

A NORMATIVE AND POSITIVE ANALYSIS OF THE SCOPE OF THE DOCTRINE OF EQUIVALENTS

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INTRODUCTION

Those associated with the practice of patent law are often admonished to recall that the claims, as distinguished from the rest of the specification, define the "metes and bounds of the invention."¹ Although accurate in a broad sense, this principle should not be misunderstood to mean that patent claims are to be evaluated in a vacuum. Rather, the law recognizes that patent claims are composed solely of words, and as such may imperfectly reflect the intent of their draftsman.² In this regard, the patent law is analogous to the many contract principles that implicitly temper the strict literal meaning of words by exempting the parties from the rigid structure imposed by the traditional doctrines of integration and the parole evidence rule.

Patents are acknowledged to be "one of the most difficult legal instruments to draw with accuracy."³ Perhaps it is the level of technical detail and the need to capture a multitude of permutations employing a single basic idea that most complicates the crafting of claims. Or, the difficulty may stem from the fact that patents may issue only for "novel" ideas⁴ that have yet to work their way into the common vernacular, forcing the draftsman to strain the meanings of well-known terms to

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1. *Pennwalt Corp. v. Durand-Wayland, Inc.*, 833 F.2d 931, 946 (Fed. Cir. 1987) (Bennett, J., dissenting in part), *cert. denied*, 485 U.S. 1009 (1988). The philosophy underlying this characterization views the description of the preferred embodiment or embodiments as analytically distinct from the claims. The former instructs society on how to capitalize on the invention, whereas the latter sets forth the breadth of the inventor's monopoly to exclude for seventeen years others from "making, using, or selling the invention throughout the United States." 35 U.S.C. § 154 (1988).

2. See Zechariah Chafee Jr., *The Disorderly Conduct of Words*, in *FREEDOM'S PROPHET* 35 (Edward D. Re ed., 1981). See generally Giles Rich, *Escaping the Tyranny of Words—Is Evolution in Legal Thinking Impossible?*, 60 J. PAT. OFF. SOC'Y 271 (1978).

3. *Sperry v. Florida*, 373 U.S. 379, 383 (1963) (quoting *Topliff v. Topliff*, 145 U.S. 156, 171 (1892)).

4. 35 U.S.C. § 101 (1988).

articulate best the core inventive notion.

Perhaps in recognition of these difficulties, the patent law includes a collection of interpretive doctrines, some statutory and some judicially-developed, that allow courts to look beyond the literal language of the claims. "[E]very patentee may be his own lexicographer,"⁵ and thus is free to define claim terms in the body of the specification. Similarly, if the court is uncertain as to the meaning of a claim, it "must look to the language of the claim, and the patent's specification and prosecution history to properly interpret the scope of a patent claim."⁶

Moreover, since 1952, inventors have been permitted to recite individual claim elements as a "means for" performing a particular function.⁷ In determining whether an accused device infringes a claim so drafted, the court first ascertains whether the accused device performs the specified function. If not, there can be no literal infringement. If so, the court then determines whether the structure in the accused device that performs the specified function is the substantial equivalent of the structure disclosed in the specification that performs the same function. If they are substantial equivalents, then that "means for" element is present in the accused device.⁸ If all other claim elements are also present, then the accused product literally infringes the disputed claim.⁹

The foregoing interpretive principles are in essence simply techniques for construing the literal language of the claims. On occasion, however, courts will set aside the literal language altogether, invoking the "doctrine of equivalents" to expand the scope of the patent monopoly conferred by the claim:

[A] patent is like any other legal instrument; but it is peculiar in this, that after all aids to interpretation have been exhausted, and the scope of the claims has been enlarged as far as the words can be stretched, on proper occasions

5. See *Dennis v. Pitner*, 106 F.2d 142, 148 (7th Cir. 1939). But, the patent applicant must clearly communicate his intended meaning. See *id.*

6. *Read Corp. v. Portec, Inc.*, 970 F.2d 816, 823 (Fed. Cir. 1992).

7. See 35 U.S.C. § 112, ¶ 6 (1988). A "means plus function" element is in essence a generic limitation that encompasses a class of items, each of which performs the specified function. See 4 DONALD S. CHISUM, PATENTS § 18.03 [5] (Supp. 1992) [hereinafter CHISUM].

8. See *Valmont Indus., Inc. v. Reinke Mfg. Co.*, 25 U.S.P.Q.2d (BNA) 1451, 1454 (Fed. Cir. 1993).

9. 4 CHISUM, *supra* note 7, § 18.04.

courts make them cover more than their meaning will bear.¹⁰

In particular, a claim not literally infringed can be infringed under the doctrine of equivalents if the accused device "performs substantially the same function in substantially the same way to obtain the same result"¹¹ as the claimed invention.

Although purporting to state a test, this tripartite function/way/result principle in fact does nothing more than restate, albeit more precisely, the problem.¹² For instance, even if a court were able to characterize precisely the "way" both the accused and patented devices "function," and the "results" thereby achieved, a formidable task in and of itself, the language of the test suggests no articulable yardstick for determining whether those "ways," "functions," and "results" are "substantially the same." The test, therefore, identifies only the factors that are to be compared, not how that comparison is to be performed.

Part I of this Article examines the relevant case law in an effort to highlight the issues that factor into the doctrine of equivalents analysis, and also to assess whether the courts have developed a coherent framework for implementing the doctrine. Based upon this analysis, part II explores in detail the practical difficulties inherent in the application of the tripartite test. This part further attempts to unravel the myriad justifications militating in favor of and against application of the doctrine. Finally, part III undertakes a constitutionally-founded normative study of the doctrine, focusing in particular on the scope of equivalents protection afforded a patent holder. This constitutional analysis is undertaken for two alternative purposes. First, it is possible that the Intellectual Property Clause¹³ requires courts to grant a certain scope of equivalents protection

10. *Royal Typewriter Co. v. Remington Rand, Inc.*, 168 F.2d 691, 692 (2d Cir. 1948) (L. Hand, J.).

11. *Sanitary Refrigerator Co. v. Winters*, 280 U.S. 30, 42 (1929). The doctrine is limited in that it cannot broaden the patent monopoly to include a device in the prior art. Further, the patentee cannot regain coverage surrendered during prosecution to obtain the patent. See *Loctite Corp. v. Ultraseal Ltd.*, 781 F.2d 861, 870 (Fed. Cir. 1985) (explaining concept of "prosecution history estoppel").

12. See *Texas Instruments, Inc. v. U.S. Int'l Trade Comm'n*, 805 F.2d 1558, 1569 (Fed. Cir. 1986).

13. The U.S. Constitution provides:

To promote the Progress of Science and useful Arts, by securing for limited Times to Authors and Inventors the exclusive Right to their respective Writings and Discoveries

to patent holders. Second, in the absence of such an obligation, the metaprinciples that underlie the Clause ought nonetheless inform the exercise of either the courts' discretion or Congress' discretion or both when determining the proper scope of equivalents. These metaprinciples, then, are the secondary foci of this final section.

I. THE CASE LAW

A. Major Supreme Court Precedent

The origins of the doctrine of equivalents, as well as the ongoing debate over its nature and scope, can be traced back nearly a century and a half to the Supreme Court's decision in *Winans v. Denmead*.¹⁴ At issue in *Winans* was a patent for an improved railroad car design. Earlier cars had generally been rectangular. While acceptable for transporting lighter loads, these rectangular cars had to be constructed from thick iron stock in order to haul heavier fare. In fact, for dense cargos such as coal, the car would often weigh as much or more than its payload.

The patent-in-suit claimed a railroad car in the shape of a frustum of a cone,¹⁵ with the smaller diameter portion directed towards the ground.¹⁶ Because of the load-distribution characteristics of this design, a car constructed in accordance with the patent would weigh only about one quarter as much as its coal cargo. The accused infringer, after observing and measuring one of the patentee's cars, apparently recognized the benefits of this approach and fashioned a car similar to the patentee's car in overall dimension, shape, and iron stock thickness, but with an octagonal cross-section. Because a frustum is circular, and notwithstanding that the accused car concededly had been constructed to realize the same advantages as the claimed car, the district court concluded that there

U.S. CONST. art. I, § 8, cl. 8.

14. 56 U.S. 330 (1853).

15. A frustum is "the basal part of a solid cone or pyramid that is formed by cutting off the top by a plane parallel to the base . . ." WEBSTER'S NEW COLLEGIATE DICTIONARY (Frederick C. 10th ed. 1993).

16. In pertinent part, the patent claimed:

What I claim as my invention . . . is, making the body of a car . . . in the form of a frustum of a cone, . . . whereby the force exerted by the weight of the load presses equally in all directions . . .

was no infringement.

On appeal, the patentee suggested several theories of infringement. First, a true, perfect frustum is a practical impossibility. Thus, the patent must have contemplated something broader. Second, it would have been impossible, given the claim-drafting standards of the day, for the claims to have encompassed the infinite number of embodiments that capitalized on the patentee's load-distribution concept. In view of this, the patentee's core idea would have been unprotectable: "if the original construction of the body in right lines saved the infringement, an hundred-sided polygon would be without the patent" ¹⁷

The Court, in a five-four opinion, followed neither course of reasoning. The majority first observed that no patent can be granted for a mere change in the form of an existing device. Rather, only a change in form that "introduce[s] and employ[s] other mechanical principles or natural powers, or, as it is termed, a new mode of operation, and thus attain[s] a new and useful result, is the subject of a patent." ¹⁸ Accordingly, that "new mode of operation is, in view of the patent law, the thing entitled to protections." ¹⁹ And thus "to copy the principle or mode of operation described, is an infringement, although such copy should be totally unlike the original in form or proportion." ²⁰

Per this analysis, that which distinguishes a claimed invention from the "prior art" ²¹ alone determines the scope of the patent monopoly. An inventor can of course limit that scope by restricting his claims, but in the absence of an express intent to do so, such a construction should be rejected for two reasons:

1. Because the reasonable presumption is, that, having a just right to cover and protect his whole invention, he intended to do so.
2. Because specifications are to be construed liberally, in accordance with the design of the Constitution and the patent laws of the United States, to promote the progress of the useful arts, and to allow inventors to retain to their own use, not anything which is

17. *Id.* at 333.

18. *Id.* at 341.

19. *Id.*

20. *Id.* at 342.

21. "[P]rior art includes both references in the art in question and references in such allied fields as a person with ordinary skill in the art would be expected to examine for a solution to the problem." 2 CHISUM, *supra* note 7, § 5.03[1].

matter of common right, but what they themselves have created.²²

Arguably, the majority's second point suggests the existence of a constitutional imperative to accord patents the broadest possible construction. The concept that judicial discretion when determining proper claim scope may not be entirely unfettered finds further support later in the Court's opinion. In the context of reiterating that the trier of fact is to look to the substance of the invention, not the form in which it was claimed,²³ the Court again echoed the language of the Intellectual Property Clause, stating:

The exclusive right to the thing patented is not secured if the public are at liberty to make substantial copies of it, varying its form or proportions.²⁴

The Court then remanded the matter for a factual determination of whether the accused device employed the patentee's mode of operation to attain the same advantageous result.

The dissent neither acknowledged nor responded to the suggestions woven throughout the opinion of an underlying constitutional constraint. Instead, it took issue with the majority's "mode of operation" analysis. The dissent perceived such an approach to be flatly inconsistent with the statutory obligation, imposed on all patent applicants, to "particularly 'specify and point' out what [the inventor] claims as his invention."²⁵ The dissent viewed the majority's efforts as nothing more than an attempt to remedy the patentee's inadequate claim drafting. Whatever merits recommended this benevolence, the dissent felt they were outweighed by the need to give clear notice of the areas of a particular art into which

22. 56 U.S. at 341 (citations omitted).

23. Where form and substance are inseparable, it is enough to look at the form only. Where they are separable; where the whole substance of the invention may be copied in a different form, it is the duty of courts and juries to look through the form for the substance of the invention — for that which entitled the inventor to his patent, and which the patent was designed to secure; where that is found, there is an infringement; and it is not a defence, that it is embodied in a form not described, and in terms claimed by the patentee.

56 U.S. at 343.

24. *Id.*

25. *Id.* at 347 (Campbell, J., dissenting). This obligation is today codified at 35 U.S.C. § 112, ¶ 2 (1988).

other practitioners may not venture:

Fullness, clearness, exactness, preciseness, and particularity, in the description of the invention, its principle, and of the matter claimed to be invented, will alone fulfil the demands of Congress or the wants of the country. Nothing, in the administration of this law, will be more mischievous, more productive of oppressive and costly litigation, of exorbitant and unjust pretensions and vexatious demands, more injurious to labor, than a relaxation of these wise and salutary requisitions of the act of Congress.²⁶

The seminal contemporary Supreme Court decision addressing the policies underlying, and the substance of, the doctrine of equivalents came nearly one hundred years later. In *Graver Tank & Manufacturing Co. v. Linde Air Prods. Co.*,²⁷ infringement by equivalents was found, again by a sharply divided Court. Unlike *Winans*, however, the *Graver Tank* opinion nowhere intimates that either the Constitution or some vision of natural rights demands a patentee's monopoly be expanded to encompass the entire "mode of operation" of the claimed invention. In fact, the Court indirectly suggests the contrary. While summarizing the nature of the doctrine, the majority noted that "pioneer" inventions, those inventions that represent great advances over the prior art, deserve a broader range of equivalents than more mundane "secondary" inventions.²⁸ However, even a pioneer invention can in no event be accorded a range of equivalents broader than its mode of operation.²⁹ If secondary inventions are necessarily entitled to something less, *a fortiori* they cannot receive the scope of equivalents protection that *Winans* suggested to be constitutionally required.³⁰

26. 56 U.S. at 47.

27. 339 U.S. 605 (1950).

28. *See id.* at 608. *See also* *Continental Paper Bag Co. v. Eastern Paper Bag Co.*, 210 U.S. 405, 414-15 (1908).

29. *See* *Wilson Sporting Goods Co. v. David Geoffrey & Assocs.*, 904 F.2d 677, 684 (Fed. Cir.), *cert. denied*, 498 U.S. 992 (1990), discussed *infra* notes 94-96 and accompanying text.

30. An alternative explanation for the Court's statement lies in the fact that the scope of a pioneering invention is, by definition, almost completely unrestrained by prior art. A secondary invention, by contrast, is by its nature an advancement on or development of some other invention or inventions, which operate as outside limits on how far the range of equivalents ascribed to the secondary invention can be extended. Thus, if each type of invention is expanded to include its full mode of operation, defined as that which

Instead, the purpose of the doctrine according to the *Graver Tank* Court is to safeguard, in view of the inherent inadequacies of language, against others committing "fraud on the patent."³¹

[T]o permit imitation of a patented invention which does not copy every literal detail would be to convert the protection of the patent grant into a hollow and useless thing. . . . One who seeks to pirate an invention, like one who seeks to pirate a copyrighted book or play, may be expected to introduce minor variations to conceal and shelter the piracy. Outright and forthright duplication is a dull and very rare type of infringement. To prohibit no other would place the inventor at the mercy of verbalism and would be subordinating substance to form.³²

In the context of reciting the test that purports to identify infringing equivalents, the majority further noted: "To temper unsparing logic and prevent an infringer from stealing the benefit of an invention," a patentee may invoke the doctrine to proceed against the producer of a device "if it performs substantially the same function in substantially the same way to obtain the same result."³³ Thus, unlike the *Winans* Court with its focus on the monopoly to which the patentee *qua* patentee is entitled, the majority in *Graver Tank* was motivated by a vaguely defined concern over inequitable behavior on the part of the accused infringers.

The claims of the patent-in-suit in *Graver Tank* related to electric welding fluxes that included "a combination of alkaline earth metal silicate and calcium fluoride."³⁴ The accused flux, however, contained

distinguishes the invention over the prior art, the pioneering patent will in all cases have a broader relative range of equivalents. To illustrate graphically:

A pioneer patent which occupies symbolically a six-inch circle will have three inches of equivalence if its range is fifty percent. An improvement [or secondary] patent occupying a two-inch circle has only one inch of equivalence with the same range. Thus with relatively identical ranges, the scope of the patent provides the pioneer patent with absolutely a larger range of equivalence.

Autogiro Co. of America v. United States, 384 F.2d 391, 401 (Ct. Cl. 1967).

31. 339 U.S. at 608.

32. *Id.* at 607.

33. *Id.* at 608 (footnote omitted, quoting *Sanitary Refrigerator Co. v. Winters*, 280 U.S. 30, 42 (1929)).

34. *Id.* at 610.

calcium silicate and manganese silicate.³⁵ Because only the former compound is an alkaline earth metal silicate, and the latter is not calcium fluoride, the accused product did not literally infringe the claims.

It did, however, infringe under the doctrine of equivalents. In concluding that the weight of the evidence supported the district judge's finding of infringement under the tripartite function/way/result test, the majority attached significance to three factors. First, the claimed and accused fluxes were similar in operation and result. Second, manganese silicate can be "efficiently and effectually" substituted for alkaline earth metal silicates in welding compositions.³⁶ Third, the prior art referenced by the patent-in-suit specified that manganese silicate "was a useful ingredient in welding compositions."³⁷

Curiously, after summarizing the various evidential indicia that supported the district court's finding of infringement, the majority commented that, in the absence of evidence that the accused product "was developed by independent research, the trial court could properly infer that the accused flux is the result of imitation rather than experimentation or invention."³⁸ Unlike copyright law,³⁹ however, patent law does not consider independent creation to be a defense to infringement. Possibly, the majority felt that such a defense was dictated by the doctrine's purpose of discouraging "theft." There could have been no theft in fact if the accused product was the fruit of independent research and development. While consistent with the stated policy, allowing such a defense would certainly further complicate an already intractable doctrinal analysis.⁴⁰ Furthermore, by shifting the focus of the inquiry from the claims of the patent and the teachings of the prior art to the actions of the accused infringer, the majority allows at least the possibility that a device clearly within the patent's unclaimed mode of operation will not be adjudged to infringe. Even more troubling, it raises the possibility that only one of two identical products might be found to infringe because one of the alleged infringers copied the product while the other independently

35. Several of the claims in the original patent did claim the use of manganese silicate. These claims were, however, invalidated as overbroad by the lower court. *Id.* at 616 (Black, J., dissenting).

36. 339 U.S. at 612.

37. *Id.*

38. *Id.*

39. *See* *Fred Fischer, Inc. v. Dillingham*, 298 F. 145, 147 (S.D.N.Y. 1924) (L. Hand, J.).

40. This defense has not been raised in any reported cases that have been reviewed.

created it.⁴¹

The dissent, per Justice Black, substantially echoed the sentiments of the dissenters in *Winans*, noting that the doctrine of equivalents conflicts squarely with the statutory requirement of claim particularity. The doctrine thus operates to disadvantage and discourage those seeking to create similar, but nonidentical, products. At bottom, Justice Black's concerns centered on the majority's failure to examine the doctrine in light of the overall statutory scheme. A patentee who realizes that his issued patent fails to claim a critical subset of his invention may seek a reissue patent covering the additional subject matter.⁴² Moreover, Justice Black argued, in appreciation of the complexity of the subject matter and the difficulties inherent in determining proper patent claim scope, Congress has entrusted a specialized body, the Patent and Trademark Office (PTO), with the task of making those determinations.⁴³ Permitting lay courts to revisit that analysis during infringement litigation therefore subverts legislative policy.

B. The Federal Circuit

The doctrine of equivalents is frequently raised, typically in the alternative to a charge of literal infringement, in patent infringement actions. As a consequence, the Court of Appeals for the Federal Circuit, created in 1982 as the exclusive appellate arbiter of patent matters at the Circuit Court level,⁴⁴ has addressed the issue repeatedly. Many have opined, however, that notwithstanding these opportunities the Federal Circuit has failed to synthesize an articulable doctrine of equivalents jurisprudence.

An early and leading example of the Federal Circuit's efforts to apply the doctrine of equivalents is *Hughes Aircraft Co. v. United States*.⁴⁵ The patent in *Hughes Aircraft* related to spin-stabilized satellites. Unlike other designs, the patented satellite when placed in orbit would retain the same

41. See *Hilton Davis Chem. v. Warner-Jenkinson Co.*, Docket No. 93-1088 (Fed. Cir. 1994). At the time of publication of this Article, this case had been argued but had not yet been decided.

42. 35 U.S.C. §§ 251-52 (1988). The claims of a reissued patent can be broader than the original claims only if the reissue is sought within two years of the grant of the original patent. *Id.* § 251.

43. See *id.* § 7.

44. 28 U.S.C. § 1295(a)(1) (1988).

45. 717 F.2d 1351 (Fed. Cir. 1983).

orientation relative to a desired point on the surface of the earth. This spin-stabilization effect was accomplished by determining the rotation of the satellite, calculating the necessary commands to correct for that rotation, and delivering those commands to small, circumferentially located jets. The patent issued in 1966. Given the state of computer technology at the time, the claims specified that all calculations were performed by ground-based computers; rotation data were transmitted to the earth, where appropriate control commands were calculated and sent back.⁴⁶

The accused infringing satellite used the same data to perform the same calculations, but, given advances in the computer field, did so using an "on-board" microprocessor. After examining the two designs, the trial court concluded that "[t]here is no obvious and exact equivalent of plaintiff's means for providing an indication of the [instantaneous spin angle] to an external location" in the accused products.⁴⁷ Accordingly, there could be no infringement under the doctrine of equivalents.

Reversing, the Federal Circuit first criticized the lower court's test for equivalents:

The failure to apply the doctrine of equivalents to the claimed invention as a whole, and the accompanying demand for "obvious and exact" equivalents of two elements the presence of which would have effectively produced literal infringement, was error.⁴⁸

Per the *Hughes Aircraft* Court, then, it is unnecessary that the accused product contain an equivalent of each limitation, or element,⁴⁹ found in

46. In pertinent part, the claims read:

1. Apparatus comprising:

....

e. means disposed on said body for providing an indication to a location external to said body of the instantaneous spin angle position of said body about said axis and the orientation of said axis with reference to a fixed external coordinate system;

f. and means disposed on said body for receiving from said location control signals synchronized with said indication;

....

Id. at 1355.

47. *Id.* at 1363.

48. *Id.* at 1364.

49. The term "element" can refer either to a limitation in a claim, or to the structural parts of an accused device or embodiment of the invention. See *Perkin-Elmer Corp. v.*

the disputed claims of the patent-in-suit.

Applying the *Graver Tank* function/way/result test, the court, consistent with its "invention as a whole" language, compared, from the record, the accused device and the claimed satellite and observed "striking overall similarities."⁵⁰ This together with testimony that it would have been obvious to substitute the later-developed computer hardware into the patented satellite, led the Federal Circuit to conclude, apparently as a matter of law,⁵¹ that the accused apparatus was an infringing equivalent.

The viability of both the holding and the sense of *Hughes Aircraft* are uncertain, however, in view of two subsequent Federal Circuit opinions. The first, *Texas Instruments, Inc. v. United States International Trade Commission*,⁵² involved the substitution of contemporary hardware for previously state-of-the-art claim elements. At issue in *Texas Instruments* was a "pioneering" patent for a pocket electronic calculator, the disputed claim of which was drafted in "means plus function" form.⁵³

In performing the literal infringement analysis, the Federal Circuit first identified the items in the specification that performed the functions recited by the "means" elements. The court then compared these items to the components in the accused products that performed the same functions, finding that each had been replaced with a technologically updated version. The Federal Circuit concluded: "the total of the technological changes beyond what the inventors disclosed transcends the equitable limits illustrated, for example, in [*Graver Tank and Hughes Aircraft*]"⁵⁴

The court turned next to the claim of infringement under the doctrine of equivalents. Echoing (but not citing) *Hughes Aircraft*, the Federal Circuit acknowledged its task to be comparing the accused device with the claimed invention "as a whole."⁵⁵ However, the court proceeded to examine "the totality of change in the accused devices from that described in the [patent] specification. For the reasons discussed in [the literal

Westinghouse Elec. Corp., 822 F.2d 1528, 1533 n.9 (Fed. Cir. 1987). Strictly speaking, claims contain limitations, not elements. By specifying limitations, the inventor in essence indicates what he is not claiming as his invention, because if a single limitation is not met by an accused device, no literal infringement can be found.

50. 717 F.2d at 1364.

51. *Id.* at 1366. The case was remanded, but only for a determination of damages.

52. 805 F.2d 1558 (Fed. Cir. 1986).

53. See *supra* note 7 and accompanying text.

54. 805 F.2d at 1571.

55. *Id.*

infringement analysis,] . . . the accused devices are not equivalent to the claimed invention, applying the criteria of *Graver Tank*.⁵⁶ The court then focused on element-by-element differences, arguably ignoring the spirit, if not the letter, of the admonition in *Hughes* to examine the accused and claimed devices for "striking overall similarities."

Moreover, the court's concluding observations suggest a concern over too-liberal application of the doctrine:

[The doctrine of equivalents] constitutes a deviation from the need of the public to know the precise legal limits of patent protection without recourse to judicial ruling. . . . We caution that the incentive to innovation that flows from "inventing around" an adversely held patent must be preserved. To the extent that the doctrine of equivalents represents an exception to the requirement that the claims define the metes and bounds of the patent protection, we hearken to the wisdom of the Court in *Graver Tank*, that the purpose of the rule is "to temper unsparing logic" and thus to serve the greater interests of justice.⁵⁷

Although purporting to draw its authority from the "wisdom of the Court in *Graver Tank*," the nature of the Federal Circuit's comments indicates that it was most persuaded by the wisdom of Justice Black in dissent.

The Federal Circuit in *Perkin-Elmer Corp. v. Westinghouse Electric Corp.*⁵⁸ again expressed reluctance to endorse the *Hughes Aircraft* practice of examining the "invention as a whole." In particular, the court dismissed as dicta the suggestion, found in several Federal Circuit opinions, that when determining infringement by equivalents a court should consider the "essence" or "gist" of an invention. *Hughes Aircraft* should not, the Federal Circuit emphasized, be read to sanction "the treatment of claim limitations as insignificant or immaterial in determining infringement."⁵⁹ Although in performing the analysis, each claim limitation must be "viewed in the context of the entire claim," the party charging infringement by equivalents "must show the presence of every

56. *Id.* at 1572.

57. *Id.*

58. 822 F.2d 1528 (Fed. Cir. 1987).

59. *Id.* at 1533.

element or its substantial equivalent in the accused device."⁶⁰ Thus, a "substantially equivalent" element does not alter "the way in which the function of the claimed invention is performed."⁶¹

Perhaps in view of the difficulty involved in harmonizing the above trio of decisions, the Federal Circuit in 1987 granted en banc review⁶² of the infringement issues raised in *Pennwalt Corp. v. Durand-Wayland, Inc.*⁶³ At issue in *Pennwalt* was a patented fruit sorter, a device that determined the color and weight of a piece of fruit and then, based on those data, routed the fruit to the appropriate location. The claims recited two "position indicating means" that "continuously" indicated the position of each piece of fruit traveling through the apparatus.⁶⁴ The first position indicating means tracked the fruit as it travelled between the color sensor and the scale, and the second tracked it as it travelled between the scale and the appropriate bin.

The accused fruit sorter also first evaluated the color of an item. Each color datum was then placed at the end of a software "color queue." From the speed of the conveyor belt on which the items travelled, the distance between the color sensor and the scale, and the elapsed time, the system was then able to identify the datum in the color queue that corresponded to the item currently at the scale. The weight information generated by the scale, together with the color information, allowed the system to determine the proper destination bin, the identity of which was then stored in a "weight queue." From this information, the system determined the proper destination of each piece of fruit.

After affirming the district court's finding of no literal infringement,

60. *Id.* (citations omitted).

61. *Id.*

62. En banc review has been granted in patent cases only 16 times in the Federal Circuit's 12-year history. *In re Donaldson*, 16 F.3d 1189 (Fed. Cir. 1994); *AC Aukerman Co. v. RL Chaides Constr. Co.*, 960 F.2d 1020 (Fed. Cir. 1992); *Aerojet-General Corp. v. Machine Tool Works, Ltd.*, 895 F.2d 736 (Fed. Cir. 1990); *In re Dillon*, 919 F.2d 688 (Fed. Cir. 1990); *Copelands' Enters., Inc. v. CNV, Inc.*, 887 F.2d 1065 (Fed. Cir. 1989); *Kingsdown Medical Consultants Ltd. v. Hollister, Inc.*, 863 F.2d 867 (Fed. Cir. 1988); *Woodard v. Sage*, 818 F.2d 841 (Fed. Cir. 1987); *Pennwalt Corp. v. Durand-Wayland, Inc.*, 833 F.2d 931, 946 (Fed. Cir. 1987), *cert. denied*, 485 U.S. 1009 (1988); *Wyden v. Commissioner of Patents and Trademarks*, 807 F.2d 934 (Fed. Cir. 1986); *In re Ener*, 756 F.2d 852 (Fed. Cir. 1985); *Paulik v. Rizkalla*, 760 F.2d 1270 (Fed. Cir. 1985); *SRI Int'l v. Matsushita Elec. Corp.*, 775 F.2d 1107 (Fed. Cir. 1985); *Atari, Inc. v. JS&A Group, Inc.*, 747 F.2d 1422 (Fed. Cir. 1984); *Gardner v. TEC Sys., Inc.*, 725 F.2d 1338 (Fed. Cir. 1983), *cert. denied*, 469 U.S. 830 (1984); *United States v. John C. Grimberg Co.*, 702 F.2d 1362 (Fed. Cir. 1983); *South Corp. v. United States*, 690 F.2d 1368 (Fed. Cir. 1982).

63. 833 F.2d 931 (Fed. Cir. 1987).

64. *Id.* at 937.

the Federal Circuit concluded that the district court had also properly found no infringement under the doctrine of equivalents. The lower court had performed an element-by-element comparison, attempting to match each of the elements in the asserted claim to some structure in the accused device. Finding nothing in the accused device that *continuously* indicated the position of each item, the district court had held for the defendant. The Federal Circuit agreed, rejecting the patentee's argument that the location of an item passing through the accused apparatus could be calculated by evaluating the positions in the queues of the data associated with the item. Because the software queues of the accused device did not perform "the same or an equivalent function" of the claimed position indicating means, the accused fruit sorter did not satisfy the tripartite *Graver Tank* test.⁶⁵

In an excoriating dissent, Judge Bennett argued that the majority's element-by-element test was in substance identical to the "obvious and exact equivalents" requirement rejected in *Hughes Aircraft*. In support of the *Hughes Aircraft* approach, the dissent observed that the majority's test "blurs, if not eliminates," the distinction, carefully recognized and identified by the majority, between means-plus-function equivalents and equivalents for purposes of the doctrine of equivalents.⁶⁶ While conceding that such a requirement of "one-to-one correspondence creates a bright line rule easier to apply," the dissent concluded that the rule would be more "costly in terms of unfair results in exceptional cases."⁶⁷

65. *Id.* at 939. The court also noted that the "continuously indicating" position means were included during patent prosecution to distinguish the claimed device from the prior art. *Id.* at 938. If this is accurate, the conclusion that the accused device contains no continuously indicating position means should therefore have ended the doctrine of equivalents analysis without even reaching the function/way/result test. Under the doctrine of prosecution history estoppel, a patentee is barred from regaining, using the doctrine of equivalents, subject matter surrendered during prosecution to secure the patent. See 4 CHISUM, *supra* note 7, § 18.05.

66. *Id.* at 943 (Bennett, J., dissenting). For a discussion of "means plus function" claims, see *supra* notes 7-8 and accompanying text. Generally speaking, a means plus function claim element must be construed with reference to the structure in the patent specification that performs that function. Because the patentee elected not to claim expressly that structure, the court then looks to whether the similar structure in the accused device is "substantially equivalent." The equivalents analysis for this type of claim element therefore must be "element-by-element." By (apparently) eschewing the "invention as a whole" analysis (wherein the court would look to whether the entire accused device is equivalent), Judge Bennett charges that the majority is also performing this "element-by-element" investigation when applying the doctrine of equivalents. If so, the means plus function element would have no independent legal content, and 35 U.S.C. § 112, ¶ 6 would be a dead letter.

67. *Id.* at 946 (Bennett, J., dissenting).

Interestingly, the dissent then proceeded to resolve the question "the majority never reached":⁶⁸ whether the accused infringer's software queues perform substantially the same function in substantially the same way to achieve substantially the same result as the claimed position indicating means. After scrutinizing the accused queue technique, the dissent concluded that the *Graver Tank* test was satisfied. In so doing, however, Judge Bennett if anything supported the reasoning of the majority. For both majority and dissent, the focus of the comparison was not the claimed and accused fruit sorters, but rather their respective position indicating elements; neither group undertook to examine the "invention as a whole." Thus, and despite his protestations to the contrary, Judge Bennett's dispute with the majority distilled down to nothing more than a different interpretation of the facts.

In an attempt to reconcile the positions of the dissent and majority, Judge Nies, who also joined the majority, submitted "additional views" on the matter. Purporting to demonstrate that the majority decision overruled no precedent, Judge Nies first surveyed a substantial volume of case law and concluded that, to establish infringement, every claim element, or a substantial equivalent thereof, must be present in the accused structure:

[T]he term "equivalents" in the "doctrine of equivalents" refers to "equivalents" of the elements of the claim, not "equivalents" of the claimed invention. While a device found to be an infringement under the doctrine of equivalents is, in a sense, "equivalent" to the claimed invention, that conclusion follows from application of the doctrine. It is not the equivalency determination to which the doctrine is directed, but to the result thereof.⁶⁹

Noting that the "invention as a whole" test does not appear in *Graver Tank*,⁷⁰ Judge Nies then explained that the use of that phrase in *Hughes Aircraft* must be evaluated in the context of the aforementioned substantial body of precedent requiring all elements to be present. Judge Nies

68. *Id.* at 944.

69. *Id.* at 953 (Nies, J., additional views).

70. Although the particular language did not appear in *Graver Tank*, the tripartite test was there applied to the claimed blasting compound, not to the individual components of the chemical.

attributed the *Hughes Aircraft* court's failure to articulate this requirement to the "everyone-knows-that" syndrome: it was simply a proposition too self-evident to bother restating. A close reading of *Hughes Aircraft*, Judge Nies asserted, reveals that "an equivalent of each element of the claim was found in the accused device."⁷¹ Judge Nies failed, however, to point to an illustrative passage. It is unclear what structure in the accused satellite Judge Nies considered to be equivalent to the claimed "means for providing an indication to a location external to said body" ⁷²

Finally, Judge Newman, who also joined the dissent, submitted a "commentary" challenging the majority's reasoning. Per Judge Newman, the majority's approach is little more than a literal infringement analysis. Some claim limitations (such as a recited function of a means element) are so insignificant that their absence from an accused device cannot, in keeping with the equitable spirit of the doctrine, be sufficient to support a finding of no infringement. Judge Newman concluded that although such a rule may be in tension with the ideal of precision claiming, and reasonable minds might differ on how best to weigh the competing underlying policies, the proper balance has been considered and fixed by the Supreme Court. It is, therefore, not the province of the Federal Circuit to strike this balance anew.

Notwithstanding that it may have raised more issues than it resolved, *Pennwalt* stands today as probably the most accurate reflection of the Federal Circuit's position on the doctrine of equivalents. A sampling of subsequent cases that have attempted to apply the doctrine illustrates how effective the element-by-element test has proved.

*Black & Decker, Inc. v. Hoover Service Center*⁷³ involved an appeal of a denial of a preliminary injunction in connection with the alleged infringement of a patent for a portable "wet and dry" vacuum cleaner. One element in the asserted claim was "a front wall and a snout extending forward of said front wall into said storage chamber" ⁷⁴ Because the accused device lacked both wall and snout, the Federal Circuit affirmed the lower court's finding that the patentee was unlikely to prevail on the issue of literal infringement.

However, the Federal Circuit reversed as clearly erroneous a similar

71. 833 F.2d at 953.

72. See *supra* note 46.

73. 886 F.2d 1285 (Fed. Cir. 1989).

74. *Id.* at 1293.

finding regarding infringement under the doctrine of equivalents. First, the court noted that the accused device functioned identically to the claimed invention. In particular, the Federal Circuit's analysis focused on functional characteristics attributable to the claimed wall and snout. Second, the Federal Circuit found that the defendant's "air-liquid separation apparatus is obviously merely an insubstantially altered form of that set forth in the claim"⁷⁵ In view of the court's earlier finding that the accused device included neither wall nor snout, it is unclear from the opinion how this could have been so.

In *Slimfold Manufacturing Co. v. Kinkead Industry*,⁷⁶ the defendant was found liable in district court for infringement under the doctrine of equivalents. The claims of the patent-at-issue set forth a spring-loaded pivot rod assembly for use as a hinge in a bi-fold door. For ease of assembly, a latch in the claimed invention held a portion of the rod retracted. When the assembly was later positioned in the door, the latch was released, allowing the rod to spring into place. The defendant's product was identical, except that it had no such latch; rather, the pin was held retracted by a styrofoam wedge that was removed and discarded during installation. The Federal Circuit first found that the latch and the wedge performed the same function to attain the same result: holding the pin in a retracted position until installation. The ways in which the two devices operated, however, were so different that the appeals court found to be clearly erroneous the district court's finding of infringement. Notwithstanding the district court's conclusions to the contrary after a full trial on the merits, the Federal Circuit determined that a separate, removable wedge that acts as a friction device operates in a different way than something that grabs and latches.

The grant of a motion for summary judgment of no infringement under the doctrine of equivalents was appealed in *London v. Carson Pirie Scott & Co.*⁷⁷ Before turning to the merits, the Federal Circuit noted that the doctrine of equivalents should in general be sparingly invoked:

Application of the doctrine of equivalents is the exception, however, not the rule, for if the public comes to believe (or fear) that the language of patent claims can never be relied on, and that the doctrine of equivalents is simply the second

75. *Id.* at 1295.

76. 932 F.2d 1453 (Fed. Cir. 1991).

77. 946 F.2d 1534 (Fed. Cir. 1991).

prong of every infringement charge, regularly available to extend protection beyond the scope of the claims, then claims will cease to serve their intended purpose.⁷⁸

Two patents were asserted in *London*, both pertaining to garment bag hanger clamps. After stating that “[t]here can be no infringement as a matter of law if a claim limitation is totally missing from the accused device,”⁷⁹ the court observed that the first patent claimed a latch that grasps the shank of a hanger, that is, the portion between the hanger hook and the triangular-shaped hanger body. The accused device, however, grasped hanger hooks. Since grasping hanger shanks was “fundamental to the way” that the invention worked, the accused device could not be an infringing equivalent.⁸⁰ The patentee argued that because the accused device could grasp a hanger shank bent by ninety degrees, it did operate in the same way. The court rejected this contention, noting that a hanger with a bent shank is no longer a hanger. Because the preamble of the claim made clear that the invention was to be used with conventional hangers, the scope of the monopoly could not be extended to hangers modified per the patentee’s suggestion.⁸¹

Regarding the second patent, which did grasp hanger hooks, the Federal Circuit again concluded that no reasonable jury could have found that the accused device was an infringing equivalent. The claim required the upper portion of the clamp to be fixed in some manner to the top of the garment bag. The lower portion was “pivotally mounted” to this upper portion, such that when the clamp was released, the lower portion partially rotated downward. In contrast, the accused device had a fixed lower portion and an upper portion that rotated upward when the clamp was released. Because of this difference,⁸² the court observed that a user

78. *Id.* at 1538.

79. *Id.* at 1539.

80. *Id.* at 1539.

81. The preamble of a patent claim is the portion of the claim that introduces, and in essence establishes the context for, the claim. For example:

A bifurcated clamp for embracing a plurality of garment hangers adapted to be positioned within a garment bag, each hanger having an upstanding shank between the supporting hook for the hanger and the support for the garment, and said upstanding shanks adapted to be spaced along the length of said clamp, said clamp comprising

Id. at 1535.

82. In fact, the court compared to the accused device the claims “interpreted in view of

operating the accused device need not lift the combined weight of the hangers and clothing when closing the accused clamp. Further, hangers clamped by the claimed device would tend to slide off the lower portion when the clamp was opened, whereas they would remain stationary in the accused product. Thus, the accused device was found to operate in a substantially different way.

The allegedly infringed patent in *Malta v. Schulmerich Carillons, Inc.*⁸³ disclosed a mechanism that enabled a handbell player to vary the "brightness" of the tone produced by the bell. The handbell clapper had three sets of striking surfaces, each constructed from a different material. The clapper could be rotated such that only one set of surfaces could contact the bell. Although some prior art handbells also had adjustable clappers, only the clapper in the patented bell could be adjusted "on the fly." Two claims were asserted in the district court. The clapper in claim two had "at least three opposed pairs of surface portions wherein each of said pairs has a different degree of hardness."⁸⁴ In claim three, the clapper had "a plurality of striking buttons positioned in opposed pairs around the outer periphery"⁸⁵

The clapper in the accused handbell was substantially as described in claim two. The jury, however, for reasons unrelated to the issues raised on appeal, had found that claim noninfringing. The issue thus focused on whether the accused device was an infringing equivalent of claim three. The trier of fact had determined that it was.

The Federal Circuit, affirming the district court's grant of judgment notwithstanding the verdict, found that no reasonable jury could have concluded that the accused product infringed under the doctrine of equivalents. However, the appeals court disagreed with the district court's analysis. The district court had applied the standard articulated in *Lear Sigler, Inc. v. Sealy Mattress Co.*,⁸⁶ decided after the jury in *Malta* had reached its verdict, which required patentees asserting infringement under the doctrine of equivalents to present the function, way, and result indicia "in the form of particularized testimony and linking argument."⁸⁷ Without such testimony, a jury "is more or less put

the specification" *Id.* at 1540. Strictly speaking this was improper, given that the claims were not drafted in "means plus function" form. See *supra* notes 7-8.

83. 952 F.2d 1320 (Fed. Cir. 1991).

84. *Id.* at 1323.

85. *Id.*

86. 873 F.2d 1422 (Fed. Cir. 1989).

87. *Id.* at 1425-26.

to sea without guiding charts when called upon to determine infringement under the doctrine."⁸⁸ After applying the *Lear Sigler* evidentiary requirement to each limitation of the asserted claim, the district court had concluded that the patentee had failed to establish function/way/result equivalency for each element. Such an analysis was found on appeal to be clear error: although "*Pennwalt* did not set forth a test as to how one proves that an element in an accused device is the 'substantial equivalent' of a claim limitation," the Federal Circuit "has never adopted the three prong approach to determining equivalency of a limitation."⁸⁹

An independent review of the record, however, revealed the lower court's error to have been harmless. At trial, the patentee, in response to questions from counsel, had indicated on a sketch of the accused product the portions of the clapper that were equivalent to the buttons specified in claim three. He had then described how the different materials selected by the defendant produced tones of differing brilliance, just as did the accused handbell. Despite this and the fact that the accused device was essentially identical to a figure shown in the specification of the patent itself, and with no acknowledgement of the relative simplicity of the claimed and accused designs, the Federal Circuit concluded that the jury had been inadequately guided in its determination. Further, regardless of the apparent wealth of support for the patentee's position, the Federal Circuit concluded that, in light of the variations in "design, flexibility and simplicity" between the embodiments of each of claims two and three,⁹⁰ those two embodiments "are not equivalent in 'way.'"⁹¹ This remarkable observation on the merits would appear to cripple completely the patentee's prospects for prevailing on remand.

II. CRITIQUE

As the above-discussed cases suggest, considerable debate and uncertainty surround the application of the doctrine of equivalents. At bottom, this failure might be ascribed to a lack of a clearly articulated justification for the doctrine's existence. Without an accurate understanding of the fundamental rationale for expanding a patent monopoly beyond the face of the patent claims, a court is also "more or less put to sea

88. *Id.* at 1426.

89. 952 F.2d at 1325.

90. These claims were described in the patent as alternatives.

91. 952 F.2d at 1327.

without guiding charts"⁹²

The *Winans* Court intimated perhaps the clearest justification for the doctrine. There the Supreme Court concluded that, in the absence of an indication that the patentee intended otherwise, patent protection should be sufficiently broad to "allow inventors to retain to their own use . . . what they themselves have created."⁹³ Thus, under *Winans*, the doctrine's focus is on what an inventor has created, not what she has claimed. This creative contribution is determined with reference to an invention's mode of operation, that aspect or those aspects of the invention that make it patentably distinct from the prior art.

Although the precise definition of mode of operation is uncertain from *Winans*, one is suggested by the Federal Circuit's decision in *Wilson Sporting Goods Co. v. David Geoffrey & Associates*.⁹⁴ There, Judge Rich noted that the range of equivalents cannot be so broad as to cover inventions known to the prior art at the time the patent application was filed.⁹⁵ As an aid to fixing the limits of the scope of permissible equivalents, the court stated:

[I]t may be helpful to conceptualize the limitation on the scope of equivalents by visualizing a hypothetical patent claim, sufficient in scope to literally cover the accused product. The pertinent question then becomes whether that hypothetical claim could have been allowed by the PTO over the prior art. If not, then it would be improper to permit the patentee to obtain that coverage in an infringement suit under the doctrine of equivalents. If the hypothetical claim could have been allowed, then prior art is not a bar to infringement under the doctrine of equivalents.⁹⁶

As the final sentence in the quoted passage makes clear, the "hypothetical claim" inquiry is merely a threshold one; only if an allowable hypothetical claim exists can the court then proceed to determine whether the accused device infringes under the doctrine of equivalents. *Winans*,

92. See *supra* note 88.

93. *Winans v. Denmead*, 56 U.S. 330, 341 (1853).

94. 904 F.2d 677 (Fed. Cir. 1990).

95. See *Senmed, Inc. v. Richard-Allan Medical Indus.*, 888 F.2d 815, 821 (Fed. Cir. 1989).

96. 904 F.2d at 684.

however, indicates that this second step is unnecessary: any accused device within this hypothetical claim would be an infringing equivalent.

The Supreme Court in *Graver Tank* did not follow the "entitled to one's creations" rationale of *Winans*. Rather, the Court justified the doctrine of equivalents as an equitable principle necessary to discourage "piracy," "stealing," and "fraud." On its face, this rationale comports tidily with courts' broad equitable powers to "provide relief in accordance with the principles of justice."⁹⁷ However, further analysis reveals that determining what is "just" in the area of infringement under the doctrine of equivalents is not so readily done. "Theft" is defined in the Model Penal Code as "unlawfully tak[ing], or exercis[ing] control over, movable property of another with purpose to deprive him thereof."⁹⁸ Critical here is the requirement that the thing taken be another's "property." Under *Graver Tank*, equivalents are deemed to be the patentee's intellectual property for fear that failing to do so would encourage theft. However, an unclaimed equivalent would not be property, and hence using such an equivalent would not be theft in the absence of the doctrine of equivalents. In other words, making, using, or selling an equivalent is theft of something that is deemed property only because of the fear of theft. As the circularity of this argument highlights, a distaste for theft cannot in fact underly the *Graver Tank* justification for the doctrine. At the core there must be some other explanation why an inventor is entitled to a broader monopoly than is provided for on the face of the patent claim. Only when such an entitlement is identified can the theft of it be a concern.

Maybe then it is the lack of a clear justification for the doctrine of equivalents that has precipitated a collection of case law that, on one level at least, is inconsistent and confusing. For instance, the *Graver Tank* opinion itself noted in conclusion that the Court might have applied the doctrine of equivalents more narrowly, or possibly in a different manner altogether, had the accused infringer demonstrated independent creation.⁹⁹ This dictum strongly suggested that the purpose of the doctrine is specific, not general, theft deterrence. Certainly strong policy arguments recommend either approach.¹⁰⁰ That the Court addressed neither position

97. *Browning v. Peyton*, 918 F.2d 1516, 1522 (11th Cir. 1990).

98. MODEL PENAL CODE § 223.2 (1980).

99. See *supra* notes 38-39 and accompanying text.

100. Two facets of the creative thought process suggest that it would be far too easy in many instances for an accused infringer to fabricate evidence of independent creation. First, all creation is to some degree based on knowledge drawn from the public domain. Second,

in detail evinces further the difficulty of the "anti-theft" rationale that purportedly underlies the doctrine.

Hughes Aircraft, *Pennwalt*, and their progeny, apart from periodic perfunctory cites to the *Graver Tank* discussion of the theft rationale, have neither undertaken a critical analysis of the specific or general theft deterrence policy, nor attempted to plumb more thoroughly the metaprinciples that ground the doctrine of equivalents. Rather, the Federal Circuit has applied itself to fleshing out the function/way/result framework.

The majority in *Pennwalt*, in a clear effort to move away from the ephemeral "invention as a whole" language of *Hughes Aircraft*, stated that the classic tripartite test is satisfied only if the patentee shows "the presence of every element or its substantial equivalent in the accused device."¹⁰¹ Thus, per the *Pennwalt* majority, there must be function/way/result equivalence for each element.¹⁰² The difficulties inherent in such an approach were not readily apparent in *Pennwalt*, in which the two elements compared were discrete, almost freestanding, portions of the respective devices. Each had a function that, standing alone, could be conceptualized independently of the operation of the fruit sorter. However, many elements will not lend themselves so readily to such analysis. For instance, in *Winans* the critical characteristic was the circular cross-section of the claimed railroad car. Whether a circle is equivalent to an octagon cannot be determined in the abstract. For example, as used to describe the shape of a railroad car, the two elements

ideas made public typically disseminate rapidly and inexpensively. Thus, all accused infringers are likely to have had access to the tools necessary for independent creation; the dispute will thus focus on whether and how those tools were utilized. Refusing to admit evidence of independent creation would therefore both minimize the already substantial evidentiary burdens of an infringement action and protect the patentee against a perjurious infringer. On the other hand, such a rule might, especially given the uncertain scope of infringing equivalents, also discourage honest inventors from working in the same general area, even though those efforts might yield new and useful noninfringing products. Such a result would be contrary to the stated policy objective of preserving the incentive to "invent around." See *Texas Instruments*, 805 F.2d at 1572.

101. *Pennwalt Corp. v. Durand-Wayland, Inc.*, 833 F.2d 931, 935 (Fed. Cir. 1987) (quoting *Lemelson v. United States*, 752 F.2d 1538, 1551 (Fed. Cir. 1985)), cert. denied, 485 U.S. 1009 (1988).

102. But see 833 F.2d at 954 n.3 (Nies, J., additional views), in which Judge Nies, also a member of the majority, noted:

The "function" in the function/way/result test of *Graver Tank* is not the "function" of a single means element. The latter is part of the of the inquiry into whether the accused device works in the "same way."

may arguably perform the same function of efficient load distribution. However, if used to describe the shape of a basketball hoop, a circle and an octagon would have entirely different functions and would produce very different results, and thus would not be infringing equivalents. Therefore, the function of an element can only be described with reference to the invention of which it is a part.

The decisions immediately following *Pennwalt* have apparently validated this observation. In *Black & Decker*, for instance, the court concluded that the "function" prong of the test was satisfied by evidence that the accused and claimed vacuum cleaners behaved identically, in a manner that implicated the features attributable to the claim limitations not literally met in the accused device. Similarly, in *London*, the court deemed the two hanger clamps not functionally equivalent because one was more difficult than the other to manipulate when fully loaded. Confusion on the subject persisted in the lower courts,¹⁰³ however, until the Federal Circuit in *Malta* stated expressly that the *Graver Tank* three-prong test is to be applied to the accused device as a whole, and not to the individual claim elements.¹⁰⁴

Thus clarified, the *Pennwalt* rule was set forth by Judge Nies:¹⁰⁵ the function/way/result test does apply to the accused device, apparently "as a whole," but the "way" prong cannot be satisfied if the accused device entirely lacks a claim element, or a substantial equivalent thereof.¹⁰⁶ While undoubtedly a longer statement of the law, this principle is far from, as characterized by the *Pennwalt* dissent; "a bright line rule, easier to apply . . ." ¹⁰⁷ Rather, the test suffers from at least three deficiencies that not only fail to make it easier to apply, but also allow courts to manipulate it, much as was done in the cases preceding *Pennwalt*, to permit any desired range of equivalents.

First, a court applying the test must, as before *Pennwalt*, determine how the claimed and accused devices function, and the results thereby achieved. Several strategies for making this determination suggest

103. See, e.g., *Malta v. Schulmerich Carillons, Inc.*, 952 F.2d 1320, 1326 (Fed. Cir. 1991) (stating that application of the function/way/result test by district judge to each element is erroneous).

104. *Id.*

105. See *supra* note 102.

106. According to "the All Elements rule, 'element' is used in the sense of a limitation of a claim." *Corning Glass Works v. Sumitomo Elec. U.S.A., Inc.*, 868 F.2d 1251, 1259 (Fed. Cir. 1989).

107. *Pennwalt*, 833 F.2d at 946 (Bennett, J., dissenting).

themselves. The court might begin by examining the preamble of the disputed claim, which may set forth at least the inventor's understanding of his invention's function and result. However, in general, the preamble will not be considered a limitation if it "merely states a purpose of intended use and the remainder of the claim completely defines the invention."¹⁰⁸ Furthermore, it would be odd to permit judicious preamble drafting to control the application of the doctrine of equivalents.¹⁰⁹

As a result, the trier of fact must evaluate the substance and nature of the invention. An invention, however, typically produces myriad results and has many functions, whereas the tripartite test demands the isolation of a single result and a single function. Thus, the proper determination of both result and function might require the application of something similar to the notorious "level of abstractions" test¹¹⁰ used in copyright cases to isolate idea from expression.¹¹¹ Without some such technique for analyzing inventive essence, it is not readily apparent how the result and function factors could best be isolated from both the invention and the accused device.

Perhaps in recognition of this difficulty, the Federal Circuit has adopted expansive notions of function and result.¹¹² However, even setting aside the level of abstraction problem, a second difficulty inheres in the *Pennwalt* reasoning, namely determining what constitutes an element for purposes of the element-by-element comparison. It is axiomatic in patent law that infringement cannot be avoided by combining, in the accused device, two claimed elements into a single element.¹¹³ Nor can infringement be avoided by using two elements in the stead of a single claimed element.¹¹⁴ Application of the test therefore first

108. *Martson v. J.C. Penney Co.*, 353 F.2d 976, 986 (4th Cir. 1965).

109. If form were to prevail over substance on the function and result issues, a claim preamble could be drafted broadly to ensnare devices not remotely contemplated by the claimed invention. For example, a preamble might claim "[a]pparatus for sorting fruit, comprising . . ." Even if the claimed fruit sorter sorts by weight and color, the patentee asserting that an apparatus that sorts by size and smell is an infringing equivalent would prevail on two of the three *Graver Tank* prongs.

110. See *Nichols v. Universal Pictures Co.*, 45 F.2d 119 (2d Cir. 1930) (L. Hand, J.); see also *Computer Assocs. Int'l, Inc. v. Altai, Inc.* 775 F. Supp. 544 (E.D.N.Y. 1991), *aff'd*, 982 F.2d 693 (2d Cir. 1992).

111. See, e.g., *Baker v. Selden*, 101 U.S. 99 (1879) (no copyright protection of expression that is inseparable from the underlying idea).

112. Cf. *Slimfold*, 932 F.2d at 1457 ("In the present case, as often happens in doctrine of equivalents cases, there is no material dispute about the 'function' and 'result' prongs of the test.")

113. See *Dolly v. Spalding & Evenflo Cos.*, 16 F.3d 394 (Fed. Cir. 1994).

114. See, e.g., *Pennwalt Corp. v. Durand-Wayland, Inc.*, 833 F.2d 931, 968 (Fed. Cir.

demands isolation of each element of the disputed claim. Although this exercise was not expressly performed in *Hughes Aircraft*, that case does provide a helpful illustration. The claimed apparatus had subcomponents that transmitted data to a ground source, processed the received data, and communicated the calculated control information back to the satellite. That the accused device had no such elements would appear, from a strict application of *Pennwalt*, to foreclose a finding of infringement by equivalents. However, the cases can be harmonized if the disputed elements are aggregated into a single element, for instance a "position data processor."¹¹⁵ Since the accused device also had such a processor, albeit one incorporated into the satellite, element-by-element correspondence existed.

Although logical, and apparently dictated by *Hughes Aircraft*,¹¹⁶ this approach threatens seriously to undermine the purported "bright line" nature of *Pennwalt*. If some noncorrelative claimed elements can be aggregated into a single constructive element, no sound justification exists for not permitting all elements of a claim to be so aggregated. This, of course, effectively resurrects the "invention as a whole" comparison flatly rejected in *Pennwalt*.

The final difficulty with the current function/way/result framework is that, after the respective elements of the accused and claimed devices have been collected into analogous pairs, the trier of fact must then determine whether these elemental pairs are "substantially equivalent."¹¹⁷ The Federal Circuit, however, admits that it can offer no guidance for determining if the equivalence between two elements is substantial.¹¹⁸ At most, the court is certain that function/way/result equivalence of each elemental pair, while sufficient to establish substantiality, is not necessary to do so.¹¹⁹

Perhaps the court's reticence to provide such guidance stems from an

1987) (Newman, J., commentary), *cert. denied*, 485 U.S. 1009 (1988); *Royal Typewriter Co. v. Remington Rand, Inc.*, 168 F.2d 691, 693 (2d Cir. 1948).

115. Cf. *supra* notes 70-71 and accompanying text.

116. Although the majority in *Pennwalt* did not comment on the viability of *Hughes Aircraft* in light of its analysis, neither did it suggest that its analysis was somehow a departure from established law.

117. It cannot be the case that the elemental pairs must be identical in order for the accused and claimed devices to operate in the same way. In *Winans*, the "circular" claim element was not identical to the "octagonal" element in the accused device, and yet the two railroad cars were deemed equivalents.

118. See *Malta v. Schulmerich Carillons, Inc.*, 952 F.2d 1320, 1326 (Fed. Cir. 1991) (stating that equivalency must be determined on a case-by-case basis).

119. *Id.*

appreciation that a comparison of elemental pairs is analytically impossible in an abstract vacuum. The facts of *Graver Tank* provide an illustration. The accused welding flux used manganese silicate, whereas the patentee's product employed magnesium silicate.¹²⁰ A chemist, if asked whether the two silicates are "substantially equivalent," would be unable to respond however that term is defined. For some applications, such as welding fluxes, the two compounds in general may be interchangeable. But for other uses, they may not be. A court must therefore determine the equivalency of an elemental pair with reference to the purpose the element serves in the claimed invention. It was this conclusion that led post-*Pennwalt* courts to examine the function and result of the entire claimed invention. Thus, the wall and snout limitations in *Black & Decker* allowed the claimed vacuum cleaner to separate water when operated at a variety of orientations. The alleged infringer's air-liquid separation apparatus imparted the same feature to the accused device. In contrast, the fact that the lower portion of the claimed garment bag clamp in *London* pivoted downward made the clamp much more difficult to use than the accused clamp, in which the upper portion of the clamp pivoted upward.¹²¹ Thus, despite the Federal Circuit's efforts to

120. Recall that the claim at issue, however, specified a flux composed of an alkaline earth metal silicate and calcium fluoride. See *supra* note 34 and accompanying text. The accused flux contained calcium silicate, an alkaline earth metal silicate, and manganese silicate, which is neither an alkaline earth metal silicate nor calcium fluoride. The patentee's commercial product was made from calcium silicate and magnesium silicate, both alkaline earth metal silicates.

Note, therefore, that neither the patentee's commercial flux nor the accused flux contained calcium fluoride. When performing the equivalents analysis, the Court therefore apparently erred by comparing the accused flux to the patentee's embodiment:

The question which thus emerges is whether the substitution of the manganese which is not an alkaline earth metal [in the accused infringer's product] for the magnesium [in the patentee's embodiment] which is, under the circumstances of this case, and in view of the technology and the prior art, is a change of such substance as to make the doctrine of equivalents inapplicable; or conversely, whether under the circumstances the change was so insubstantial that the trial court's invocation of the doctrine of equivalents was justified.

Graver Tank, 339 U.S. at 610. Instead, the Court should have endeavored to determine if manganese silicate is equivalent to calcium fluoride. For purposes of discussion, the facts will be taken to be as the Court in its analysis presumed them to be, to wit, that the claim at issue reflected the patentee's commercial embodiment.

121. In *Carroll Touch v. Electro Mechanical Sys.*, 15 F.3d 1573 (Fed. Cir. 1993), the disputed claim recited light beams, spaced apart. The invention related to touch-screen computer monitors. An orthogonal matrix of light beams was placed over the monitor surface, such that a finger approaching the screen would break two beams, indicating where

the contrary, the equivalents analysis inevitably shifts back to an examination of the invention as a whole.¹²²

In light of these uncertainties and practical limitations, *Pennwalt* has not made the doctrine of equivalents easier to apply. Understandably, courts tend simply to recite the function/way/result mantra, cite *Pennwalt*, and then proceed to analyze the facts on a completely ad hoc basis. Given this, commentators have suggested that any effort to reconcile the myriad decisions into a coherent vision is Sisyphean.¹²³ Rather, most commentators simply catalog the various cases and highlight those facts that apparently were central to the finding, all in an effort to assist the attorney seeking a factual analogy. At best, one might conclude from a survey of the more recent Federal Circuit decisions that the doctrine will be applied in a narrow ad hoc manner. This result was perhaps precipitated by *Pennwalt*, in which the majority was chastised by the dissent for rebalancing policy considerations weighed and debated forty years earlier in *Graver Tank*. Interestingly, as the above analysis has shown, nothing inherent in *Pennwalt* compels the result suggested by the dissent in that case; there is today no analytical constraint on courts' ability to find element-by-element equivalence.

The extended doctrine of equivalents debate has, therefore, generated far more heat than light. The resultant framework of ad hoc resolution is an anathema to adherents of the philosophy that "[t]he primary rights and duties with which jurisprudence busies itself again are nothing but prophecies."¹²⁴ There is little prophetic about the attempts to date to apply the doctrine of equivalents. One attempting to determine today whether a device is equivalent to a patented invention may know how the arguments on either side will unfold, but he is unlikely to be able to

the screen was touched. The accused device was identical in material respects, except that the orthogonal light beams intersected, and thus were not "spaced apart" as required by the claim. *Id.* at 1577. The patent specification pointed out that because the beams were spaced apart, the claimed monitor not only could determine the velocity of the finger approaching the screen, but also prevent a "false trigger" when an object, such as an insect, was near the screen. Because its beams intersected, the accused device lacked these features, and was thus found not to be an infringing equivalent. *Id.* at 1579.

122. Note also that under the element-by-element approach the doctrine of equivalents analysis focuses exclusively on non-matching elemental pairs. These "discontinuities" alone therefore define the difference between the accused and claimed inventions. A sufficiently broad understanding of "substantial similarity," one limited only by the teachings of the prior art, would therefore effectively grant to the patentee the entire relevant mode of operation, as defined in *Winans*. An element-by-element analysis does not therefore inherently dictate a narrower range of equivalents.

123. See generally 4 CHISUM, *supra* note 7, § 18.04.

124. Oliver Wendell Holmes, *The Path of The Law*, 10 HARV. L. REV. 457, 458 (1897).

predict with any real certainty which of those sides is likely to prevail, and why. To remedy this uncertainty, it is necessary to probe the justifications that gave rise to the doctrine in the first place. Only by discerning and parsing these principles might a consistent and coherent jurisprudence emerge.

III. ANALYSIS

How much should be read into the statement in *Winans v. Denmead* that the doctrine of equivalents is not only supported by, but indeed required under the Intellectual Property Clause of the Constitution?¹²⁵ Although, as the analysis below demonstrates, there is little support for the argument that the doctrine is a constitutional requisite, the principles reflected in the Intellectual Property Clause should nonetheless inform the courts' application of the doctrine. *Winans* suggests that the doctrine is necessary both to promote the useful arts and to secure to an inventor his discoveries. For analytical convenience, these two ideas will be considered separately below.

A. The Constitution

1. "To promote the Progress of Science and useful Arts by securing for limited Times to Authors and Inventors . . ."

Congress generally has broad latitude when legislating to promote the progress of the useful arts. Thus the Court in *McClurg v. Kingsland*¹²⁶ concluded that "the power of Congress to legislate upon the subject of patents is plenary by the terms of the Constitution, and as there are no restraints on its exercise, there can be no limitation of their rights to modify them at their pleasure. . . ."¹²⁷

Also favoring this view are the so-called "patent extension" cases, which involved constitutional challenges to legislation extending the terms

125. See *supra* note 13.

126. 42 U.S. (1 How.) 202 (1843).

127. *Id.* at 206 (holding that retroactive changes to the patent laws that deprive license-holders of their rights do not constitute *ex post facto* laws within the meaning of the Constitution; Congress cannot so act as to take away the rights in existing patents). See also *United States v. Duell*, 172 U.S. 576, 583, 588 (1899) (stating that Congress may provide whatever instrumentality, here, a specialized judicial tribunal, is necessary in its judgment to promote the progress of the useful arts).

of expired patents. Even where the person challenging the extension had made a considerable investment under the presumption that the patent had fallen into the public domain, the Court uniformly sustained Congress' authority to lengthen the standard term.¹²⁸ In this regard, Justice Story stated in *Blanchard v. Sprague*:¹²⁹

For myself, I never have entertained any doubt of the constitutional authority of congress to make such a grant. The power is general, to grant to inventors; and it rests in the sound discretion of congress to say, when and for what length of time and under what circumstances the patent for an invention shall be granted. There is no restriction, which limits the power of congress to enact, where the invention has not been known or used by the public. All that is required is, that the patentee should be the inventor.¹³⁰

Similar reasoning informed the holdings in the "patent non-use" cases. In these cases, the accused infringer raised in defense that the patent in question was invalid because the patentee had not employed the patent towards productive ends. Granting patents for inventions that go unused does not, the challengers argued, promote the progress of the useful arts as demanded by the Constitution. However, in *Continental Paper Bag Co.*,¹³¹ the Court upheld, without considering the merits of the challenger's claim, just such an exercise of legislative discretion.¹³²

Likewise, in *Special Equipment Co. v. Coe*,¹³³ the Court held that Congress "could have concluded that the useful arts would be best promoted by compliance with the conditions of the statutes which it did

128. See, e.g., *Evan v. Jordan*, 8 F. Cas. 872 (C.C.D. Va. 1813) (No. 4564) (Marshall, Cir.J.), *aff'd* 13 U.S. (9 Cranch) 199 (1815); *Bloomer v. Stolley*, 3 F. Cas. 729 (C.C.D. Ohio 1850) (No. 1559).

129. 3 F. Cas. 648 (C.C.D. Mass. 1839) (No. 1518).

130. *Id.* at 650 (citing *Evans v. Eaton*, 20 U.S. (7 Wheat) 356 (1822); *Evans v. Hettich*, 20 U.S. (7 Wheat.) 453 (1822)).

131. 210 U.S. 405 (1908).

132. *Id.* at 429-30 ("We may assume that experience has demonstrated [the] wisdom and beneficial effect [of the policy that a U.S. patent is not affected by non-use] upon the arts and sciences.")

133. 324 U.S. 370 (1945). As one commentator has observed, the validity of the "non-used" patent at issue in *Special Equipment* was upheld notwithstanding that the case was decided during "the era when the Court's 'passion . . . for striking [patents] down' burned brightest . . ." Kenneth J. Burchfiel, *Revising the "Original" Patent Clause: Pseudo-history in Constitutional Construction*, 2 HARV. J.L. TECH. 155, 177 (1989) (quoting *Jungerson v. Ostby & Barton Co.*, 335 U.S. 560, 572 (1949) (Jackson, J., dissenting)).

enact"¹³⁴ The constitutional mandate thus appears to require no more than a statutory structure that broadly furthers the progress of the useful arts in the overall sense. Such progress need not be furthered in every instance. In view of this precedent, one commentator has concluded that the validity of patent statutes, and therefore also of the patents issued under them, are threatened only if there fails to exist "a minimal rational relation between the constitutional purpose and the means selected by Congress."¹³⁵

Under this minimum scrutiny standard,¹³⁶ it would appear that Congress would have the authority to restrict recovery to cases of literal patent infringement only. Definiteness decreases litigation costs and eliminates uncertainty from the task of designing around a patented invention.¹³⁷ Either or both of these costs might discourage would-be inventors from applying their arts to inventive ends. Eliminating recovery for infringement by equivalents would thus appear to bear a minimal rational relation to the constitutional purpose.

2. ". . . exclusive Right to their respective Writings and Discoveries"

Even in the absence of a viable argument that the progress of the useful arts is promoted in accordance with the Constitution only if patent holders are permitted to recover under the doctrine of equivalents, *Winans*

134. 324 U.S. at 378.

135. Burchfiel, *supra* note 133, at 177.

136. Congressional exercise of power under the Intellectual Property Clause is not, however, entirely unfettered. In *Graham v. John Deere Co.*, the Court concluded:

The Congress in the exercise of the patent power may not overreach the restraints imposed by the stated constitutional purpose. Nor may it enlarge the patent monopoly without regard to the innovation, advancement or social benefit gained thereby.

The Clause is therefore "both a grant of power and a limitation." In particular:

Congress may not authorize the issuance of patents whose effects are to remove existing knowledge from the public domain, or to restrict free access to materials already available. Innovation, advancement, and things which add to the sum of useful knowledge are inherent requisites in a patent system which by constitutional command must "promote the Progress of . . . useful Arts." This is the standard expressed in the Constitution and it may not be ignored.

383 U.S. at 6.

137. See *Graver Tank & Mfg. Co. v. Linde Air Prods. Co.*, 339 U.S. 605, 617 (1950) (Black, J., dissenting).

also indicated that substantial equivalents of a claimed invention are a part of the inventor's "discovery." Thus, those equivalents must also be granted monopoly protection.

Assuming that an inventor has a monopoly right to her entire "discovery," the focus of the doctrine of equivalents analysis then shifts to the meaning of the term "discovery." Several early Supreme Court cases suggest that the scope of an inventor's discovery within the meaning of the Intellectual Property Clause is coextensive with the scope of her natural property rights in her invention. In *Blanchard*, the Court declared patents to be "a just reward to ingenious men."¹³⁸ Similarly, Chief Justice Marshall, in *Evans v. Jordan*,¹³⁹ characterized the grant of a patent as "[an enlightened legal recognition of the] inchoate and indefeasible property in the thing discovered."¹⁴⁰ In light of this, the purpose of the patent system was to maintain "the sacred rights of property."¹⁴¹ The temptation evoked by these statements is to construe the term "discoveries" to include everything to which an inventor has a natural right, by dint of her contribution to the common knowledge pool.¹⁴²

138. *Blanchard v. Sprague*, 3 F. Cas. 648, 650 (C.C.D. Mass. 1839) (No. 1518).

139. 8 F. Cas. 872 (C.C.D. Va. 1813) (No. 4564), *aff'd* 13 U.S. (9 Cranch) 199 (1815).

140. *Id.* at 873.

141. *Id.* See also *Allen v. Blunt*, 1 F. Cas. 450, 460 (C.C.D. Mass. 1846) (No. 217) (stating that the monopoly right to discoveries "sacredly recognized both by the laws and the constitution").

142. *But see* *Graham v. John Deere Co.*, 383 U.S. 1, 8 n.2 (1966) (quoting Letter from Thomas Jefferson to Isaac McPherson (Aug. 1813), in VI WRITINGS OF THOMAS JEFFERSON 180-181 (Washington, ed.):

It would be curious then, if an idea, the fugitive fermentation of an individual brain, could, of natural right, be claimed in exclusive and stable property That ideas should freely spread from one to another over the globe, for the moral and mutual instruction of man, and improvement of his condition, seems to have been peculiarly and benevolently designed by nature . . . and like the air in which we breathe, move, and have our physical being, incapable of confinement or exclusive appropriation. Inventions then cannot, in nature, be a subject of property.

But see Burchfiel, *supra* note 133, at 166 (footnotes omitted):

Jefferson, who was in France during the Constitutional Convention in the summer of 1787, played no role in the drafting of the Constitution, but promptly responded to the adoption of the intellectual property clause with a proposal for its effective repeal by a bill of rights provision that would have prohibited any "monopolies," including those for a limited term intended to stimulate "ingenuity." This suggestion was rejected by the drafters of the Bill of Rights in Congress, along with Jefferson's later proposals for a ninth article to the Constitution which would have permitted limited "monopolies" for literary productions and inventions.

There are numerous theories that might be employed to make a normative assessment of an inventor's property rights in her invention. Only a handful of these are considered in this Article.

John Locke offered his theory of natural rights in the seventeenth century.¹⁴³ Locke's conclusions are premised on the notion that God gave the world to all persons collectively. Anything held in common, therefore, is owned by all. Labor, by contrast, is possessed exclusively by the laborer.¹⁴⁴ Observing how productivity increased when things were brought from a natural to a cultivated state, Locke postulated that God could not have intended commonly-owned wealth to remain uncultivated and unused.¹⁴⁵ In light of this presumption and the impossibility of one individual bargaining with all others to remove an item from the common, Locke concluded that persons who remove an object from its preexisting natural state by means of their own labor acquire a natural right to that object.

Although Locke expressly confined his discussion to the possession and ownership of physical, tangible property, there is no apparent reason why his observations are not equally, if not more, apt in the context of property rights in intangible intellectual "objects." Ideas are universally owned in the sense that they are all essentially manipulations of the physical laws that govern and account for existence. The complete set of these permissible manipulations was therefore determined the instant the realm of physical laws was defined in nature. Notwithstanding this everpresence, ideas are not necessarily readily apparent from nature.¹⁴⁶ Rather, an individual must generally use his mental processes to speculate on the nature of and interrelations among physical laws in order to extract heretofore unappreciated ideas from the common pool.¹⁴⁷

143. See JOHN LOCKE, *TWO TREATISES OF GOVERNMENT: A CRITICAL EDITION WITH AN INTRODUCTION AND APPARATUS CRITICUS* (Peter Laslett ed., rev. ed. 1989).

144. *Id.* at 303-20.

145. *Id.*

146. Cf. *In re Mancy*, 499 F.2d 1289, 1294 (C.C.P.A. 1974) (containing dictum that no patent may be granted for a "product of nature"); *In re Bergy*, 563 F.2d 1031, 1036 (C.C.P.A. 1977), *remanded sub nom.*, *Parker v. Bergy*, 438 U.S. 902 (1978), *on remand* 596 F.2d 952 (C.C.P.A. 1979), *aff'd sub nom.*, *Diamond v. Chakrabarty* 160 S. Ct. 2204 (1980).

147. Cf. Yoram Barzel, *Optimal Timing of Innovations*, 50 REV. ECON. & STATISTICS 348 (1968); Partha Dasgupta & Bruce M. Stiglitz, *Uncertainty, Industrial Structure and the Speed of R & D*, 11 BELL J. ECON. 1 (1980); Brian D. Wright, *The Resource Allocation Problem in R & D*, in *THE ECONOMICS OF R & D POLICY* 41 (G. Tolley ed. 1985) (all analogizing invention to fishing).

Similarly, one commentator has analogized the inventive process to mining, and the patents themselves to mining claims. See Edmund Kitch, *The Nature and Function of the*

A Lockian analysis suggests that the labor involved in extracting an idea from common ownership gives rise to a natural right in that idea.¹⁴⁸ That extracted, and not the skill with which it was described in a patent claim, would thus seem to measure the scope of the inventor's "discovery." But the fact that a person has labored to extract something from the common does not necessarily give rise to a natural right in that thing. To the question of to how much can one obtain property rights, Locke answers:

As much as any one can make use of to any advantage of life before it spoils; so much he may by his labor fix a Property in. Whatever is beyond this is more than his share, and belongs to others. Nothing was made by God for Man to spoil or destroy.¹⁴⁹

The critical question, then, is whether any portion of an extracted idea

Patent System, 20 J.L. & ECON 265 (1977).

These common-pool analogues, however, are used to describe the effects of patent grants on the inventive process. Kitch, for example, concludes that, because a patent is granted after invention but prior to exploitation of that invention, the inventor's incentive to commercialize his efforts is preserved, and the inventor is free to bargain with imitators to reduce duplicative inventive efforts.

148. Jean-Jaques Rousseau objected to Locke's labor desert formulation as an unjust mechanism, depriving most men of property by virtue of its historical reference to an individual's efforts. See JEAN-JACQUES ROUSSEAU, *THE FIRST AND SECOND DISCOURSES OF ROUSSEAU* (Roger D. Masters ed., 1964). By installing a social system of rights and duties after the commons had been apportioned among a few, property owners preserved their position in the economic strata. Rousseau's argument rests on the inherent scarcity of most forms of property. It is this scarcity that breeds conflict, conflict that breeds the need for rights and duties, and the rights and duties that fix property rights. While it is true that individuals may compete to be the first to extract an idea from the common, it is not necessary that they do so in order to obtain rights to some piece of intellectual property, presuming that the supply of ideas is inexhaustible. *But cf.* Jack Smith, *Criticizing Inventions as not an Incandescent Idea*, L.A. TIMES, Oct. 3, 1991, at E1: According to Charles H. O'Duell, the 1899 Commissioner of Patents, "[w]e should close the patent office, for everything that can be invented has been invented." Since that infamous quote, however, roughly four and one-half million patents have issued. Regardless, Rousseau's concerns would therefore seem to be limited to property rights in tangible objects.

149. LOCKE, *supra* note 143, at 303-20. Locke does justify accumulations of wealth on the grounds that it is permissible to barter perishable for non-perishable, or durable, items. However, at bottom this conclusion is premised on the understanding that the non-perishable items received in exchange are employed for the benefit of the one who receives them. They can be used either towards later exchange for perishables, or simply to give aesthetic or other enjoyment to their possessor. A patent holder who has a broad property right in his invention, one extending beyond the particular embodiment described in his claims, cannot be said to possess wealth in this sense. This inventor is simply unaware that he possesses this additional property. Because the inventor cannot exploit that of which he is unaware (nor, of course, can he barter or exchange it), this additional property is "wasted," in the Lockian sense.

might go unused by its extractor, the inventor. If so, there can be no right to the unused portion.

The answer to such an inquiry will of course vary with the circumstances, the idea, and the invention. However, the generalization that the claims determine how an idea will be exploited has much to recommend it. Claims are typically drafted with reference to the inventor's speculations as to how she intends to exploit the idea. If these speculations are accurate and complete, the inventor has no natural right to unclaimed exploitations that are nevertheless encompassed by the idea.

While there are many plausible reasons why an inventor might not claim all that she intends to exploit,¹⁵⁰ in general the premise that she does so intend seems accurate:

[This] model of behavior . . . ignores the limits on cognitive capacity and the tendency to focus on past experience that are characteristics of other models and of organizational behavior as we know it. Once a firm develops and becomes competent in one part of a "prospect," it may be very hard for it to give much attention to other parts, even though in the eyes of others, there may be great promise there.¹⁵¹

On this analysis, the claims alone would therefore measure the inventor's discovery. At most, the inventor could be said to have a natural right to those embodiments of the idea that rely on elements developed after the claims were drafted and the patent awarded.¹⁵²

Another analysis of the nature of property rights is offered by the British economic historian R. H. Tawney.¹⁵³ By discriminating between and among different types of property, Tawney challenges what he perceives to be a monolithic notion of property. From this he concludes that only certain kinds of property, particularly property closely interrelated with the process of production, can be justified. Tawney's position is distinct from Locke's in that the latter is concerned with the acquisitional history of a particular piece of property. Tawney, in contrast, focuses on the function to which a particular piece of property will be put in the

150. See *infra* section III.B.1.b. (discussing the tactic of "strategic claiming").

151. Robert P. Merges & Richard P. Nelson, *On the Complex Economics of Patent Scope*, 90 COLUM. L. REV. 839, 873 (1990) (footnotes omitted).

152. See, e.g., *Hughes Aircraft Co. v. United States* 717 F.2d 1351 (Fed. Cir. 1983).

153. See RICHARD H. TAWNEY, *THE ACQUISITIVE SOCIETY* (1920).

future. Property rights in tools, for example, are "justified," that is, natural, not because the possessor labored to fashion them from raw materials drawn from the common, but rather because they will be utilized by the possessor to create other products.

Tawney illustrates this principle with examples of property spanning the spectrum from the most to the least justified:

1. Property in payments made for personal services.
2. Property in personal possessions necessary for health and comfort.
3. Property in land and tools used by their owners.
4. Property in copyright and patent rights owned by authors and inventors.
5. Property in pure interest, including much agricultural rent.
6. Property in profits of luck and good fortune: 'quasi-rents.'
7. Property in monopoly profits.
8. Property in urban ground rents.
9. Property in royalties.¹⁵⁴

Tawney deems that the first four enumerated examples "obviously accompany, and in some sense condition, the performance of work."¹⁵⁵ The inclusion of intellectual property in this quartet is curious. Unlike the other three, there is no requirement that intellectual property, to merit protection, be possessed and practiced by the author or inventor of that property. While in some sense it could certainly be said that intellectual property is a tool of production, just as is a pick or saw, so also then should be the capital invested in the firm that generates monopoly profits.

154. *Id.* at 63-64. Note that Tawney separates monopoly rights from patent rights. Earlier, he states:

Property was to be an aid to creative work, not an alternative to it. The patentee was secured protection for a new invention, in order to secure to him the fruits of his own brain, but the monopolist who grew fat on the industry of others was to be put down.

Id. at 59-60. Tawney apparently refuses to acknowledge that monopolies can result from superior industry as well as fortune and connivance. See PHILLIP AREEDA & LOUIS KAPLOW, *ANTITRUST ANALYSIS* ¶ 310 (4th ed. 1988).

155. TAWNEY, *supra* note 153, at 64.

The "function" of the property in the productive process therefore fails to capture the essence of the distinction.

Perhaps the best explanation for Tawney's demarcation may be discerned from his vitriolic distaste for passive wealth:

[F]unctionless property is the greatest enemy of legitimate property itself. It is the parasite which kills the organism that produced it. Bad money drives out good, and, as the history of the last two hundred years shows, when property for acquisition of power and property for service or for use jostle each other freely in the market, without restrictions such as some legal systems have imposed on alienation and inheritance, the latter tends normally to be absorbed by the former, because it has less resisting power. Thus functionless property grows, and as it grows it undermines the creative energy which produced property and which in earlier ages it protected.¹⁵⁶

The core of Tawney's classification scheme thus hinges on creation, or, more particularly, how detached the putative property is from the creative process. Capital invested to yield rents and profits has only a tenuous link to this process, as is evidenced by the fungibility of the capital source from the point of view of the profitable productive process. In contrast, that process is very sensitive to the abilities of the particular laborers who participate in it.

Similarly, the successes of a particular productive process may depend directly on the various intellectual properties embodied in it. Any intellectual property that enables or otherwise facilitates creation is a justified property right under this approach. The focus of the analysis is therefore on the productive effect of the inventor's efforts, and not on the actions or intentions of the inventor. This conclusion would suggest that the range of an inventor's "discoveries" should be measured with regard to the commercial use resulting from the inventor's public disclosure. Irrespective of the literal scope of the claims, competitors' efforts that could be traced to the teachings of the inventor's patents would therefore be included within the inventor's "discovery."

A third understanding of the origin of rights in property may be

156. *Id.* at 81.

synthesized from the works of Georg William Frederick Hegel. Hegel reasoned that private property is necessary to realize the independence and freedom of the person:

In property my will is the will of a person; but a person is a unit and so property becomes the personality of this unitary will. Since property is the means whereby I give my will an embodiment, property must also have the character of being "this" or "mine." This is the important doctrine of the necessity of private property.¹⁵⁷

An individual therefore comes to exist partly by differentiating himself from his environment, and partly by maintaining relationships with that environment. Private property ownership is critical to this differentiation.

Setting aside the particular mechanisms by which property ownership operates to facilitate the development and maintenance of personality,¹⁵⁸ a threshold question prompted by the quoted passage is, even accepting the author's premise, what degree of private property possession is sufficient to secure to the individual his or her liberty? A response can be gleaned from Hegel's postulate that:

A person has as his substantive end the right of putting his will into any and every thing and thereby making it his, because it has no such end in itself and derives its destiny and soul from his will. This is the absolute right of appropriation which man has over all "things."¹⁵⁹

Later in the text comes the expansion:

157. GEORG W.F. HEGEL, *HEGEL'S PHILOSOPHY OF RIGHT* 236 (T.M. Knox trans., 1967).

158. See, e.g., JEREMY WALDRON, *THE RIGHT TO PRIVATE PROPERTY* ch. 8 (1988) (drawing from Hegel and T.H. Green to develop a general rights theory of property); Charles A. Reich, *The New Property*, 73 *YALE L.J.* 733, 771-87 (1964) (stating that property is crucial for securing to the individual an area of freedom from domination by society or the state).

159. HEGEL, *supra* note 157, at 41. One general response that might be made to Hegel is that the unlimited exercise of this "absolute right" would inevitably come into tension with the fact that most forms of property are inherently scarce. However, as discussed *supra* notes 148-49 and accompanying text, intellectual property may be unique in that there is an unlimited "stock" from which to draw.

"To appropriate" means at bottom only to manifest the preeminence of my will over the thing and to prove that it is not absolute, is not an end in itself. This is made manifest when I endow the thing with some purpose not directly its own.¹⁶⁰

Reasoning back from this statement, one who endows something "with some purpose not directly its own" would thereby have a right privately to possess that thing as property. In the context of invention, the analysis therefore hinges on determining the "purpose" attributable to an idea. Prior to its discovery, that idea existed nowhere but in Locke's commons.¹⁶¹ In this state it cannot then be said to have, within Hegel's framework, an independent purpose "directly its own." Only when an idea is employed to some end, for example by creating a tangible embodiment, is it provided with a purpose.¹⁶²

An inventor who uses for some purpose a heretofore undiscovered idea therefore has some property right to that idea. For purposes of the doctrine of equivalents question, the next critical issue is defining the idea in which the right inheres. Any investigation attempting to isolate a simple idea from its embodiments, however, raises the specter of a "level of abstractions" problem.¹⁶³ A particular embodiment incorporates a series of ideas, each of successively higher generality.¹⁶⁴ Certainly the inventor would be happiest if possessed of a right to the broadest possible idea reflected by his described embodiment or embodiments: Hegel, however, is concerned only with property rights

160. *Id.* at 236. For a critical analysis of the Hegelian analysis, see ALAN B. CARTER, *THE PHILOSOPHICAL FOUNDATIONS OF PROPERTY RIGHTS* 89-98 (1989). Carter concludes from the quoted passages that "Hegel appears to be saying that found 'things' are without purpose, but they can be given a purpose by using them for our purpose." *Id.* at 91. Carter notes that the reasoning that a thing becomes the individual's because it is invested with her purpose is as fallacious as Locke concluding that the product of labor belongs to the laborer because one's labor is one's own. See *id.* This syllogism however, can itself be attacked for its premise that there is nothing to recommend the Lockian analysis. Locke's approach was never intended to be a rigorous mathematical proof, rather only an attempt to isolate and reflect the particular social mores that might have given rise to the system of property observable in Locke's era.

161. See *supra* notes 146-47 and accompanying text.

162. That one has a property right in an idea does not imply necessarily that one also has a right in an item embodying that idea. Cf. CARTER, *supra* note 160, at 91-92.

163. See *supra* note 110.

164. For example, was the idea at issue in *Winans* constructing a railroad car of circular cross-section? Constructing a railroad car that distributes load efficiently? Constructing a railroad car that distributes load in some manner?

that provide a means to embody the inventor's will. At the very least, the inventor must be entitled to a private property right in an idea sufficiently broad to encompass his embodiments, that is, the purpose to which the idea has been put. If the right were to something less, then the unpossessed portion could theoretically be possessed by another; the inventor might then be barred from behaving in exactly the same manner that gave rise to the right in the first instance. The inventor's appropriative efforts to inject his will into the idea would thus remain unacknowledged by society.

But does the inventor have a right to something greater? Two responses suggest that he does not. First, the inventor has invested no will in anything else; he has not sought in any additional way to differentiate himself from his environment. Because his identity is bound up only in his specific behavior and fruits thereof, he need not possess a right to more than the idea that is precisely coterminous with that behavior. Because the inventor has invested no will in a broader idea, denying him a right to such will not frustrate his liberty interests. Second, a right to something more might deny freedom and independence of will to others. If the inventor were granted a right to something more than the narrowest right, others would then be unable to invest their will in those additional rights. Because the additional rights do nothing to improve the inventor's personality development, as noted above, the mere possibility that such additional rights might limit another's development suggests an affirmative justification for not vesting those rights in the original inventor.

The purpose to which an idea has been put therefore appears to mirror exactly the content of the idea in which the inventor has a natural property right. In the case where the inventor has evidenced a claim to this right by applying for a patent, the patent claims provide the best enumeration of the idea's purposes.

One might argue that the claims reflect only what the inventor considered to be the idea's purposes, and therefore should not be determinative of what those purposes in fact are. That the measure is subjective should not, however, be objectionable. The Hegelian analysis is inherently subjective: an individual can invest no will into property of which he does not perceive himself to be possessed.¹⁶⁵

165. Cf. Margaret J. Radin, *Property and Personhood*, 34 STAN. L. REV. 957 (1982). Radin argues that one needs stable control over a certain amount of material resources in order to satisfy one's needs. The individual should therefore have a right to material

Because the inventor "has as his substantive end the right of putting his will into any and every thing and thereby making it his,"¹⁶⁶ anything beyond the literal scope of the claims can contain none of the inventor's will. Given this conclusion, nothing beyond the inventor's patent claims can be deemed his by virtue of natural right.

B. The Role of the Courts

Notwithstanding the absence of a constitutional basis for the doctrine of equivalents, the courts' application of the doctrine of equivalents should at least be informed by the policies that underly the Intellectual Property Clause.

As demonstrated, a belief that a patentee has a natural right to a certain range of equivalents is difficult to support with traditional property rights analyses.¹⁶⁷ Perhaps, then, the doctrine is a response to the concern that holding patentees strictly to their claim language, especially in view of the vagaries of claim drafting and expression, would discourage invention and fail to "promote the Progress of . . . useful Arts . . ." ¹⁶⁸

To facilitate the selection of a rule best geared to the constitutional purpose, the "economic analysis of law" school suggests establishing an analytical framework to model the concerns and behaviors of the relevant principals. The various possible rules¹⁶⁹ can then be tested against the model to determine which most closely achieves the ultimate goal. It is this approach that is adopted in this Article.

resources that the individual "is bound up with." *Id.* at 960. It would be difficult to be "bound up with," in any meaningful way, things of whose existence you were, until another demonstrated them, unaware.

166. HEGEL, *supra* note 157, at 41.

167. A possible exception to this conclusion might be a natural right to later-discovered equivalents of claimed elements, as in *Hughes Aircraft*. *But see* *Texas Instruments, Inc. v. United States Int'l Trade Comm'n*, 805 F.2d 1558 (Fed. Cir. 1986).

168. U.S. CONST. art. I, § 8, cl. 8.

169. For purposes of the analyses in this section, it is presumed that there are only two viable rule choices: either no recovery for non-literal infringement, or recovery for all equivalents encompassed by the *Wilson Sporting Goods* hypothetical claim. Anything "in between" is necessarily an *ad hoc* rule that not only cannot be analyzed in the abstract, but also is likely to raise uncertainty costs for all involved parties. Either of the "polar" rule choices is thus likely to be superior with respect to any intermediate solution in all situations.

1. *Unilateral Models*

a. *The Ignorant Inventor*

This model postulates an inventor ignorant of all but the relevant prior art and the characteristics of the market in which his invention is to be sold. This inventor is unaware of the doctrine of equivalents, and therefore believes patent claims to be the sole measure of the monopoly right.

The inventor has an idea that, with some effort, could become a patentable invention. Before investing time and funds developing the idea, the inventor will first determine, based on the prior art and his vision of the invention, the probable scope of his patent claims. Armed with this estimate, the inventor can then determine the expected monopoly profits that he will be able to extract from sales of patented articles. If his total expected costs of development and patent acquisition are below these expected returns, the rational¹⁷⁰ ignorant inventor will elect to develop the invention.

In a subsequent suit on the inventor's patent, it is immaterial whether the court permits the inventor to recover under the doctrine of equivalents. Because the inventor when making his decision to invest in research and development was ignorant of the doctrine, the potentially broader patent scope, and hence the larger monopoly profits attainable, played no role in that decision. Thus, the presence or absence of the doctrine for this inventor had no bearing on the progress of the useful arts. So, though an inventor may feel morally wronged that another was able to alter a trivial detail and escape infringement, the inventive process is neither stimulated nor hindered by the breadth of the doctrine of equivalents. Under this analysis, the doctrine might best be eliminated in order to simplify litigation and preserve scarce judicial resources.

b. *The Savvy Inventor in a Certain World*

The ignorant inventor model might accurately characterize the lone inventor who files a *pro se* patent application, or an inventor advised by relatively unsophisticated patent counsel. However, the majority of patent

170. In economic terms, a "rational" individual is one who acts only when the anticipated benefits exceeds the anticipated costs.

practitioners are well aware of the doctrine of equivalents. This awareness might in some circumstances lead them to "underclaim" the invention,¹⁷¹ relying on the courts in any future litigation to broaden the claims to encompass equivalents of the "underclaimed" device.

Although seemingly implausible, such behavior might possibly be rationalized as a measure to reduce the cost of the patent application.¹⁷² Maximizing the breadth of the claims increases total application and processing costs for three reasons. First, the attorney must locate and closely review all relevant prior art to determine the justified limits of the inventor's claims. Second, the attorney must carefully draft the claims to reflect precisely these limits. Finally, the closer the inventor's claims come to ensnaring the prior art, the more difficult it will be to convince the examiner to allow the application. Assuming the attorney made the appropriate initial determination of claim scope, and assuming also that the examiner does not turn up any additional prior art that necessitates the redrafting of the claims, the examiner should eventually allow the patent. This may require, however, extensive discussions and debates between the attorney and the examiner, and possibly an appeal to the PTO Board of Appeals.

Against this ex ante cost savings, the properly advised inventor must balance the ex post increased litigation costs. Should litigation eventuate, if the accused device does not fall within the literal scope of the claims, the inventor's attorneys will be forced to perform the prior art analysis foregone during the application process to determine if the inventor could have obtained a claim covering the accused device.¹⁷³ Even if this burden is met, convincing the court that a product falling within this hypothetical claim is an infringing equivalent is likely to be far more expensive than persuading an examiner on this same point. Proceedings at the PTO are all ex parte. When an alleged infringer who faces considerable liability is interjected into the analysis, costs are certain to increase.

171. "Underclaiming" an invention means that the claims intentionally do not reflect the broadest possible hypothetical claims that the patentee could have obtained. An "underclaim" might claim only one narrow embodiment, rather than the "inventive essence" of that embodiment, and hence would be easier to invent around.

172. Obtaining a patent with the assistance of a patent attorney can cost an inventor several thousand dollars. See generally Pamela Samuelson, Benson Revisited: *The Case Against Patent Protection for Algorithms and Other Computer Program-Related Inventions*, 39 EMORY L.J. 1025 (1990) (stating that application costs per patent can exceed \$10,000).

173. See *Wilson Sporting Goods Co. v. David Geoffrey & Assocs.*, 904 F.2d 677, 684 (Fed. Cir. 1990) (holding that the burden is on the patentee to establish that the necessary hypothetical claim would have been allowable over the prior art).

That the costs of litigation are likely to exceed the costs of the application process does not end the analysis, because not every patent that issues is litigated. In 1992, nearly ninety-eight thousand patents issued.¹⁷⁴ During that same period, only 523 patent cases were resolved at the district court level.¹⁷⁵ This suggests that only about one half of one percent of issued patents are ever litigated. While it is true that most litigated patents issued many years prior to litigation, when fewer patents were sought and granted,¹⁷⁶ and that many cases settle before reaching court, even doubling or tripling this figure would suggest a litigation rate of about one or two percent.

The suggestion that these considerations might actually factor into an inventor's decision to seek narrower or broader claims might seem incredible. However, it is not unusual to find patents the value of which would not be increased dramatically by broader claims. Also, for one reason or another the patent applicant might think it very unlikely that anyone will ever infringe his invention, literally or otherwise. Lastly, a representative, such as an in-house patent attorney, will in many cases stand between the inventor and the attorney preparing the draft. These representatives might balance the added expense of a maximally-claimed patent against the added value achieved by the increase in claim breadth.

The rational, savvy inventor faced with the collection of facts enumerated above would, before deciding whether to invest in development of an invention, first determine expected monopoly profits, as did the ignorant inventor. To this he would compare development costs and transactional costs. In determining transactional costs, the inventor has two choices, either secure the broadest possible patent, or rely on the doctrine of equivalents should litigation ensue. Which he chooses depends on the relative costs of each course of action. The total cost of relying on the doctrine would be the cost of securing patent claims of minimal scope, plus the expected excess litigation costs that will result from the need to assert the doctrine of equivalents.¹⁷⁷ If this figure exceeds the cost of obtaining the broadest possible patent protection, then the inventor will opt for this latter approach. Accordingly, if the patent

174. See 1134-45 Off. Gaz. Pat. Office (1992).

175. LEXIS survey by author.

176. In 1990, 90,592 patents issued. See 1110-21 Off. Gaz. Pat. Office (1990). In 1985, 71,741 patents issued. See 1050-61 Off. Gaz. Pat. Office (1985). And in 1980, 61,890 patents issued. See 990-1001 Off. Gaz. Pat. Office (1980).

177. The expected increase in litigation cost is the likelihood of litigation multiplied by the total increase in litigation costs.

litigation rate is, as suggested above, only one or two percent, the added litigation cost must exceed the added prosecution costs by fifty to one hundred times before underclaiming looks unattractive to the rational investor. Of course, whatever the inventor's transaction costs, when added to the development costs they must be below the expected market return in order for the inventor to invest.

Under this model, courts should always permit patentees to assert the doctrine of equivalents, and the scope of protection should extend to the broadest possible hypothetical claim. This conclusion follows from the fact that the fully informed inventor made the socially optimal decision *ex ante*. To illustrate: if the inventor decided that obtaining broad patent protection was in his best interests, then there will be no need for the court to apply the doctrine, so the issue is moot. If, however, the patent claims are minimal, that must be because the total cost of obtaining broad claims was higher than the expected increase in litigation costs, even given the additional expense incurred by the need to address the doctrine of equivalents issue. If the court in this situation refuses to apply the doctrine of equivalents, then *ex ante* some inventors, before deciding to invest in research, will be forced to incur the higher transaction cost of obtaining broader claims. For the inventor on the margin, this increase in total expected costs will be sufficient to make the entire project unattractive. Solely because they were denied the opportunity to assert the doctrine of equivalents, these inventors will have consciously decided not to further the progress of the useful arts.

c. The Savvy Inventor in an Uncertain World

Irrespective of his understanding of the law, and regardless of the accuracy of that understanding, the savvy inventor still faces the prospect that in subsequent litigation a court might misunderstand or misapply the law. The doctrine of equivalents asks the court to determine the hypothetical broadest claim that could have been granted at the time the patent in dispute issued. The difficulties inherent in this exercise are numerous. Paramount among them is filtering out subsequent advancements in the art that would have rendered, if in existence prior to the application for patent, the asserted equivalents obvious. This hindsight problem is complicated by the fact that often many years have passed between the filing of the application and the date of litigation.

To account for this, the inventor evaluating the merits of broad versus

narrow patent claiming must interject uncertainty into the analysis. There is some finite probability that a too-limited range of equivalents will be ascribed to the narrow patent, erroneously denying recovery to the patent holder. Expected transaction costs must therefore be increased, *ex ante*, to account for this contingency. There are two methods to calculate this increase. The first simply multiplies the expected recovery, should litigation eventuate, by the chance that the recovery will be erroneously denied. One might respond that there is an equal and offsetting probability that the court will err in the patentee's favor, and ascribe to the patent a range of equivalents broader than is justified. However, as discussed above, the courts are more likely to overly restrict the permissible range of equivalents. Systematically, therefore, the patentee is likely to be disfavored by errors in the court's judgment.

The second approach is based on the premise that many individuals would prefer a certain loss of a given amount today to an expected loss of exactly the same amount. This phenomenon is known as risk aversion.¹⁷⁸ Essentially, a risk-averse individual considers uncertain future contingencies more costly than does a risk-neutral person.¹⁷⁹ Risk aversion, therefore, further increases the chances that an inventor will elect to obtain a broader patent, and makes the prospect of relying on the doctrine of equivalents less attractive.

Although these increased costs make the doctrine of equivalents a less valuable prospect to patent applicants, the court for two reasons should still permit the broadest possible application of the doctrine. First, given uncertainty and risk aversion, an increased number of broader patents will

178. See STEVEN SHAVELL, *ECONOMIC ANALYSIS OF ACCIDENT LAW* 186-88 (1987).

179. For example, a risk-neutral actor is indifferent between a certain loss of \$10 and a 5% chance of a \$200 loss. If faced with the 5% chance situation, the actor knows that one time out of twenty he will be forced to pay the \$200, but for the other nineteen times, he pays nothing. Thus, he spreads the \$200 cost over the twenty times, and he figures that his actions cost him, on average, \$10 per time.

A risk-averse actor, however, prefers a certain loss of \$10 to a 5% chance of a \$200 loss, even though the expected losses are identical. This phenomenon is due to the fact that people have a finite amount of wealth. To illustrate: suppose a risk-averse individual has \$200 in wealth, and he needs \$50 in groceries to survive. If his actions pose a 5% threat of costing him \$200, then this individual would be willing to pay much more than the expected \$10 loss to avoid this threat, because if he is one of the unlucky 5%, he dies. In fact, the rational risk-averse individual would be willing to pay \$150 to avoid even this small risk. Thus, it is not implausible that a risk-averse actor might, depending on his wealth utility function, be indifferent between a certain loss of \$11 and a 5% chance of a \$200 loss. Imposing the risk on the actor in this case forces him to bear an extra dollar in cost. There is, however, no offsetting benefit when the actor anticipates a probable gain. See *id.* at 189-90.

be sought, lessening the likelihood that the doctrine will be resorted to at all. Second, as under the savvy inventor model, the inventor's choice comports with the optimal social result. If an inventor has elected to seek narrower protection, the total costs associated with this strategy will be less than under the alternative "broad claim" approach.

2. *Multilateral Models*

The useful arts are certainly promoted by maximizing the incentives of a particular individual to develop a particular invention. However, it is unlikely that the Framers of the Intellectual Property Clause would have been satisfied by just any scheme that results in some promotion of the useful arts. Rather, there is implied in the Clause a goal of maximizing, at least subject to other considerations, the overall progress of the useful arts. Thus the clause is utilitarian in purpose: Congress and the courts should choose the scope and nature of intellectual property rights so as to maximize aggregate advancement of the useful arts.¹⁸⁰

In the invention context, the utilitarian concern is that overprotecting the rights of those who come first in a particular field will discourage others from entering and advancing the state of the art in that field.¹⁸¹ This must be balanced against the concern that underprotecting inventors will discourage invention in the first place.¹⁸²

a. The Ignorant Inventors

When the first inventor is ignorant of the doctrine of equivalents, the analysis is as in the unilateral case. Because the inventor expects no more than what he literally claims, his decision to invest is uninfluenced

180. See generally JEREMY BENTHAM, *THE THEORY OF LEGISLATION* (C.K. Ogden ed. 1931) (1802). Bentham advocated that the state should allocate property rights in the manner that produced the greatest aggregate happiness. Unlike Locke and Hegel, Bentham focused on the present and the future, not the past. According to Bentham's formulation, in order to correct for any undesired distributional results of the chosen property rights allocation, the state also has the role of identifying those who have received "excessive" benefit, and reallocating a portion of that benefit to those who have fared less well.

181. See, e.g., *Graver Tank & Mfg. Co. v. Linde Air Prods. Co.*, 339 U.S. 605, 617 (1950) (Black, J., dissenting); *Texas Instruments, Inc. v. United States Int'l Trade Comm'n*, 805 F.2d 1558, 1572 (Fed. Cir. 1986).

182. As noted *supra*, see text accompanying notes 171, 178, an inventor's decision to invest in development may depend on his expected return, which in turn depends on the scope of the monopoly right in an invention. Thus, narrowing the monopoly right can make the entire venture unprofitable and eliminate the incentive to invent.

by the prospect that he might get more. In addition to the cost and complexity justifications discussed in the unilateral model, here there is a further affirmative justification for eliminating the doctrine of equivalents. The existence of the doctrine might chill the actions of a subsequent inventor who intends to concentrate his research and development efforts in the same or a similar area. Because the existence of the doctrine in no way advanced the useful arts in the case of the first inventor, the possibility that a second inventor might elect not to invent because of the existence of the doctrine is alone sufficient to justify eliminating the doctrine in this setting.¹⁸³

b. The Savvy Inventors in a Certain World

In a certain world, where both original and subsequent inventors are fully aware of the outcome of any future litigation, the analysis of the first inventor's incentives is also as described in the unilateral model: if the doctrine of equivalents is available, the first inventor selects the claim breadth that results in the lowest total cost. Under the multilateral model, social costs are then increased by any additional costs that the doctrine imposes on the subsequent inventor. However, because the world is certain, the subsequent inventor is confident that, should the matter be litigated, the court will extend the patentee's monopoly to the broad, hypothetical limit, and no farther.

The only invention discouraged by the doctrine, therefore, is that which would fall into the range between the literal claims and the broad, hypothetical claims. In terms of the useful arts, this effect is of no moment because, in theory, the patentee could have also claimed this range of material had he been willing to invest the extra time and money in the "ministerial" transactional effort of obtaining broader claims. In fact, as the subsequent inventor's efforts would not advance the state of the art, those efforts would be a social waste. Society would be better off if the subsequent inventor were induced instead to invest his research resources in a separate productive area. Under this permutation of the "perfect world" model, therefore, there is a second affirmative reason for courts to permit patentees to invoke the doctrine of equivalents to the fullest permissible extent.

183. Note, however, that if the subsequent inventor is also ignorant of the existence of the doctrine of equivalents, then it is impossible for that inventor's behavior to be chilled by the existence of the doctrine of equivalents.

c. *The Savvy Inventors in an Uncertain World*

As discussed above, when uncertainty is injected into the analysis, obtaining broader claims becomes more attractive to the first inventor. Similarly, the subsequent inventor factors into his decision whether to act the likelihood that the doctrine will be improperly applied. Because of uncertainty, the court might grant to the patentee a scope of protection either broader or narrower than the hypothetical limit. The possibility that the patentee will be denied the broadest possible monopoly of course inures to the subsequent inventor's benefit.¹⁸⁴

Additionally, a subsequent inventor would be uncertain as to whether his actions would be found to fall within the deemed range of equivalents. Presumably, the chance that the accused device will be erroneously found to be an infringing equivalent equals the chance that it will be erroneously found to be noninfringing. On the surface, it might appear that these two effects would cancel, and the second inventor would be indifferent to the existence of the doctrine of equivalents. While this would be the case for a perfectly risk-neutral individual, a risk-averse subsequent inventor would prefer to eliminate entirely the prospect of error.

To the extent of his risk-aversion, the subsequent inventor bears a cost that must be added to his development and acquisition costs when deciding if his anticipated return justifies his investment. From society's perspective, this additional cost must be added to the total transactional cost incurred by the first inventor who elects to rely on the doctrine of equivalents. Only if this total cost is exceeded by the costs to the original inventor of obtaining a broadly claimed patent is the doctrine socially desirable.¹⁸⁵

The determination of whether in general the excess cost to the subsequent inventor is greater than the cost savings to the first inventor presents an empirical question well beyond the scope of this Article. Nonetheless, in the abstract it is reasonable for two reasons to conclude that the costs to the subsequent inventor will generally be higher, and thus the doctrine should be eliminated. First, only original inventors who

184. Systematically, it would seem that the court would err in the subsequent inventor's favor in this manner. See *supra* section III.B.1.c.

185. If such is the case, then total social costs with the doctrine are less than total social costs without it. Because both the original and subsequent inventors bear these costs, the existence of the doctrine decreases the total transactional cost incurred by each inventor, therefore making development of the invention more attractive. More inventions "on the margin" are thus invested in if the doctrine of equivalents is an available alternative.

would otherwise have chosen to draft their claims narrowly bear the cost of eliminating the doctrine. As observed in the unilateral analysis, uncertainty and risk aversion are likely to make this alternative very unattractive for most original inventors in the first place. In many cases, therefore, denying the original inventor the option of relying on the doctrine costs society nothing.

If the doctrine is viable, however, the subsequent inventor in every instance bears the costs of uncertainty, regardless of whether the original inventor elects to claim narrowly in reliance on the doctrine, or as broadly as possible. This observation follows from the fact that when the original inventor becomes the plaintiff in an infringement action, he then has an incentive to exploit the probability that the court will err in his favor, even if he knows that the scope of the literal claims exactly equals the hypothetical limit claim. In view of this, the possibility that some original inventors might bear inefficiently large ex ante transactional costs if denied the opportunity in ex post litigation to rely on the doctrine of equivalents is almost certainly outweighed by the fact that every subsequent inventor incurs uncertainty costs due to a feared misapplication of the doctrine. The specter of the doctrine of equivalents is therefore likely to cause society as a whole to lose the benefit of the inventive efforts of those who choose to invest in the development of incremental advances over existing art.

CONCLUSION

As is characteristic of the approach, the relevance of the economic analysis hinges fundamentally on one's personal world view. If inventors are primarily lone individuals with a limited understanding of the minutia of the patent law, then there is little to recommend the doctrine of equivalents. However, while this model may have reflected reality a century ago, there is little doubt today that most invention takes place in a more structured research environment. Generally, this structure includes the assistance and advice of patent agents or attorneys who possess a much more sophisticated understanding of an inventor's rights and obligations.

The normative economic analysis of the desirable scope of the doctrine therefore shifts to an evaluation of courts' institutional ability to apply the principle. The greater the uncertainty that surrounds litigation involving the doctrine of equivalents, the less appealing the doctrine becomes.

Facially, in view of these concerns about uncertainty it should always be preferable to eliminate or cut back on the doctrine, which would in effect force the determination of permissible claim scope back into the expert body expressly created for that purpose, the PTO. However, it cannot be ignored that all litigated patent cases are appealable as of right to the Federal Circuit, the same body that reviews patentability determinations by the PTO. Moreover, because patent matters on appeal before the Federal Circuit are adversarial, the issues of prior art and claim scope may be more fully explored than in *ex parte* PTO proceedings. In light of this, litigants may be able to rely with some certainty on the courts' ability to apply the doctrine of equivalents in a consistent and predictable manner. If so, this militates in favor of a broad application of the doctrine of equivalents.

The problem facing courts today is the lack of a clearly articulated doctrinal formulation. The doctrine is neither broad nor nonexistent. Arguably, this is the worst of both worlds. The uncertainty surrounding the doctrine detrimentally affects both potential infringers and the potentially infringed. Fearing a sweeping application of the doctrine, would-be inventors may be dissuaded from investing in research and development out of fear that the products of their efforts might be labelled infringing equivalents. Conversely, the concern that the doctrine might be narrowly applied will encourage many patentees to overinvest in the patent application process, attempting to claim all possible permutations and combinations of their inventive idea. Uncertainty and imprecision also provide a powerful temptation to those embroiled in litigation to increase cost and complexity of an already expensive and intricate practice, all in the hope of influencing the final resting places of the falling ad hoc doctrine of equivalents chips. Certainly the alternative solutions to the doctrine of equivalents problem, namely limiting patent holders to recovering solely for literal infringement or according them the full limits of the hypothetical broadest claim, are far from being absolutely precise. They must, however, be superior to the current approach, in which both the literal and the hypothetical analyses are in every case performed before the doctrine of equivalents analysis is entered into in earnest.