.* at 951 (“Thus, the only inventive concept contained in the patent is the discovery of cfDNA, which is not patentable.”); *id.* at 953 (“Therefore, looking at the claimed processes as a whole, the only inventive component of the processes in the ‘540 patent is to apply those well-understood, routine processes to paternally inherited cfDNA, a natural phenomenon.”).

16. 717 F.3d 1269 (Fed. Cir. 2013) (en banc) (per curiam).

17. See Adam Mossoff, *The Trespass Fallacy in Patent Law*, 65 FLA. L. REV. 1687, 1690 (2013).

18. *CLS Bank*, 717 F.3d at 1282 (Lourie, J., concurring).

19. See *id.* at 1283.

20. See *id.* at 1303 (Rader, J., concurring in part and dissenting in part). As this interpretation involves neither “inventive” nor “concept,” it may be fair to say that Judge Randall Rader viewed “inventive concept” as entirely surplus verbiage.

The context of history is critical to an understanding of *Mayo* and the rest of the Supreme Court's subject-matter eligibility jurisprudence. For the Court has turned often to historical practice to justify its decisions; perhaps the most consistent rationale the Court has invoked for excluding fundamental principles from patent eligibility is that the Court has been doing so for over 150 years.²¹ In particular, in both *Mayo* and *Parker v. Flook*,²² the Court has drawn upon English and American precedent from the nineteenth century to ground the inventive application requirement. Most notably, the modern Court has relied extensively on a decision rendered by the Court of Exchequer in 1841, *Neilson v. Harford*,²³ that sustained the validity of James Neilson's patent to the hot-blast smelting process.²⁴ Scholarly commentary has also advanced the argument that nineteenth-century precedent, such as *Neilson* and the Supreme Court's famous opinion in *O'Reilly v. Morse*,²⁵ demanded that the application of a fundamental principle be creative or inventive to qualify for patent eligibility.²⁶

Yet while *Neilson* has certainly occupied a central role in American patent jurisprudence since the mid-nineteenth century, modern courts and commentators have not examined the case in context—context that was quite familiar to the early American interpreters of *Neilson*, but is too often overlooked today. And while modern judges frequently invoke the great nineteenth-century cases that set the doctrinal foundations of today's patent-eligibility doctrine, they have paid too little attention to the development of that doctrine in the early twentieth century, when those cases were recent guidance rather than hoary relics. An examination of these gaps reveals a very different story than the one told by the Court in *Mayo* and *Flook*. For *Neilson* and its progeny did not stand for the proposition that only inventive application could transform a fundamental principle into a patentable invention. In fact, *Neilson* stood for the opposite premise: that a patentee's means of application might well be trivial and known in the art, yet his discovery

21. See, e.g., *Alice Corp. Pty. Ltd. v. CLS Bank Int'l*, 134 S. Ct. 2347, 2354 (2014) (“We have interpreted § 101 and its predecessors in light of this exception for more than 150 years.”).

22. 437 U.S. 584 (1978).

23. (1841) 151 Eng. Rep. 1266 (Ex.); see also Michael Risch, *America's First Patents*, 64 FLA. L. REV. 1279, 1300–01 (2012) [hereinafter Risch, *America's First Patents*] (discussing the Court's historical application of *Neilson*).

24. *Neilson*, 151 Eng. Rep. at 1275.

25. 56 U.S. (15 How.) 62 (1854).

26. See, e.g., Joshua D. Sarnoff, *Patent-Eligible Inventions After Bilski: History and Theory*, 63 HASTINGS L.J. 53, 67–74 (2011) (reviewing nineteenth-century precedent). But see Richard H. Stern, *Mayo v. Prometheus: No Patents on Conventional Implementations of Natural Principles and Fundamental Truths*, 34 EUR. INTELL. PROP. REV. 502, 504 (2012) (suggesting Neilson's application was a trivial implementation of his discovery).

of a new scientific principle would sustain his patent.²⁷ In both England and the United States, *Neilson* established the line between principles in the abstract, which were not patent eligible, and practical applications of principles, which were.²⁸ That understanding was carried forward through the early twentieth century in the United States, where it became black-letter law that nearly every practical application of a fundamental principle might properly be the subject of a patent. It was not until 1948, when the Supreme Court decided *Funk Brothers Seed Co. v. Kalo Inoculant Co.*,²⁹ that a test of inventive application entered the mainstream of American patent law.

Part I of this Article briefly traces the development of the Supreme Court's modern subject-matter eligibility jurisprudence leading up to the Court's statement of the inventive application test in *Mayo*. Part II examines in detail not only *Neilson*, but the related cases in the English and Scottish courts, showing that the Exchequer sustained Neilson's patent not because his application was inventive, but rather because it was conventional. Part III addresses American developments in the nineteenth century, examining how *Neilson* shaped the Supreme Court's jurisprudence and how the lower courts and authorities of the late nineteenth century drew the boundary between discovery and invention. Part IV carries the story into the first half of the twentieth century as American law continued to differentiate between principles in the abstract and patent-eligible inventions. Part V then turns to *Funk Brothers* and its test of inventive application, and how courts in the years leading up to *Flook* implemented *Funk Brothers'* standard. This Article's Conclusion considers the lessons of this historical survey and how the patent-eligibility doctrine might move forward from *Mayo* in the wake of *Alice*.

I. THE ROAD TO *MAYO*: A BRIEF SKETCH

The Supreme Court's modern patent-eligibility jurisprudence began with *Gottschalk v. Benson*³⁰ in 1972. *Benson* considered claims to a method of interconverting between two different representations of numerical data in computers: binary and binary-coded decimal.³¹ *Benson's* basic premise was simple: "phenomena of nature," "mental processes," and "abstract intellectual concepts" are not patent eligible.³²

But Justice William O. Douglas's analysis was anything but simple. In what seems to have become a tradition for the Court, *Benson* invoked

27. See *Neilson*, 151 Eng. Rep. at 1273.

28. See Risch, *America's First Patents*, supra note 23, at 1301.

29. 333 U.S. 127 (1948).

30. 409 U.S. 63 (1972).

31. *Id.* at 64.

32. *Id.* at 63.

multiple rationales for unpatentability without definitively committing to any of them. Much of Justice Douglas's analysis focused on tangibility: unlike previous process claims sustained by the Court, the claimed processes in *Benson* neither required any particular machinery or apparatus, nor transformed matter from one state to another.³³ *Benson* also suggested that as a matter of policy, the decision to "extend" the patent system to computer programs was for Congress to make, not the Court.³⁴ Yet according to Justice Douglas, *Benson* "in a nutshell" was about preemption.³⁵ To grant Benson exclusive use of his claimed process would effectively preempt all uses of the underlying algorithm: "[I]f the judgment below is affirmed, the patent would wholly pre-empt the mathematical formula and in practical effect would be a patent on the algorithm itself."³⁶

Pursuing a course that might well be commended to today's courts, the Court in its next software case declined to address the § 101 question because the claims were obvious under § 103.³⁷ But in 1978 the Court tackled the question head on in *Parker v. Flook*,³⁸ adopting an analysis entirely different from *Benson*'s. The claims in *Flook* were drawn to a process of calculating an "alarm limit" for the catalytic conversion of hydrocarbons.³⁹ Seeking to distinguish *Benson*, the applicant pointed out that his claims did not "wholly pre-empt" the use of a mathematical algorithm; unlike *Benson*, where the claims encompassed the only practical use of the algorithm, the claims in *Flook* were limited to the use of the mathematical formulation in the catalytic conversion of hydrocarbons.⁴⁰

But for Justice John Paul Stevens, writing for the majority of the Court, the scope of preemption was not the test of patent-eligible subject matter. Limiting the reach of a claim by adding "conventional or obvious" steps could not transform a principle into patent-eligible subject matter.⁴¹ Nor did the Court regard tangibility of the claimed process as the key to patent eligibility. Rather, Justice Stevens's majority opinion held that courts should disregard the mathematical algorithm, or other underlying principle, when evaluating the eligibility of claims under § 101.⁴² Relying on *Neilson*, Justice Stevens explained that courts should treat the "principle or mathematical formula"

33. *See id.* at 70.

34. *See id.* at 71–73.

35. *Id.* at 71.

36. *Id.* at 72.

37. *See* *Dann v. Johnston*, 425 U.S. 219, 220 (1976) (declining to reach the subject-matter question because the invention was obvious).

38. 437 U.S. 584 (1978).

39. *Id.* at 585.

40. *See id.* at 589–90 (agreeing that applicant's claims did not seek to preempt every use of the underlying algorithm).

41. *Id.* at 590.

42. *See id.* at 591–92.

underlying a claim, whether previously known or not, “as though it were a familiar part of the prior art.”⁴³ The patent eligibility of the claim would then depend on what remained. In particular, subject-matter eligibility would turn on whether the claim represented an *inventive application* of a fundamental principle, such as a law of nature or mathematical algorithm: “Even though a phenomenon of nature or mathematical formula may be well known, an inventive application of the principle may be patented. Conversely, the discovery of such a phenomenon cannot support a patent unless there is some other inventive concept in its application.”⁴⁴

The dissenters in *Flook*⁴⁵ protested that Justice Stevens’s approach wrongly injected notions of novelty and inventiveness, more properly the domain of §§ 102 and 103, into the subject-matter inquiry.⁴⁶ And the *Flook* dissenters appeared to have won the debate three years later, when the Court decided *Diamond v. Diehr*.⁴⁷ Joined in that case by Justices Byron White and Lewis Powell as well as the other dissenters in *Flook*, Justice William Rehnquist squarely rejected the notion that novelty played any role in the § 101 inquiry.⁴⁸ The applicant in *Diehr* claimed a process for molding rubber in which a computer continuously monitored the temperature of the mold and opened the mold once the rubber was fully cured.⁴⁹ The claimed process employed a well-known mathematical algorithm, the Arrhenius equation, to calculate the curing time based on the observed temperature in the mold.⁵⁰ Following the broad construction the Court had given § 101 the previous Term in *Diamond v. Chakrabarty*,⁵¹ Justice Rehnquist emphasized that only laws of nature, natural phenomena, and abstract ideas were categorically excluded from patent protection.⁵² An industrial process for curing rubber was patent-eligible subject matter, not an abstract idea, and the involvement of computers or mathematical formulas in the claim did not detract from this conclusion.⁵³ To be sure, mathematical formulas, like scientific principles, were not patentable in the

43. *Id.* at 592.

44. *Id.* at 594.

45. Justice Potter Stewart, joined by Chief Justice Warren E. Burger and Justice William Rehnquist. *See id.* at 598.

46. *Id.* at 600 (Stewart, J., dissenting).

47. 450 U.S. 175 (1981).

48. *See id.* at 188–89 (“The ‘novelty’ of any element or steps in a process, or even of the process itself, is of no relevance in determining whether the subject matter of a claim falls within the § 101 categories of possibly patentable subject matter.”). *But see Flook*, 437 U.S. at 591 (“The process itself, not merely the mathematical algorithm, must be new and useful.”).

49. *Diehr*, 450 U.S. at 178–79.

50. *Id.* at 178.

51. 447 U.S. 303 (1980).

52. *Diehr*, 450 U.S. at 185.

53. *See id.* at 188.

abstract,⁵⁴ but whether aspects of the claimed process were novel or “inventive” were concerns of novelty under § 102 or nonobviousness under § 103, not a concern of subject matter under § 101.⁵⁵ Nor was it relevant whether the claims preempted all uses of the underlying principle.⁵⁶

Unfortunately *Diehr*, beginning a pattern that would be repeated in *Mayo*, maintained the pretense that all of the Court’s § 101 precedents were consistent with each other.⁵⁷ Justice Stevens’s dissent pointed out, of course, that *Flook* required the Court to treat the Arrhenius equation as part of the prior art, and ask whether the claim disclosed a further “inventive concept.”⁵⁸ Given that the steps beyond calculation of the Arrhenius equation were old, under *Flook* they could “not constitute a part of the inventive concept that the applicants claimed to have discovered.”⁵⁹ But according to Justice Rehnquist, *Flook* had held no such thing. To accept such reasoning would render all inventions unpatentable “because all inventions can be reduced to underlying principles of nature which, once known, make their implementation obvious.”⁶⁰

And in the face of silence from the Supreme Court, matters remained in the hands of the lower courts for nearly thirty years. The Court did not take up the question of patent eligibility again until it decided *Bilski* in 2010. *Bilski* concerned an application for a patent on a business method: the applicant had claimed a method for “managing the consumption risk costs of a commodity sold by a commodity provider at a fixed price,” said to be useful for long-term producers and consumers of commodities such as coal.⁶¹

The Supreme Court’s *Bilski* opinion clarified at least one thing. By a 5–4 majority the Court rejected the approach advocated by Justice Stevens, who would have excluded “business methods” from the scope of § 101.⁶² Rather, Justice Anthony Kennedy emphasized that only

54. *See id.* at 191.

55. *See id.* at 191, 193 n.15.

56. *See id.* at 192 n.14 (“A mathematical formula in the abstract is nonstatutory subject matter regardless of whether the patent is intended to cover all uses of the formula or only limited uses.”).

57. Justice Rehnquist would have no such compunctions in an unrelated case decided the same term as *Diehr*: “The most arrogant legal scholar would not claim that all of these cases applied a uniform or consistent test under equal protection principles.” U.S. R.R. Ret. Bd. v. Fritz, 449 U.S. 166, 176 n.10 (1980) (describing the Court’s equal protection jurisprudence).

58. *Diehr*, 450 U.S. at 204 (Stevens, J., dissenting).

59. *Id.* at 215.

60. *Id.* at 189 n.12 (majority opinion).

61. *Bilski v. Kappos*, 130 S. Ct. 3218, 3232 (2010) (Stevens, J., concurring) (internal quotation marks omitted).

62. *See id.* at 3232.

fundamental principles—laws of nature, natural phenomena, and abstract ideas—were excluded from patent eligibility under § 101.⁶³ Beyond that, the Court said little about how to determine whether a claim was drawn to an abstract idea. *Bilski* reiterated both *Flook*'s suggestion that algorithms should be regarded as part of the prior art,⁶⁴ and *Diehr*'s admonition to treat the claims as a whole.⁶⁵ The Court regarded the “machine-or-transformation” test, put forth by the majority of the Federal Circuit as the exclusive test for patent eligibility, as merely a “useful and important clue” in deciding the eligibility of a process under § 101.⁶⁶ But the Court's analysis declared that the claims in suit were nothing more than the abstract concept of hedging, and that the narrower claims merely provided examples of the use of the abstract idea in particular contexts.⁶⁷ The Court's brief analysis took its cue from *Flook*: the claims merely instructed “the use of well-known random analysis techniques . . . add[ing] even less to the underlying abstract principle than the invention in *Flook* did.”⁶⁸

Mayo, decided by a unanimous Court two years after *Bilski*, carried *Bilski*'s nod to *Flook* much further. The Court's opinion in *Mayo* did two things that *Bilski* did not. First, the Court firmly grounded the doctrine of subject-matter exclusion, at least in the context of natural phenomena, as a response to the concern that patents on fundamental principles would foreclose more innovation than they would promote.⁶⁹ Such a concern had been among Justice Douglas's rationales in *Benson*.⁷⁰ Yet in cases after *Benson*, the Court had tended to invoke the exclusion of fundamental principles as an unassailable axiom, or to justify their exclusion on other grounds.⁷¹ In *Mayo*, however, the danger of granting monopolies on “the basic tools of scientific and technological work”⁷² assumed center stage again. Yet while Justice Stephen Breyer discussed extensively the policy concern that “patent law not inhibit further discovery by improperly tying up the future use

63. *See id.* at 3229–30 (majority opinion).

64. *See id.* at 3230.

65. *See id.*

66. *See id.* at 3227.

67. *See id.* at 3231.

68. *Id.*

69. *See Mayo Collaborative Servs. v. Prometheus Labs., Inc.*, 132 S. Ct. 1290, 1293 (2012).

70. *See supra* text accompanying note 36.

71. In *Flook*, Justice Stevens suggested that a scientific principle was excluded from patentability because it “reveals a relationship that has always existed,” rather than being the creation of the inventor. *Parker v. Flook*, 437 U.S. 584, 593 n.15 (1978).

72. *Mayo*, 132 S. Ct. at 1293 (quoting *Gottschalk v. Benson*, 409 U.S. 63, 67 (1972) (internal quotation marks omitted)).

of laws of nature,”⁷³ preemption per se did not appear to be the primary test for patent-eligible subject matter. Preemption concerns “simply reinforce[d]” the Court’s conclusion that the claimed processes were not patent-eligible subject matter.⁷⁴

The second and more significant aspect of *Mayo* was the test it articulated for patent eligibility. Harkening back to *Flook*, Justice Breyer explained that a process focusing on a law of nature must “also contain other elements or a combination of elements, sometimes referred to as an ‘inventive concept,’ sufficient to ensure that the patent in practice amounts to significantly more than a patent upon the natural law itself.”⁷⁵ And as had Justice Stevens in *Flook*, Justice Breyer turned to the Court of Exchequer’s decision in *Neilson* to ground his rule. Quoting at length, Justice Breyer portrayed *Neilson* as a case in which the inventor had not merely disclosed a fundamental principle but instead had “explained how the principle could be implemented in an *inventive way*.”⁷⁶ According to Justice Breyer, the Court of Exchequer in *Neilson* had sustained the patent because “the claimed process included not only a law of nature but also several unconventional steps . . . that confined the claims to a particular, useful application of the principle.”⁷⁷

The *Mayo* Court therefore appeared to premise patent eligibility on *unconventional* application. According to the Court, the relationship between 6-TG levels and therapeutic efficacy, though triggered by human action,⁷⁸ was nothing but a law of nature.⁷⁹ The additional steps recited by the claim consisted of “well-understood, routine, conventional activity already engaged in by the scientific community.”⁸⁰ Such conventional activity could not transform an unpatentable law of nature into a patent-eligible application.⁸¹

73. *Id.* at 1301.

74. *Id.* at 1302. The Court indicated that the degree to which Prometheus’s claims covered all processes making use of the correlation between metabolite level and therapeutic efficacy or the degree to which the claims would interfere with future refinements were not factors in its analysis. After discussing those concerns, the Court stated: “We need not, and do not, now decide whether *were the steps at issue here less conventional*, these features of the claims would prove sufficient to invalidate them. For here, as we have said, the steps add nothing of significance to the natural laws themselves.” *Id.* (emphasis added). The conventionality of the appended steps, rather than preemption per se, was the failing of the *Mayo* claims. But the Court seemed to leave open the possibility that even unconventional applications might be unpatentable if unduly preemptive.

75. *Id.* at 1294 (quoting *Flook*, 437 U.S. at 594).

76. *Id.* at 1300 (emphasis added).

77. *Id.*

78. In *Mayo*, the human action was the administration of a thiopurine drug. *Id.* at 1296–97.

79. *Id.*

80. *Id.* at 1298.

81. *See id.*

Such an approach—focusing on whether the inventor’s implementation of a scientific principle was conventional at the time of the invention—was clearly contrary to *Diehr*. While *Diehr* expressly separated subject-matter eligibility from questions of novelty and nonobviousness, the *Mayo* Court recognized that “in evaluating the significance of additional steps, the § 101 patent-eligibility inquiry and, say, the § 102 novelty inquiry might sometimes overlap.”⁸² Yet as the *Diehr* Court maintained that its decision was compatible with *Flook*, the *Mayo* Court likewise maintained that its decision was compatible with *Diehr*. According to *Mayo*, the steps beyond the Arrhenius equation in *Diehr*—monitoring the temperature in the mold, feeding that data to a computer, and opening the mold when the cure was calculated to be complete—were not, at least in combination, “obvious, already in use, or purely conventional.”⁸³ The supposed unconventionality of these steps meant that the applicants had not attempted to preempt all uses of the Arrhenius equation. Instead, the applicants had claimed only an inventive application of the Arrhenius equation.⁸⁴ In contrast, the steps in *Flook* “did not limit the claim to a particular application.”⁸⁵ They were mere “conventional or obvious” activity, evincing no inventive concept that would transform the underlying principle into a patent-eligible process.⁸⁶

These quotations reveal two intertwined strains of thought in *Mayo*: that something more than “conventional or obvious” activity is necessary to transform a fundamental principle into an inventive application, and that a claim extending to all applications of a fundamental principle is not patent eligible. The two are paired throughout *Mayo*. For example, in his exegesis of *Neilson*, Justice Breyer wrote that the “unconventional steps” confined Neilson’s patent to “a particular, useful application of the principle.”⁸⁷ While *Mayo* seems to assume that unconventional steps confine fundamental principles to particular applications, the two are not necessarily dependent on each other. Depending on the state of the art, an inventive application of a fundamental principle might well preempt all practical applications of that principle (at least at the time of discovery).⁸⁸

82. *Id.* at 1304.

83. *Id.* at 1299.

84. *Id.*

85. *Id.*

86. *Id.* (quoting *Parker v. Flook*, 437 U.S. 584, 589, 590, 594 (1978) (internal quotation marks omitted)).

87. *Id.* at 1300; *see also id.* at 1302 (stating that Prometheus’s claims were invalid because the steps were conventional, and noting that the claims were not confined to “particular applications” of underlying laws).

88. Unless some conventional application would invariably be implied by preexisting nature and science, the time-dependence of the preemption inquiry makes it problematic as a

Conversely, given the Court's constant reiteration that field-of-use restrictions cannot circumvent the prohibition against claiming fundamental principles,⁸⁹ the mere fact that steps confine a principle to a particular application cannot be decisive in the analysis.⁹⁰

Regardless of whether the ultimate criterion for eligible subject matter is inventive application, application less extensive than the underlying principle, or some other test, the notion of inventive application in the Court's precedent clearly emerges from a particular view of historical precedent. In particular, both *Flook* and *Mayo* drew on the Court of Exchequer's 1841 opinion in *Neilson*. *Flook* viewed the Court's landmark *Morse* case as founded upon *Neilson*, as well as other foundational nineteenth-century Supreme Court cases,⁹¹ such as *Risdon Iron & Locomotive Works v. Medart*⁹² and *Tilghman v. Proctor*.⁹³ One might assume from the Court's earlier opinions, as Justice Stevens argued in his dissent in *Diehr*, that the distinction between a fundamental principle and an inventive application of that principle was "well-established precedent"⁹⁴ in English and American law. And even those who would reject the notion of inventive application still turn to *Neilson* (particularly through the medium of *Morse*) to define the boundary between unpatentable principle and patentable invention.⁹⁵

II. THE HOT-BLAST CASES

Neilson and related cases were indeed the paradigm cases for debates over "principle" in both English and American patent jurisprudence in the nineteenth century. With the long prominence of *Neilson* in American patent jurisprudence, and particularly with its recent revival, it is surprising how poorly understood the case is today. For an examination of *Neilson* reveals a very different picture from the one drawn in *Flook* and *Mayo*. *Neilson* did not stand for the proposition that

criterion for patent eligibility. If, following *Bilski*, one defines patent eligibility solely in terms of the excluded categories, the definition of law of nature or abstract idea should not vary depending on the state of the art. Restricting "inventions" to the products of human creativity, on the other hand, permits evolution of the category.

89. See, e.g., *Mayo*, 132 S. Ct. at 1300–01 (explaining that limiting use of a formula to a particular technological environment does not render it patent eligible).

90. That ambiguity, coupled with the Court's pretense that *Diehr* was compatible with the analysis in *Flook* and *Mayo*, led to (or at least permitted) the Federal Circuit's failure to articulate a coherent standard for computer-implemented inventions in *Alice*.

91. *Flook*, 437 U.S. at 592, 593 n.13.

92. 158 U.S. 68 (1895).

93. 102 U.S. 707 (1880).

94. *Diamond v. Diehr*, 450 U.S. 173, 216 (1981) (Stevens, J., dissenting).

95. *CLS Bank Int'l v. Alice Corp. Pty. Ltd.*, 717 F.3d 1269, 1298–99 (Fed. Cir. 2013) (en banc) (per curiam) (Rader, J., concurring in part and dissenting in part) (discussing *Morse*'s treatment of *Neilson*).

unconventional activity was necessary to transform a newly discovered principle into a patentable invention. Just the opposite was true: The patent in *Neilson* was sustained by the Court of Exchequer not because the patentee's application was inventive, but because his application was entirely routine and conventional. Beginning with *Neilson*, courts on both sides of the Atlantic understood the boundary between principle and invention to reside in *practical* application, not *inventive* application. This Part provides the historical content of the hot-blast cases, and reveals the true meaning of the famous language from *Neilson* that is quoted in *Flook* and *Mayo*. It also examines how the hot-blast cases came to be the definitive authority on the patentability of fundamental principles for later English courts and commentators.

A. *Antecedents: The Watt Patent and "Principles"*

Prior to *Neilson*, the most extensive discussions of "principle" in English patent law arose from James Watt's patent on the improved steam engine at the very end of the eighteenth century.⁹⁶ However, these discussions provided little guidance. Watt's unfortunate choice of language in his specification encumbered the litigation over the patent, particularly at Common Pleas. Watt invented seven separate improvements to the steam engine. But in his specification, rather than explicitly describing a steam engine that embodied those improvements, he instead disclosed seven "principles" upon which steam engines should be constructed for maximum efficiency.⁹⁷ These principles were practical directives for the construction of steam engines, not laws of nature or scientific truths.⁹⁸ Nevertheless, by describing his improvements as principles, he invited extensive debate over whether he claimed a patentable manufacture or, as contended by the defendants, merely "unorganized principles."⁹⁹ Common Pleas divided equally over the issue, largely on disagreement about what the term "principle" actually meant.¹⁰⁰ But King's Bench agreed that despite Watt's choice of words, his patent was not for a principle but a manufacture: an improved steam engine.¹⁰¹ Thus, it was not necessary for the court to consider "whether or not mere abstract principles are the subject of a patent."¹⁰²

96. *Boulton & Watt v. Bull*, (1795) 126 Eng. Rep. 651 (C.P); *Hornblower v. Boulton*, (1799) 101 Eng. Rep. 1285 (K.B.).

97. *Boulton & Watt*, 126 Eng. Rep. at 651, 652.

98. *Id.* at 659. For example, he explained that the steam cylinder should be kept as hot as the steam that entered it by enclosing it in an insulated case. *Id.* at 652.

99. *Id.* at 655.

100. *See id.* at 658–70.

101. *See Hornblower*, 101 Eng. Rep. at 1291.

102. *Id.* (opinion of Laurence, J.).

B. *The Hot Blast*

Just as *Neilson v. Harford* was a landmark case for English and American patent law, the technology at issue in *Neilson* was a landmark innovation of the Industrial Revolution. The litigation in *Neilson v. Harford*, and related cases, originated with Scottish inventor James Beaumont Neilson's development of the hot-blast iron smelting process, which industrial historian Alan Birch described as "the most important single innovation in the industry in the age of iron."¹⁰³ Running counter to the conventional wisdom that air introduced into the furnace should be as cold as possible, Neilson proposed preheating the air before feeding it into the furnace.¹⁰⁴ The use of the hot blast revolutionized the production of iron. Not only did it immediately reduce by two-thirds the fuel required for smelting,¹⁰⁵ perhaps more significantly, it also permitted the use of raw coal rather than coke for fuel, making the exploitation of lower-quality iron ores economically feasible.¹⁰⁶ The great expansion of iron production in Wales and Pennsylvania was founded on the hot blast as well because the process permitted, for the first time, the economical use of local anthracite deposits as fuel.¹⁰⁷

Significantly for the subsequent litigation, Neilson's patent was short on detail. His brief specification, for "the improved application of air to produce heat in fires, forges, and furnaces," taught that air from a bellows or other blowing apparatus be directed into "an air vessel or receptacle," where it ought to be heated to a "considerable temperature."¹⁰⁸ The specification disclosed typical vessel volumes for small-scale operations and, in the case of larger blast furnaces, that "air vessels of proportionably increased dimensions and numbers are to be employed."¹⁰⁹ Most significant for the ensuing litigation, the specification declared that "[t]he form or shape of the . . . receptacle was immaterial to the effect," as were the composition of the air vessel and the manner of applying heat.¹¹⁰

103. ALAN BIRCH, *THE ECONOMIC HISTORY OF THE BRITISH IRON AND STEEL INDUSTRY 1784–1879*, at 181 (1968).

104. Paul Belford, *Hot Blast Iron Smelting in the Early 19th Century: A Re-Appraisal*, 46 *HISTORICAL METALLURGY* 32, 33 (2012). Paul Belford, a historical archaeologist, notes that other workers in the field, such as Thomas Botfield, may have been experimenting with hot blast prior to Neilson. *See id.* at 37–42.

105. BIRCH, *supra* note 103, at 183.

106. *See id.* at 173.

107. *See id.* at 186; R. D. Corrins, *The Great Hot-Blast Affair*, in 7 *INDUSTRIAL ARCHAEOLOGY* 233–34 (1970); ROBERT B. GORDON & PATRICK M. MALONE, *THE TEXTURE OF INDUSTRY: AN ARCHAEOLOGICAL VIEW OF THE INDUSTRIALIZATION OF NORTH AMERICA* 155–56 (1994).

108. THOMAS WEBSTER, *REPORTS AND NOTES OF CASES ON LETTERS PATENT FOR INVENTIONS* 273 (1844) [hereinafter *Neilson's Patent*].

109. *Id.*

110. *Id.* at 273–74.

C. *The Neilson Case*

Neilson v. Harford was only one of some twenty actions asserting Neilson's patents against defendants in England and Scotland, and was not even the largest case.¹¹¹ After most of a decade in which nearly all the major iron works had taken a license, Scottish ironmakers led by James and William Baird organized a coalition of firms to challenge and resist the Neilson patents.¹¹² Ironmakers of the coalition agreed to coordinate litigation strategy and apportion the costs of the defense by volume of production.¹¹³ The Scottish litigation had begun first, but *Neilson v. Harford*, which arose from proceedings against a similar coalition of English ironmasters, was the first to rule on the validity of Neilson's patent.¹¹⁴ *Neilson* was tried at *nisi prius* before the Court of Exchequer, Baron James Parke presiding, from May 4th to May 6th, 1841.¹¹⁵ But the famous opinion in the case is the June 9th judgment of the full Court of Exchequer, which heard the case on the plaintiff's rule after Baron Parke had directed a verdict in favor of the defendants.¹¹⁶

To understand *Neilson*, and to understand *Neilson's* treatment in subsequent nineteenth-century patent cases, one must remember the relatively undeveloped state of patent jurisprudence at the time. English patent law of the late eighteenth and early nineteenth century was plagued by uncertainty about what kind of inventions could be the subject of patents, and about the role of the patent specification.¹¹⁷ When patents lacked formal claims, defining "the invention" involved a holistic examination of the specification and, in some cases, the actual embodiments or experiments carried out by the patentee.¹¹⁸ Much of the dispute in *Neilson* revolved around the nature of the patentee's invention. At the time the case was litigated, that inquiry raised at least three fundamental issues that patent law would recognize as doctrinally distinct today, but were not clearly differentiated at the time. First, there was a question that is today the eligibility issue: did Neilson's patent claim an unpatentable principle or a patentable invention? Second, *Neilson* presented a question of scope: given his disclosure, how far did

111. See Correns, *supra* note 107, at 245.

112. *Id.*

113. *Id.* at 245–46.

114. See *id.* at 248. According to R. D. Correns, the English coalition was in communication with the Scottish Baird group and adopted similar tactics. See *id.*

115. *Neilson v. Harford*, 1 Web. P. C. 295 (1841).

116. *Neilson v. Harford*, 1 Web. P. C. 331 (1841). The defendants also obtained a rule for a new trial, but that rule was not sustained by the Court. See *Neilson v. Harford*, 1 Web. P. C. 328, 329–30 & n.(p) (1841).

117. See H. I. DUTTON, *THE PATENT SYSTEM AND INVENTIVE ACTIVITY DURING THE INDUSTRIAL REVOLUTION, 1750–1852*, at 72–76 (1984).

118. David J. Brennan, *The Evolution of English Patent Claims as Property Definers*, 4 INTELL. PROP. Q. 361, 362–81 (2005).

Neilson's rights extend beyond the apparatus he disclosed? And third, at least for later courts, the case raised the question of whether a process could be patented separately from the instrumentalities through which it operated.

The argument in *Neilson* was extensive,¹¹⁹ but Baron Parke provided a relatively brief opinion for the full court.¹²⁰ The portion that has been the subject of so much attention from American courts appears at the beginning of his opinion as a question of “the proper construction to be put on the specification itself.”¹²¹ Examining the “nature of the invention,” Baron Parke stated:

It is very difficult to distinguish it from the specification of a patent for a principle, and this at first created in the minds of some of the court much difficulty; but after full consideration, we think that the plaintiff does not merely claim a principle, but a machine embodying a principle, and a very valuable one. We think the case must be considered as if the principle being well known, the plaintiff had first invented a mode of applying it by a mechanical apparatus to furnaces; and his invention then consists in this—by interposing a receptacle for heated air between the blowing apparatus and the furnace.¹²²

This was the language on which Justice Stevens relied in *Flook*, for the proposition that a “principle or mathematical formula” in a claim should be regarded as “well known”—that is, assumed to be within the prior art.¹²³ Justice Breyer also reached back to this language in *Mayo*, citing it in support of the proposition that only appending *unconventional* steps—in the case of *Neilson*, inserting the receptacle, applying heat to the receptacle, and blowing the hot air into the furnace—could transform a new discovery into a patent-eligible process.¹²⁴ Describing the legal problem in *Neilson* as very similar to the one faced by the Court in *Mayo*, Justice Breyer explained that the patent was sustained because Neilson's invention—his mode of applying the discovery—consisted of a new and inventive arrangement of machinery.¹²⁵

Yet the primary dispute in *Neilson* was not whether Neilson had attempted to patent a discovery or law of nature. According to the

119. *Neilson*, 1 Web. P. C. at 331–69.

120. *See id.* at 369–73.

121. *Id.* at 370.

122. *Id.* at 370–71.

123. *Parker v. Flook*, 437 U.S. 584, 592 (1978).

124. *Mayo Collaborative Servs. v. Prometheus Labs., Inc.*, 132 S. Ct. 1290, 1293 (2012).

125. *Id.*

defendant, Neilson did not even fully understand the principle underlying the hot blast.¹²⁶ Both at trial and on appeal, the defendant's challenge to the patent hinged almost entirely on inadequate disclosure, especially Neilson's failure to specify the form of the heating vessel.¹²⁷ To scale up the process from the small forges that Neilson had employed, the defendant found it necessary to route the air through an elaborate system of cross-connected pipes, which provided sufficient surface area to achieve the necessary degree of heating.¹²⁸ Neilson's patent did not suggest such an apparatus or even the need to reconfigure the heating vessel when scaling up the process. To the contrary, Neilson had expressly stated that the shape of the heating vessel was immaterial to its operation.¹²⁹ In modern terms, the defendant made a straightforward enablement argument: based on Neilson's paltry disclosure of a heating vessel, one of ordinary skill in the art could not practice the invention, at least on an industrial scale.

Formally, adequacy of the specification was the only issue before the court on appeal. At trial, Baron Parke had directed a verdict for the defendant on this question, contrary to the jury's finding that the specification sufficiently disclosed the heating apparatus.¹³⁰ The correctness of that rule was the grounds of appeal to the full Court of Exchequer.¹³¹ So if the question in *Neilson* was whether the patentee had adequately disclosed the invention's heating apparatus, why was it necessary for the Court of Exchequer to state that the invention's principle should be regarded as "well known"?

Clues to this cryptic phrase may appear upon perusal of Baron Edward Alderson's comments during argument of the case. In discussing the distinction between a patent for a principle and a patent for a principle embodied in a machine, Baron Alderson elaborated on

126. *Neilson*, 1 Web. P. C. at 339–40 (defendant's argument).

127. *See, e.g., id.* at 339. Defendant's argument on appeal was the following:

[T]he vice of the specification is, that it directs nothing but the heating of the vessel, and assumes the heating of the air as a consequence, and yet tells you that the shape and form of the vessel which is to be heated for the purpose of producing the result, are quite immaterial to the effect to be produced.

Id.

128. *Id.* at 304 (defendant's argument at trial) (describing defendant's apparatus); *id.* at 339 (defendant's argument on appeal) (pointing out the necessity of increasing surface area).

129. *See id.* at 371 (quoting specification).

130. A special jury had found that Neilson's specification was sufficient, despite his statement that the form and shape of the heating vessel was immaterial. *See Neilson*, 1 Web. P. C. at 327. Baron Parke directed a verdict for the defendants on that issue, with liberty to the plaintiffs to move for a rule directing a verdict in their favor. *See id.* at 327–28.

131. *Id.* at 331. The defendant secured a rule for a new trial on the same grounds, but that appeal appears to have been disallowed by the Exchequer. *See id.* at 330 n.p.

the idea that the “principle” of the invention should not be regarded, in the legal sense, as the patentee’s creation:

I have always thought that the real test was this; that in order to discover whether it is a good or a bad patent, you should consider that what you cannot take out a patent for must be considered to have been invented *pro bono publico*—that is to say, the principle must be considered as having had an anterior existence before the patent.¹³²

Considering the principle to have “an anterior existence”—being well known—was a way to rationalize dedicating the patentee’s underlying discovery to the public. Baron Alderson was attempting to reconcile the legal doctrine that the abstract principle behind the invention was not patentable with the recognition that the discovery of the principle may have been the real “invention” by the patentee. This is not a paradox for modern patent doctrine founded on the peripheral claim. The inventor’s creation and the scope of patent protection are ontologically quite distinct. But in a time where “invention” and “scope of protection” were essentially synonymous, it was necessary to explain how an inventor who had discovered a new principle was nonetheless not entitled to claim it. Treating the principle as having an anterior existence was a way to assess whether the patentee was claiming a principle in the abstract or a mode of practically applying that principle.¹³³ As Baron Alderson’s application of his test to the patent in *Neilson* shows:

Now, here, supposing it had been known that hot air applied to a furnace was a great improvement on cold air, and that this person had taken out his patent, and this patent was a patent for the application of a well-known thing, the hot air to furnaces; then he takes out a patent for applying it, by means of an intermediate reservoir between the blast furnace and the bellows; then surely any body else may apply the same principle, provided he does not do it by a reservoir intermediately between the blast furnace and the bellows, and the question for a jury is, whether or not a

132. *Id.* at 342 n.(c). Thomas Webster attributes this dialogue to “a subsequent part of the case.” *Id.*

133. Because the patentability of methods per se was uncertain when *Neilson* was decided, the question of patentability was also bound to the distinction between a claim to an apparatus and a claim to a method of heating air. See Risch, *America’s First Patents*, *supra* note 23, at 1300–01.

long spiral pipe is a reservoir; if it be not a reservoir, or a colourable imitation of a reservoir, it is no infringement.¹³⁴

Thus in Baron Alderson's view, if the principle of the hot blast was known, it would be clear that Neilson had claimed not the principle but his mode of application. The only question remaining would be one of scope: whether the defendants' heating apparatus was equivalent to Neilson's "reservoir."

But the key to understanding Baron Parke's analysis in *Neilson* is the Exchequer's prior opinion in *Minter v. Wells*,¹³⁵ which had been decided by the court in 1834. *Minter* involved a patent drawn to what must have been one of the first reclining chairs. The patentee was supposedly the first to apply a previously known principle—the self-adjusting leverage—to the back and seat of chairs.¹³⁶ Like Neilson, Minter had not restricted his claim to a particular apparatus, instead claiming in general terms the application of a self-adjusting leverage to chairs.¹³⁷

On motion for nonsuit, the defendant's central argument was that the patent was for "a principle only."¹³⁸ According to the defendant, the patent attempted to monopolize "one of the first principles in mechanics," the self-adjusting lever.¹³⁹ The Court of Exchequer was not impressed. As Baron Parke put it:

The claim of the patent is not to the principle, but to the combination of the principle and the machine—the application of the self-adjusting lever to the construction of a chair.¹⁴⁰

The patent was therefore drawn to a patentable application, rather than to an unpatentable principle. Moreover, because the claim was to the application of the self-adjusting lever to a chair, rather than the particular mechanism employed, the patent extended to every chair adapting the principle with similar effect.¹⁴¹ That included the defendant's chairs, which implemented the principle by a different mechanism.¹⁴²

134. *Neilson*, 1 Web. P. C. at 342 n.(c). Likewise, Baron Alderson suggests that if Watt's discovery had been known prior to his invention, his patent would still be valid. *Id.*

135. (1834) 149 Eng. Rep. 1180 (Ex.).

136. *Id.* at 1180.

137. *Id.*

138. *Minter v. Wells*, 1 Carp. P. C. 639, 639 (1843).

139. *Id.* at 641–42; *see also* *Minter v. Wells*, 1 Web. P. C. 127, 135 (1834) ("The plaintiff, by his specification, has appropriated to himself a first principle in mechanics, *viz.* the lever, and therefore nobody else may use it.")

140. *Minter*, 1 Carp. P. C. at 646.

141. *Id.* at 642 (Lyndhurst, C.B.) ("Any application of the self-adjusting principle to the back and seat of a chair producing this effect . . . would be an infringement of this patent, but nothing short of that."). That scope may have extended the patent too far; in a subsequent suit against different defendants, King's Bench determined that a prior art chair had also embodied a

In light of the Court of Exchequer's previous opinion, it becomes clear that *Neilson's* reasoning is simply an extension of *Minter's*. In *Minter*, the court upheld the patent against the charge that it monopolized a principle by pointing out that the patent merely claimed an application of that principle.¹⁴³ *Neilson* presented a similar challenge, except that the patentee had also discovered the principle underlying the patent. But if one regarded the principle that hot air was better than cold as "well-known," then it would appear that his patent was drawn to something beyond the principle itself: namely, a mode of putting that principle to practical effect "by interposing a receptacle for heated air between the blowing apparatus and the furnace."¹⁴⁴ Under *Minter*, the patent would be valid subject matter if Neilson had applied a previously known principle to the blast furnace. To defease Neilson of his patent because he happened to discover a new principle as well would be a curious result.¹⁴⁵ And if *Minter* could exclude all chairs embodying the application of the self-adjusting lever to a chair, was not Neilson entitled to exclude all processes employing the interposition of a heated receptacle to preheat the air?

The analogy to *Minter* was made explicit in proceedings on Neilson's Scottish patent, discussed in more detail below. Lord Justice Clerk John Hope's summing to the jury used *Minter's* case to illustrate the distinction between principle and application:

[I]t was the application of a well-known principle, but for the first time applied to a chair. . . . Lord Lyndhurst and the rest of the court held, that this was not a claim to a principle, but to the construction of a chair on this principle, in whatever shape or form it may be constructed. Just so as to the hot blast, only the principle is also new.¹⁴⁶

But *Neilson* presented a more difficult case than *Minter*. While Neilson had suggested that hot air was better than cold, his disclosure was remarkably short on details concerning the means of heating the

self-adjusting leverage. *Minter v. Mower*, (1837) 112 Eng. Rep. 282, 282 (K.B.). *Minter* was thereby nonsuited. *Id.* at 286.

142. See *Minter*, 1 Carp. P. C. at 641 (defendant's argument).

143. *Minter v. Wells*, (1834) 149 Eng. Rep. 1180, 1180 (Ex.) ("The defendant has confined himself . . . to the benefit of the principle." (internal quotation marks omitted)).

144. *Neilson v. Harford*, 1 Web. P. C. 331, 371 (1841).

145. See also Lord Justice Clerk John Hope's comments in *Househill Coal & Iron Co. v. Neilson*. 1 Web. P.C. 673, 684 (1843) ("It would be very strange and unjust to refuse [a patent applying a principle], when the inventor has the additional merit of discovering the principle as well as its application to a practical object.").

146. *Id.* at 686 (footnote omitted) (Lord Justice Clerk Hope's instruction to the jury at trial).

air,¹⁴⁷ or any other aspect of the process for that matter.¹⁴⁸ For the Court of Exchequer, this raised the question of whether Neilson was attempting to patent a naked principle—in which case his patent was bad—or a practical mode of carrying that principle into effect—in which case his patent was good.¹⁴⁹

And that is the great irony of the Supreme Court’s treatment of *Neilson* in *Mayo*, where Justice Breyer suggested that Neilson’s patent was sustained because his mode of application was unconventional and inventive.¹⁵⁰ The Court of Exchequer sustained Neilson’s patent not because his application was inventive, but because his application was *entirely conventional*. In refuting the defendant’s challenge based on lack of disclosure, both the patentee and the court hammered away at the point that Neilson’s instrumentalities were known and conventional in the field. As the patentee argued:

The mode of heating air was perfectly well known; it was no discovery of Mr. Neilson’s, every body knew it. Air had been heated, and there had been different shaped vessels employed for heating the air; for heating the air economically, and for heating it to a higher or lesser degree of temperature; all that was perfectly well known.¹⁵¹

Or as Baron Alderson responded to the defendant’s charge:

The blowing apparatus was perfectly well known; the heating of air was perfectly well known; the twire was perfectly well known as applicable to blast furnaces; then what he really discovered is, that it would be better for you to apply air heated up to red heat, or nearly so, instead of cold air as you have hitherto done. That is the principle; that is the real discovery; but, in order to take out a patent, you must have an embodiment of the principle, and his embodiment of the principle is the heating of air in a

147. Neilson’s specification stated the approximate size of the air vessel for “an ordinary smith’s fire or forge,” and that for blast furnaces and the like “air vessels of proportionably increased dimensions and numbers are to be employed. The form or shape of the vessel or receptacle is immaterial to the effect, and may be adapted to the local circumstances or situation.” *Neilson’s Patent*, *supra* note 108, at 273.

148. As to temperature, Neilson directed, “It is better that the temperature be kept to a red heat or nearly so, but so high a temperature is not absolutely necessary to produce a beneficial effect.” *Id.*

149. *Neilson*, 1 Web. P. C. at 342.

150. *See Mayo Collaborative Servs. v. Prometheus Labs., Inc.*, 132 S. Ct. 1290, 1300 (2012).

151. *Neilson*, 1 Web. P. C. at 344 (patentee’s argument on appeal).

separate vessel, intermediately between the blowing apparatus and the point where it enters the furnace.¹⁵²

The point of these arguments was twofold. The first was a direct response to the defendant's inadequate-disclosure challenge. If the instrumentalities for heating were old and well known in the field, and if one of ordinary skill in the art could construct various means of heating the air, then the defendant's enablement challenge failed. Because the jury had expressly found that a "competent workman" could design an air vessel to provide the necessary heating of air, Neilson's patent was not invalid for lack of adequate disclosure.¹⁵³

The second was to identify precisely what Neilson's patent embraced. Had Neilson merely claimed the abstract principle that hot air was better than cold? If so, his patent was invalid as drawn to a mere "principle." There had been serious doubt, at least in Baron Alderson's mind, whether Neilson had sufficiently disclosed *any* practical mode of application.¹⁵⁴ That doubt is likely what Baron Parke had been referring to when he stated that "some of the court" had "much difficulty" in distinguishing Neilson's patent from a patent on a principle.¹⁵⁵ But the Exchequer ultimately concluded that Neilson had claimed not a principle but a mode of application—the interposition of a heated vessel between the blower and the furnace.¹⁵⁶ The practical difference between a patent drawn to "interposing a receptacle for heated air"¹⁵⁷ and a patent drawn to "hot air is better than cold"¹⁵⁸ may appear slight. Yet it was sufficient for the Court of Exchequer to regard Neilson's patent as drawn to more than a mere principle. And having disclosed enough to enable one of ordinary skill in the art to practice that mode, Neilson's patent extended to any process that drew air through a heated receptacle before introducing it into the blast—regardless of the shape or size of the heating vessel.

152. *Id.* at 337 (interposition of Baron Alderson).

153. *Id.* at 372.

154. *See id.* at 342 (interposition of Baron Alderson) ("The difficulty which presses on my mind here is, that this party has taken out a patent, in substance like Watt's, for a principle, that is, the application of hot air to furnaces, but he has not practically described any mode of carrying it into effect.").

155. *Id.* at 371.

156. *Id.*

157. *Id.*

158. *See O'Reilly v. Morse*, 56 U.S. (15 How.) 62, 116 (1854) (positing that had this been the construction of the patent in *Neilson*, "the court, it appears, would have held this patent to be void").

D. *The Hot-Blast Cases Following Neilson*

Opinions in the other hot-blast cases immediately following *Neilson* leave no doubt: contemporaneous courts did not interpret *Neilson* as demanding unconventional application, nor prior art treatment of fundamental principles. The first case arising from the efforts of the Baird coalition in Scotland was *Neilson v. Househill Coal & Iron Co.*,¹⁵⁹ although the Bairds themselves had not yet been sued.¹⁶⁰ The case was tried before the Court of Session in April 1842.¹⁶¹ Although it was not entirely clear if the defendant's plea properly raised the issue,¹⁶² Lord Justice Clerk Hope laid before the jury the question of whether *Neilson's* patent was an unpatentable principle or a patentable application:

It is quite true that a patent cannot be taken out solely for an abstract philosophical principle—for instance, for any law of nature, or any property of matter, apart from any mode of turning it to account in the practical operations of manufacture, or the business, and arts, and utilities of life. The mere discovery of such a principle is not an invention, in the patent law sense of the term. . . . But a patent will be good, though the subject of the patent consists in the discovery of a great, general, and most comprehensive principle in science or law of nature, if that principle is by the specification applied to any special purpose, so as thereby to effectuate a practical result and benefit not previously attained.¹⁶³

But was that distinction founded on whether the patentee's application of the principle was inventive rather than conventional?

The main merit, the most important part of the invention, may consist in the conception of the original idea—in the discovery of the principle in science, or of the law of nature, stated in the patent, and *little or no pains may have been taken in working out the best manner and mode of the application* of the principle to the purpose set forth in the patent.¹⁶⁴

Far from endorsing the position that the application of the principle must be inventive, Lord Justice Clerk Hope emphatically denied it. Though the new scientific discovery or law of nature was not patentable in the abstract, it was the *discovery* that conferred “merit” on the

159. (1842) 14 Scottish Jurist 626.

160. See Corrins, *supra* note 107, at 246–47.

161. See *Househill*, 14 Scottish Jurist at 630.

162. *Househill Coal & Iron Co. v. Neilson*, 1 Web. P. C. 673, 677 (1843).

163. *Id.* at 683.

164. *Id.* (emphasis added).

invention. Developing the application may well have been trivial in light of the discovery, but it nonetheless sufficed to transform the abstract principle into a patentable invention.¹⁶⁵ Following the Court of Exchequer, Lord Justice Clerk Hope concluded that the true invention was the patentee's mode of carrying his principle into effect,¹⁶⁶ and Neilson's patent was therefore not confined to the particular form of the apparatus he constructed or disclosed.¹⁶⁷

Upon the defendant's motion for a new trial, the Court of Session's Second Division rejected the defendants' exception to Lord Justice Clerk Hope's charge.¹⁶⁸ It is plain from the Court's opinions that the judges regarded Neilson's invention not as the particular mode or apparatus for preheating air, but rather the heating of air between the blower and the furnace.¹⁶⁹ Such a patent could be sustained, as Lord James Moncreiff put it, "as long as it is clear that there is a principle discovered, and a mechanical process for carrying that principle into operation pointed out."¹⁷⁰ The implications of Lord Moncreiff's statement are clear: the principle was what the inventor had *discovered*, and was the foundation of the invention.¹⁷¹ A mode of application was certainly necessary for the patent, but the application was something the inventor *pointed out*, not discovered. And the Court of Session's decision seems to have settled the matter. The appeal to the House of Lords turned entirely on a question of prior use; the other issues were argued cursorily,¹⁷² and the judges seemingly regarded them as either waived by the defendant or settled conclusively by *Neilson*.¹⁷³

The Bairds finally took the field on their own account against Neilson in 1843. The trial at the Court of Session lasted for a record ten days, took testimony from over a hundred witnesses, and was litigated by many of the leading attorneys of the time.¹⁷⁴ Unlike *Househill*, the question of whether Neilson had claimed a principle was raised directly,

165. Lord Justice Clerk Hope proceeded to reason by analogy to *Minter*: if a new application of a well-known principle yielded "a practical result for a special purpose," then "[i]t would be very strange and unjust to refuse the same legal effect, when the inventor has the additional merit of discovering the principle as well as its application to a practical object." *Id.* at 684.

166. *Id.* at 685.

167. *See id.* at 685–86 (analogizing the case to *Minter*).

168. *Neilson v. Househill Coal & Iron Co.*, (1842) 14 Scottish Jurist 626, 653.

169. *See id.* at 650 (Moncreiff, L.J.).

170. *Id.* at 651.

171. *See id.* at 650 ("There is not any doubt, that, at the bottom of the invention, there is the principle, that a blast of hot air will produce more heat in a furnace than a blast of cold air.").

172. *Househill*, 1 Web. P. C. at 699–702 (appellate argument).

173. *See id.* at 701 (Campbell, L.J.) (questioning whether the issue of principle was properly raised); *id.* at 715 (following Baron Parke's opinion from the Court of Exchequer).

174. *See Correns, supra* note 107, at 250.

as Lord Justice General David Boyle directed the jury that the patent was not to an abstract principle.¹⁷⁵ The defendants having excepted to that instruction, that question was also before the First Division of the Court of Session on appeal when the defendants brought their bill of exceptions, following a jury verdict in Neilson's favor.¹⁷⁶ Yet the judges of the court regarded the legal question as conclusively settled by *Neilson* and *Househill*: the patent might be founded on the discovery of a principle, but if the inventor had disclosed a practical mode of applying the principle, the patent was good.¹⁷⁷

While agreeing that the patentee must disclose his mode of application, none of the judges suggested that the mode need be novel or inventive. It was sufficient if the patentee disclosed a practical mode. As Lord Francis Jeffrey put it, in refuting the defendants' argument:

It seemed to be argued, that because the chief and essential part of a discovery might consist in a principle, that on that account the reward due for what may have proved of the highest possible benefit to the country is to be withheld. . . . No doubt, if the discovery was for some very general principle, such as the law of gravitation, for that a patent could not be taken out. . . . You must show, in order to obtain a patent, . . . a discovery that is of use for certain economical purposes, for increasing the wealth or conducing to the comfort of the inhabitants, and for that

175. Boyle's instruction was as follows:

2. That the patent is not void, as being merely for an abstract philosophical principle which the law does not acknowledge, because it combines a principle with the special purpose and important result of having atmospheric air heated in a vessel or receptacle between the blowing apparatus and fires, forges and furnaces, into which it is introduced, as an improved application of air to produce heat.

Neilson v. Baird, (1843) 15 Scottish Jurist 618, 618. Boyle also directed that the patent claimed no particular mode of heating air or form of heating vessel. *See id.* (third instruction).

176. *See id.* at 619.

177. *See id.* at 622 (Fullerton, L.) ("Then as to the abstract principle, the question is settled both by [the Court of Exchequer] and by the Lord Chancellor. The patent was not for a general property, but for a mechanical contrivance, viz., for heating the receptacle between the blast and the furnace."); *id.* at 619–20 (Mackenzie, L.) (providing that a valid patent must, in addition to discovery, contain the invention of a practical mode of application); *id.* at 626 (Boyle, L.P.). The judges also regarded the Court of Chancery's revival of the injunction against Harford, following the Exchequer's decision in *Neilson v. Harford*, as the Lord Chancellor's endorsement of the reasoning in *Neilson*. *See id.* at 619; *id.* at 626. Hearing *Neilson v. Harford* in Chancery, Lord Chancellor Lyndhurst had agreed with the Exchequer's construction of the specification. *See Neilson v. Harford*, 1 Web. P. C. 331, 373–74 (1841).

reason you must describe the application of the discovery.¹⁷⁸

And that description was necessary even if disclosure of the principle would make its application self-evident:

[A]lthough its use and application might be perfectly evident on that very announcement, so that all persons having common information could easily devise a mode of carrying it into operation; still, in order to satisfy the law, it is necessary that the method by which this is to be done must be set forth.¹⁷⁹

Lord Jeffrey's framing of the doctrine cannot be reconciled with the argument that the hot-blast cases imposed a requirement for inventive application. A rule that a patent must disclose even a self-evident application of a new discovery would make no sense, unless self-evident applications were themselves patent-eligible subject matter.

The Court of Session's decision effectively ended resistance to Neilson's patents. Upon rejection of their bill of exceptions, the Bairds settled with Neilson for £100,000 plus his costs.¹⁸⁰ And that decision leaves no doubt about how English and Scottish jurists understood *Neilson*, and how they viewed the distinction between unpatentable principle and patentable invention. Principles in the abstract were not patentable but practical applications were. It was necessary for the patentee to disclose and claim the mode of application, but that application need not be nonobvious or unconventional. The merit of the invention lay in the discovery. The application, in Lord Jeffrey's words, might well be "perfectly evident" and easily devised once the principle was known.

E. *The Hot-Blast Cases in Subsequent English Law*

While the hot-blast cases became central to discussions of patent-eligible subject matter in United States patent law, American courts paid little attention to developments in English law after the Neilson cases. But in England, *Neilson* and *Househill* remained the benchmark cases for the distinction between unpatentable principle and patentable invention throughout the nineteenth century. And *Neilson* clearly represented a

178. *Baird*, 15 Scottish Jurist at 623 (Jeffrey, L.).

179. *Id.* (emphasis added).

180. The Bairds had given notice of their intent to appeal to the House of Lords, but settled before any appeal was heard. See Corrins, *supra* note 107, at 256–57. The settlement prompted further disputes among the members of the anti-Neilson coalition as to whether those damages, or just the legal expenses alone, should be borne pro rata by the members. See *id.* at 257–58.

requirement for practical application, not inventive application.¹⁸¹ Given that the Exchequer's opinion rested on the determination that Neilson's means were well-known and conventional, *Neilson* stood for the proposition that a patentee's means of application might well be trivial. David Fulton's treatise summarized this view of *Neilson* in 1902:

It was not and cannot be pretended that [Neilson's] air-heating means involved any invention at all. . . . [W]herever it is a question of claiming anything which seems to be of the nature of a principle, the rule is to claim it in conjunction with and as effected by the means for carrying the principle into effect, *however simple and self-evident such means may be*.¹⁸²

It was clear that "principles in the abstract" were not patentable, but the conjunction of a new principle and a mode of carrying it into effect was patentable. Novelty of principle, rather than of means, sufficed. According to Robert Frost's 1891 treatise:

Principles in a concrete form, together with a method of applying them to a new and useful purpose, may form the subject of a grant of letters patent. In other words, a new principle or a new idea as regards any art or manufacture, together with a mode of carrying it into practice, may be patented, though the idea alone, and very likely the machine alone, because the machine might not be new, is not proper subject-matter.¹⁸³

Therefore, according to Frost, "[i]t is not necessary that the means, as well as the principle, should be new, for the novelty of the invention consists in applying the new principle by the means specified."¹⁸⁴

Notably, none of the post-*Neilson* case law, nor any of the English authorities, ever suggested that Baron Parke's famous passage required fundamental principles to be treated as part of the prior art, nor unconventional application. English courts and commentators never reached *Flook* and *Mayo*'s interpretations of *Neilson*.

181. For a modern interpretation of *Neilson* and *Househill* as abstraction cases, see Norman Siebrasse, *The Rule Against Abstract Claims: History and Principles*, 26 CAN. INTELL. PROP. REV. 205, 210 (2011).

182. DAVID FULTON, *THE LAW AND PRACTICE RELATING TO PATENTS, TRADE MARKS AND DESIGNS* 41 (1902) (emphasis added). Fulton regarded *Boulton & Watt v. Bull* as setting forth the same doctrine, though Watt's means, unlike Neilson's, "might have called for the exercise of the inventive faculties." *Id.* at 42.

183. ROBERT FROST, *A TREATISE ON THE LAW AND PRACTICE OF LETTERS PATENT FOR INVENTIONS* 48 (1891)

184. *Id.* at 55.

As in the United States, later English cases founded upon the hot-blast cases eventually supplanted them. Cases such as *Otto v. Linford*¹⁸⁵ became more canonical than *Neilson* for the line separating principle and invention. Yet *Otto* rests almost entirely upon the hot-blast cases for that point. And the doctrine that invention may subsist in the obvious application of a new discovery has remained the law in the English courts to the present day. In *Genentech, Inc.'s Patent*,¹⁸⁶ Justice John Whitford of the Patents Court explained:

It is trite law that you cannot patent a discovery, but if on the basis of that discovery you can tell people how it can be usefully employed, then a patentable invention may result. This in my view would be the case, even though once you have made the discovery, the way in which it can be usefully employed is obvious enough.¹⁸⁷

The Court of Appeal agreed; as Lord Justice Brian Dillon put it, the proposition “that the application of the discovery is only patentable if the application is itself novel and not obvious” would “represent a drastic change from English law as previously understood.”¹⁸⁸ Justice Whitford’s view of the law was later quoted with approval by the House of Lords.¹⁸⁹ Thus it is clear that in the land of its birth, *Neilson* has always been understood, not as a requirement for unconventional application, but merely as a requirement for practical application in questions of patent-eligible subject matter.

III. THE HOT-BLAST CASES AND SUBJECT-MATTER ELIGIBILITY IN THE UNITED STATES: THE NINETEENTH CENTURY

The premise that principles or abstract discoveries could not be patented was a part of American patent jurisprudence prior to *Neilson* and the other hot-blast cases. But the American patent law precepts regarding the distinction between an unpatentable principle and a patentable invention developed out of *Neilson*. This Part examines these trends through the rest of the nineteenth century, first in Supreme Court jurisprudence, then in the lower courts, and finally in scholarly treatises.

185. [1882] 46 L.T. (N.S) 35.

186. [1987] R.P.C. 553, 566 (Eng.).

187. *Id.*

188. *Genentech, Inc.'s Patent*, [1989] R.P.C. 147, 239–40 (Dillon, L.J.). Lord Justice Francis Purchas agreed. *See id.* at 206–13. Lord Justice Michael Mustill questioned whether this interpretation was consistent with § 1(2)(a) of the Patents Act of 1977, *see id.* at 267–69, but assumed that it was for purposes of the appeal. *See id.* at 270; *see also* *Gale's Application*, [1991] R.P.C. 305, 312–14 (Nicholls, L.J.); *id.* at 330–31 (Parker, L.J.) (explaining that obvious application of a new discovery may be a patentable invention).

189. *Kirin-Amgen Inc. v. Hoechst Marion Roussel Ltd.*, [2004] UKHL 46, ¶ 76 (Hoffman, L.).

A. Neilson at the Supreme Court

Even before *Neilson* was decided, American case law had concluded that principles or abstract discoveries could not be patented.¹⁹⁰ But in the latter half of the nineteenth century, the hot-blast cases became authoritative for American courts seeking to divine the line between principle and invention. Henry Merwin, writing of *Neilson* in 1883, claimed that “its correctness has never been doubted or denied.”¹⁹¹ One cannot understand foundational nineteenth-century American cases without understanding *Neilson* and its companion cases; the Supreme Court judged the patents before it by analogy or comparison to Neilson’s patent.

Though American courts cited *Neilson* as early as 1844,¹⁹² the Supreme Court’s first significant engagement with the Neilson cases came in 1852, with *Le Roy v. Tatham*.¹⁹³ *Le Roy* later became the fountainhead of subject-matter exclusion in American patent law, via its oft-quoted (and largely tautological) pronouncement on the unpatentability of principles: “A principle, in the abstract, is a fundamental truth; an original cause; a motive; these cannot be patented, as no one can claim in either of them an exclusive right.”¹⁹⁴

But far less often quoted is what follows that pronouncement—Justice John McLean’s statement distinguishing between an unpatentable principle and a patentable application. According to Justice McLean, under the laws of both England and the United States:

A new property discovered in matter, when practically applied, in the construction of a useful article of commerce or manufacture, is patentable; but the process through which the new property is developed and applied, must be stated, with such precision as to enable an ordinary mechanic to construct and apply the necessary process.¹⁹⁵

That is, a practical application of a new discovery was patentable so long as the patentee enabled the stated application. Justice McLean’s formulation echoes Lord Moncreiff’s: the new property was *discovered*, but the patentee’s mode of application is merely *stated*. There is no

190. See Risch, *America’s First Patents*, *supra* note 23, at 1304–07 (describing early exclusion of abstract principles); *In re Kemper*, 14 F. Cas. 286, 288 (C.C.D.C. 1841) (No. 7687) (“[N]o discovery will entitle the discoverer to a patent which does not in effect amount to the contrivance or production of something which did not exist before; or, in other words, to an invention.”).

191. HENRY CHILDS MERWIN, *THE PATENTABILITY OF INVENTIONS* 539 (1883).

192. See, e.g., *Washburn v. Gould*, 29 F. Cas. 312, 325 (C.C.D. Mass. 1844) (No. 17,214).

193. 55 U.S. (14 How.) 156 (1853).

194. *Id.* at 175.

195. *Id.*

doubt that *Le Roy* turned to the hot-blast cases for the distinction between abstract principles and patentable invention. Referring not to *Neilson* but to *Househill*, Justice McLean quoted Lord Justice Clerk Hope's opinion for the proposition that one could patent a discovery or principle "if that principle is by the specification applied to any special purpose, so as thereby to effectuate a practical result and benefit not previously attained."¹⁹⁶ One could therefore patent a new application of a natural principle without being limited to—or without having invented—the apparatus involved so long as the specification was sufficiently enabling.¹⁹⁷

Le Roy itself was not decided on patent-eligibility grounds. The patentee in *Le Roy* had discovered a way to manufacture wrought pipe by extruding metal through a die, improving on the casting typically employed before.¹⁹⁸ The patentee's difficulty was that, although he had based his invention on the discovery that solid lead will re-anneal under heat and pressure, a similar apparatus existed in the prior art for the manufacture of clay pipes, and even macaroni.¹⁹⁹ The trial judge instructed the jury that the patentee's invention lay not in his machinery, but in first applying a newly discovered principle to the manufacture of wrought pipe, which made the invention novel.²⁰⁰ The majority of the Supreme Court rejected this interpretation, holding instead that the patentee had claimed only the combination of machinery used to form the pipes.²⁰¹

The outcome in *Le Roy* therefore turned entirely on the Court's narrow construction of the claim. The question of whether a broader claim, drawn from the application of the newly discovered property of lead to the manufacture of pipes, might be sustained "was not in the case,"²⁰² though Justice Samuel Nelson's dissent advocated vigorously for the patentability of such a claim.²⁰³ So in the end, all of *Le Roy*'s pronouncements on "principle" were dicta. *Le Roy* nonetheless shows that the Court drew from the hot-blast cases the doctrine that discovery of a principle, if applied to any practical purpose, will sustain a patent

196. *Id.* (quoting *Househill Coal & Iron Co. v. Neilson*, 1 Web. P. C. 673, 683 (1843) (internal quotation marks omitted)).

197. *See id.* at 176 (stating that "precise specification" is required if a patentee has achieved a result without the invention of any machinery).

198. *Id.* at 177–78 (Nelson, J., dissenting).

199. *See id.* at 164 (majority opinion).

200. *See id.* at 176.

201. *See id.* (quoting the claim of patent)

202. *Id.* at 177. According to Justice McLean's majority opinion, the patent expressly claimed the described machinery, not the process of manufacture. *See id.* 176–77. Consequently, the invention might lack novelty over the clay pipe and macaroni machines. *See id.* at 177.

203. *Id.* at 183–88 (Nelson, J., dissenting). Justice Nelson did not view the majority as contesting that view, *see id.* at 188, although he would have construed the patent to cover the application of the annealing property rather than the machinery. *See id.* at 181–82.

without regard to the particular means employed.²⁰⁴ Indeed, when the case was retried (in equity) and reached the Supreme Court again, Justice McLean sustained the patent despite the admitted lack of novelty of the patentee's machinery.²⁰⁵

The Supreme Court discussed *Neilson* at length in *O'Reilly v. Morse*,²⁰⁶ when it considered Morse's patent on the telegraph. The case is memorable today for Morse's infamous eighth claim, which attempted to cover every use of electromagnetism for writing at a distance.²⁰⁷ The hot-blast cases were Morse's principal support for his claim in his argument before the Court: just as Neilson's patent was thought to encompass any use of hot air in the blast furnace, so too could Morse's patent encompass any use of electromagnetism for writing at a distance.²⁰⁸

Morse has often been regarded as a case about the unpatentability of scientific discoveries and laws of nature, such as electromagnetism.²⁰⁹ The Court's modern opinions regard *Morse*, along with *Le Roy*, as the historical foundation of its subject-matter jurisprudence; it was *Morse*—and *Morse*'s treatment of *Neilson* in particular—that provided the foundation for Justice Stevens's treatment of principles as part of the prior art in *Flook*.²¹⁰ Because so much of *Morse*'s discussion revolves around *Neilson*, an understanding of the hot-blast cases is crucial to understanding the Supreme Court's discussion of fundamental principles in *Morse*.

Certainly *Morse*, like *Le Roy*, proclaims the unpatentability of fundamental principles in the abstract. The Court grounded this doctrine in *Neilson*. According to the Court, if Neilson's patent had been directed to the discovery that hot air is better than cold, the Exchequer "would have held his patent to be void; because the discovery of a principle in natural philosophy or physical science, is not patentable."²¹¹ As the

204. *See id.* at 175 (majority opinion) (quoting *Househill Coal & Iron Co. v. Neilson*, 1 Web. P. C. 673, 683 (1843)).

205. *Le Roy v. Tatham*, 63 U.S. (22 How.) 132, 141 (1860). Strangely enough, McLean appeared to reach a different construction than the one he set forth in the original case. McLean held that while the machinery was old, the patentee claimed it only in connection with the process of forming metal pipes under heat and pressure. *Id.* at 138–40. This seems close to the position of the dissent in the original case. *See Le Roy*, 55 U.S. at 188 (Nelson, J., dissenting). The argument on novelty thereby being negated, the patent was sustained in light of its enabling disclosure. *Le Roy*, 63 U.S. (22 How.) at 140–41. Merwin described the opinion in the second case as "so extremely obscure that it cannot be quoted as supporting any view of the law upon the subject of principle." MERWIN, *supra* note 191, at 576.

206. 56 U.S. (15 How.) 62, 62, 114–16, 131–32 (1854).

207. *See id.* at 77–78. The validity of the eighth claim was actually relevant only to the question of costs, the other claims in the patent being valid and infringed. *Id.* at 119–20, 123–24.

208. *See id.* at 114–16 (stating that the Neilson cases were patentee's principal argument).

209. *See, e.g., Sarnoff, supra* note 26, at 67–68.

210. *See Parker v. Flook*, 437 U.S. 584, 589, 592 (1978) (citing *Le Roy* and *Morse*).

211. *Morse*, 56 U.S. (15 How.) at 115–16.

Court pointed out, the Exchequer would not have sustained Neilson's patent if it had claimed a discovery rather than a practical mode of application.²¹²

Why, then, was Morse's eighth claim denied where Neilson's had been sustained? The distinction was *not* that Neilson had claimed an inventive means. The Court was quite clear that Neilson's application did not involve a particular apparatus: "Neilson claimed no particular mode of constructing the receptacle, or of heating it."²¹³ If the Court understood that Neilson had claimed no particular form or arrangement of the heating receptacle, then of course the Court could not have regarded his invention as founded upon an inventive or unconventional apparatus.²¹⁴

The difference was simply enablement. As the Court explained, in *Neilson* the jury had found that once Neilson disclosed the heating of air between the blower and the furnace, one of ordinary skill in the art could easily construct a heating vessel of the appropriate size and form. Neilson, according to the Court, had disclosed enough to enable the universal application of his discovery, independent of the particular means that he employed.²¹⁵ Morse had not. His invention depended upon "complicated and delicate machinery, adjusted and arranged upon philosophical principles, and prepared by the highest mechanical skill."²¹⁶ Unlike Neilson's heating vessel, Morse's telegraphic apparatus was not independent of form.²¹⁷

Once we understand, as the *Morse* Court did, that *Neilson* was an enablement case, then the true nature of *Morse* becomes clear. Like *Neilson*, *Morse* is about disclosure and scope, not patent-eligible subject matter. To put it in modern terms, Neilson's disclosure enabled the full scope of his claims, whereas Morse's did not. That factual difference between the patents, which the Court well appreciated, is the key to understanding the Court's opinion in *Morse*.

Of course, the Court did not decide *Le Roy* and *Morse* in a vacuum. In particular, the cases coincided with the Court's evolution of the

212. *See id.* at 116 (noting that the Exchequer "emphatically denied" that Neilson would have the right to the general discovery that hot air promoted ignition better than cold).

213. *Id.* at 115.

214. *See id.* at 116 ("The interposition of a heated receptacle, *in any form*, was the novelty he invented." (emphasis added)).

215. *See id.* at 116–17 ("And this effect was always produced, whatever might be the form of the receptacle, or the mechanical contrivances for heating it, or for passing the current of air through it, and into the furnace.").

216. *Id.* at 117. This mechanism was, of course, inventive. This fact highlights the implausibility of treating *Morse* as a case about the patent eligibility of discoveries absent inventive application. Morse did not pretend to have discovered electromagnetism, nor was his application of electromagnetism routine or conventional. Yet his claim was denied.

217. *Id.* at 116–17.

nonobviousness requirement.²¹⁸ Two years before *Le Roy* and three years before *Morse*, the Court decided *Hotchkiss v. Greenwood*,²¹⁹ articulating, for perhaps the first time, a requirement for human creativity and ingenuity in patentable invention.²²⁰ In contrast, when *Neilson* and the other hot-blast cases were decided, English law had no clear requirement for ingenuity. English courts of the early nineteenth century had suggested that “substantial” or “material” novelty—not necessarily entailing ingenuity or creativity—was necessary for patentability, but by 1842 they seemed to embrace the doctrine that novelty and utility sufficed.²²¹ Thus, at the time the Exchequer decided *Neilson*, trivial but novel applications of a well-known principle might have been regarded as patentable under English law.

On this argument, it would make no difference if Neilson discovered the underlying principle of the hot blast or not; any novel application would have been patentable.²²² Granting that *Neilson* and the other hot-blast cases rejected the notion of inventive application, does *Hotchkiss*’s requirement for invention and creativity signal a departure from the reasoning of *Neilson* as well, along with a distinctly American demand that *invention* lie in the application, and not the discovery, of fundamental principles?²²³

The English courts, of course, continued to reject that argument long after they evolved their own doctrine of inventive step.²²⁴ But it is certainly possible to formulate a coherent doctrine along these lines: An invention is the product of human creativity. Discovery of fundamental principles is not human creativity. Therefore, discovery without

218. See, e.g., John F. Duffy, *Inventing Invention: A Case Study of Legal Innovation*, 86 TEX. L. REV. 1, 32–33 (2007).

219. 52 U.S. (11 How.) 248 (1851).

220. Sarnoff, *supra* note 26, at 69.

221. See Duffy, *supra* note 218, at 32–33 (describing erosion of the standard of invention in English law). English law later embraced the American conception of obviousness in a series of decisions in 1889 and 1890. See *id.* at 53–58.

222. Though I raise this argument as an objection to my account, it is not entirely convincing. For one, the rejection of ingenuity may not have been complete, at least at mid-century. Some English commentators of the 1850s treated “ingenuity” as necessary, at least in the application of old devices to new ends. See JAMES JOHNSON & J. HENRY JOHNSON, *THE PATENTEE’S MANUAL: A TREATISE ON THE LAW AND PRACTICE OF PATENTS FOR INVENTIONS* 14–16 (6th ed. 1890) (discussing the requirement of ingenuity). Moreover, as befell Minter, the patentee who broadly claimed the application of a known principle was vulnerable to anticipation by another who had employed the same mode, but with a different apparatus. See *supra* note 141 and accompanying text.

223. See Sarnoff, *supra* note 26, at 69–70 (connecting *Hotchkiss*’s demand for creativity with creative application).

224. See *supra* text accompanying notes 182–89. Inventive step is the English analogue of nonobviousness.

additional human creativity is not invention.²²⁵ But while the syllogism is logically correct, historical support for the minor premise is difficult to find. Justice Nelson wrote the *Hotchkiss* opinion. Yet it was Justice Nelson whose dissent in *Le Roy* argued forcefully against any requirement for novelty in the means of application:

The original conception—the novel idea in the one case, is the new application of the principle or property of matter, and the new product in the arts or manufactures—in the other, in the discovery of the principle or property, and application, with like result. The mode or means are but incidental, and flowing naturally from the original conception; and hence of inconsiderable merit.²²⁶

That the author of *Hotchkiss* rejected a requirement for creative application two years later in *Le Roy* does not preclude the possibility that such a conception developed later in the century. Yet those writers near the end of the nineteenth century who focused the most on the mental process of invention—Henry Merwin and William Robinson—were those who most expressly denied that additional creativity was necessary to transform a discovery into an invention.²²⁷ So while it would be logically permissible to reject the doctrine espoused by the English courts on the basis of a new requirement for human creativity and ingenuity, there is little evidence that American courts followed that path in the nineteenth century.²²⁸

225. This formulation is probably the foundation of the Supreme Court's decisions in *Ass'n for Molecular Pathology v. Myriad Genetics, Inc.*, 133 S. Ct. 2107, 2116 (2013), *Mayo Collaborative Services v. Prometheus Laboratories, Inc.*, 132 S. Ct. 1289, 1293–94 (2012), and *Parker v. Flook*, 437 U.S. 584, 589–91 (1978).

226. *Le Roy v. Tatham*, 55 U.S. (14 How.) 156, 187 (1853) (Nelson, J., dissenting). See also *id.* at 185–88 (arguing that the discoverer of a principle was not confined to his mode of application). As noted above, Justice Nelson maintained that the majority opinion did not controvert this view. See *id.* at 188. Justice Nelson also joined Justice Robert Grier's dissent in *Morse. O'Reilly v. Morse*, 56 U.S. (15 How.) 62, 124 (1854) (Grier, J., dissenting).

227. See *infra* text accompanying notes 276–94.

228. Professor Joshua Sarnoff has also suggested that the Supreme Court's decision in *Ansonia Brass & Copper Co. v. Electric Supply Co.*, 144 U.S. 11, 18–19 (1892), which denied patentability to a new but analogous use of an old product, entailed a requirement for creative application. See Sarnoff, *supra* note 26, at 77–78. One might argue that if discovery alone could confer patentability, then the discovery of a new property leading to an analogous use ought to be patentable. The Court's restriction to non-analogous uses (demanding inventive skill) in *Ansonia Brass* would indicate a restriction to inventive or creative applications. However, as Professor Stefan Riesenfeld pointed out, *Ansonia Brass* is phrased in terms of “patentable novelty” and “invention” rather than subject matter as such. See Stefan A. Riesenfeld, *The New United States Patent Act in the Light of Comparative Law I*, 102 U. PA. L. REV. 291, 298 n.45 (1954). The Court's subsequent decisions on new uses treated the question of eligibility versus invention inconsistently. See Lothar Wachsner, *Patentability of New Uses*, 34 J. PAT. OFF. SOC'Y 397, 401–03 (1952). Moreover, if the prohibition against double uses embodied a

Neilson last received significant consideration at the Supreme Court in 1880, in *Tilghman v. Proctor*.²²⁹ In *Tilghman*, the Court considered a claim to a process of separating glycerine and various triglycerides from fat by heat and water, which was not restricted to a particular apparatus or precise reaction conditions.²³⁰ The Court's decision in *Tilghman* established that processes could be patented apart from their physical instrumentalities, thus reversing its earlier decision in *Mitchell v. Tilghman*,²³¹ where the Court had confined the patent to the particular conditions and machinery disclosed.²³² Once again, the Court turned to *Neilson* for support. According to the Court, Neilson's patent was sustained as a patent for a process.²³³ As in *Morse*, the key for the Court was the independence of Neilson's patent from the particular apparatus he disclosed.²³⁴ Like Neilson, Tilghman had not disclosed the apparatus necessary to implement his process on an industrial scale.²³⁵ But for the Court, Baron Parke's opinion in *Neilson* pointed the way:

[The Court of Exchequer] drew the true distinction between a mere principle, as the subject of a patent, and a process by which a principle is applied to effect a useful result. That a hot-blast is better than a cold-blast for smelting iron in a furnace was the principle or scientific fact discovered by Neilson, and yet, being nothing but a principle, he could not have a patent for that. But having invented and practically exemplified a process for utilizing this principle, namely, that of heating the blast, in a receptacle, between the blowing apparatus and the furnace, he was entitled to a patent for that process, although he did not distinctly point out all the forms of apparatus by which the process might be applied²³⁶

So the nineteenth-century Court regarded *Neilson* the same way it had been regarded in England, as representing the dividing line between unpatentable abstract principles and patentable applications.²³⁷ Yet there

requirement for creative application, it is difficult to see why trivial structural changes, not involving invention, sufficed to render a new use patentable. *See id.* at 404–07; L. James Harris, *Some Aspects of the Underlying Legislative Intent of the Patent Act of 1952*, 23 GEO. WASH. L. REV. 658, 666 n.29 (1954–55) (noting that courts recognized inventions in the discovery of a new use of an old composition even when the discovery involved a slight change).

229. *See* 102 U.S. 707, 722–26 (1880).

230. *See id.* at 719.

231. *See* 86 U.S. (19 Wall.) 287, 396 (1874).

232. *See Tilghman*, 102 U.S. at 729–30.

233. *Id.* at 722.

234. *See id.* at 725.

235. *Id.* at 723.

236. *Id.* at 724–25.

237. *Id.* at 724.

was no suggestion at all that the application need be novel or inventive. Indeed, in *Mitchell*, the Court invoked *Househill* for the proposition that practical applications of a principle were patentable without any novel means:

Doubtless, an invention may be good though the subject of it consists in the discovery of some principle of science or property of matter, never before known or used, by which some new and useful result is obtained, and such an invention or discovery may be the subject of a valid patent without including in the claim any new arrangement of machinery to accomplish the object, provided the inventor describes, as required in the patent law, the method, process, or means of applying the invention to practical use and of obtaining the described new and useful result.²³⁸

Without belaboring the cases further, it is clear that for the nineteenth-century Supreme Court, *Neilson* stood for three different propositions. First, in general, *Neilson* and *Househill* defined the boundary between unpatentable principle and patentable application, though none of the Court's cases actually turned on this distinction. Second, *Neilson* came to stand for the proposition that while a process depended on physical instrumentalities, the process might be patentable independent of the particular instrumentalities employed by the inventor.²³⁹ And third, a sufficiently enabling specification would permit the patentee to claim well beyond the particular embodiments that he disclosed. *Neilson* was certainly not understood as restricting patentability to an inventive application, nor mandating that abstract principles be treated as prior art.

Beyond the Supreme Court cases endorsing *Neilson* and *Househill*, American case law was generally consistent with the notion that fundamental principles were patent eligible if embodied in a practical manufacture or process, with no requirement of novelty or invention in the means of application. Thus in 1863, Justice Robert Grier referred to:

[T]hose inventions which consist in a new application of certain natural forces to produce a certain result to which they had never before been applied, and which, when once pointed out, *required no invention to construct devices for its application*. Such inventions partake of the nature of discoveries, either found out by experiment or the result of a happy thought, which, when once expressed, is plain to

238. *Mitchell v. Tilghman*, 86 U.S. (19 Wall.) 287, 392 (1874) (citing *Househill Coal & Iron Co. v. Neilson*, 1 Web. P. C. 673, 683 (1843)).

239. *See O'Reilly v. Morse*, 56 U.S. (15 How.) 62, 117 (1854) (explaining *Neilson*).

all intelligent persons, who could point out at once many devices for making it effectual.²⁴⁰

But in truth, the Supreme Court's cases do little more than allude to the theoretical distinction between unpatentable abstractions and patentable applications. If *Morse* is viewed as an enablement case, then none of the Court's decisions actually address the boundary between principle and patent.

B. Lower Courts in the Late Nineteenth Century

Beyond the Supreme Court, only a handful of decisions from the lower courts addressed the boundary between discovery and invention in the latter half of the century. The leading case was probably *Morton v. New York Eye Infirmary*,²⁴¹ an 1862 case decided by the Circuit Court for the Southern District of New York. The case considered the patentability of the use of ether as a surgical anesthetic.²⁴² *Morton* acknowledged the significance of the inventor's discovery; yet waxed poetic about the unpatentability of the discoveries alone:

A discovery may be brilliant and useful, and not patentable. No matter through what long, solitary vigils, or by what importunate efforts, the secret may have been wrung from the bosom of Nature, or to what useful purpose it may be applied. . . . The new force or principle . . . can be patented only in connection or combination with the means by which, or the medium through which, it operates.²⁴³

So does *Morton* therefore stand for the proposition that discovery of a new natural phenomenon is not patentable without an additional inventive concept or principle in the application, as some commentators have argued?²⁴⁴ *Morton* focuses primarily on the physical application of the inventor's discovery: the inventor must identify "some particular medium or mechanical contrivance" through which the new principle might act on the material world.²⁴⁵ *Morton* therefore presents more of a demand for tangible application than for inventive application. Yet, ultimately, the case does not appear to have been decided on either ground. According to the court, it had been long known that inhalation of ether vapors "produced an effect like that of intoxication,

240. *Burr v. Duryee*, 68 U.S. (1 Wall.) 531, 568 (1864) (emphasis added). The hat-making invention in *Burr* was not of this sort. *See id.* at 569.

241. 17 F. Cas. 879 (C.C.S.D.N.Y. 1862) (No. 9865).

242. *Id.* at 882.

243. *Id.* at 884.

244. *See, e.g., Sarnoff, supra* note 26, at 71 (stating that *Morton* requires "new and additional principle to such mere application of a discovery").

245. *Morton*, 17 F. Cas. at 881.

exhilaration, and more or less stupefaction.”²⁴⁶ There being no novel step or apparatus, all the patentee claimed was the improved effect of higher dosages, stating, “the specification presents nothing new except the effect produced by well-known agents, administered in well-known ways on well-known subjects. This new or additional effect . . . is simply produced by increasing the quantity of the vapor inhaled.”²⁴⁷

For the court, the patentee’s discovery reduced to the finding that an increased quantity of ether yielded a “more perfect effect” than the partial intoxication already known in the art.²⁴⁸ The *Morton* court seemingly decided the case, not on the grounds that the patentee had failed to provide an inventive application of his discovery, but rather on the grounds that his discovery itself was not particularly inventive.²⁴⁹ That was also the view of *Morton* later adopted by the Patent Office.²⁵⁰ While the development of a new or inventive instrumentality certainly would have helped the patentee’s case, in the end a deficiency in the discovery department doomed the patent in *Morton*.²⁵¹

The case that came closest to addressing “principle” in the late nineteenth century was *Wall v. Leck*,²⁵² decided by the U.S. Court of Appeals for the Ninth Circuit in 1895. *Wall* involved a previously known process of fumigating plants with hydrogen cyanide as an insecticide.²⁵³ According to the patent, the patentees discovered that fumigation was more effective against insects, and less toxic to plants if performed in the dark—although apparently the only way to ensure sufficient darkness was to fumigate at night.²⁵⁴ The Ninth Circuit regarded this as nothing more than a naked principle.²⁵⁵ Unlike Neilson, who had described a means for applying his principle, the patentees in *Wall* relied solely on nature—in the form of night—to implement their invention:

246. *Id.* at 882.

247. *Id.* at 883.

248. *Id.* at 882.

249. *See id.* (stating that the effect of ether discovered “was produced by old agents, operating by old means upon old subjects” and that the “mere discovery” was not patentable notwithstanding its novelty and importance).

250. *See Ex parte Scherer*, 103 U.S.P.Q. (BNA) 107, 110 (Pat. & Tr. Office Bd. App. 1954) (stating that patent in *Morton* was invalidated because use of ether was known).

251. *Morton* was also subsequently read as casting doubt on the patentability of medical treatments. Matthew D. Show, *A Dreadful Prognosis: Patentability of Diagnostic and Personalized Medical Procedures in the Wake of In re Bilski*, 2 HASTINGS SCI. & TECH. L.J. 301, 306 (2010). But the *Morton* court seemed to regard the invention as a potentially patentable “improvement in the art of surgery.” *See Morton*, 17 F. Cas. at 882. *See also Scherer*, 103 U.S.P.Q. (BNA) at 110–11 (denying that *Morton* stood for unpatentability of medical or surgical methods).

252. 66 F. 552 (9th Cir. 1895).

253. *Id.* at 555.

254. *Id.* at 554.

255. *Id.* at 555.

They simply discovered a truth,—that the fumigation of the trees and plants could be made more effective and beneficial by using it in the old way, only at night, or in cloudy days or foggy weather; at any time when the actinic rays of light were absent by the natural condition of nature. To have entitled them to a patent, they should have followed up their valuable discovery by inventing some new method by the application of which the deleterious effect of the actinic rays of light could have been avoided.²⁵⁶

Wall is the case perhaps most analogous to *Mayo*: the patentees, by discovery of an ostensible natural law, better defined the conditions under which an old process should be performed.²⁵⁷ Like *Mayo*, *Wall* denied patentability to the performance of a prior art process under optimized conditions, at least where those conditions were the result of natural circumstances rather than human intervention.²⁵⁸

Yet in *Wall*, the primary fault of the patent was that it required no artificial means to implement the claimed method.²⁵⁹ The inventors, in their patent, referred to the use of coverings to exclude the light, but stated their belief that such coverings would be futile in full daylight.²⁶⁰ The Ninth Circuit denied patentability not because the inventors' means of application was obvious, but rather because their patent did nothing more than invoke a force of nature: "No natural function of the day or of the night, of the sun or of the moon, is patentable."²⁶¹ If they had invented "some new process, device, or apparatus" to exclude light, the patentees would have "brought themselves within the principle announced in the Neilson Case."²⁶² But because the patentees seem to have ruled out the possibility that their process could be effectively

256. *Id.* at 556.

257. *See id.* at 555 (providing that appellants' discovery, however important, was an elaboration and improvement on "the old process of fumigating trees by means of an oiled tent and hydrocyanic acid gas").

258. *Wall* may in reality be an inherency case. One assumes that the old process must at some point have been carried out at night or at least in cloudy weather. That suspicion is highlighted by the Ninth Circuit's rhetorical question at the end of the opinion: if it was discovered that breathing night air was more healthful, then would the inventor be entitled to "the exclusive use of the air at the beneficial hours of day, and invest him with the power and authority, under the shield of the patent law, to enjoin each and every other individual from utilizing the air"? *Id.* at 557. Obviously, a claim to the breathing of air at certain hours would have been inherently anticipated.

259. *Id.*

260. U.S. Patent No. 445,342 col. 1. ll. 33–37 (filed Dec. 10, 1889).

261. *Wall*, 66 F. at 557.

262. *See id.* at 556.

implemented by artificial means, the Ninth Circuit did not have occasion to address whether those means need be inventive.²⁶³

C. *Learned Treatises in the Nineteenth Century*

When asking how the legal community defined the boundary between discovery and invention in the nineteenth century, reported cases can only represent the tip of the iceberg. One can glean at least some sense of how the broader community regarded that boundary by turning to the great treatises of the era, which remained major points of reference for courts well into the twentieth century. How did the major nineteenth-century commentators view *Neilson*? And how did those authors understand the boundary between unpatentable principle and patentable application?

In the mid-nineteenth century, George Ticknor Curtis's treatise was unquestionably the dominant work on patent law from the 1847 publication of its first edition, and for some time after the 1873 publication of its fourth and final edition.²⁶⁴ In his later editions, Curtis devoted an entire chapter to the question of "Extent of Principle."²⁶⁵ But as his title suggests, Curtis's main interest was not the distinction between an unpatentable principle and a patentable invention, but the question of scope: when was an implementation of the inventor's principle by other means an infringement of the patent?²⁶⁶ Not recognizing *Morse* as an enablement case hampered Curtis on this question; for Curtis, if the patent disclosed a practical means of implementing a principle, then any other implementations of the principle would infringe.²⁶⁷ Without sufficient attention to the point highlighted by the Supreme Court in *Morse*—that in *Neilson* the disclosure was sufficient for one of ordinary skill to implement any heating means—Curtis had difficulty explaining why *Neilson* was able to reach beyond his embodiment but *Morse* could not.²⁶⁸

263. See *id.* at 555 ("It is true that a mode was pointed out, but not approved, to so color the tent or covering as to exclude the actinic rays of light; but they neither invented nor discovered any process, texture, or coloring that would sufficiently accomplish that purpose.").

264. See Oren Bracha, *The Statute of Anne: An American Mythology*, 47 HOUS. L. REV. 877, 913 (2010) (discussing the first edition of Curtis's treatise and the influence it gained over the preceding years); Edmund W. Kitch, *Graham v. John Deere Co.: New Standards for Patents*, 1966 SUP. CT. REV. 293, 313 (referring to Curtis's work as "the leading treatise on patent law" in 1850); William C. Rooklidge & Stephen C. Jensen, *Common Sense, Simplicity and Experimental Use Negation of the Public Use and on Sale Bars to Patentability*, 29 J. MARSHALL L. REV. 1, 11 n.40 (1995) (noting that Curtis was "the author of four editions of the preeminent pre-1890 patent law treatise").

265. GEORGE TICKNOR CURTIS, A TREATISE ON THE LAW OF PATENTS FOR USEFUL INVENTIONS, at v (4th ed. 1873).

266. See *id.* § 124, at 140–41; *id.* § 149, at 166.

267. See *id.* § 136, at 149–50.

268. See *id.* § 156, at 181–82 ("It is somewhat difficult to see that *Neilson*'s claim, as allowed by the Court of Exchequer, was valid if *Morse*'s claim was void . . .").

On the distinction between patentable principle and unpatentable invention, however, Curtis clearly identified abstractness as the boundary line. In his analysis of *Neilson* he stated, “[t]he principle itself, which may be an element, or truth, or force in nature, when abstracted from practical application, is not within the field of invention, in the sense of the patent law.”²⁶⁹ But it was not necessary for the means of application to be novel or inventive; it was merely necessary that the instrumentalities had not been previously used in application of the principle.²⁷⁰

Likewise, Curtis ultimately concluded from the American cases (such as *Morse* and *Morton*) that abstractness was the test for patent eligibility.²⁷¹ It was only when a patentee “severe[d] the use of a motive-power or other elemental agency from all conditions of its application”²⁷² that the claim became void. That, rather than the unpatentability of scientific principles, was the lesson of *Morse*. In Curtis’s analysis, the Court’s decision turned on the view that *Morse*’s eighth claim was nothing more than an abstraction.²⁷³

Abstractness was also the boundary between principle and patent in Merwin’s 1883 work. “Naked principles” such as newly discovered laws of nature or properties of matter could not be the subject of patents, though a method or process of applying the principle to practical use could.²⁷⁴ But Merwin was quite emphatic in stating that nothing unconventional or inventive was necessary in the application: “[N]evertheless, the means by which the principle is applied may be devoid of all invention, and such as any workman skilled in the art wherein the application is made might supply, when the discovery is told him.”²⁷⁵

According to Merwin, practical application, “*though simple and obvious*,” would suffice to transform an abstract principle into a patent-eligible invention.²⁷⁶ *Neilson* illustrated this view, for in the Court of Exchequer’s ruling on the sufficiency of the specification, Merwin found confirmation “that the application of the law discovered by

269. *Id.* § 141, at 156 (commenting on the *Neilson* cases).

270. *See id.* (“The means itself is in such cases new in its relation to the application of the principle, whether it be in other relations and for other uses new or old.”).

271. *See id.* §§ 154–55, at 180.

272. *Id.* § 160, at 187.

273. *See id.* § 159, at 184–85 (“[I]n truth the decision turned entirely upon a view taken of the general claim, which gave it an extent that divested it of all conditions and made it an abstraction.”); *id.* § 155, at 180 (“The principal ground on which [*Morse*] was reached appears to have been that the eighth claim of the patent was virtually a claim for an abstraction . . .”).

274. MERWIN, *supra* note 191, at 4; *see also id.* at 532 (“[A] law of nature or a property of matter, in the abstract, is clearly not an art.”).

275. *Id.* at 4 (emphasis added).

276. *Id.* at 5 (emphasis added).

[Neilson] did *not* require invention.”²⁷⁷ Thus, Merwin regarded both *Neilson* and *Le Roy* as cases in which the merit of the patent, as Lord Justice Clerk Hope explained in *Househill*, lay not in the application but in the discovery.²⁷⁸

William Robinson’s monumental treatise of 1890 brought some much needed clarity to the subject of principle by differentiating between the senses in which the term was used. Principles, in the sense of laws of nature or properties of matter, were clearly not the subject of patents.²⁷⁹ Regarded as the common property of mankind, fundamental principles could not be appropriated to exclusive use; lacking this attribute of property, they could not be the subject of patents.²⁸⁰ Nor were natural forces themselves the product of “inventive skill”; though humans might discover them, they were not products of the inventive mind unless some human intervention turned them to new ends.²⁸¹ And perhaps most fundamentally, the natural force alone was not an operative means; without application to some object, it remained “practically a mere abstraction.”²⁸² That an unapplied natural force could not be patented was an ineluctable consequence of Robinson’s theory of invention. In Robinson’s view, the true subject of patents was the inventor’s “idea of means.”²⁸³ An abstract natural principle was not an idea of means.²⁸⁴ But in the sense that principle referred to the inventor’s idea of means, an inventor *could* patent his principle, for in Robinson’s view every thing or process that employed the inventor’s idea of means was an infringement of his patent.²⁸⁵

For Robinson, the mental part of the inventive act necessarily comprised both “discovery” and “construction.”²⁸⁶ Discovery required the inventor to uncover some quality in a force, an object, or a mode of

277. *Id.* at 6.

278. *See id.* at 5. Merwin actually divided patents into two categories: “inventions,” for which a creative mental process was required, and “discoveries,” i.e., newly discovered principles, for which no inquiry into the inventor’s mental process was necessary. *See id.* at 3.

279. 1 WILLIAM C. ROBINSON, *THE LAW OF PATENTS FOR USEFUL INVENTIONS* § 135, at 194–95 (1890).

280. *See id.* § 137, at 196.

281. *See id.* § 136, at 195–96.

282. *Id.* § 138, at 197–98; *see also id.* § 143 n.1, at 203; Robinson quotes Lord Justice Clerk Hope’s instructions in *Househill* at length, and regards him as having denied the patentability of principles not on the ground that principles are laws of nature, but on the ground that a principle is “abstract and incapable of producing practical results.” Robinson thought Lord Justice Clerk Hope’s discussion explained the correct doctrine of principle “in the clearest light.” *Id.* § 143 n.2, at 208.

283. *See id.* § 141, at 201.

284. *See id.* § 140, at 200.

285. *See id.* § 141, at 201–02.

286. *See id.* § 96, at 142. Construction was a mental act, distinct from reduction to practice.

application that made their union possible,²⁸⁷ while construction consisted of combining the three into an operative means. Although this conception of construction was essential to the mental part of the inventive act,²⁸⁸ for Robinson only discovery involved the exercise of the inventive faculties.²⁸⁹ By definition, Robinson's theory of invention embraced inventive discovery rather than inventive application. Although the naked discovery of a new quality in a known substance did not constitute invention,²⁹⁰ the discovery of new qualities in a known substance, made available for practical use by means of well-known forces and well-known methods, yielded patentable invention.²⁹¹

Thus, Robinson viewed Neilson's true invention as the discovery that materials in a blast furnace were susceptible to the action of hot air.²⁹² Having discovered this susceptibility, Neilson's invention was, in fact, the treatment of those materials with hot air rather than cold.²⁹³ Whether his means of heating were novel was immaterial to Robinson: "If his method of heating the air had been previously employed, as, for instance, to warm buildings or dry clothes, would the merit or originality or patentability of his invention have been any less . . . ?"²⁹⁴ Patentable invention could therefore reside in the discovery of a new property of matter, which, once discovered, immediately suggested the use of well-known and conventional instrumentalities to achieve practical results.

In sum, examination of the nineteenth-century cases and authorities²⁹⁵ demonstrates the following state of affairs at the end of the

287. *See id.* In Robinson's complex theory of "idea of means," every invention consisted of the union of an object, a force, and a mode by which the force was applied to the object. *See id.* § 91, at 138. This definition was said to emerge from "[a] moment's reflection." *Id.* The major irony of Robinson's work is that the "idea of means" was the heart of his system; the unworkability of his definition destined it to obscurity even as his treatise became authoritative.

288. *See id.* § 100 n.1, at 146.

289. *See id.* § 96, at 142.

290. *See id.* § 100, at 146. Robinson regarded the lower court's decision in *Ansonia Brass* as an example; the Supreme Court had not yet heard the case when Robinson wrote. *See id.* § 100 n.1, at 146 (citing *Ansonia Brass & Copper Co. v. Elec. Supply Co.*, 32 F. 81 (C.C.D. Conn. 1887), *aff'd*, 144 U.S. 11 (1892)).

291. *See id.* § 101 n.2, at 147.

292. *See id.* § 143 n.2, at 204-05.

293. *See id.*

294. *Id.* § 143 n.2, at 205. Robinson was thus taking the sensible view that the superiority of hot air to cold in the artificial environment of a blast furnace was hardly a "law of nature."

295. Albert Walker's treatise, which became more or less authoritative by default as the only one continually updated in the twentieth century, has very little to say on the subject. Walker does not address the English precedent at all, and his analysis of the "laws of nature" problem beyond summarizing the cases is minimal. In Walker's view, the distinction between Morse's invalid claim and the valid claims of Tilghman, Bell, and others was that Morse had claimed a process utilizing only a single law of nature; those patents approved by the Supreme Court instead utilized several laws of nature in a particular order and method. ALBERT H.

century. Neither courts nor scholars understood *Neilson* to demand prior art treatment of fundamental principles, nor to require invention in the application of discoveries. Principles, such as scientific discoveries or laws of nature, were unpatentable because they were mere abstractions.²⁹⁶ Following Curtis's treatment, *Morse* was usually regarded as a case about the unpatentability of abstractions, not about laws of nature per se.²⁹⁷ But once embodied in a practical application—whether device or process—principles became patentable, although the question of patent scope remained a difficult one. Patentable novelty and invention could arise from the underlying discovery, rather than the application itself.

IV. THE TWENTIETH CENTURY BEFORE *FUNK BROTHERS*

For the first half of the twentieth century, the consensus *Neilson* established—that the boundary of the patent system lay between abstract principles and practical application—went nearly undisturbed. Until the Supreme Court decided *Funk Brothers* in 1948, American patent law did not impose a requirement of inventive application as a matter of subject-matter eligibility. This Part again examines the course of the eligibility doctrine in the decisions of the Supreme Court, the lower courts, and commentators both within and without the patent system.

A. *The Supreme Court in the Early Twentieth Century*

As was true in the late nineteenth century, the Supreme Court's few early twentieth-century cases did not address the boundary between discovery and invention directly. In 1931, the Court acknowledged the unpatentability of pure "scientific explanation" in *De Forest Radio Co. v. General Electric Co.*²⁹⁸ Yet the Court's analysis in *De Forest Radio* does not suggest a test of inventive application. Rather, it seems to endorse the view that scientific discovery alone might supply the creativity needed for patentability.

The issue in *De Forest Radio* was the patentability of Langmuir's high-vacuum triode tube over prior low-vacuum triodes, principally Lee

WALKER, TEXT-BOOK OF THE PATENT LAWS OF THE UNITED STATES OF AMERICA § 13 (2d ed. 1889).

296. See, e.g., William B. Whitney, *Patentable Processes*, 19 HARV. L. REV. 30, 41 (1905) (noting that a function of a machine is not patentable as "mere abstraction").

297. See *id.* at 37–38 ("[Morse] made his claim to an art or principle in the abstract—to the use of a power of nature to perform an abstract function or effect an abstract result, regardless of the particular process or apparatus employed . . ."); see also Edward A. Ruestow, *Principles and Products of Nature Rule as Patentable Subject Matter*, 9 GEO. WASH. L. REV. 86, 87–88 (1940) (characterizing *Morse* and subsequent cases as excluding from patentability "the intangibles of the invention—the bare principle of operation itself").

298. 283 U.S. 664, 684–85 (1931), amended by 284 U.S. 571 (1931) (per curiam).

de Forest's Audion.²⁹⁹ De Forest had erroneously believed that the residual ionized gas in the low-vacuum tube served as the conductor for the triode current.³⁰⁰ Irving Langmuir, however, had determined that thermionic emission operated by "pure electron discharge"—the direct emission of electrons from the cathode—which meant that residual gas was not necessary for operation of the vacuum tube.³⁰¹ The ionized gas present in the low-vacuum tube caused operational instability and disintegration of the cathode; Langmuir's high-vacuum tube was free of these drawbacks and replaced the Audion for essentially all applications.³⁰²

The Court determined that if "the relationship of the degree of vacuum within the tube, to ionization" was known, "it required no inventive genius to avoid ionization and secure the desired result by creating the vacuum in a De Forest tube or other form of low vacuum discharge device."³⁰³ If inventive application had been the test of patentability, then the Court's analysis ought to have ended there: given the discovery that emission of electrons from a cathode was an inherent property of the metal, and not of a gaseous carrier, the application in the form of a high-vacuum tube was conventional and obvious.³⁰⁴ But the Court's analysis did *not* end there. The Court went on to state that "[e]ven . . . so simple a change in structure as could be brought about by reducing the pressure in the well known low vacuum tube by a few microns" might be "invention" if the relationship between vacuum and ionization had not been known.³⁰⁵ The Court then reviewed in detail Edgar Lilienfeld's prior work in the field, concluding that Lilienfeld had already described the space charge effect, the independence of discharge from gas density below a certain threshold, and the $3/2$ power relationship between current and voltage

299. *See id.* at 664–86.

300. *See id.* at 682–84.

301. *See* Irving Langmuir, *The Pure Electron Discharge and Its Applications in Radio Telegraphy and Telephony*, 3 PROC. IRE 261 (1915), reprinted in 85 PROC. IEEE 1496, 1499 (1997).

302. *See id.* at 1499–1500, 1502.

303. *De Forest Radio*, 283 U.S. at 678–79.

304. *See id.* at 681–82 (noting the application of the relationship between discharge and reduced pressure in the form of high vacuum involved only skill in the art, not "inventive faculty"). One could reconcile *De Forest Radio* with a requirement for inventive application on the grounds that pure electron discharge in a vacuum tube is not a law of nature or natural phenomenon. Without belaboring the obvious criticism that arbitrary definition of fundamental principles is a major problem in the Court's recent § 101 jurisprudence, I will merely note that the relationship between vacuum and ionization seems no less of a natural law than the relationship between dosage of a thiopurine drug and therapeutic effectiveness deemed a natural law in *Mayo*.

305. *Id.* at 678 (stating that there was a question of fact as to whether the relationship between the degree of vacuum and ionization was known to the art at the time of Langmuir's invention).

that Langmuir described as all characteristic of pure electron discharge in his patent.³⁰⁶

If the Court had treated the underlying relationship between degree of vacuum and ionization as part of the prior art *de jure*, as in *Flook*, then of course it would not have needed to determine whether the relationship was in fact part of the prior art. But given that Lilienfeld had already described the phenomenon of electron discharge in a high vacuum, the Court held that Langmuir could not claim invention based on “the discovery of the principle” that electron discharge above the ionization voltage was possible with sufficiently high vacuum.³⁰⁷ Langmuir’s patent was invalid because, though he may have been the first to explain the physics of electron discharge in a high vacuum, he was not the first to discover it.³⁰⁸ Nowhere did the Court hint that, if Langmuir *had* been the first to discover the phenomenon, he still would have been denied the patent.

In *Mackay Radio & Telegraph Co. v. Radio Corp. of America*,³⁰⁹ decided in 1939, the Court distinguished between an unpatentable scientific or mathematical truth and a potentially patentable “novel and useful structure created with the aid of knowledge of scientific truth.”³¹⁰ Along with *Neilson* and *Funk Brothers*, that language from *Mackay Radio* provided the basis for *Flook*’s treatment of fundamental principles as “familiar part[s] of the prior art.”³¹¹

Yet like *De Forest Radio*, *Mackay Radio* lends more support to the patentability of simple applications of natural laws than it lends to the contrary. The patent in *Mackay Radio* claimed the design of a standing wave antenna whose dimensions were determined by a mathematical formula disclosed in the patent.³¹² According to the Court, the claimed antenna design formula was based on an *old* scientific discovery, but the Court assumed that the patentee’s application was patentable “even though it was achieved by the logical application of a known scientific law to a familiar type of antenna.”³¹³ The issue in the case was infringement.³¹⁴ Because the defendant’s antennas did not conform to the known scientific law disclosed in the patent, the patentee had attempted to

306. *Id.* at 679–80.

307. *See id.* at 680.

308. *See id.* at 684–85 (“It is the method and device which may be patented and not the scientific explanation of their operation.”).

309. 306 U.S. 86 (1939).

310. *Id.* at 94.

311. *Parker v. Flook*, 437 U.S. 584, 591–92 (1978) (citing *Mackay Radio* and *Funk Brothers*).

312. *Mackay Radio*, 306 U.S. at 91–92.

313. *Id.* at 94.

314. *Id.* at 88.

extend the claims beyond the mathematical relationship disclosed in the patent.³¹⁵ The patentee's problem, according to the Court, was that he had *not* discovered any new scientific principle that would support broader claims:

[Patentee] Carter's empirical formula, wholly derived from Abraham's formula, and taken together with it, therefore discloses no invention or discovery more than the application of the Abraham formula to the V antenna. It reveals no scientific law applicable to wire lengths which are intermediate of multiples of half wave lengths³¹⁶

Thus to the extent it addressed the issue at all, *Mackay Radio* seems to suggest the patentability of straightforward applications of scientific principles rather than deny it.³¹⁷

B. *The Lower Courts in the Early Twentieth Century*

At the lower courts, the doctrine of patent-eligible subject matter restricted patents in two primary areas: claims involving mental steps or processes, and claims to purified natural products. The prohibition against mental processes was probably more significant in practice.³¹⁸ Patents held invalid as "mental processes" included: systems of devising coded messages;³¹⁹ systems for preventing fraud;³²⁰ a method of producing an aesthetic combination of color and sound;³²¹ and methods for transacting business, playing games, solving problems, and even training animals, among a variety of others.³²² The "printed matter" or "symbolic matter"

315. *Id.* at 99.

316. *Id.* at 98.

317. *See id.* at 100 ("This use of the empirical formula for a purpose for which it was not devised does not justify our construing the application as though all reference to the Abraham formula had been eliminated and a new and different one expressing a new and different scientific law had been substituted for it.").

318. For discussion of the "mental steps" doctrine, see generally Kevin Emerson Collins, Prometheus Laboratories, *Mental Steps, and Printed Matter*, 50 HOUS. L. REV. 391, 393 (2012).

319. *Berardini v. Tocci*, 190 F. 329, 333 (C.C.S.D.N.Y. 1911), *aff'd*, 200 F. 1021 (2d Cir. 1912).

320. *Hotel Sec. Checking Co. v. Lorraine Co.*, 160 F. 467, 472 (2d Cir. 1908) (referring to bookkeeping, cash registering, and account-checking systems).

321. *Greenewalt v. Stanley Co. of Am.*, 54 F.2d 195, 196 (3d Cir. 1931).

322. CHARLES W. RIVISE & A.D. CAESAR, PATENTABILITY AND VALIDITY § 20, at 35 (1936). For further discussion and summary, see 1 DONALD S. CHISUM, CHISUM ON PATENTS § 1.03[6][a] (2014); *see also In re Shao Wen Yuan*, 188 F.2d 377, 383 (C.C.P.A. 1951). *But see In re Sheffield*, 288 F. 463 (D.C. Cir. 1923) (holding that the patentee's claim to a "method of visually indicating the structure and meaning of a sentence" was patentable). Charles Rivise and A.D. Caesar viewed some cases, including the Telephone Cases, as upholding the patentability of mental steps. *See RIVISE & CAESAR, supra*, § 21.

cases might be classified as mental processes as well.³²³ The exclusion of these categories from the patent system was generally regarded as *sui generis*, and not an aspect of the exclusion of abstract ideas or other fundamental discoveries.³²⁴

On the question of patentability of natural products purified from nature, the leading authorities supporting the patentability of natural products were the aspirin case,³²⁵ and Judge Learned Hand's opinion in *Parke-Davis & Co. v. H.K. Mulford Co.*,³²⁶ upholding the validity of a claim to adrenalin purified from natural sources.³²⁷ Chiefly opposed were the U.S. Court of Appeals for the Third Circuit's decision in *General Electric Co. v. De Forest Radio Co.*³²⁸—denying patentability to purified tungsten³²⁹—and the *Marden* cases from the Court of Customs and Patent Appeals (CCPA), which followed *General Electric* in denying claims to purified vanadium and uranium.³³⁰ However, by 1939, the CCPA seemed to have settled on the position that products purified from nature were patentable if (and only if) the purified form had utility not possessed by the natural source.³³¹

The interesting aspect of *General Electric* and the *Marden* cases is that in these cases the inventors also included claims to novel and useful structures made from then newly available metals—in *General Electric*, wires formed of ductile tungsten (immediately useful for light bulbs and

323. See, e.g., *Latz v. Reliance Graphic Corp.*, 98 F.2d 679, 679 (2d Cir. 1938) (finding a blank form not patent eligible); *id.* at 680–81 (discussing cases analogous to, and distinguishable from, *Latz*); *Wier v. Coe*, 33 F. Supp. 142, 143 (D.D.C. 1940) (finding claim to form for printed music not patentable), *aff'd*, 122 F.2d 959 (D.C. Cir. 1941) (per curiam); see also EUSTACE STRAUGHN GLASCOCK & EMERSON STRINGHAM, *PATENT LAW: SUBSTANTIVE ASPECTS* §§ 1210, 1212, 1214, 1216, 1218 (1943) (demonstrating the dubious patentability of printed or symbolic matter in case law); Morton C. Jacobs, Editorial Note, *The Patentability of Printed Matter: Critique and Proposal*, 18 GEO. WASH. L. REV. 475 (1949–50) (discussing printed matter cases). But see *Cincinnati Traction Co. v. Pope*, 210 F. 443, 446–47 (6th Cir. 1913) (finding a printed transfer ticket patentable “manufacture”).

324. See, e.g., *Collins*, *supra* note 318, at 392–93 (“A method claim reciting a mental process was not categorically excluded from patentable subject matter. Rather, it was beyond patentable subject matter only if a mental-process limitation was the claim’s sole point of novelty.”).

325. *Kuehmsted v. Farbenfabriken of Elberfeld Co.*, 179 F. 701, 705 (7th Cir. 1910) (affirming patentability of purified aspirin).

326. 189 F. 95 (C.C.S.D.N.Y. 1911), *aff'd in part, rev'd in part*, 196 F. 496 (2d Cir. 1912).

327. See *id.* at 97, 102.

328. 28 F.2d 641 (3d Cir. 1928).

329. *Id.* at 642–43.

330. *In re Marden*, 47 F.2d 957, 958 (C.C.P.A. 1931); *In re Marden*, 47 F.2d 958, 959–60 (C.C.P.A. 1931).

331. See *In re Merz*, 97 F.2d 599, 601 (C.C.P.A. 1938) (explaining that while purification of a natural product did not ordinarily confer patentability, new utility of the purified substance might confer patentability); see also *In re King*, 107 F.2d 618, 620 (C.C.P.A. 1939) (same); *In re Macallum*, 102 F.2d 614, 616 (C.C.P.A. 1939) (same).

vacuum tubes),³³² and in the *Marden* cases, wires and filaments of vanadium or uranium.³³³

In *General Electric*, the Third Circuit conceded that the wires were new and useful creations of the inventor because it was impossible to draw wires from the brittle form of tungsten known in the prior art.³³⁴ But considering whether there was “invention” in the inventor’s creation of drawn tungsten wire, the *General Electric* court stated:

Given the knowledge of the art and particularly the disclosures of [scientists] Just and Hanaman as to the advantages of a tungsten filament *and given pure tungsten with its natural characteristics of great ductility and high tensile strength*, the drawing of such tungsten into a wire for filament purposes was obvious.³³⁵

In other words, although the discovery of pure ductile tungsten represented a great advance in the art, if that discovery was treated as prior art, then the manufacture of a wire was obvious.³³⁶ Over a dissent by Judge Joseph Buffington,³³⁷ the Third Circuit held the claims to tungsten wires invalid.³³⁸ Likewise in the *Marden* cases, the CCPA, on the authority of *General Electric*, held invalid not only claims to ductile uranium and vanadium, but also to wires and filaments composed of the new ductile forms.³³⁹

The *General Electric* court reached this conclusion in part because the utility of a drawn tungsten wire was recognized long before the inventor made the wire.³⁴⁰ The court therefore regarded the inventor as having created a process for producing ductile tungsten but not the *idea* of a tungsten wire: “In other words, the idea of ‘tungsten wire’ ran ahead of the production of ductile tungsten so that when ductile tungsten was finally produced the drawing of it into wire was a thing long intended and therefore obvious.”³⁴¹

Unlike cases such as *Neilson*, where the application could not have been conceived prior to the inventor’s discovery, in *General Electric* the

332. *Gen. Elec.*, 28 F.2d at 641, 643.

333. *In re Marden*, 47 F.2d at 957; *In re Marden*, 47 F.2d at 958.

334. 28 F.2d at 642, 644.

335. *Id.* at 644 (emphasis added).

336. *See id.* (noting that the art was at a “standstill” before the inventor’s discovery, but concluding that the advancement was obvious).

337. *Id.* at 648 (Buffington, J., dissenting).

338. *Id.* at 644 (majority opinion).

339. *In re Marden*, 47 F.2d 957, 957 (C.C.P.A. 1931); *In re Marden*, 47 F.2d 958, 959 (C.C.P.A. 1931).

340. *See Gen. Elec.*, 28 F.2d at 644 (stating that history of attempts to produce drawn tungsten wire fortified the court’s conclusion). Perhaps ironically by modern standards, the long-felt need and the failure of others reinforced the conclusion of obviousness.

341. *Id.*

desired application had long existed and was simply awaiting the enabling discovery. It was not a case where “inventiveness” could have been supplied by an inventive discovery. However, whether or not *General Electric* implied a requirement of inventive application, that aspect of the case appears to have been forgotten. Subsequent decisions still cited *General Electric* for the proposition that natural products were not patentable,³⁴² but no decision beyond the *Marden* cases seems to have relied on the holding regarding wire, or pursued the reasoning that an invention enabled by a new discovery is unpatentable because it was long envisioned.³⁴³

But beyond the categories of mental processes and natural products, lower courts in the first half of the twentieth century recognized few limits on the scope of patent-eligible subject matter other than the long-standing restriction of the patent system to the technological arts. Courts continued to declare the unpatentability of principles and ideas in the abstract,³⁴⁴ and one might regard some of the mental process cases as examples of this exclusion. But aside from the mental process cases, no decisions in the first half of the twentieth century actually invalidated claims as drawn to principles or discoveries in the abstract.³⁴⁵ The trend of the case law actually ran in the opposite direction.

342. See, e.g., *Merck & Co. v. Olin Mathieson Chem. Corp.*, 253 F.2d 156, 162 (4th Cir. 1958); *Merck & Co. v. Chase Chem. Co.*, 273 F. Supp. 68, 82 (D.N.J. 1967).

343. This aspect of *General Electric* and the *Marden* cases is no longer viable after *Ass’n for Molecular Pathology v. Myriad*—at least as a question of patent-eligible subject matter. See *Myriad*, 133 S. Ct. 2107, 2111 (2013) (holding “that a naturally occurring DNA segment is a product of nature and not patent eligible merely because it has been isolated, but that cDNA is patent eligible because it is not naturally occurring”). Certainly the “idea” of *BRCA* cDNAs well preceded their isolation, and once the *BRCA* sequence was known, the creation of a cDNA would be “a thing long intended and therefore obvious.” Compare *Myriad*, 133 S. Ct. at 2113–14 (stating that “isolation is necessary to conduct genetic testing, and Myriad was not the only entity to offer *BRCA* testing after it discovered the genes”), with *Gen. Elec.*, 28 F.2d at 644 (“[T]he idea of ‘tungsten wire’ ran ahead of the production of ductile tungsten so that when ductile tungsten was finally produced the drawing of it into wire was a thing long intended and therefore obvious.”). Yet the Supreme Court confirmed the patent eligibility of *BRCA* cDNAs in *Myriad*. 133 S. Ct. at 2119.

344. See, e.g., *Ind. & Ill. Coal Corp. v. Clarkson*, 91 F.2d 717, 721 (7th Cir. 1937) (“A mere idea, of course, is not patentable.”); *Buck v. Ooms*, 63 F. Supp. 715, 717 (D.D.C. 1945) (“It must be borne in mind, however, that patents are not granted on discoveries of abstract laws or principles.”).

345. Only three twentieth-century cases were classified as “abstract principle” cases by Rivise and Caesar (writing in 1936). See RIVISE & CAESAR, *supra* note 322, § 31. Two were cases where the invention was disclosed or suggested by the prior art, the patentee having only discovered an inherent property or explanation of the prior art: *American Mercerizing Co. v. Hampton Co.*, 147 F. 725, 725, 731 (D. Mass. 1906) (involving a claim to the discovery that tension created silky luster in the mercerizing process), and *De Forest Radio Co. v. General Electric Co.*, 283 U.S. 664, 676 (1931) (finding that the desirability of high vacuum was suggested in prior art), amended by 284 U.S. 571 (1931) (per curiam). The third, *Ex parte Mills*, denied patentability to fibrogen, said to be a protein-phospholipin compound newly isolated from natural sources. 1928 Dec. Comm’r Pat. 4, 5.

The 1908 decision of the U.S. Court of Appeals for the Second Circuit in *Cameron Septic Tank Co. v. Village of Saratoga Springs*³⁴⁶ led that trend. The inventors in *Cameron* developed a new method of sewage treatment—letting raw sewage incubate undisturbed in a tank before exposing it to air and light.³⁴⁷ This process permitted the successive and separate action of both anaerobic and aerobic bacteria to break down the waste.³⁴⁸ There was nothing new about the tank. Both the trial court and the Second Circuit regarded the patentee's apparatus as old and the claims drawn to the apparatus as invalid.³⁴⁹ The trial court also found little novelty in the steps of the process.³⁵⁰ Given that the apparatus and basic steps were known in the art, the trial court regarded the growth of the bacteria as merely a natural process, a principle unpatentable under *Le Roy* and *Morse*.³⁵¹ The trial court's discussion, wavering between lack of novelty in the means, the unpatentability of a principle, and the lack of human intervention in the process of bacterial growth, is difficult to pin down doctrinally. Yet even assuming the patentee was the first to discover that undisturbed bacteria would form a scum over the sewage, fostering anaerobic conditions, the district court regarded that discovery as nothing more than a principle.³⁵²

The Second Circuit disagreed. Most of its opinion addressed differences between conditions in the prior art and the claimed process that the trial court had overlooked.³⁵³ But the court also rejected the trial court's conclusion that the claims covered a process of nature.³⁵⁴ According to the court, the inventor was the first to provide conditions that amplified the bacteria's natural capacity for the effective disposal of sewage.³⁵⁵ In the court's view, "[t]his certainly involved 'the use of one of the agencies of nature for a practical purpose.' The process is one which puts a force of nature into a certain specified condition and then uses it in that condition for a practical purpose."³⁵⁶

346. 159 F. 453 (2d Cir. 1908).

347. *See id.* at 453–54.

348. *Id.* at 455.

349. *See id.* at 463–64.

350. *Cameron Septic Tank Co. v. Village of Saratoga Springs*, 151 F. 242, 260 (C.C.N.D.N.Y. 1907), *rev'd*, 159 F. 453 (2d Cir. 1908).

351. *See id.* at 260–61.

352. *See id.* at 262.

353. *See, e.g., Cameron*, 159 F. at 450.

354. *See id.* at 462–63.

355. *Id.*

356. *Id.* at 463 (citation omitted) (quoting *Risdon Iron & Locomotive Works v. Medart*, 158 U.S. 68, 77 (1895)). *Cameron* might stand for nothing more than a rejection of *Wall v. Leck*, 66 F. 552 (9th Cir. 1895). Whereas *Wall* had denied patentability to a process employing natural darkness, 66 F. at 557, *Cameron* endorsed a process employing natural bacterial action, 159 F. at 462–63. In both cases the patentee had used old means to provide suitable conditions.

The same distinction—between natural phenomena in the abstract and practical application—undergirded *Dick v. Lederle Antitoxin Laboratories*,³⁵⁷ decided in 1930 by the U.S. District Court for the Southern District of New York. *Dick* is usually remembered today as a case supporting the patentability of medical and diagnostic methods.³⁵⁸ But more so than the inventions in other early twentieth-century cases, basic scientific discovery was the foundation of the invention in *Dick*. The inventors in that case—University of Chicago researchers—discovered that a toxin secreted by hemolytic streptococci caused scarlet fever.³⁵⁹ The purification of the scarlet fever toxin quickly led to the claimed inventions: processes for administering the toxin to humans for diagnostic tests and immunization, and administration to animals for the production of an antitoxin.³⁶⁰ Claims to the purified toxin appeared in the patent as well.³⁶¹

On a suit under the patent,³⁶² the district court regarded the discovery of the true cause of scarlet fever—the soluble toxin—as the key to the invention.³⁶³ The court recognized that no patent could be granted for a discovery or law of nature.³⁶⁴ Invention required “an operable means or method” to achieve a practical result.³⁶⁵ But the application claimed in *Dick*—administering the toxin to humans or animals—was apparently routine in the art:

Having determined what the cause [of scarlet fever] was, then, by the application of what was already known in the art, the processes could be devised.

Or, to put it [a] different way, when the experimental form of the processes had been employed to the point when

Cameron thus stood for the patentability of methods depending on principles of nature for their action. Yet if one regards the action of anaerobic bacteria in sewage as a law of nature, there was certainly nothing inventive about the patentee’s application. The problem, obviously, is how to identify the law of nature operative in a claim.

357. 43 F.2d 628, 631 (S.D.N.Y. 1930).

358. See, e.g., Show, *supra* note 251, at 307.

359. See *Dick*, 43 F.2d at 633.

360. See *id.* at 630.

361. Claim 8 recited “[a] sterile toxin specific to scarlet fever.” U.S. Patent No. 1,547,369 (filed Nov. 28, 1924) (issued July 28, 1925). Claim 9 added the limitation that the toxin be obtained from a pure culture of scarlet fever streptococci. *Id.*

362. The inventors had assigned the patents to the “Scarlet Fever Committee.” See *Dick*, 43 F.2d at 638.

363. See *id.* at 630.

364. *Id.* at 631.

365. See *id.* at 630 (distinguishing the skin test claim at issue in *Dick* from invalid claims in *O’Reilly v. Morse*, 56 U.S. (15 How.) 62, 119–20 (1853), and *Morton v. N.Y. Eye Infirmary*, 17 F. Cas. 879, 881–82 (C.C.S.D.N.Y. 1862)).

it had been proved what was the cause of the disease, thereupon they became an invention.³⁶⁶

Other sources corroborate the view that there seemed little (if any) inventiveness in culturing the bacteria or in producing the toxin and antitoxin.³⁶⁷ The court nonetheless validated the claims.³⁶⁸ *Dick* is a brief opinion, possibly delivered from the bench,³⁶⁹ and there is no appellate opinion in the case. *Dick* nonetheless clearly set the dividing line between discovery and invention at practical application, not the addition of a further inventive concept.

Similar to *Dick*—but even more similar to *Funk Brothers*—was *Guaranty Trust Co. v. Union Solvents*,³⁷⁰ which concerned Chaim Weizmann’s patent for the production of acetone by bacterial fermentation.³⁷¹ Acetone had been produced (inefficiently) by bacterial fermentation before,³⁷² and there appeared to be nothing novel or inventive about Weizmann’s fermentation process. In litigation on the English counterpart patent, Weizmann’s attorneys even admitted that his fermentation process, aside from the bacteria involved, was identical to processes of the prior art.³⁷³ The only apparent novelty or invention was the new bacteria Weizmann had isolated from nature.³⁷⁴ Thus, while Weizmann had claimed the fermentation process rather than the bacteria per se, the only “inventive genius” exercised was in the discovery and isolation of a natural phenomenon.³⁷⁵ The application consisted solely of employing the new bacteria according to old and known techniques.

366. *See id.* at 631.

367. *See, e.g.*, Editorial, *Ethics and Patents*, 16 AM. J. PUB. HEALTH 919, 919 (1926) (“There does not appear to be anything strictly original in the method of growing the germ or the production of the serum . . .”).

368. *Dick*, 43 F.2d at 639. Most of the opinion is devoted to the question of invention. The defendants argued separately that the skin test claim did not define a “process.” *See id.* at 630.

369. *See id.* at 629 (noting that Judge Francis Caffey did not have enough time to fully prepare due to his caseload).

370. 54 F.2d 400 (D. Del. 1931), *aff’d*, 61 F.2d 1041 (3d Cir. 1932) (per curiam).

371. *Id.* at 401. The production of acetone was important during World War I as a solvent for the manufacture of nitrocellulose-based explosives. *See id.*; H.E. Hall, *Solvents Produced by Bacteria*, 29 CHEMICAL AGE 103, 103 (1921).

372. *See Guaranty Trust*, 54 F.2d at 403.

373. *See Commercial Solvents Corp. v. Synthetic Prods. Co.*, 43 R.P.C. 185, 199 (High Ct. Ch. 1926) (patentee’s argument) (“If *Weizmann’s* bacillus were the same as that indicated in *Fernbach and Strange*, then the two processes would be the same.”). The patent referred to by Weizmann’s attorneys was the *Fernbach and Strange* patent, No. 21,073 of 1912. *See id.*

374. *See Guaranty Trust*, 54 F.2d at 403 (“The problem with which he was dealing and successfully solved was that of isolating a particular bacteria or a culture containing some particular bacteria that would produce butyl alcohol and acetone *in commercial quantities better than any other known bacteria.*”).

375. *See id.*

Yet the courts upheld the validity of the patent against the charge that it was for a phenomenon or process of nature.³⁷⁶

The last “natural law” controversy before *Funk Brothers* arose in connection with Harry Steenbock’s vitamin D patents. Steenbock discovered that exposing foods to ultraviolet radiation increased their vitamin D content.³⁷⁷ The process, applied to cereals, milk, and medicinal preparations, led to the near eradication of rickets.³⁷⁸ The patents also led to the establishment of the first university technology transfer organization, the Wisconsin Alumni Research Foundation (WARF).³⁷⁹

Process claims in the Steenbock patents recited the step of subjecting foodstuff to ultraviolet rays “such as are produced by a quartz mercury vapour lamp.”³⁸⁰ When WARF asserted the Steenbock patents in 1941, the defendant argued, among other defenses, that the process claims were drawn to nothing more than a process or law of nature.³⁸¹ The defendants based their argument on *Wall v. Leck*: just as the natural action of darkness was not patentable in *Wall*, the action of ultraviolet light—which might originate from the sun as well as an artificial source—should not be patentable.³⁸²

The district court viewed the claims in suit as limited to the use of artificial light produced by ultraviolet lamps.³⁸³ Because the patentee used lamps as the source of ultraviolet, the district court rejected the defense:

The principle of law is settled that if one has gone beyond the *domains* of discovery and laid hold of a new force and connected it with some *mechanical contrivance* through which it acts, he is entitled to secure control of it, for the existence in nature of a force that can be and is used by man does not argue against invention unless the invention consists simply in adopting what nature, unaided, gave. It is the use that is patentable, the utilizing of a law of nature by means of a method.³⁸⁴

376. The defendant argued that the patent was invalid because it attempted to patent “the life process of a living organism.” *Id.* at 410. The district court allowed that a claim to the bacteria per se might pose issues, but regarded the defendant’s argument foreclosed by *Cameron and Dick*. *See id.* On appeal, the Third Circuit, per curiam, affirmed the validity of the patent, on “the careful and comprehensive opinion of the learned District Judge.” *Union Solvents Corp. v. Guaranty Trust Co.*, 61 F.2d 1041, 1041 (3d Cir. 1932) (per curiam).

377. *Wis. Alumni Research Found. v. Vitamin Technologists, Inc.*, 41 F. Supp. 857, 861 (S.D. Cal. 1941), *aff’d in part, rev’d in part*, 146 F.2d 941 (9th Cir. 1944).

378. *See id.*

379. *See History*, WARF, <http://www.warf.org/about-us/background/history/history.cmsx> (last visited Jan. 19, 2015).

380. U.S. Patent No. 1,680,818, Claim 1 (filed June 30, 1924) (issued Aug. 14, 1928).

381. *See Wis. Alumni Research*, 41 F. Supp. at 864.

382. *See id.* at 865.

383. *Id.* at 864–65.

384. *Id.* at 865.

There was certainly nothing inventive about the patentee's means; ultraviolet lamps were old and well known. The district court accepted that under *Wall v. Leck*, patentable invention lay only in the exercise of "inventive skill" or "creative genius," not the discovery of natural laws.³⁸⁵ Yet the use of an ultraviolet lamp sufficed. So long as the patentee followed up on his discovery by employing some artificial means, the resulting method was patentable.³⁸⁶

When the appeal came before the Ninth Circuit in 1944, the court proved remarkably hostile to the Steenbock patents. It construed the limitation "ultra-violet rays, such as are produced by a quartz mercury vapour lamp" to encompass the natural ultraviolet rays of the sun.³⁸⁷ Hence, the process claims were inherently anticipated by the ancient practice of drying foods in sunlight.³⁸⁸ The court invalidated the process claims, as well as the claims of another patent directed to medicinal preparations, as indefinite for failing to specify the degree of ultraviolet irradiation.³⁸⁹ In addition, a patent directed to the treatment of yeast was "invalid" on account of laches.³⁹⁰ The Ninth Circuit also regarded WARF's restrictive licensing as against public policy because it withheld the simple cure for rickets from the poor (who were most afflicted),³⁹¹ and the court urged the U.S. Attorney General to investigate the patentee for patent misuse.³⁹²

The only thing favorable the Ninth Circuit had to say regarding the patents was that they were *not* monopolies on a law of nature. Though the court had construed the process claims to include irradiation by the sun, the court emphasized that the use of ultraviolet rays was "part of a process which comprises the preparation of food substances."³⁹³ Hence, the claims no more monopolized the power of the sun than machines operating by gravity monopolized the gravitational force of the earth.³⁹⁴ If the claims encompassed exposing food to natural ultraviolet light, then it seems difficult to distinguish between night as a source of darkness in *Wall* with the sun as a source of ultraviolet light in *Vitamin Technologies*. In *Wall*, patentees claimed natural darkness as part of a process for the fumigation of plants. Yet the Ninth Circuit summarily

385. *See id.* at 865–66.

386. *See id.* at 866.

387. *Vitamin Technologies, Inc. v. Wis. Alumni Research Found.*, 146 F.2d 941, 947–48 (9th Cir. 1944).

388. *Id.* at 949.

389. *See id.* at 951.

390. *Id.* at 951–52.

391. *Id.* at 945.

392. *See id.* at 946.

393. *Id.* at 949.

394. *Id.*

dismissed its prior decision in *Wall v. Leck* as irrelevant.³⁹⁵ Certainly there was no pretense in the case that Steenbock's means of irradiation was inventive: once the natural phenomenon of the activation of vitamin D by ultraviolet light was discovered, Steenbock's application of his discovery was entirely conventional and obvious. Given the Ninth Circuit's hostility towards the Steenbock patents, one assumes that if some notion of inventive application had been current in the patent law of the time, the court would not have been so quick to reject the "law of nature" argument.³⁹⁶

C. Commentary in the Early Twentieth Century

Treatise writers of the early twentieth century, like their nineteenth-century counterparts, continued to maintain that practical application sufficed to transform a principle into a patentable invention. Inventiveness or ingenuity in the application was unnecessary. For example, Rivise and Caesar's 1936 treatise summarized the case law thus:

In all of the decided cases, the Courts have taken great pains to point out the fact that though neither the cause nor its effect is patentable by itself, the means by which the cause is applied to produce the effect is patentable. . . . In other words, the principle of nature itself is not patentable, but its utilization by means of an art, machine, manufacture or composition of matter, when properly expressed in one of these forms, is patentable.

. . . .

In the cases where the inventor was required to be also the discoverer of the law or force utilized, it appeared that the application or utilization of the law became self-evident as soon as the principle was formulated.³⁹⁷

395. *See id.* (rejecting appellant's argument based on *Wall v. Leck*).

396. Judge William Healy authored a somewhat ambiguous concurrence in the case. He began by stating that the claims should be regarded as anticipated by the prior use of natural sunlight, rather than as the attempted monopoly on the use of sunlight. *See id.* at 953 (Healy, J., concurring). But he also stated that if Steenbock's real invention had been to determine the most effective degree of ultraviolet exposure, then "[i]t would amount to no more than the ascertainment of a naked fact or principle in nature existing independently of the efforts of the discoverer." *Id.* at 954. If he meant that the discovery of optimal conditions for a prior art process should be regarded as a naked principle, then his reasoning is reminiscent of *Mayo*. But it is not clear if that was Healy's meaning; he next stated that if such discovery were patentable, it would be "broader than the process itself" in that it would include all processes with the same effect, including exposure of foodstuffs to the sun. *Id.*

397. RIVISE & CAESAR, *supra* note 322, §§ 33–34 (emphasis added); *see also* GLASCOCK & STRINGHAM, *supra* note 323, § 1170 (listing and expounding on cases falling under the

Those outside the legal community also saw practical application as the boundary between invention and discovery. In 1934, a committee of the American Association for the Advancement of Science (AAAS) produced a report, *The Protection by Patents of Scientific Discoveries*, that evaluated both the current state of patent protection, and the possibility of a sui generis regime for the protection of scientific property.³⁹⁸ The report described the current scope of patent-eligible subject matter:

[N]early all the results of research which have some practical application can be patented. Mere theories, formulation of data or discoveries of laws can not be patented unless they are applied practically in a physical, chemical, or electrical process, to produce some new, useful and tangible result.³⁹⁹

Scientific theories were not unpatentable because they lacked inventive application; they were unpatentable because theories themselves did not qualify as processes, machines, manufactures, or compositions of matter.⁴⁰⁰

The AAAS's proposed sui generis regime defined eligible scientific discoveries as follows:

- a. At the time the discovery is made, it shall not be obvious as to how the same could be utilized as a new and useful manufacture.
- b. The discovery shall be of such a nature that it may subsequently lend itself to practical application for the creation of a new manufacture⁴⁰¹

categorical title: "Natural Process: Claims Have Usually Been Sustained When in Process Form, Even If Pretty Close to Nature").

398. AM. ASS'N FOR THE ADVANCEMENT OF SCI., *THE PROTECTION BY PATENTS OF SCIENTIFIC DISCOVERIES: REPORT OF THE COMMITTEE ON PATENTS, COPYRIGHTS AND TRADE MARKS* (1934) (Supp. to 79 SCIENCE).

399. *Id.* at 7. The standard of "new, useful, and tangible result" very much calls to mind the language of *State Street*, although "tangible" here clearly imputes "physical." See *State Street Bank & Trust Co. v. Signature Fin. Grp., Inc.*, 149 F.3d 1368, 1373 (Fed. Cir. 1998) (discussing the standard for patentability of an abstract idea when reduced to a practical application as producing "a useful, concrete and tangible result" (quoting *In re Alappat*, 33 F.3d 1526, 1544 (Fed. Cir. 1994), *abrogated by In re Bilski*, 545 F.3d 943, 959–60 (Fed. Cir. 2008), *aff'd*, 130 S. Ct. 3218 (2010))), *also abrogated by In re Bilski*, 545 F.3d at 959–60).

400. See Richard Spencer, *Scientific Property*, 18 A.B.A. J. 79, 80 (1932) (stating that scientific discoveries are unpatentable because they are not processes, machines, manufactures, or compositions of matter as defined by statute).

401. AM. ASS'N FOR THE ADVANCEMENT OF SCI., *supra* note 398, at 32. In the proposed scheme, while the researcher would be required to register upon discovery, no rights would

The sole purpose of the scheme was to provide protection that the patent system could not; by defining its subject matter as those discoveries without obvious applications, the AAAS report seems clearly premised on the assumption that obvious applications of new discoveries were patent eligible.

So in marking the boundary between discovery and invention, the law approaching the midpoint of the twentieth century remained much the same as it was when the century began. The patentability of natural compounds and mental steps was contested, but for all other kinds of inventions, the division remained between abstract principles on one hand, and practical applications on the other.⁴⁰² If anything, the courts expanded the domain of invention at the expense of unpatentable discovery. Claims in cases like *Dick* recited little beyond the patentee's new principle. As in the vitamin D cases, the courts either disregarded *Wall v. Leck* entirely, or treated it as a mere requirement for some artificial means. Likewise, when courts invoked *Morton v. New York Eye Infirmary*, *Morton* usually stood for the proposition that some physical medium or means was necessary to transmute the inventor's discovery into practical and patentable application.⁴⁰³

V. THE BIRTH OF INVENTIVE APPLICATION

The preceding Parts have shown that from the hot-blast cases of the 1840s through the mid-twentieth century, a doctrine of inventive application was almost unknown in English and American patent law. Practical application nearly always sufficed to transform a discovery into patent-eligible subject matter. However, in 1948, the Supreme Court's decision in *Funk Brothers*⁴⁰⁴ announced a new requirement for inventive application. Contemporaneous courts and commentators recognized that *Funk Brothers* demanded inventive application for patent eligibility, and recognized that demand as a radical departure from established law. A small but significant line of cases in the 1950s

attach until the discovery became capable of practical exploitation. *See id.* at 32–33. At that point, a compulsory licensing scheme kicked in. *See id.* at 33.

402. *See* RIVISE & CAESAR, *supra* note 322, § 31; Ruestow, *supra* note 297, at 92 (characterizing “principle of nature” cases as requiring the inventor to claim only tangible manifestations of his discovery).

403. *See, e.g.,* Miami Copper Co. v. Minerals Separation, Ltd., 244 F. 752, 756 (3d Cir. 1917) (“[I]n its naked sense a discovery is not patentable and can be embraced in and controlled by a patent only when and to the extent that its principle is developed into invention by the disclosure of a medium or means which brings it into practical action.” (citing *Morton v. New York Eye Infirmary*, 17 F. Cas. 879 (S.D.N.Y. Cir. Ct. 1862))); *see also* *Cunningham Piano Co. v. Aeolian Co.*, 255 F. 897, 900 (3d Cir. 1919) (citing *Morton* for the proposition that “very simple means” suffices to transform discovery into invention).

404. *Funk Bros. Seed Co. v. Kalo Inoculant Co.*, 333 U.S. 127 (1948).

and 1960s carried forward the *Funk Brothers* doctrine to *Flook*, which in turn became the foundation of *Mayo*.

A. Funk Brothers

The true origin of inventive application as a test for patent eligibility was Justice Douglas's opinion in *Funk Brothers*.⁴⁰⁵ The patent in *Funk Brothers*, entitled "Bacterial Inoculant for Leguminous Plants,"⁴⁰⁶ dealt with cultures of bacteria useful to promote nitrogen fixation in plants like soy and alfalfa.⁴⁰⁷ Bacteria of the genus *Rhizobium* exist in symbiotic association with leguminous plants, forming root nodules that enable the plant to fix atmospheric nitrogen.⁴⁰⁸ It had long been the practice for farmers to apply cultures of *Rhizobium* to seeds before planting to enhance nitrogen fixation.⁴⁰⁹ However, each crop is susceptible to infection by a different species of *Rhizobium*.⁴¹⁰ This presented a problem because different species of *Rhizobium* inhibited each other's nitrogen fixation.⁴¹¹ It was therefore necessary for producers to manufacture, dealers to stock, and farmers to purchase a separate culture for each type of leguminous crop.⁴¹²

The patentee (Bond) discovered that particular naturally occurring strains of *Rhizobium* would not inhibit each other's activity when mixed together.⁴¹³ Hence, selected non-inhibitory strains could be combined in the form of a "mixed culture," a single product that could be conveniently applied to a variety of different leguminous plants.⁴¹⁴ Bond's patent did not identify any properties of the desired bacteria other than their non-inhibition.⁴¹⁵ Nor, in a time before biological deposits were common, did the patent make available particular non-inhibitory strains.⁴¹⁶ It simply instructed that one should culture candidate *Rhizobia* and determine whether they inhibited each other's action when applied to a host plant.⁴¹⁷

405. *Id.*

406. U.S. Patent No. 2,200,532 (filed Aug. 24, 1938) (issued May 14, 1940).

407. *Id.* at 1.

408. *Id.*

409. *See id.* at 2.

410. *Id.* at 1.

411. *Id.* at 2.

412. *Id.* The limited shelf life of bacterial cultures exacerbated the problem of dealing with multiple separate cultures of *Rhizobium*. Brief for Respondent at 8–9, *Funk Bros. Seed Co. v. Kalo Inoculant Co.*, 333 U.S. 127 (1948) (No. 280).

413. *Funk Bros.*, 333 U.S. at 130.

414. *Id.*

415. *See* '532 Patent, at 1, 5.

416. *See* John Edward Schneider, Note, *Microorganisms and the Patent Office: To Deposit or Not to Deposit, That Is the Question*, 52 *FORDHAM L. REV.* 592, 595–97 (1984) (discussing history of deposit requirement).

417. *See* '532 Patent, at 5. Justice Felix Frankfurter regarded the claims as unpatentable not because they were drawn to products of nature, but because the patentee had not provided

Nonetheless, the patent claimed not only the method of producing a mixed culture, but also broadly claimed all inoculants for leguminous plants where the constituent strains were selected for their mutual non-inhibition.⁴¹⁸

The trial court held the asserted product claims invalid.⁴¹⁹ While finding that Bond had indeed discovered the existence of non-inhibitory strains in nature, the trial court regarded Bond's discovery as beyond the categories of patent-eligible subject matter enumerated by statute.⁴²⁰ The U.S. Court of Appeals for the Seventh Circuit reversed, finding that Bond had made an "inventive step" in the production and distribution of inoculants,⁴²¹ and that the mixed culture qualified as a new and useful composition of matter.⁴²² The Supreme Court reversed in turn, with Justice Douglas holding that the product claims did "not disclose an invention or discovery within the meaning of the patent statutes."⁴²³

Over the last few decades, *Funk Brothers* has often been remembered as a case about products of nature. That view arises because the usual exposure to *Funk Brothers* has been through the lens of *Diamond v. Chakrabarty*.⁴²⁴ In discussing whether Chakrabarty's genetically modified bacteria were products of nature (a discussion entirely in dictum),⁴²⁵ the Supreme Court cited the statement in *Funk*

sufficient disclosure to support claims encompassing all non-inhibitory mixtures of bacteria. *See Funk Bros.*, 333 U.S. at 133–34 (Frankfurter, J., concurring).

418. *See* '532 Patent, at 7 ("4. An inoculant for leguminous plants comprising a plurality of selected mutually non-inhibitive strains of different species of bacteria of the genus *Rhizobium*, said strains being unaffected by each other in respect to their ability to fix nitrogen in the leguminous plant for which they are specific."). Claim 4 was regarded as representative in the litigation. *Funk Bros.*, 333 U.S. at 128 n.1.

419. *Kalo Inoculant Co. v. Funk Bros. Seed Co.*, 161 F.2d 981, 984 (7th Cir. 1947) (discussing the district judge's findings), *rev'd*, 333 U.S. 127 (1948). The district court's opinion was not reported.

420. *See id.*; *see also* Patent Act of 1870, ch. 230, § 24, 16 Stat. 198, 201 (1870) (current version at 35 U.S.C. § 101 (2012)) (defining as patentable "new and useful art, machine, manufacture, or composition of matter").

421. *See Kalo*, 161 F.2d at 985, 991.

422. *See id.* at 986.

423. *Funk Bros.*, 333 U.S. at 132.

424. *See* 447 U.S. 303, 309–10 (1980).

425. According to the Supreme Court, the claims in *Chakrabarty* were originally rejected on the grounds that (1) bacteria were "products of nature," and (2) that living things were not patent eligible under 35 U.S.C. § 101. *Id.* at 306. The Patent Office Board of Appeals did not sustain the "product of nature" rejection. *Id.* at 306 & n.3. Because the Board of Appeals had "ignored" a similar rejection in the *Bergy* case, which had been combined with *Chakrabarty*, the Court of Customs and Patent Appeals felt it necessary to hold summarily that *Bergy's* claim did not define a product of nature. *See In re Bergy*, 596 F.2d 952, 972–73 (C.C.P.A. 1979), *aff'd sub nom.*, *Chakrabarty*, 447 U.S. 303. *Bergy* was not appealed. The Commissioner's brief in *Chakrabarty* raised and argued only the question of whether living organisms were patent eligible. Brief for Petitioner, *Chakrabarty*, 447 U.S. 303 (No. 79-136), 1980 WL 339757, at *5.

Brothers that the patentee had discovered only “nature’s handiwork,” and went on to quote the following:

Each of the species of root-nodule bacteria contained in the package infects the same group of leguminous plants which it always infected. No species acquires a different use. The combination of species produces no new bacteria, no change in the six species of bacteria, and no enlargement of the range of their utility. Each species has the same effect it always had. The bacteria perform in their natural way. Their use in combination does not improve in any way their natural functioning. They serve the ends nature originally provided and act quite independently of any effort of the patentee.⁴²⁶

The Court contrasted the unmodified bacteria in *Funk Brothers* with the engineered bacteria produced by Chakrabarty, regarding the latter as a creation of the inventor rather than “nature’s handiwork.”⁴²⁷ More recently, in *Myriad*, Justice Clarence Thomas characterized *Funk Brothers* as holding “that the composition was not patent eligible because the patent holder did not alter the bacteria in any way.”⁴²⁸

But while Justice Douglas refers to the general unpatentability of natural laws and natural phenomena,⁴²⁹ he does not appear to have been discussing *products* of nature. The early twentieth-century patent literature commonly discussed the “product of nature” theory.⁴³⁰ Yet Justice Douglas neither refers to those cases⁴³¹ nor uses that term. He instead calls the patentee’s culture an *aggregation*.⁴³² This was not an accident; “aggregation” was a long-standing concept of patent law when

Funk Brothers was only raised by the *applicant*, who noted that no party in *Funk Brothers* had challenged the claims because they encompassed living subject matter. Brief for Respondent, *Chakrabarty*, 447 U.S. 303 (No. 79-136), 1980 WL 339758, at *12–14.

426. *Chakrabarty*, 447 U.S. at 310 (quoting *Funk Bros.*, 333 U.S. at 131).

427. *Id.* at 309–10.

428. *Ass’n for Molecular Pathology v. Myriad Genetics, Inc.*, 133 S. Ct. 2107, 2117 (2013) (citing *Funk Bros.*, 333 U.S. at 132).

429. *See Funk Bros.*, 333 U.S. at 130.

430. *See, e.g., RIVISE & CAESAR, supra* note 322, § 28; GLASCOCK & STRINGHAM, *supra* note 323, § 1226.

431. Most notably absent is a reference to the tungsten case, *General Electric v. De Forest Radio Co.*, 28 F.2d 641 (3d Cir. 1929). The defendant urged *General Electric* upon the Court. *See* Brief for Petitioner at 26, *Funk Bros.*, 333 U.S. 127 (No. 280). While the defendant’s argument on appeal touched on a variety of themes, the most consistent argument was that, because mixed inoculants were old, the patentee had not created a novel structure by the use of the law of nature. *See id.* at 31 (“Bond does not create a ‘novel structure,’ for the mixed inoculant was known before him.”); *see also id.* at 15, 23.

432. *Funk Bros.*, 333 U.S. at 131 (“But we think that the aggregation of species fell short of invention within the meaning of the patent statutes.”); *id.* (“The aggregation of select strains . . . is an application of that newly-discovered natural principle.”).

the Court decided *Funk Brothers*. The aggregation doctrine held that a collection of old parts or steps was not patentable, unless some new or different function emerged from the juxtaposition of known elements.⁴³³ In contrast to a patentable “combination,” an “aggregation” lacked invention unless the known elements cooperated or synergized in some fashion.⁴³⁴ This was why Justice Douglas emphasized that Bond had done nothing to alter the bacteria from their natural state, and that the bacteria acquired no new function by Bond’s manipulations. Bond had only collected old bacteria into a single package. Without some change in the structure of the bacteria, or some change in their individual or collective function, Bond’s mixed cultures were mere aggregations.⁴³⁵

Justice Douglas’s conclusion was questionable, even under such a notoriously muddied doctrine as “aggregation.”⁴³⁶ While courts had denied patentability to mere “judicious selections” of prior art elements as aggregations,⁴³⁷ they upheld collections of old elements that achieved old results more efficiently or economically as patentable combinations.⁴³⁸ Indeed, the Court itself had previously upheld patents where the combination of old elements yielded a more effective and convenient result, even if the elements merely performed their accustomed functions.⁴³⁹

433. See *Lincoln Eng’g Co. v. Stewart-Warner Corp.*, 303 U.S. 545, 549 (1938) (“The mere aggregation of a number of old parts or elements which, in the aggregation, perform or produce no new or different function or operation than that theretofore performed or produced by them, is not patentable invention.”).

434. See *In re Gustafson*, 331 F.2d 905, 908 (C.C.P.A. 1964).

435. Compare *Funk Bros.*, 333 U.S. at 131 (“Each species has the same effect it always had. . . . Their use in combination does not improve in any way their natural functioning.”), with *Toledo Pressed Steel Co. v. Standard Parts, Inc.*, 307 U.S. 350, 355–56 (1939) (holding that the claim to an old torch and cap was unpatentable aggregation because “[t]hey performed no joint function. Each served as separately it had done”).

436. See *Sachs v. Hartford Elec. Supply Co.*, 47 F.2d 743, 748 (2d Cir. 1931) (opinion of Hand, J.) (“[W]e can find little advantage in a discussion of what is or what is not an ‘aggregation.’ . . . Any attempt to define it in general terms has always proved illusory; it is best to abandon it.”), *reh’g granted*, 1931 WL 25758 (2d Cir. 1931) (per curiam); see also *In re Gustafson*, 331 F.2d at 909 (opinion of Rich, J.) (celebrating the end of the “mental anguish” of aggregation doctrine after passage of 1952 Patent Act).

437. See *Newcomb, David Co. v. R.C. Mahon Co.*, 59 F.2d 899, 901 (6th Cir. 1932).

438. E.g., *Weil Pump Co. v. Chi. Pump Co.*, 74 F.2d 13, 16 (7th Cir. 1934); *Nat’l Hollow Brake-Beam Co. v. Interchangeable Brake-Beam Co.*, 106 F. 693, 706–07 (8th Cir. 1901); see also *Funk Bros.*, 333 U.S. at 135 (Frankfurter, J., concurring) (noting that the claimed inoculant had the “new property of multi-service applicability”).

439. In *Seabury v. Am Ende*, the Court sustained the validity of a cotton wound dressing containing boracic acid and glycerine. See 152 U.S. 561, 567–69 (1894). Even though the elements performed only previously known functions, “the patentee was the first to perceive that by combining these articles, in the manner he pointed out, there would be formed a convenient and permanent dressing with the desirable qualities of the several constituents.” *Id.* at 567.

Was *Funk Brothers* then a case about obviousness? An “aggregation” was unpatentable because of its “lack of invention,” and today one might call a collection of old parts with predictable functions an obvious combination. Justice Douglas described the mixed inoculant as an “aggregation of species” that “fell short of invention,”⁴⁴⁰ citing *Cuno Engineering v. Automatic Devices Corp.*⁴⁴¹—his infamous “flash of creative genius” opinion⁴⁴²—for the proposition that a product claim “must also satisfy the requirements of invention or discovery.”⁴⁴³ A number of commentators, albeit a minority, have therefore taken the view that *Funk Brothers* should properly be regarded as an obviousness case.⁴⁴⁴ Part of the attraction of such a position is that *Funk Brothers* can then be dismissed as obsolete after the 1952 Patent Act eliminated tests such as “invention” and “synergy” in favor of the nonobviousness test under § 103.⁴⁴⁵

But the Court’s analysis makes it impossible to characterize *Funk Brothers* as an obviousness case in the modern sense. Before Bond’s discovery, there was no reason why one of ordinary skill in the art would have combined different strains of bacteria. The prior art instead taught that it was a “dangerous practice” to combine multiple *Rhizobium* species in a composite inoculant.⁴⁴⁶ Even under the pre-1952 Patent Act, that fact would sustain the validity of a claim against a challenge for “lack of patentable inventive quality” or “aggregation,” as

440. *Funk Bros.*, 333 U.S. at 131.

441. 314 U.S. 84 (1941), *mandate amended by* 314 U.S. 587 (1942).

442. *Cuno Engineering* held that an adaptation or combination of old elements was patentable only if it “reveal[ed] the flash of creative genius,” not merely ordinary skill in the art. *Id.* at 91. Congress was commonly thought to have targeted this controversial phrase when it enacted § 103 of the 1952 Patent Act, embodying the requirement of nonobviousness. See *Graham v. John Deere Co.*, 383 U.S. 1, 15 (1966) (discussing “flash of creative genius” test).

443. *Funk Bros.*, 333 U.S. at 131–32.

444. See *Ass’n for Molecular Pathology v. U.S. Patent & Trademark Office*, 689 F.3d 1303, 1327 (Fed. Cir. 2012) (Lourie, J.) (summarizing the Supreme Court’s treatment of *Funk Brothers* in *Chakrabarty* as “again casting this case, more relating to obviousness, in terms of § 101”), *aff’d in part, rev’d in part*, 133 S. Ct. 2107 (2013); CHISUM, *supra* note 322, § 1.02[7][b]; Michael Risch, *Everything Is Patentable*, 75 TENN. L. REV. 591, 599 (2008) [hereinafter Risch, *Everything is Patentable*] (characterizing *Funk Brothers* as an obviousness case); Shine Tu, *Funk Brothers—An Exercise in Obviousness*, 80 UMKC L. REV. 637, 637 (2012); Karen Goodyear Krueger, *Building a Better Bacterium: Genetic Engineering and the Patent Law After Diamond v. Chakrabarty*, Note, 81 COLUM. L. REV. 159, 171 n.104 (1981) (stating that *Funk Brothers* invalidated claimed compositions for obviousness).

445. See Brief for The Biotechnology Indus. Org. as Amicus Curiae Supporting Respondents, *Ass’n for Molecular Pathology v. Myriad Genetics, Inc.*, 133 S. Ct. 2107 (2013) (No. 12-398) (arguing that *Funk Brothers*’ mode of analysis, requiring “invention,” was eliminated by and replaced by § 103 of 1952 Patent Act); Risch, *Everything is Patentable*, *supra* note 444, at 599 (noting *Funk Brothers*’ reliance on pre-Act obviousness law).

446. See *Kalo Inoculant Co. v. Funk Bros. Seed Co.*, 161 F.2d 981, 988 (7th Cir. 1947), *rev’d*, 333 U.S. 127 (1948).

the Seventh Circuit pointed out when it rejected the defendant's charge.⁴⁴⁷ The only way to regard *Funk Brothers* as an obviousness case is to assume that one of ordinary skill in the art was already aware of Bond's discovery. Such was not the state of the law at the time the Court decided *Funk Brothers*.⁴⁴⁸

And that, of course, is the point. Whether Bond altered the bacteria from their natural state, or whether the claimed inoculant was an aggregation, were subsidiary questions in the case. *Funk Brothers* radically redefined the boundary between discovery and invention by withdrawing the discovery from the inventor's account. Rather than a *practical application* of the inventor's discovery, Justice Douglas demanded an *inventive application* for patent eligibility. The claim to a mixed inoculant was not invalid simply because the bacteria were unaltered from nature; innumerable inventions are combinations of unaltered building blocks. The patents were invalid because once the Court assumed away the discovery of compatible strains, the mixed culture became nothing more than the aggregation of known elements with predictable results.

The discovery that certain strains could be combined was, for Justice Douglas, a basic scientific fact:

Discovery of the fact that certain strains of each species of these bacteria can be mixed without harmful effect to the properties of either is a discovery of their qualities of non-inhibition. It is no more than the discovery of some of the handiwork of nature and hence is not patentable.⁴⁴⁹

Patentable invention could reside only in its application: "If there is to be invention from such a discovery, it must come from the application of the law of nature to a new and useful end."⁴⁵⁰

The distinction between an unpatentable discovery and a patentable application was hardly new. What was new in *Funk Brothers* was the demand that the practical application be "inventive" as well. Justice Douglas did not ask whether there was *an invention* in the application of the patentee's discovery; he asked whether there was *invention*. Prior to *Funk Brothers*, inventiveness in the underlying discovery sufficed to confer inventiveness in the application.⁴⁵¹ But for Justice Douglas, the

447. *Id.*

448. See Norman J. O'Malley, Recent Decisions, Patents—*The Discovery and Application of a Principle of Nature Is Not Inventive if the Application Would be Obvious to Anyone Knowing the Principle*, 36 GEO. L.J. 703, 706 (1948).

449. *Funk Bros. Seed Co. v. Kalo Inoculant Co.*, 333 U.S. 127, 131 (1948).

450. *Id.* at 130.

451. See, e.g., *supra* notes 303–05 and accompanying text (discussing the Court's analysis in *De Forest Radio*); see also *supra* notes 370–76 (discussing the court's analysis in *Guaranty Trust*).

question was whether the application itself, beyond the discovery, was sufficiently inventive to merit a patent.⁴⁵²

Patentability in *Funk Brothers* was thus predicated on the ingenuity in the application, not the ingenuity of the discovery. Though the discovery of bacterial compatibility might have been “ingenious,” the practical application of that discovery simply identified compatible bacteria and combined them according to methods known in the art.⁴⁵³ Once the patentee’s discovery had already been made, that application in the form of a mixed culture would have been well within the ordinary skill in the art.⁴⁵⁴

Or to put it in the language of *Mayo*, given the natural phenomenon of non-inhibition, the patentee’s application in the form of a mixed inoculant was nothing more than “well-understood, routine, conventional activity” already engaged in by workers in the field.⁴⁵⁵ That was the point of Justice Douglas’s discussion of “aggregation”: Once he took the compatibility of the bacteria as a given, then even the emergent property of the system—non-inhibition—became nothing more than the expected result of combining elements of known function. If the Court assumed away the cooperative functioning of the bacteria in the mixed culture, then the mixture truly was an aggregation, given that the patentee had altered neither the structure nor the function of the individual bacteria themselves.

Justice Douglas clearly recognized that the resulting mixture would be “inventive” in the sense of nonobviousness over the prior art, if the patentee had been the first to discover compatible strains. But an act of discovery was not an act of invention. Though an inventor might have discovered a new principle, a patent could not borrow from discovery to the credit of invention:

That is to say, there is no invention here unless the discovery that certain strains of the several species of these bacteria are non-inhibitive and may thus be safely mixed is invention. But we cannot so hold without allowing a patent to issue on one of the ancient secrets of nature now disclosed. All that remains, therefore, are advantages of the mixed inoculants themselves. They are not enough.⁴⁵⁶

452. *See id.* at 131 (“But however ingenious the discovery of that natural principle may have been, the application of it is hardly more than an advance in the packaging of the inoculants.”).

453. *Id.*

454. *See id.* at 132 (“But once nature’s secret of the non-inhibitive quality of certain strains of the species of *Rhizobium* was discovered, the state of the art made the production of a mixed inoculant a simple step.”).

455. *See Mayo Collaborative Servs. v. Prometheus Labs., Inc.*, 132 S. Ct. 1289, 1294 (2012).

456. *Funk Bros.*, 333 U.S. at 132.

For Justice Douglas, permitting Bond to patent the direct application of his discovery, without some intermediating inventive act, would be sanctioning a monopoly on a law of nature.

B. *The Reaction to Funk Brothers*

In contrast to modern commentary that has tended to characterize *Funk Brothers* as a product of nature or obviousness case, commentary in the immediate wake of *Funk Brothers* recognized its true nature. Contemporaneous commentators recognized that *Funk Brothers* demanded inventive application as a condition of patentability.⁴⁵⁷ Moreover, those commentators further recognized that such a demand departed radically from the state of the law at the time. For example, a comment in the *Minnesota Law Review* argued:

[T]he Court formerly awarded a patent to one who succeeded in teaching his creation so as to advance the prior art without regard to whether his effort consisted more largely of discovery or of invention. . . . The holding of the majority in the instant case appears to be an unrealistic departure from this approach to invention.⁴⁵⁸

Likewise, a comment in the *Georgetown Law Journal* noted:

Though an advance may seem simple in retrospect, its very simplicity coupled with the fact that the prior art is void of sufficient teaching to light the way has almost universally been considered an inventive step. Previously, it was only the discoverer who was allowed to patent means made simple and obvious by his discovery. The unobviousness of the discovery cloaked the simple step with the ingenuity required of a patentable invention.⁴⁵⁹

This commentary makes clear how contemporaneous observers understood *Funk Brothers*: that it imposed a test of inventive

457. See Howard W. Haftel, Comment, *Patent Law—Patentability as Affected by the Law of Nature Rules—The Kalo Doctrine*, 47 MICH. L. REV. 391, 392 (1949) (“Thus the practical application, apart from the discovery of the law of nature, must itself show inventive genius. The Court admitted that in this case the discovery of the law of nature was ingenious, but held that once the law was known its practical application merely required the exercise of ordinary skill.”); see also Recent Cases, *Patents—Validity—Invention in Discovery of Principles of Nature*, 33 MINN. L. REV., 430, 431 (1949) [hereinafter *Patents—Validity—Invention*]; O’Malley, *supra* note 448, at 703–04.

458. *Patents—Validity—Invention*, *supra* note 457, at 433; see also Haftel, *supra* note 457, at 398 (pointing out that *Funk Brothers*’ doctrine was inconsistent with the Court’s treatment of the Langmuir patents in *De Forest Radio*).

459. O’Malley, *supra* note 448, at 706 (citations omitted).

application, and that such a test represented a departure from the historical standard of patent eligibility.⁴⁶⁰

The pharmaceutical industry was sufficiently alarmed by *Funk Brothers* to raise the issue in before Congress in the hearings leading up to the enactment of 1952 Patent Act. In hearings held in 1951 on H.R. 3760 (a precursor to the 1952 Patent Act), a representative of the veterinary pharmaceutical industry, I. J. Fellner, testified before a subcommittee of the House Judiciary Committee on proposed § 101.⁴⁶¹ Fellner's testimony is revealing: the patent community saw *Funk Brothers* as imposing a new and unprecedented requirement for inventive application.⁴⁶² Moreover, the dialogue between Fellner and the members of the Subcommittee may be the only evidence on whether Congress intended to embrace or reject *Funk Brothers* and its demand for inventive application in the 1952 Patent Act.

According to Fellner, *Funk Brothers* called into doubt the patentability of inventions "where a discovery has been made which involves a natural principle and is useful and practically applicable, but such application of the newly discovered principle of nature does not in itself call for inventive ingenuity."⁴⁶³ He therefore urged Congress to clarify that newly discovered laws of nature, if embodied in new and useful applications, remained patentable.⁴⁶⁴

Anticipating the reaction of the modern pharmaceutical industry to *Mayo*, Fellner argued that the Court's exclusion of discovery from the patentability inquiry would endanger any patent based on a newly discovered use for a known compound:

But what would happen if we went along with the decision of the Supreme Court in the Funk Bros. case is that about 90 percent of the patents in the pharmaceutical industry would have to be thrown out

. . . .

460. See also Norman Siebrasse, *The Rule Against Abstract Claims: A Critical Perspective on U.S. Jurisprudence*, 27 CAN. INTELL. PROP. REV. 3, 9–10 (2011) (arguing that *Funk Brothers* was the first modern departure from the rule that any practical application was patent eligible).

461. See *Patent Law Codification and Revision: Hearings on H.R. 3760 Before Subcomm. No. 3 of the Comm. on the Judiciary H.R.*, 82nd Cong. 116–18 (1951) [hereinafter *Patent Law Codification and Revision*] (statement of I. J. Fellner, Manager, Patent Department, Dr. Salsbury's Laboratories).

462. See *id.* at 117–18.

463. See *id.* at 118. Fellner may have had some connection to Patent Act co-drafter and soon-to-be-CCPA-Judge Giles Rich, see *id.* at 150. Rich represented the company in antitrust litigation a few years later. See *Dr. Salsbury's Labs. v. I. D. Russell Co. Labs.*, 212 F.2d 414, 414 (8th Cir. 1954).

464. See *Patent Law Codification and Revision*, *supra* note 461, at 117–18.

Now most of these inventions representing the discovery of new effects in known chemicals would be absolutely nonpatentable, under the Funk [B]rothers decision.⁴⁶⁵

Fellner's testimony also raises a question regarding the extent to which Congress had *Funk Brothers* in mind when it enacted § 100 of the 1952 Patent Act, which defined "invention" as "invention or discovery."⁴⁶⁶ For although the modern Supreme Court has never treated the exclusion of fundamental principles as an ordinary problem of statutory interpretation, understanding Congress's intent with respect to *Funk Brothers* should be crucial to interpreting §§ 100 and 101 of the 1952 Patent Act. Unfortunately, the legislative history on point is almost perfectly ambiguous.

Section § 4886 of the earlier patent statute, the Act of 1870, had already used the language "invented or discovered" in its definition of patentability.⁴⁶⁷ However, an earlier draft of the proposed new patent law, H.R. 9133, had included language expressly defining discoveries embodied in one of the statutory classes of patent-eligible subject matter. The earlier draft had defined patent-eligible subject matter to include inventions "*in the nature of a discovery as embodied in a new and useful art, machine, manufacture or composition of matter . . .*"⁴⁶⁸ Later, H.R. 3760 had dropped that language, substituting in its place a new definition in § 100, which stated that "[t]he term 'invention' includes discoveries", and revised the text of § 101 to its current form.⁴⁶⁹

Fellner urged the Subcommittee to return to the language of H.R. 9133, expressly extending the patent system to discoveries embodied in one of the statutory classes of subject matter. That language, according to Fellner, would overrule *Funk Brothers* and restore patentability to practical applications of new discoveries.⁴⁷⁰ But the Subcommittee's response was equivocal. On the one hand, members of the Subcommittee told Fellner that including "discoveries" in the definition of invention in § 100 accomplished the same purpose as the language that had appeared in H.R. 9133.⁴⁷¹ On the other hand, members told Fellner that the new § 100 and § 101 were not intended to change the

465. *See id.* at 118. According to Fellner, inventions based on new uses of old compounds were patentable prior to *Funk Brothers*. *See id.* at 117–18.

466. *See* Patent Act of 1952, Pub. L. No. 593, ch. 950, § 100, 66 Stat. 792, 797 (codified as amended at 35 U.S.C. § 100 (2012)).

467. Patent Act of 1870, ch. 230, 16 Stat. 198, 201 (1870).

468. *Patent Law Codification and Revision*, *supra* note 461, at 117 (emphasis added).

469. *See id.* at 5–6.

470. *See id.* at 117–18.

471. *See id.* at 120–21 (statement of Mr. Willis) (pointing out new definition of invention including discoveries in § 100); *id.* at 121 (statement of Mr. Crumpacker) (same).

law as then written,⁴⁷² and that if the Supreme Court had interpreted “invented or discovered” in the 1870 Patent Act as it had in *Funk Brothers*, then they would likely interpret the “discovery as embodied” language of H.R. 9133 in the same way.⁴⁷³

Yet according to L. James Harris, who had been counsel to the Patent, Trademark, and Copyright Subcommittee, and who claimed to have supervised the drafting and revision process leading to the 1952 Patent Act,⁴⁷⁴

[t]he primary purpose of the inclusion [of ‘discovery’ in § 100] was to make it clear that a discovery could be patented as well as an invention, if it were embodied in one of the classes of patentable subject matter.

. . . .

It was intended to protect an inventive contribution where the contribution is embodied in a class of subject matter which is patentable.⁴⁷⁵

Noting the recent controversy over *Funk Brothers*,⁴⁷⁶ Harris denied that “Congress intended that invention must be in a mechanical structure and that a discovery could not be patentable whether or not it was embodied in some useful process or composition.”⁴⁷⁷ Thus from Harris’s point of view, it would seem that Congress intended to abolish *Funk Brothers*’ test of inventive application, to the extent that test denied patentability to a discovery embodied in a composition of matter. Yet, while Harris was explicit when he claimed that Congress intended § 103 to overturn *Cuno Engineering*’s infamous “flash of genius” requirement,⁴⁷⁸ he never states explicitly that Congress intended §§ 100 and 101 to overrule *Funk Brothers*. So in the end, the legislative history is largely inconclusive as to whether Congress intended to reject or incorporate a test of inventive application in the 1952 Patent Act.

472. *See id.* at 121 (statement of Mr. Bryson) (“There is no intention to change the law as it is presently written; the purpose is just to make it clearer.”); *see also id.* (statement of Mr. Willis) (stating that H.R. 3760 was not intended to accomplish what Fellner sought).

473. *See id.* at 122 (statement of Mr. Crumpacker) (“[I]f the Supreme Court has interpreted the words as you indicate, I do not see how including that language in the paragraph would cause them to make a different interpretation.”).

474. *See* L. James Harris, *Some Aspects of the Underlying Legislative Intent of the Patent Act of 1952*, 23 GEO. WASH. L. REV. 658, 658 n.* (1954–1955).

475. *Id.* at 665 (footnote omitted). Harris emphasized that “mere scientific discoveries per se,” not embodied in a statutory class, remained unpatentable. *See id.* Harris also emphasized that the revision in § 101 from the language of H.R. 9133 was not substantive. *See id.* at 663–65.

476. *See id.* at 663–64.

477. *See id.* at 663.

478. *See id.* at 674–80 (discussing the congressional intent to replace the “flash of genius” test).

C. Funk Brothers' Progeny

Regardless of whether the 1952 Patent Act overruled *Funk Brothers* or not, it is clear that commentators recognized *Funk Brothers* as an inventive application test at the time it was decided. But why have more recent commentators seldom acknowledged this aspect of the case? In part, this is because most modern readers encounter *Funk Brothers* through *Chakrabarty*, which frames *Funk Brothers* as a product of nature case. Perhaps more significantly, *Funk Brothers*' reference to *Cuno Engineering*, and its talk of "lack of invention," leads the casual reader to suppose that *Funk Brothers*' doctrinal foundation rests on the amorphous law of "invention" that existed before the 1952 Patent Act. If the 1952 Patent Act swept away that doctrinal clutter and supplanted it with the pristine law of nonobviousness,⁴⁷⁹ then the 1952 Patent Act made *Funk Brothers* irrelevant a few years after its promulgation.

1. The Davison Chemical Line

That, however, was not the case. Notwithstanding the subsequent passage of the 1952 Patent Act, the circuit courts of appeal did not ignore *Funk Brothers*' inventive application analysis. In a small but significant line of cases decided between 1950 and 1968, the circuit courts employed *Funk Brothers*' inventive application test to invalidate claims based on the discovery of a new law of nature or natural phenomenon. These cases, in part through their contribution to *Flook*, establish a thread of continuity between *Funk Brothers* and *Mayo*. They may also portend the future. The claims that were historically invalidated for lack of an "inventive application" exemplify claims that may be vulnerable to subject-matter challenges in *Mayo*'s wake.

Two years after *Funk Brothers*, the Seventh Circuit applied *Funk Brothers*' analysis in *Davison Chemical Corp. v. Joliet Chemicals, Inc.*⁴⁸⁰ *Davison Chemical* dealt with a process for producing silica gel.⁴⁸¹ While the process for making silica gel was known in the art, the patentee had discovered that the temperature of the wash step determined the size of the gel's pores.⁴⁸² He therefore claimed an improved process of adjusting the temperature of the wash step to control the density of the final product.⁴⁸³ But the Seventh Circuit regarded the relationship between wash

479. See, e.g., *CLS Bank Int'l v. Alice Corp. Pty.*, 717 F.3d 1269, 1295–96 (Fed. Cir. 2013) (Rader, J., concurring in part and dissenting in part) (stating that inquiries into "inventiveness" and "invention" were replaced by the test of nonobviousness in § 103), *aff'd*, 134 S. Ct. 2347 (2014).

480. 179 F.2d 793, 795 (7th Cir. 1950).

481. *Id.* at 793.

482. *Id.* at 794.

483. *Id.*

temperature and pore size as a “newly discovered scientific fact.”⁴⁸⁴ Under *Funk Brothers*, the patentee’s application of that fact was required to be inventive.⁴⁸⁵ According to the court, once the patentee discovered the relationship between temperature and pore size, the application in the form of the improved process was not inventive:

[W]e assume that [the inventor] Connolly discovered that the temperature of the wash water determined the pore size and, therefore, the specific gravity or density of the gel but, we think, that, once having discovered this, it required nothing more than the ordinary skill of the scientist to determine that maintaining the temperature of the water at a constant point would make the size of the pore, and the density of the silica gel, uniform.⁴⁸⁶

In other words, once the inventor’s discovery was assumed away, the additional steps of the method became nothing more than “well-understood, routine, conventional activity, previously engaged in by researchers in the field.”⁴⁸⁷ The Seventh Circuit therefore held the claims invalid.⁴⁸⁸

The CCPA followed *Davison Chemical in In re Arnold*,⁴⁸⁹ involving a claim to a process of electrostatic welding.⁴⁹⁰ The process of heating materials by alternating electrostatic fields was known.⁴⁹¹ But the patent applicant had discovered that molecules near the surface of a material responded more readily than interior molecules to alternating electrostatic fields.⁴⁹² By choosing a particular frequency based on the response of surface molecules, the applicant could selectively weld either the surface of the material or a plasticizer applied to the surface.⁴⁹³

But according to the CCPA, the fact that surface molecules had a different anomalous dispersion range compared to the interior molecules was a “phenomenon of nature” that had been discovered by the applicant.⁴⁹⁴ Arnold’s application—choosing a frequency that would

484. *See id.*

485. *See id.* at 795.

486. *Id.* at 795.

487. *See Mayo Collaborative Servs. v. Prometheus Labs., Inc.*, 132 S. Ct. 1289, 1294 (2012).

488. *Davison Chem.*, 179 F.2d at 795.

489. 185 F.2d 686 (C.C.P.A. 1950).

490. *Id.* at 687.

491. *Id.*

492. *Id.* at 687–88. The basis for this effect was said to be the difference in anomalous dispersion range of a dipolar substance between the interior and surface molecules. *See id.* at 690–91.

493. *See id.* at 688.

494. *See id.* at 691.

selectively weld the surface molecules—was merely the result of his discovery.⁴⁹⁵ The claims accordingly lacked “invention” under *Funk Brothers*.⁴⁹⁶

*National Lead Co. v. Western Lead Products Co.*⁴⁹⁷ was similar to *Davison Chemical*. In a process for making a lead/lead oxide suspension (useful for storage batteries), the patentee had supposedly discovered that two different crystalline forms of lead oxide were present.⁴⁹⁸ The patentee further claimed to have discovered that the temperature of the reaction determined the relative proportions of the two crystalline forms of lead oxide.⁴⁹⁹ By regulating the temperature of the reaction, the patentee could control the proportion of these two forms and thereby control the uniformity of the final product.⁵⁰⁰ The patentee therefore claimed an improved process, in which the temperature of the reaction was held within particular ranges by regulating the rate of influx of molten lead.⁵⁰¹

However, even assuming that the patentee had been the first to discover these phenomena, the Ninth Circuit held the process not patentable under *Funk Brothers*.⁵⁰² The court considered the relationship between reaction temperature and product uniformity to be a scientific fact or law of nature.⁵⁰³ The question then was whether the patentee’s application of that law was inventive:

Our inquiry must therefore focus upon whether an artisan, knowing that the temperature of the reaction determines the uniformity of the product, would require more than ordinary skill to discover the process of controlling the reaction temperature by varying the feed of molten lead into the [prior art] Barton pot.⁵⁰⁴

495. *See id.*

496. *See id.* Arnold did eventually succeed in patenting other claims from the same application. *See* U.S. Patent No. 2,575,251 (filed Sept. 9, 1943) (issued Nov. 13, 1951). As precedent of the CCPA, *In re Arnold* is technically binding upon the Federal Circuit, though no decision of the court has cited it. *See* *South Corp. v. United States*, 690 F.2d 1368, 1369 (Fed. Cir. 1982) (establishing all holdings of the CCPA as binding precedent on the Federal Circuit).

497. 324 F.2d 539 (9th Cir. 1963).

498. *See id.* at 541, 542.

499. *Id.* at 541.

500. *See id.*

501. *See id.* at 540–41.

502. *Id.* at 541–42, 545.

503. *See id.* at 541–42 (citing *Davison Chem. Corp. v. Joliet Chems.*, 179 F.2d 793 (7th Cir. 1950)).

504. *Id.* at 542.

The patentee's method of regulating temperature was simply to regulate the rate at which molten lead fed into the reaction vessel.⁵⁰⁵ Because there was nothing inventive in regulating the influx of molten lead, the method of performing the reaction at an optimized temperature was unpatentable.⁵⁰⁶

Contrasting *National Lead* with a pre-*Funk Brothers* decision illustrates how *Funk Brothers* shifted the landscape of patentability. *United Verde Copper Co. v. Peirce-Smith Converter Co.*,⁵⁰⁷ decided by the Third Circuit in 1925, presented facts very similar to *National Lead*. The process of copper smelting had long been hampered by the tendency of silicate slag to attack the unprotected lining of the smelting vessel.⁵⁰⁸ However, the patentee discovered that limiting the temperature of the slag could prevent the slag from eroding the vessel's lining.⁵⁰⁹ Much like the patentee in *National Lead*, the patentee in *United Verde Copper* regulated the temperature of the slagging step by controlling the temperature and composition of the silica flux added during the smelting process.⁵¹⁰ It did not appear that there was anything inventive about that solution. Yet it was sufficient that the patentee, having discovered the properties of hot versus cold slag, had disclosed a medium or means by which his discovery could be brought to practical application.⁵¹¹

Returning to the *Davison Chemical* line of authority, perhaps the starkest illustration of the reach of the inventive application test was the Third Circuit's decision in *Armour Pharmaceutical Co. v. Richardson-Merrell, Inc.*⁵¹² The patentee made the surprising discovery that trypsin—a proteolytic enzyme with anti-inflammatory properties—could be absorbed by the small intestine and thereafter transported into the bloodstream.⁵¹³ The prior art had administered trypsin to patients via injection or other cumbersome methods.⁵¹⁴ But in light of the small intestine's ability to absorb the enzyme, the patentee determined that

505. *Id.* at 541.

506. *See id.* at 542–45.

507. 7 F.2d 13 (3d Cir. 1925).

508. *See id.* at 13–14. It was therefore necessary to periodically apply the silicate flux to the sides of the smelting vessel, rather than simply add it to the input. *See id.* at 14.

509. *See id.* at 15.

510. *See id.*

511. *See id.* at 15–16 (“Having made this discovery he was the first to show the art the difference between a vicious slag and an innocent slag and he proceeded to embody this discovery in an invention which avoided one and obtained the other.”).

512. 396 F.2d 70, 75 (3d Cir. 1968).

513. *See id.* at 71–72. The discovery was unexpected, due to the large size of the trypsin molecule and the fact that the human body already secretes these enzymes into the digestive system. *Id.*

514. *See id.* at 71–72.

oral administration would be possible if the trypsin was given a coating permitting it to resist digestion in the stomach and reach the small intestine intact.⁵¹⁵ The patentee therefore claimed a composition of trypsin given an enteric coating for use in the treatment of inflammation.⁵¹⁶

Though the Third Circuit regarded the patentee's invention as precisely the sort of discovery the patent laws ought to protect, the court felt bound by *Funk Brothers* to invalidate the claim.⁵¹⁷ The ability of the small intestine to absorb trypsin and similar enzymes was, according to the court, a natural phenomenon.⁵¹⁸ Under *Funk Brothers*, the question of patentability was whether anything more than ordinary skill would be necessary to reach the patentee's application of that discovery.⁵¹⁹ The answer was no, as the court concluded that "[o]nce nature's secret that the ileum would absorb trypsin was uncovered, any artisan would have known the process of enterically coating the trypsin to enable it to pass through the acidic environment of the stomach and continue into the ileum."⁵²⁰ And even if the patentee's discovery was the anti-inflammatory effect of trypsin administered to the small intestine, not merely the ability of the small intestine to absorb trypsin, the application of that newly discovered principle still lacked inventiveness under *Funk Brothers*.⁵²¹

Commentators have occasionally classified the *Davison Chemical* cases, like *Funk Brothers*, as obviousness cases.⁵²² Yet, as in *Funk Brothers*, without the patentees' discoveries, none of the inventions in these cases would have been obvious in the prior art. Nor can *National Lead* and *Armour Pharmaceutical*, decided in 1963 and 1968

515. *See id.* at 71 & n.3.

516. *See id.* at 71 n.3.

517. *See id.* at 73 ("Thus, it would seem that allowing a patent on the restricted use Martin made of his discovery of a natural phenomenon would not only be consistent with our patent laws, but would further their purpose. The employment of the newly discovered principle of nature would remain open to all those desiring to utilize it. We discern no requirement in the policy of the patent law that the method by which the discovery be utilized also be a new method. However, the Supreme Court and several courts of appeal have held to the contrary." (footnote omitted)).

518. *See id.* at 72.

519. *Id.* at 74.

520. *Id.*

521. *See id.* at 75.

522. *See, e.g.*, ERNEST BAINBRIDGE LIPSCOMB III, 2 LIPSCOMB'S WALKER ON PATENTS § 6:34 (3d ed. 1985); Joseph P. Anderson III, Note, *Distinguishing Patentable Process Claims from Unpatentable Laws of Nature in the Medical Technology Field*, 59 ALA. L. REV. 1203, 1208, 1220 (2008) (framing the analysis in *Armour Pharmaceutical* as an application of the obviousness test for patentability).

respectively,⁵²³ be easily dismissed as aberrations no longer relevant after the 1952 Patent Act dispensed with the requirement of “invention.”

2. *Flook*: *Funk Brothers* Revived

This examination of *Funk Brothers* and its progeny has significant implications for our view of *Mayo*. The Federal Circuit’s initial reception of *Mayo* denied that *Mayo* demands an inventive application for a law of nature or abstract idea to become patent eligible. When the Federal Circuit heard *CLS Bank v. Alice Corp.* en banc, the court failed to agree on a framework for the analysis of “abstract ideas” under § 101.⁵²⁴ Instead, division among the court’s judges produced two principal opinions with significantly different views on the patent-eligibility analysis.⁵²⁵

Yet both opinions agreed that *Mayo*’s requirement for an “inventive concept” had nothing to do with inventive application. Thus, Judge Alan Lourie, writing on behalf of four other members of the court, denied that the Supreme Court’s “occasional use” of the term “inventive concept”—Judge Lourie believed the Court had introduced the term in *Flook*—entailed any requirement of inventiveness in the § 101 inquiry.⁵²⁶ The novelty or nonobviousness of the patentee’s application was irrelevant to the question of patent-eligible subject matter.⁵²⁷ Rather, “inventive concept” only required that the subject matter in the claim, beyond the fundamental principle, be the “product of human ingenuity.”⁵²⁸

Judge Randall Rader, writing on behalf of three other judges,⁵²⁹ agreed that the 1952 Patent Act forbade “any requirement for ‘inventiveness’ beyond sections 102 and 103.”⁵³⁰ “Inventive concept,” as used by the Supreme Court in *Mayo*, could not be interpreted to

523. *Nat’l Lead Co. v. W. Lead Prods. Co.*, 324 F.2d 539 (9th Cir. 1963); *Armour Pharm. Co. v. Richardson-Merrell, Inc.*, 396 F.2d 70 (3d Cir. 1968).

524. 717 F.3d 1269, 1273 (Fed. Cir. 2013) (en banc), *aff’d*, 134 S. Ct. 2347 (2014).

525. *See id.* at 1273 (Lourie, J., concurring); *id.* at 1292 (Rader, J., concurring in part and dissenting in part).

526. *Id.* at 1273, 1282 (Lourie, J., concurring).

527. *See id.* at 1284.

528. *Id.* at 1283. For Judge Lourie, fundamental principles could be discovered but not “invented”; thus the application had to be the product of human ingenuity. *See id.* While scientific truths may be discovered rather than invented, it is difficult to see how abstract ideas such as risk hedging, or a financial exchange’s employment of shadow records and trusted intermediaries, are “discovered.”

529. *Id.* at 1292 (Rader, J., concurring in part and dissenting in part). Judges Richard Linn and Kathleen O’Malley joined Judge Rader’s § 101 analysis, but interpreted the method claims to require computer implementation. *See id.* at 1313; *id.* at 1329–31 (Linn and O’Malley, JJ., dissenting). The method claims would therefore be patent eligible under Judge Rader’s analysis. *See id.* at 1313 (Rader, J., concurring).

530. *Id.* at 1297 (Rader, J., concurring in part and dissenting in part).

instill “inventiveness” or “ingenuity” into questions of patent eligibility.⁵³¹ Rather, “inventive concept” should be read as shorthand for the requirement that a patent-eligible claim must include steps beyond those inherently necessary to implement the abstract idea.⁵³²

These denials become less plausible given *Mayo*’s roots in *Funk Brothers*. For the Supreme Court revived the analysis from *Funk Brothers* in *Mayo*. *Funk Brothers* demanded “invention” in the patentee’s application of a law of nature.⁵³³ *Mayo* begins with the fundamental premise that an unpatentable principle, such as a law of nature or abstract idea, becomes a patent-eligible *application* only when combined with a further “inventive concept.”⁵³⁴ In *Funk Brothers*, once the patentee discovered the non-inhibitive qualities of the *Rhizobia*, the creation of a mixed culture was routine to one of ordinary skill in the art.⁵³⁵ In *Mayo*, once the patentee discovered the relationship between thioguanine levels and therapeutic efficacy, the creation of a process for optimizing dosage required nothing more than “routine, conventional activity previously engaged in by researchers in the field.”⁵³⁶ In both cases, the form of the Court’s inquiry was the same: assume the existence of the underlying principle, and ask whether the patentee’s application required something “inventive.”

The *Mayo* Court did not expressly ground its requirement of inventive concept, or its conclusion that “conventional and obvious” activity cannot confer patent eligibility, in Justice Douglas’s opinion in *Funk Brothers*. But *Mayo*’s resemblance to *Funk Brothers* is clearly by direct descent, not parallel evolution. *Mayo*’s “inventive concept” came directly from *Parker v. Flook*.⁵³⁷ In *Flook*, Justice Stevens wrote: “Even though a phenomenon of nature or mathematical formula may be well known, *an inventive application* of the principle may be patented. Conversely, the discovery of such a phenomenon cannot support a patent unless there is some other inventive concept in its application.”⁵³⁸

Undeniably, *Flook*’s *inventive concept* is synonymous with *inventive application*. This is the core of *Flook*: the difference between an unpatentable principle and a patent-eligible invention is invention in the application.⁵³⁹ But *Flook* took this core from *Funk Brothers*. It was from *Funk Brothers* that Justice Stevens drew the fundamental distinction

531. *Id.* at 1302.

532. *See id.* at 1303.

533. *See Funk Bros. Seed Co. v. Kalo Inoculant Co.*, 333 U.S. 127, 130–32 (1948).

534. *Mayo Collaborative Servs. v. Prometheus Labs. Inc.*, 132 S. Ct. 1289, 1294 (2012).

535. *See Funk Bros.*, 333 U.S. at 132.

536. *Mayo*, 132 S. Ct. at 1294–95.

537. *See id.* at 1294 (citing *Parker v. Flook*, 437 U.S. 584, 594 (1978)).

538. *Flook*, 437 U.S. at 594 (emphasis added).

539. *See id.*

between discovery and invention: “If there is to be invention from such a discovery, it must come from the application of the law of nature to a new and useful end.”⁵⁴⁰ According to Justice Stevens, *Funk Brothers*, along with *Mackay Radio*, required that the fundamental principle—a mathematical algorithm in *Flook*—be disregarded when assessing whether the patentee’s claimed application was inventive.⁵⁴¹ Yet, *Mackay Radio* assumed that the “logical application” of a mathematical algorithm—an application lacking inventiveness—represented patent-eligible subject matter.⁵⁴² In this aspect, *Funk Brothers* was the sole intellectual progenitor of *Flook* and, by descent, of *Mayo* as well.

The thread from *Funk Brothers* to *Flook* passes directly through the *Davison Chemical* line. When the Commissioner of Patents appealed *Gottschalk v. Benson* in 1972, the Solicitor’s opening argument against patent eligibility rested, for the most part, on two premises: first, the claimed process of converting binary coded decimal numbers was an unpatentable mental process;⁵⁴³ and second, computer programs should not be patentable absent some indication from Congress.⁵⁴⁴ But six years later, in *Parker v. Flook*, the Solicitor’s entire argument rested on one premise: Abstract ideas were not patentable “*absent invention in the application of the idea.*”⁵⁴⁵ According to the Solicitor, “[t]o merit monopoly protection, it is not sufficient that a claim embody a concrete, tangible application of a mathematical or scientific principle; it must also extend beyond the routine, conventional, or un inventive applications that follow once the applicant possesses the idea.”⁵⁴⁶ The Solicitor’s primary authority was, of course, *Funk Brothers*,⁵⁴⁷ but

540. *Id.* at 591 (quoting *Funk Bros.*, 333 U.S. at 130).

541. *See id.* at 591–92.

542. *Mackay Radio & Tel. Co. v. Radio Corp. of Am.*, 306 U.S. 86, 94 (1939); *see also supra* text accompanying notes 312–17.

543. *See* Brief for Petitioner, *Gottschalk v. Benson*, 409 U.S. 63 (1972) (No. 71-485), 1972 WL 137527, at *17.

544. *See id.* at *32–33.

545. Brief for Petitioner, *Flook*, 437 U.S. 584 (No. 77-642), 1978 WL 206636, at *13 (emphasis added). The shift in the government’s position actually began between the opening and reply briefs in *Benson*. E-mail from Richard H. Stern, Att’y for the Dep’t of Justice in *Benson* and *Flook*, to author (May 12, 2014, 12:40 PDT) (on file with author); *see also* Reply Brief for Petitioner at 4, *Benson*, 409 U.S. 63 (No. 71-485) (“But if a translation of an unpatentable mathematical principle could itself become patentable, it could only do so by reason of a further inventive ingredient, such as a novel and unobvious device for carrying out the translated principle, or if a conventional device were used then a new and unconventional synergism or cooperation between the conventional device and the translation of the mathematical principle.”).

546. Brief for Petitioner, *Flook*, *supra* note 545, at *19.

547. *See id.* at *19–20 (citing *Funk Bros. Seed Co. v. Kalo Inoculant Co.*, 333 U.S. 127, 131 (1948)).

Davison Chemical and its progeny featured almost as prominently as *Funk Brothers*.⁵⁴⁸

Given the Supreme Court's pretense that *Diehr* is entirely consistent with the analysis in *Flook* and in *Mayo*,⁵⁴⁹ one can hardly fault the Federal Circuit's heroic attempts to exclude inventiveness from *Mayo*'s inventive concept. Yet when one considers that (1) *Mayo*'s analysis recapitulates Justice Douglas's in *Funk Brothers*, (2) the thread of inventive application runs from *Funk Brothers* to *Flook* through the *Davison Chemical* line, and (3) *Flook*'s inventive concept was synonymous with *inventive application*, it becomes increasingly difficult to maintain that the Supreme Court spoke loosely or colloquially when it spoke of inventive concept in *Flook* and *Mayo*. Rather, inventive application was the fundamental principle of patent eligibility articulated in *Funk Brothers*, and *Mayo*'s heritage from *Funk Brothers* suggests that inventive application lies at the heart of *Mayo* as well.

If inventive application is the test for patent eligibility in the future, then the *Davison Chemical* line also provides some guidance on what kinds of inventions might be challenged under an inventive application analysis. *Davison Chemical*, *In re Arnold*, and *National Lead* were all cases where the optimization of a known process consisted of performing the process under conditions indicated by the patentee's (or applicant's) underlying discovery.⁵⁵⁰ *Mayo* was also such a case: its patentee claimed the performance of a known process of treating

548. See *id.* at *20–21, *21 n.19 (citing *Davison Chem. Corp. v. Joliet Chems., Inc.*, 179 F.2d 793 (7th Cir. 1950), *Armour Pharm. Co. v. Richardson-Merrell, Inc.*, 396 F.2d 70 (3d Cir. 1968) and *National Lead Co. v. W. Lead Prods. Co.*, 324 F.2d 539 (9th Cir. 1963)). In *re Arnold*, 185 F.2d 686 (C.C.P.A. 1950), was not cited, but the Solicitor also cited *Loew's Drive-In Theaters, Inc. v. Park-In Theatres, Inc.*, 174 F.2d 547 (1st Cir. 1949), and *Templeton Patents, Ltd. v. J. R. Simplot Co.*, 336 F.2d 261 (9th Cir. 1964). See *id.* at *21 n.19. *Loew's Drive-In Theaters* concerned a patent for the structure of a drive-in theater, which pre-*Funk Brothers* had been held patentable by the Ninth Circuit. See *Park-In Theatres v. Rogers*, 130 F.2d 745, 746, 748 (9th Cir. 1942). *Loew's Drive-In Theaters* did not cite *Funk Brothers*, but framed the patentability question as whether, “given the idea or conception of an open-air drive-in theatre, an exercise of the inventive faculty was required to devise the means for carrying it out.” *Loew's Drive-In Theaters*, 174 F.2d at 551. *Templeton Patents*, which concerned a process of drying potatoes, is perhaps more analogous to *De Forest Radio*: discovering a scientific explanation cannot render otherwise obvious applications patentable. See *Templeton Patents*, 336 F.2d at 264 (“[A]ll this discovery did was to supply a scientific explanation of why this already well-known method of drying . . . was particularly well suited to the dehydration of potatoes.”). The Solicitor had also raised some of these cases in *Dann v. Johnston*, See *Dann v. Johnston*, 425 U.S. 219, 220 (1976); Brief for Petitioner, *Dann*, 425 U.S. 219 (No. 74-1033), 1975 WL 173464, at *22–23.

549. See *Mayo Collaborative Servs. v. Prometheus Labs., Inc.*, 132 S. Ct. 1289, 1293–94 (2012).

550. See *supra* Subsection V.C.1.

gastrointestinal disorders, but with the dosage optimized according to the patentee's correlation between metabolite levels and therapeutic efficacy.⁵⁵¹ The lesson from the historical record is that any claim to an improvement of an old process, at least where that improvement does not involve new compositions or modalities, is questionable under an inventive application analysis.

More generally, the historical record suggests patentability problems for inventions where the advance has been to recognize the nature of a problem in the prior art. Prior to *Funk Brothers*, it was quite clear under the Supreme Court's precedent that invention might subsist in the inventor's recognition of a problem in the prior art.⁵⁵² And after the passage of the 1952 Patent Act, as a question of obviousness, it became black-letter law that a "patentable invention may lie in the discovery of the source of a problem even though the remedy may be obvious once the source of the problem is identified."⁵⁵³ But if one characterizes that discovery as a "law of nature," then any solution that does not require novel processes or materials becomes suspect for lack of inventive application. The patentees in *Davison Chemical* and *National Lead* had arguably discovered that problems of reproducibility in the prior art processes resulted from a failure to control the temperature of the reaction; once the problem was known, the solution was obvious. Likewise, *In re Arnold* might be viewed as a case where the limitation of the prior art process was a failure to recognize the differential excitability of surface and interior molecules; once that differential response was discovered, it was obvious to solve the problem by adjusting the frequency of the welding process. Or suppose *Funk Brothers* had been a case where the patentee had been the first to discover that mixed cultures functioned poorly because incompatible bacterial strains inhibited nitrogen fixation. The patentee might have solved the problem by providing a mixed culture of compatible strains. Yet given Justice Douglas's premise that the patentee did not "create [the] state of inhibition or of non-inhibition in the bacteria,"⁵⁵⁴ that solution would have been unpatentable. The discovery that different types of bacteria in mixed cultures were mutually inhibitive would have been just as much a law of nature as the discovery of non-inhibitory bacteria, and the subsequent application just as obvious.

551. *Mayo*, 132 S. Ct. at 1294–95. Arguably *Neilson* was also an optimization case, at least when the Supreme Court characterized it as a process case in *Tilghman*. See *Tilghman v. Proctor*, 102 U.S. 707, 725 (1880).

552. *Eibel Process Co. v. Minn. & Ont. Paper Co.*, 261 U.S. 45, 68 (1923) ("It was the discovery of the source not before known[,] and the application of the remedy[,] for which Eibel was entitled to be rewarded in his patent.").

553. See *In re Sponnoble*, 405 F.2d 578, 585 (C.C.P.A. 1969).

554. *Funk Bros. Seed Co. v. Kalo Inoculant Co.*, 333 U.S. 127, 130 (7th Cir. 1948).

CONCLUSION

It is quite clear from the historical context, extending from *Funk Brothers* to *Flook*, that *Mayo*'s inventive concept requires *inventive application* for a law of nature or abstract idea to become patent eligible. Yet it is equally clear that when *Funk Brothers* introduced the notion of inventive application in 1948, the case broke radically with a century of English and American precedent, under which practical application was sufficient to confer patent eligibility.⁵⁵⁵ And if history means anything, it is equally clear that *Flook* and *Mayo* founded the inventive application test on a profoundly mistaken interpretation of *Neilson* and the other hot-blast cases.

It was also history that led the Federal Circuit in *CLS Bank* to uniformly deny that *Mayo*'s inventive concept entails an inventive application.⁵⁵⁶ The court's rejection of inventive application follows necessarily from the court's underlying conception of the foundation of patent law. The Federal Circuit's paradigm of patent law remains largely defined by the late Judge Giles Rich: The invention is the physical matter or steps defined by the claims and nothing more or less.⁵⁵⁷ The requirements of patentability are only those set out by the 1952 Patent Act, and those requirements must be lodged doctrinally and intellectually in a single section of the 1952 Patent Act, not between or across them.⁵⁵⁸ In such a patent law paradigm, to the extent one concedes any extra-statutory limits on patent-eligible subject matter, it is an ill-formed question to ask whether a claim embodies an inventive application of an abstract idea, law of nature, or natural phenomenon. As Judge Rader argued in *CLS Bank*, in that paradigm of patent law, inventiveness is the sole concern, if any, of § 103; it cannot be relevant to whether something is an "invention" within the categories defined by § 101.⁵⁵⁹

But that paradigm is not necessarily the patent law of the Supreme Court. Notwithstanding the passage of the 1952 Patent Act, today's Court continues to reach back to an older paradigm of patent law, one with a different conception of "the invention" and perhaps one with more fluidity between the various doctrines of patentability and infringement.⁵⁶⁰ For attention to the mental process of invention did not

555. Excepting mental processes, and perhaps natural products. See *supra* Part IV.

556. See *supra* notes 526–32 and accompanying text.

557. See Jeffrey A. Lefstin, *The Constitution of Patent Law: The Court of Customs and Patent Appeals and the Shape of the Federal Circuit's Jurisprudence*, 43 LOY. L.A. L. REV. 843, 861–64 (2010).

558. See *id.* at 857, 858.

559. *CLS Bank Int'l. v. Alice Corp.*, 717 F.3d 1269, 1294, 1302–03 (Fed. Cir. 2013) (Rader, J., concurring in part and dissenting in part).

560. Today's Federal Circuit demands a strict separation between doctrines of infringement and validity, and analysis tends to be compartmentalized in one doctrine or the other. For

die with Justice Douglas's "flash of genius." Justice Stevens explained that "'invention' in the Patent Act unquestionably refers to the inventor's conception rather than to a physical embodiment of that idea."⁵⁶¹ And Justice Thomas declared that patents have an inventive essence—an essence that may subsist in objects outside the boundaries defined by the claims.⁵⁶² In this paradigm of patent law, an "invention" is *not* the set of objects or acts defined by the claims; an "invention" is a product of human ingenuity.⁵⁶³ It is permissible under this conception, though not required, to conclude that an obvious application of a newly discovered fundamental principle is not an invention. Discoveries, at least, are not the product of humans and obvious applications are not the product of ingenuity.

That definition was the foundation of *Flook*. For Justice Stevens, fundamental principles were unpatentable because they were things that had "always existed,"⁵⁶⁴ not creations of the human mind. "Postsolution activity," whether insignificant or not, might be part of the inventor's *claim*, but it could not confer patent eligibility on an invention if it did not form part of the *inventive concept*.⁵⁶⁵ As a limiting principle, Justice Thomas rejected that notion in *Alice*, asserting that the category of unpatentable "abstract ideas" encompasses human creations (such as business methods) as well as "preexisting, fundamental truths."⁵⁶⁶ But in *Myriad*, while the case ultimately seemed to turn on whether isolated DNA was "new" within the meaning of § 101, Justice Thomas viewed the central dispute in the case as whether the process of separating a gene from the rest of the chromosome was "*an inventive act*."⁵⁶⁷ He

example, it is usually necessary in modern patent litigation for a litigant to prevail separately on both infringement and validity. See Paul M. Janicke & LiLan Ren, *Who Wins Patent Infringement Cases?*, AIPLA Q.J., Winter 2006, at 1, 8. But adjudication in the nineteenth century, and the early twentieth as well, might have resolved a case by concluding that a litigant could not simultaneously prevail on infringement and validity, without actually deciding which doctrine resolved the case. See Lefstin, *supra* note 557, at 876.

561. *Pfaff v. Wells Elecs., Inc.*, 525 U.S. 55, 60 (1998).

562. See *Quanta Computer, Inc. v. LG Elecs., Inc.*, 553 U.S. 617, at 632–35 (2008) (holding that sale of products embodying inventive aspects of patents triggers exhaustion of patents, even though products did not fall within claims).

563. Robinson, for example, founded his system on the principle that the invention was the result of an inventive act, yet he viewed the discovery of new properties of matter as integral to the inventive act. See 1 WILLIAM C. ROBINSON, *THE LAW OF PATENTS FOR USEFUL INVENTIONS* § 96, at 142–43 (1890).

564. *Parker v. Flook*, 437 U.S. 584, 593 & n.15 (1978).

565. See *Diamond v. Diehr*, 450 U.S. 175, 215 & n.39, 216 (1981) (Stevens, J., dissenting).

566. *Alice Corp. Pty. Ltd. v. CLS Bank Int'l*, 134 S. Ct. 2347, 2356–57 (2014) (internal quotation marks omitted) (rejecting the argument that abstract ideas are limited to truths that always existed).

567. See *Ass'n for Molecular Pathology v. Myriad Genetics, Inc.*, 133 S. Ct. 2107, 2114, 2116 (2013) (emphasis added).

concluded that separating a gene from its natural context was not, in the end, “an act of invention.”⁵⁶⁸

And yet, despite *Mayo*’s resuscitation of *Funk Brothers* and *Flook*, there are signs that the Court may be retreating from the use of inventive application as a test for patent eligibility. In *Alice*, Justice Thomas held that *Mayo*’s inventive concept is the sine qua non for patent eligibility,⁵⁶⁹ despite the complete absence of that doctrine from *Myriad*. *Alice*, however, emphasizes the *genericness* of the patentee’s application, rather than its lack of *inventiveness*,⁵⁷⁰ the word *obvious* is conspicuously lacking from the opinion.⁵⁷¹

But that distinction between specific application and generic application perhaps occurs in *Mayo* as well. For Justice Breyer tells us that one cannot transform a law of nature into a patent-eligible application by simply disclosing the law of nature, and adding the words “apply it;”⁵⁷² nor could Einstein or Archimedes have patented their famous discoveries by merely appending an instruction to apply them.⁵⁷³ With that statement Baron Parke would have concurred: Neilson could not have secured a patent if he had disclosed that hot air is better than cold, and then stated “apply it” without disclosing a mode of practical application. And perhaps that was the distinction Justice Felix Frankfurter would have drawn in *Funk Brothers*. His concurrence argued that Bond’s claims were unpatentable, not because they monopolized a law of nature, but because they were drawn to the *idea* of compatible strains, rather than the mode of application Bond invented.⁵⁷⁴ Surveying the tortuous path of the law since Justice Douglas set forth the test of inventive application in *Funk Brothers*, one must ask if the goals of patent law would be better served by returning to that historical distinction between principles in the abstract—whether they be laws of nature, natural phenomena, or

568. *Id.* at 2117 (emphasis added).

569. *See Alice*, 134 S. Ct. at 2357 (explaining that inventive concept is necessary to transform a claim into a patent-eligible application of an abstract idea).

570. *See* Jeffrey A. Lefstin, *The Three Faces of Prometheus: A Post-Alice Jurisprudence of Abstractions*, 16 N.C. J.L. & TECH. (forthcoming 2015).

571. Nor does *Alice* contradict Judge Lourie’s or Judge Rader’s rejection of inventiveness as an aspect of inventive concept. But one can draw little from this omission, since *Alice* refrains altogether from addressing the Federal Circuit’s opinions.

572. *Mayo Collaborative Servs. v. Prometheus Labs., Inc.*, 132 S. Ct. 1289, 1294 (2012).

573. *See id.* at 1297.

574. According to Frankfurter, while Bond was entitled to claim the mixtures of bacteria he had shown experimentally to be compatible, his claims were drawn to all mixtures of bacteria having the property of compatibility. *Funk Bros. Seed Co. v. Kalo Inoculant Co.*, 333 U.S. 127, 133 (1948) (Frankfurter, J., concurring). For Frankfurter, a claim based on “the idea that there might be mutually compatible strains” could not be sustained. *Id.* at 133–34. He regarded this as the equivalent to the discoverer of a particular alloy with desirable properties patenting “the idea of alloying metals for this purpose.” *Id.* at 134.

creations of the human mind—and their embodiment in practical applications to the useful arts.