

INFRINGEMENT, UNBOUND

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I. INTRODUCTION

Patents are intended to strike a delicate balance — to encourage innovation by rewarding past invention without unduly hindering future progress.¹ In order to achieve this balance, patent rights are bounded by limitations on subject matter, term, and scope. Like fence posts, scholars tell us, these limits serve as important signals — to both the patent owner (staking her claim) and to “neighbors” (who can create without infringing, using the fence posts as a guide).² But what happens if these carefully-drawn boundaries are later loosened by enforcement rules in unpredictable ways? At first glance, that appears to be what is happening in recent years. In response to sophisticated technology and a global cross-border marketplace, patent enforcement doctrines are changing. For example, courts and lawmakers sometimes relax application of the requirement that all elements of a claim must be met in the United States when the infringer is engaged in a cross-border act. And manufacturers and retailers may be held liable for the infringement of their customers as “indirect” infringers.

It is tempting, perhaps, to view these modern boundary-loosening enforcement rules as a risk to the delicate balance patent law seeks to maintain. This article argues, however, that the unbound infringement rules should be viewed not as a challenge to the balance but as a complement to it. Viewing the enforcement doctrines in this way — as a companion to the boundaries governing patent scope — reveals new insights on the would-be limiting principles that apply to unbound infringement. I argue that some of the patent infringement doctrines that allow for expanded liability beyond the normal bounds of patent en-

1. See ROBERT P. MERGES, PETER S. MENELL & MARK A. LEMLEY, *INTELLECTUAL PROPERTY IN THE NEW TECHNOLOGICAL AGE* 14 (5th ed. 2010); Louis Kaplow, *The Patent-Antitrust Intersection: A Reappraisal*, 97 HARV. L. REV. 1813, 1817, 1821–22 (1984); Michael J. Meurer, *Notice Failure and Notice Externalities*, 5 J. LEGAL ANALYSIS 1 (2013) (Before discussing their shortcomings, the article notes that “[p]roperty rights encourage investment in resource development by granting property owners rights to exclude and develop their resources, which can enhance owners’ ability to derive value from their investments.”).

2. Michael A. Carrier, *Cabining Intellectual Property Through a Property Paradigm*, 54 DUKE L.J. 1 (2004); see also Dan L. Burk & Mark A. Lemley, *Fence Posts or Sign Posts? Rethinking Patent Claim Construction?*, 157 U. PA. L. REV. 1743, 1747 (2009) (describing how the current method of “peripheral claiming purports to mark the outermost boundary of the patentee’s claims” before critiquing it).

forcement are overbroad while others are overly strict. The key to reform, however, is that — like our understanding of the fence posts around the scope of the patent itself — patent enforcement rules must be moored to the same fundamental purposes that motivate the delicate balance patent law seeks in the first place.

Patent law balances interests through the use of numerous boundaries — in time, subject matter, scope, and eventually, enforcement. A patent grants the right to exclude others from making, using, offering for sale, selling, or importing a patented invention during the patent term. By excluding others from the market, patent owners can charge higher prices, motivating inventors to create and investors to invest in new technologies.³ This system also provides benefits to society by adding to the storehouse of knowledge, encouraging sales of new inventions, spurring others to innovate in order to compete, and, when the patent term ends, making the technology available to all.⁴ However, patents come with some costs too, such as reduced access due to higher consumer prices and higher costs for future innovators who must license the patented technology or research its limits and employ other technologies to avoid using it.⁵

The boundaries of patent rights are designed to balance these conflicting goals. Scholars have likened patent claims to fence posts, showing the boundaries of the intellectual “property” to which an inventor stakes a claim and which others must avoid.⁶ Boundaries that constrain the reach of patent rights — temporally, by subject matter, and by

3. 3 ABRAHAM LINCOLN, *Second Lecture on Discoveries and Inventions*, in THE COLLECTED WORKS OF ABRAHAM LINCOLN 356, 363 (Roy P. Basler et al. eds., History Book Club ed. 1953) (explaining that patents are intended to add “the fuel of interest to the fire of genius” by granting inventors exclusive rights in their inventions).

4. See Dan L. Burk & Mark A. Lemley, *Policy Levers in Patent Law*, 89 VA. L. REV. 1575, 1580 (2003) (“[T]he purpose of the patent system is to promote innovation by granting exclusive rights to encourage invention.”); Jeanne C. Fromer, *Patent Disclosure*, 94 IOWA L. REV. 539, 541 (2009) (patent disclosures “reveal[] the invention’s design so that others can use it fruitfully when the patent term expires and design around, improve upon, or be inspired by the invention, even during the patent term.”); Sarah R. Wasserman Rajec, *Tailoring Remedies to Spur Innovation*, 61 AM. U. L. REV. 733, 773 (2012) (“Patent suits may determine rights of private parties, but they also routinely set the scope, validity, and enforceability of patents — all of which are secured against the public.”)

5. Michael Abramowicz & John F. Duffy, *The Inducement Standard of Patentability*, 120 YALE L.J. 1590, 1594 (2011).

6. See *Markman v. Westview Instruments, Inc.*, 517 U.S. 370, 390 (1996); *Warner-Jenkinson Co. v. Hilton Davis Chem. Co.*, 520 U.S. 17, 27 n.4 (1997). There is a rich literature on the boundary-like nature of claims in patent law. See, e.g., Christopher A. Cotropia, “*After-Arising*” *Technologies and Tailoring Patent Scope*, 61 N.Y.U. ANN. SURV. AM. L. 151, 165 (2005); Mark A. Lemley, *The Changing Meaning of Patent Claim Terms*, 104 MICH. L. REV. 101, 116 (2005); Kevin Emerson Collins, *The Reach of Literal Claim Scope into After-Arising Technology: On Thing Construction and the Meaning of Meaning*, 41 CONN. L. REV. 493, 495 (2008) (suggesting that claim scope can be interpreted literally and also encompass technology arising after a patent’s filing date).

scope — are understood as a means of balancing the costs and benefits associated with patents. Doctrines that limit patent rights to the invention — as disclosed in the patent itself — ensure that third parties have notice of what the patent prohibits and what it allows.⁷ This is particularly important in patent law, where the public interest favors third parties engaging with all technology *not* prohibited by the patent and where uncertainty in those boundaries may chill desirable innovative activities.⁸

All of these boundaries on the scope of patent rights are subject to loosening in some circumstances, generally when it appears that a strict interpretation of the boundaries would undermine the purpose of the patent grant.⁹ So, for example, the term of a patent may be extended by law if the patent holder was subject to regulatory delays.¹⁰ The reasoning behind this loosening of the patent term boundary is that agency delays unfairly limit a patent holder's exclusive rights to the U.S. market and diminish the reward to which she is entitled. However, the potential extension is limited to a maximum of five years.¹¹ This represents the importance of the other side of the patent balance — the value of having ideas enter the public domain and the cost to consumers and other innovators of tying up technology. Importantly, all of the boundary-loosening doctrines have limits that reflect the importance of notice and the value of a robust public domain.¹²

Like the bounded scope of patent protection, infringement liability is constrained by boundaries that further these same patent law purposes of encouraging invention without chilling third-party behavior. Infringement determinations naturally focus on the acts or products of an accused infringer more than the boundaries of the patent; however, these are two sides of the same coin because the patent boundaries determine

7. Clarisa Long, *Information Costs in Patent and Copyright*, 90 VA. L. REV. 465, 476 (2004).

8. For a discussion on how boundaries in other fields of tort law, such as products liability, may similarly chill desirable activity. *See, e.g.*, Dmitry Karshedt, *Causal Responsibility and Patent Infringement*, 70 VAND. L. REV. 565, 620 (2017) (discussing the argument that “expansive approaches to liability might damage the innovation infrastructure.”). The difference is that products liability law draws the line at behavior that would interfere with consumers' safety interests, whereas patent law infringement boundaries determine whether a patent holder can stop someone else from an activity that would interfere with the patent holder's economic interests. Products liability therefore represents an innovation-safety trade-off between the producer of the goods and consumers, while patent law balances economic interests of patent holders and other innovators with the interests of consumers in innovation (but not, through patent law, safety).

9. *See infra* Part II.B.1.

10. This provision is meant to compensate for the long process of regulatory review. *See* 35 U.S.C. § 156 (2018), 21 C.F.R. § 60 (2018).

11. 35 U.S.C. § 156(g)(6).

12. *See infra* Part II.B.1.

what competing product features constitute infringement.¹³ The basic inquiry in an infringement determination requires analysis of whether every element of a patent claim is present in the accused product or every step of an accused process has been performed.¹⁴ There are other, subsidiary requirements, however. Thus, all steps in an accused process must be performed by or attributable to a *single entity*. And, those steps must all be carried out within the United States. These requirements are also examples of bounding patents. However, they are enforcement boundaries rather than rights boundaries. These requirements, like rights boundaries, serve the purpose of giving notice to third parties, constraining patent enforcement so that it does not reach acts that fall in the public domain or outside the scope of United States patent rights and ultimately limiting the scope of the exclusive right that has been granted.

Just as patent scope boundaries may be loosened, lawmakers and courts occasionally seek to loosen enforcement boundaries when strict applications lead to underenforcement¹⁵ for patent holders. For example, boundaries on patent claim scope are subject to loosening in enforcement proceedings through the doctrine of equivalents.¹⁶ This doctrine allows a patent holder to apply her exclusive right to things not explicitly claimed in the patent when the differences are insubstantial and would have been appreciated by one skilled in the art.¹⁷ The doctrine is a holdover from when patents were written differently and has been criticized because of the notice costs and uncertainty it imposes on third parties.¹⁸

13. Roger Allan Ford, *Patent Invalidity Versus Noninfringement*, 99 CORNELL L. REV. 71, 81–82 (2013); Mark A. Lemley & Mark P. McKenna, *Scope*, 57 WM. & MARY L. REV. 2197, 2203 (2016) (“Patent courts hold a pretrial Markman hearing to determine what the patent does and does not cover; they use that determination to inform both validity and infringement.”).

14. *Larami Corp. v. Amron*, No. CIV. A. 91-6145, 1993 WL 69581, at *3 (E.D. Pa. Mar. 11, 1993) (“because every element of a claim is essential and material to that claim, a patent owner must, to meet the burden of establishing infringement, show the presence of every element or its substantial equivalent in the accused device.”) (internal quotation omitted); see also ROBERT PATRICK MERGES & JOHN FITZGERALD DUFFY, *PATENT LAW AND POLICY: CASES AND MATERIALS* 798 (6th ed. 2013).

15. Part of the difficulty of the boundary-loosening rules and their limiting principles is defining “under” enforcement. It could refer to offering less market exclusivity than what is necessary to induce invention — probably the definition that hews closest to a utilitarian view of patents. However, cases often refer to fairness to patent holders, rooted in their expectations or to intent by potential infringers, both of which are problematic, as discussed in Part IV, *infra*.

16. See, e.g., *Graver Tank & Mfg. Co. v. Linde Air Products Co.*, 339 U.S. 605 (1950) (setting out the contours of the doctrine of equivalents); *Warner-Jenkinson Co. v. Hilton Davis Chem. Co.*, 520 U.S. 17, 21 (1997) (holding that the doctrine of equivalents remained good law following the passage of the 1952 Patent Act).

17. Michael J. Meurer & Craig Allen Nard, *Invention, Refinement and Patent Claim Scope: A New Perspective on the Doctrine of Equivalents*, 93 GEO. L.J. 1947, 1978–79 (2005).

18. Jeanne C. Fromer, *Claiming Intellectual Property*, 76 U. CHI. L. REV. 719, 736 (2009) (explaining how the doctrine of equivalents is traceable to the practice of “central claiming,” in which patent applicants claimed embodiments of their inventions, as opposed to the current, “peripheral claiming” practice, in which claims denote the boundaries of what a patent holder claims to have invented).

Laws and doctrines that allow for indirect infringement liability and liability for cross-border acts are other examples of patent enforcement boundary loosening — and they are becoming more common.¹⁹ In indirect infringement cases, a defendant may not have performed all the claimed steps of a patent but may have induced its customers to do so or otherwise contributed to customers' later, direct infringement.²⁰ In these cases, the defendant did not combine all the claim elements or perform every step, and courts must decide whether enforcement boundaries can be stretched to encompass the acts of customers and attribute liability to manufacturers and sellers. Cross-border patent infringement cases must address whether acts that occur abroad can be “counted” for purposes of finding infringement of a U.S. patent, essentially loosening the geographical borders that normally constrain enforcement of U.S. patent rights.²¹ In addition, provisions of the Patent Act allow for infringement liability when substantial components of a good are manufactured within the United States and exported for assembly.²² The importation of goods manufactured through patented processes abroad is also labeled as infringement.²³

These provisions that loosen patent enforcement boundaries have become more important in the past twenty years, and a number of difficult patent enforcement questions have caught the attention of the Supreme Court and the Court of Appeals for the Federal Circuit (“Federal Circuit”).²⁴ The Court’s growing interest in these cases reflects the increasingly international production of goods²⁵ and has also coincided

19. See *infra* Part III for discussion of 35 U.S.C. § 271(b), (c), (f), and (g).

20. See *Commil USA, LLC v. Cisco Sys., Inc.*, 135 S. Ct. 1920 (2015) (holding that a good faith belief in invalidity does not negate the intent requirement in a claim for induced infringement); see also *Limelight Networks, Inc. v. Akamai Techs., Inc.*, 134 S. Ct. 2111 (2014) (holding that liability for induced infringement requires an act of direct infringement); Ford, *supra* note 13, at 78; Greg Reilly, *Decoupling Patent Law*, 97 B.U. L. REV. 551, 559–61 (2017).

21. See, e.g., *Life Techs. v. Promega*, 137 S. Ct. 734 (2017) (interpreting § 271(f)); *Suprema, Inc. v. ITC*, 796 F.3d 1338, 1341 (Fed. Cir. 2015) (en banc) (holding it proper to exclude imports of goods that, after importation, were combined with software and sold so as to induce infringement of method patents); *NTP, Inc. v. Research in Motion, Ltd.*, 418 F.3d 1282, 1317 (Fed. Cir. 2005) (finding that product patents are infringed where they are put into use, but there is no direct infringement of a method patent if any of the steps are performed outside of the United States).

22. 35 U.S.C. § 271(f) (2018).

23. *Id.* § 271(g).

24. The Court of Appeals for the Federal Circuit has jurisdiction over appeals in cases involving patents, including cases brought at the International Trade Commission under 19 U.S.C. § 1337.

25. See, e.g., *WesternGeco LLC v. ION Geophysical Corp.*, 138 S. Ct. 2129 (2018) (holding that United States patent holder can recover lost profits for foreign service contracts when infringement action is based on export of components for later assembly into patented device); *Life Techs.*, 137 S. Ct. at 737 (describing the case as “concern[ing] the intersection of international supply chains and federal patent law”); *Microsoft Corp. v. AT&T Corp.*, 550 U.S. 437, 457 (2007) (concerning Microsoft’s export of computer software on a master disc that is then

with the rise of digital technology and its difficult-to-detect distribution facilitated by the internet.²⁶ These changes to the manufacture and distribution of goods have in turn changed the structure of businesses in tangible and intangible products, with the advent of 3D printing raising the possibility of decentralizing the production and distribution of tangible goods even further.²⁷ As a result, the production and distribution of patented goods is a global and cross-border enterprise, making it complicated to apply territorial boundaries to patent rights. Similarly, digital goods and processes have many steps that may be spread among entities. Processes may include steps taken by distributors and users, or used by customers in conjunction with end-users, such as a doctor prescribing steps for a patient to take.²⁸ These situations raise the possibility that a patent holder will be unable to enforce her exclusionary rights in a way that meaningfully preserves the market position meant to accompany a patent grant.²⁹ Thus, the innovation-encouraging purposes of patent law justify some loosening of patent enforcement boundaries.

Like doctrines that loosen patent scope boundaries, patent enforcement boundary-loosening doctrines are also subject to limitations. For example, indirect infringement doctrines include a knowledge requirement.³⁰ Contributory infringement is also strictly interpreted so that it only applies to components of machines that represent “a material part of the invention” and cannot apply to “a staple article or commodity of commerce suitable for substantial noninfringing use.”³¹ And indirect infringement claims that rely on underlying direct infringement of method claims have been very much limited by courts’ single entity require-

copied and installed abroad); *Suprema*, 796 F.3d at 1341 (concerning fingerprint scanners manufactured abroad and imported to the United States); *NTP*, 418 F.3d at 1317 (presenting question of whether the location of one component abroad defeated infringement claims of a United States patent for method and system when accused infringing device contained components that were located in both the United States and Canada).

26. See, e.g., *Commil USA, LLC v. Cisco Sys., Inc.*, 135 S. Ct. 1920, 1922 (2015) (examining “patent for a method of implementing short-range wireless networks”); *Limelight Networks, Inc. v. Akamai Techs., Inc.*, 134 S. Ct. 2111, 2113 (2014) (examining patent for “a method of delivering electronic data using a content delivery network”).

27. Mark A. Lemley, *IP in A World Without Scarcity*, 90 N.Y.U. L. REV. 460, 461 (2015) (“[N]ew technologies promise to do for a variety of physical goods and even services what the Internet has already done for information.”).

28. See *Eli Lilly & Co. v. Teva Parenteral Meds., Inc.*, 845 F.3d 1357, 1367–68 (Fed. Cir. 2017).

29. W. Keith Robinson, *Economic Theory, Divided Infringement, and Enforcing Interactive Patents*, 67 FLA. L. REV. 1961 (2015) (explaining the difficulties of enforcing patents and arguing for the type of boundary loosening explored in this article).

30. *Aro Mfg. Co. v. Convertible Top Replacement Co.*, 377 U.S. 476, 488 (1964) (“[Section] 271(c) does require a showing that the alleged contributory infringer knew that the combination for which his component was especially designed was both patented and infringing.”).

31. 35 U.S.C. § 271(c) (2018).

ments for direct infringement.³² In some instances, courts adjudicating cross-border cases have applied the same strict interpretations as domestic indirect infringement cases,³³ while generally falling back on a strict territoriality requirement as the main limiting principle.³⁴

These limiting doctrines indirectly address the notice and preemption problems with opening the boundaries of infringement liability. However, their success has been inconsistent. The comparison of patent enforcement boundaries to the boundaries governing patent scope suggests two questions to be asked in evaluating the laws and doctrines that loosen those boundaries and the limiting principles accompanying such unbounding. The first is whether the boundary loosening is for legitimate purposes. That is, whether it is in response to a patent holder's inability to capture the (United States) market exclusivity through strict interpretations of the patent grant. The second is whether the principles limiting the unbounding apply in ways that increase notice and certainty for third parties while carefully guarding the public domain. In other words, when boundaries are loosened, is it for the right reasons and is it done in ways that are consistent with the patent balance?

Applying this framework to the set of doctrines that result in infringement liability outside the bounds of patents yields different insights for the different doctrines. For example, while contributory infringement seems most clearly to contradict the all-elements rule of patent infringement, its application has been strictly interpreted in ways that appear to target the third parties most likely to have notice of the patent.³⁵ In addition, the limiting principles that exclude liability if the components sold have substantial noninfringing uses seek to shield third-party acts that are desirable, such as using technology within the public domain. However, application of the intent requirement is harder to defend under patent law principles. The purpose of the requirement appears to be increasing notice to third parties by only finding liability when an accused infringer knows of a patent and of infringement. Yet, by allowing liability for an accused indirect infringer who has a good faith but incorrect belief in invalidity, the doctrine once again chills behaviors consistent with patent law's interests in a robust public domain.³⁶

32. *See, e.g.,* *Limelight Networks, Inc. v. Akamai Techs., Inc.*, 134 S. Ct. 2111, 2111 (2014).

33. *Life Techs. v. Promega*, 137 S. Ct. 734, 737 (2017) (holding that one component cannot be "a substantial portion of the components" of a patented combination under § 271(f)(1)).

34. *Microsoft Corp. v. AT&T Corp.*, 550 U.S. 437, 441–42 (2007) (recognizing the presumption against the extraterritorial application of U.S. patent laws in deciding not to give § 271(f) an expansive interpretation). Territoriality as a principle serves a number of purposes, such as sovereignty, comity, and enforceability.

35. *See infra* Part IV.B.

36. *See id.*

Cross-border laws and doctrines that loosen enforcement boundaries also differ in how well they align with patent law purposes. Laws imposing liability for the export of components for later assembly fail on the first question. Because a United States patent promises exclusivity only in the United States, acts of assembly abroad should not be brought within the bounds of United States patent infringement. Patents are territorial, and so the rewards inherent in a United States patent contemplate rewards in U.S. markets. Although the Court has generally constrained application of infringement under § 271(f),³⁷ the law itself remains problematic. The refusal to reach other extraterritorial actions that do affect a patent holder's U.S. market interests are also of concern. The Federal Circuit has interpreted § 271(a) to require that all the steps of a method claim must be performed within the United States to find liability.³⁸ This can result in noninfringement rulings when a single step of a claimed process is performed outside of the country, even when there is harm to a United States patent holder's commercial interests in the United States. These examples suggest that some of the patent infringement doctrines that allow for expanded liability beyond the normal bounds of patent enforcement are overbroad while other doctrines are overly strict.

The Article proceeds as follows. Part II discusses the boundaries that constrain the patent grant and its enforcement and the purposes served by those boundaries. Part III explains the legal rules that allow for loosening patent boundaries, including infringement liability for acts outside the bounds of the patent. Part IV identifies and critiques the limiting principles that constrain application of these rules in cases of unbound infringement and explores doctrinal and statutory changes that would bring infringement doctrines into line with their underlying principles. Part V concludes.

II. PATENTS AND THEIR BOUNDARIES

Patent rights embody a balance between society's interest in rewarding inventors and in preserving freedom for future innovators to operate. This balance is evident in the boundaries placed on the scope of the right and the boundaries that constrain enforcement. This section starts with a discussion of the balance patent law strikes, followed by examples of how scope and enforcement boundaries — and their occasional loosening — serve to support this balance.

37. *See infra* Part III.B.2.a.

38. *NTP, Inc. v. Research In Motion, Ltd.*, 418 F.3d 1282, 1290 (Fed. Cir. 2005) (finding method claims not infringed because the relay that performed one of the claimed steps was located in Canada).

A. The Patent Balance

Patents represent a quid pro quo: in exchange for the invention and its disclosure to the public, a patent holder will be able to collect a premium from consumers and other innovators during the term of the patent, commensurate with the value of her contribution. Patents are exclusive rights in information, which is non-rivalrous.³⁹ Their grant imposes artificial scarcity and results in a deadweight loss to society by increasing consumer costs and decreasing access.⁴⁰ Moreover, if granted to obvious improvements on the prior art, the patent holder receives the exclusivity of a patent right without giving society much in return. In this vein, Thomas Jefferson famously explained that patents should be granted only for “the things which are worth to the public the embarrassment of an exclusive patent.”⁴¹ The deadweight social loss is offset because it is granted in exchange for something — an invention and information about it — that theoretically would not otherwise exist.⁴² In order to effect this balance between encouraging innovation without stifling access or future progress, patent rights are bounded in numerous ways. For example, a disclosed invention must be new, useful, and nonobvious in order to merit a patent.⁴³ In addition to constraining patent scope, boundary rules also serve the purposes of giving notice and certainty to consumers and other innovators. Disclosure requirements ensure that the patent will teach other artisans how to use the invention and provide notice of the scope of the patent right.⁴⁴

The justifications for the modern patent grant have the dual purposes of encouragement of invention and disclosure.⁴⁵ Patent law encourages

39. See Mark A. Lemley, *Property, Intellectual Property, and Free Riding*, 83 TEX. L. REV. 1031, 1050–51 (2005) (“Information is what economists call a pure ‘public good,’ which means both that its consumption is nonrivalrous — my use of an idea does not impose any direct cost on you — and that it is not something from which others can easily be excluded.”).

40. See, e.g., Steven Shavell & Tanguy van Ypersele, *Rewards Versus Intellectual Property Rights*, 44 J.L. & ECON. 525, 529 (2001) (“there is a deadweight loss in social welfare because too little is sold at the monopoly price”); Amy Kapczynski, *The Cost of Price: Why and How to Get Beyond Intellectual Property Internalism*, 59 UCLA L. REV. 970, 974 (2012).

41. Letter from Thomas Jefferson to Isaac McPherson (Aug. 13, 1813), in 13 THE WRITINGS OF THOMAS JEFFERSON 326, 333–35 (Andrew A. Lipscomb et al. eds., 1905).

42. See Abramowicz & Duffy, *supra* note 5, at 1594.

43. 35 U.S.C. §§ 101, 103 (2018).

44. *Festo Corp. v. Shoketsu Kinzoku Kogyo Kabushiki Co.*, 535 U.S. 722, 730–31 (2002) (“A patent holder should know what he owns, and the public should know what he does not.”).

45. While current accounts of patent law seem to take it as a given that patents are available only to inventors and the rights are limited to their inventions, encouragement of invention has not always been the core purpose of patents. The legal progenitors of United States patents — early patent grants in England — rewarded those who were willing to bring technological information from abroad and train apprentices, thereby building up domestic industry in those technologies and increasing consumer access to new goods. Patents therefore were not only a means of identifying and encouraging inventors, necessarily. CHRISTINE MACLEOD, *INVENTING THE INDUSTRIAL REVOLUTION, THE ENGLISH PATENT SYSTEM, 1660–1880*, at 10 (1988) (Let-

invention by allowing inventors exclusive market rights that are alienable and thereby allow them to attract investment. Patents provide these investment incentives, tailored to the worth of the contribution, by allowing patent holders to reap rewards proportional to the value of their inventions for the term of the patent.⁴⁶ This is particularly efficient in an area of law governing innovation, where *ex ante* government valuation — or any type of prediction — is especially difficult.⁴⁷ Through exclusive rights, a patent holder is able to stop others from making, using, selling, offering for sale, or importing goods that embody the claims of the patent without authorization.⁴⁸ As a result, a United States patent secures market exclusivity to a patent holder who has the opportunity to make, sell at a supracompetitive price, license, or choose not to pursue the invention further.⁴⁹ This is the core of the patent grant. The assumption is that valuable inventions that otherwise might not exist will become available to the public through the grant of patents — at a premium during the term of the patent and then through normal competitive processes following its expiration.

The need to limit patents to the scope of the invention also fulfill the teaching — or disclosure — purposes of patent law and through strict enforcement, notice interests as well. In addition to benefiting from the availability of new inventions, patent law is seen as a means of encouraging disclosure of new technologies that might otherwise be kept as

ters patent were granted “by the English crown to named foreign craftsmen, mainly weavers, saltmakers and glassmakers, with the intention of encouraging them to settle in England and transmit their skills to native apprentices.”); *see also* STEPHEN VAN DULKEN, BRITISH PATENTS OF INVENTION 1617–1977, A GUIDE FOR RESEARCHERS 2 (1999) (“The patent system in England gradually evolved out of the royal prerogative used to encourage new trades, especially from abroad.”). For a discussion of the tandem evolution of patent and trade theory from mercantilism to free trade ideals, see Sarah R. Wasserman Rajec, *Free Trade in Patented Goods: International Exhaustion for Patents*, 29 BERKELEY TECH. L.J. 317, 333–41 (2014). The second half of the eighteenth century saw a greater focus on inventiveness as the justification for patent grants. MACLEOD, INVENTING THE INDUSTRIAL REVOLUTION at 7 (“The connection between inventing and patenting is historically tentative; it only started to be firmly established in the second half of the eighteenth century.”). The modern limiting doctrines for patent rights find their basis in the American focus on invention and innovation on the one hand, and a general distrust of market monopolization, on the other, reflected in Jefferson’s statement about the “embarrassment” to the government of patent grants.

46. Harold Demsetz, *Information and Efficiency: Another Viewpoint*, 12 J.L. & ECON. 1, 11–14 (1969).

47. Critiques include the difficulty of picking winners and losers in addition to the potential for abuse.

48. 35 U.S.C. § 271(a).

49. *Cont’l Paper Bag Co. v. E. Paper Bag Co.*, 210 U.S. 405, 429 (1908) (there is no requirement for a market competitor to make use of — or “work” — a patent in order to pursue injunctive relief against an infringer). The *Continental Paper Bag* Court noted that there was a brief period in which the United States had a working requirement for foreign patent holders, calling for forfeiture of a patent when it was not introduced into public use within the United States. *Id.*

trade secrets.⁵⁰ For example, § 112 of the Patent Act requires patents to provide a written description that enables a person skilled in the art to make and use the invention.⁵¹ Narrow patent boundaries limit a patent holder to that which she invented, while clear boundaries provide certainty to future innovators and competitors about what they are free to do. From this view, patents operate best when their boundaries are clear to third parties and infringement is avoidable with a minimum amount of information-seeking.⁵²

Doctrines that govern the boundaries of both patent grants and patent enforcement must balance patent holder interests with third-party notice interests. This is because rights and their enforcement cannot be entirely separated.⁵³ Patent litigation includes steps to determine validity and construe claims separate from the process of infringement determinations.⁵⁴ These seemingly separate decisions are intertwined and aim to achieve the same, rights-bounding purposes.

B. Patent Boundaries: Patent Grants, Scope Determinations, and Enforcement

The balance of the patent system is maintained by limiting principles that apply to (1) interpreting the validity and scope of rights granted by the U.S. Patent and Trademark Office (“USPTO”) and (2) determining infringement.⁵⁵ There are limits on what subject matter is amenable to patenting,⁵⁶ the scope of claims,⁵⁷ and the term of a patent.⁵⁸ In litigation,

50. For a discussion and critique of the role disclosure plays in patent applications, see Sean B. Seymore, *The Teaching Function of Patents*, 85 NOTRE DAME L. REV. 621 (2010) and Fromer, *supra* note 4, at 541.

51. 35 U.S.C. § 112.

52. Clarisa Long, *Information Costs in Patent and Copyright*, 90 VA. L. REV. 465 (2004); Thomas W. Merrill & Henry E. Smith, *Optimal Standardization in the Law of Property: The Numerus Clausus Principle*, 110 YALE L.J. 1, 8 (2000) (“When property rights are created, third parties must expend time and resources to determine the attributes of these rights, both to avoid violating them and to acquire them from present holders.”).

53. For a discussion of the connection between rights and remedies, see Hanoch Dagan, *Remedies, Rights, and Properties*, 4 J. TORT L. 1, 3 (2011). The particular remedies associated with patent infringement are beyond the scope of this paper.

54. See Reilly, *supra* note 20, at 559–61 (describing differences between patent acquisition and enforcement proceedings).

55. In discussing the determinations of validity and scope of rights granted, this article includes prosecution at the USPTO, pre- and post-grant, and court proceedings in an infringement determination that determine the scope of patent claims. Infringement determinations are then addressed separately. This differs somewhat from Reilly’s approach, *supra* note 20, which looks at both on forum and the timing of procedures to distinguish different patent decisions.

56. Subject matter boundaries leave unpatentable broad claims to scientific principles that would preempt others from continued research. There has been a strong and renewed interest by the Supreme Court in cases addressing patentable subject matter in recent years. See, e.g., *Alice Corp. v. CLS Bank Int’l*, 134 S. Ct. 2347, 2354 (2014); *Ass’n for Molecular Pathology v. Myriad Genetics, Inc.*, 569 U.S. 576, 589 (2013); *Mayo Collaborative Servs. v. Prometheus*

these limits are revisited through courts' determinations of validity and claim scope as well as through infringement determinations. The first stage of bounding patent rights has been heavily theorized in terms of how it serves the purposes of patent law.⁵⁹

Limits drawn through infringement law and doctrine have recently begun to receive greater attention from courts and scholars, as has the connection between determinations about the scope of rights and infringement.⁶⁰ The greater weight given to these initial determinations is not surprising, given that determinations of patent scope (through claim interpretation) are often determinative of infringement outcomes in litigation.⁶¹ However, increasing global production and trade of technological goods has resulted in expansive infringement claims by rights holders and posed difficulties for courts enforcing the boundaries of infringement determinations.⁶² Infringement determinations and their limits play an increasing role in crafting and enforcing the boundaries of patent exclusivity.

This Part describes in more detail the substantive limits that are placed on the patent grant and on enforcement before showing that pa-

Labs., Inc., 566 U.S. 66, 70 (2012). Many academics have weighed in on this complicated topic as well. *See, e.g.*, John M. Golden, *Patentable Subject Matter and Institutional Choice*, 89 TEX. L. REV. 1041, 1061 (2011) (discussing the “coarse-grained and categorical” rules of subject matter eligibility and the institutions charged with implementing those rules); Katherine J. Strandburg, *Much Ado About Preemption*, 50 HOUS. L. REV. 563, 587 (2012) (critiquing preemption as a sole explanatory factor for subject matter eligibility); Rochelle C. Dreyfuss & James P. Evans, *From Bilski Back to Benson: Preemption, Inventing Around, and the Case of Genetic Diagnostics*, 63 STAN. L. REV. 1349, 1355–57 (2011) (critiquing the courts for a lack of guidance on subject matter eligibility); Mark A. Lemley et al., *Life After Bilski*, 63 STAN. L. REV. 1315, 1329 (2011) (patentable subject matter exclusions are “about encouraging cumulative innovation”); Joshua D. Sarnoff, *Patent-Eligible Inventions After Bilski: History and Theory*, 63 HASTINGS L.J. 53, 91–94 (2011).

57. *Festo Corp. v. Shoketsu Kinzoku Kogyo Kabushiki Co.*, 535 U.S. 722, 730–31 (2002) (“A patent holder should know what he owns, and the public should know what he does not.”).

58. *See, e.g.*, Benjamin N. Roin, *The Case for Tailoring Patent Awards Based on Time-to-Market*, 61 UCLA L. REV. 672, 703 (2014) (discussing the fixed twenty-year term of patents and critiquing it for over-rewarding in some industries and under-rewarding in others) and Michael Abramowicz, *The Danger of Underdeveloped Patent Prospects*, 92 CORNELL L. REV. 1065 (2007) (arguing that the patent term is sometimes too short, and suggesting a system in which patent term extensions would be auctioned).

59. *See supra* Part II.A.

60. Lemley & McKenna, *supra* note 13, at 2197 (arguing the need for courts to assess the scope of intellectual property rights in a way that integrates conditions on the breadth of the rights granted and the scope of their enforcement).

61. Claim scope determinations occur earlier during the course of trial, which helps explain the greater focus of courts and scholars on these boundaries.

62. Patent suits that contain a cross-border element have found their way to the Supreme Court with increasing frequency. *See, e.g.*, *WesternGeco LLC v. ION Geophysical Corp.*, 138 S. Ct. 2129 (2018); *Life Techs. v. Promega*, 137 S. Ct. 734 (2017); *Impression Prods., Inc. v. Lexmark Int'l, Inc.*, 137 S. Ct. 546 (2016); *Microsoft Corp. v. AT&T Corp.*, 550 U.S. 437 (2007).

tent law in fact allows these boundaries to be loosened in certain circumstances.

1. Staking Claim to Inventions — How Boundaries Constrain the Patent Grant and Scope Determinations

Patent boundaries that constrain scope include limits on patentable subject matter, claim scope, and the length of patent protection. The law and doctrine surrounding these boundaries serve the purposes of granting the patent holder market control while limiting that control based on the actual contribution of the invention. They also serve the purpose of giving clear notice to third parties so as not to stifle research and activities that do not fall within the bounds of the patent grant. Each of these boundaries is loosened, on occasion. However, the loosening doctrines themselves contain constraints. Thus, while the length and scope of a patent may be extended to ensure the patent holder receives her due, those extensions are carefully constrained to account for notice concerns and the interests of the public and third parties in accessing that to which a patent holder has no claim.

The process of claim construction — when a court determines the meaning of patent claim terms — demonstrates the limiting and notice-giving purposes of patent law boundaries.⁶³ The Federal Circuit has explained that patent claims “are of primary importance, in the effort to ascertain precisely what it is that is patented.”⁶⁴ The court discussed fairness to the public by explaining that it would be “unjust to the public” to construe claims “in a manner different from the plain import of its terms.”⁶⁵ The meaning of claims are determined through objective interpretation of terms as they would be understood at the time of invention by a person of ordinary skill in the art.⁶⁶ Part of the justification for courts’ reliance on the patent document (and disfavor of external sources) as its own best interpretive tool is the public notice function of patents.⁶⁷

However, there is some flexibility — or boundary-loosening — when it comes to claim construction. Importantly, the boundary-loosening doctrine of equivalents relates both to claim scope and to infringement — demonstrating the close connection between the various

63. Sometimes these two boundary determinations meet, and claim construction becomes central to a patent eligibility determination. *See, e.g., Berkheimer v. HP Inc.*, 881 F.3d 1360, 1369–70 (Fed. Cir. 2018).

64. *Phillips v. AWH Corp.*, 415 F.3d 1303, 1312 (Fed. Cir. 2005) (quoting *Merrill v. Yeomans*, 94 U.S. 568, 570 (1876)).

65. *Id.* at 1312 (quoting *White v. Dunbar*, 119 U.S. 47, 52 (1886)).

66. *Id.* at 1313.

67. *Id.* at 1319.

types of patent right limitations. Boundaries are loosened when it appears that a strict interpretation of patent terms would unfairly exclude from protection goods that embody the meaning of the invention even though they might not meet the literal terms of the patent claims. The judge-made doctrine of equivalents allows a patent holder to expand the reach of her claims to cover the equivalents of her invention when a strict interpretation would allow for circumvention of the patent by insubstantial changes to a product. In applying the doctrine to hold that a claim for a railroad car with a circular cross section could be found to cover a railroad car with an octagonal cross section, the Supreme Court explained that “[t]he 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.”⁶⁸ In so holding, the Court did explain that the accused device had to “substantially [] embody the patentee’s mode of operation, and thereby attain the same kind of result” as the invention.⁶⁹

Courts have limited their application of the doctrine of equivalents in two ways, both of which demonstrate concerns about constraining third-party activity. *First*, the doctrine has been sparingly applied because of concerns about a lack of notice to third parties.⁷⁰ *Second*, the Court has rejected arguments that evidence of copying was relevant to a determination of infringement under the doctrine of equivalents.⁷¹ Both are discussed further in relation to infringement.⁷²

One of the seemingly-clearest of patent boundaries is the temporal limitation. Patents are granted for a term beginning when the patent is issued and ending twenty years from the effective date the application was filed.⁷³ The purpose of this boundary is to ensure that third parties are able to access and build upon the insight of the invention in the future, while giving the inventor sufficient time to recoup her investment and profit from her invention.⁷⁴ There can be no infringement before a

68. *Winans v. Denmead*, 56 U.S. 330, 343 (1853).

69. *Id.* at 344.

70. *Warner-Jenkinson Co. v. Hilton Davis Chem. Co.*, 520 U.S. 17, 28–29 (1997) (constraining the application of the doctrine of equivalents and noting that “[w]e do, however, share the concern of the dissenters below that the doctrine of equivalents, as it has come to be applied since *Graver Tank*, has taken on a life of its own, unbounded by the patent claims.”)

71. *Id.* at 36 (“[O]ne wonders how ever to distinguish between the intentional copyist making minor changes to lower the risk of legal action and the incremental innovator designing around the claims, yet seeking to capture as much as is permissible of the patented advance.”).

72. *See infra* Part III.B.

73. 35 U.S.C. § 154(a)(2) (2018).

74. *See Demsetz, supra* note 46, at 11–14 (explaining that patents provide efficient investment incentives by allowing inventors to reap rewards proportional to the value of their inventions for the term of the patent); Michael W. Carroll, *One Size Does Not Fit All: A Framework for Tailoring Intellectual Property Rights*, 70 OHIO ST. L.J. 1362, 1373–79 (2009) (arguing that that intellectual property law is economically justifiable as opposed to other methods of encouraging innovation because of the difficulty of valuing innovation).

patent issues — a boundary that seems obvious but has been challenged.⁷⁵ In refusing to find that a competitor was inducing infringement by selling products to retailers before a patent issued on them, the Federal Circuit noted that this would retroactively “make illegal an act that was not illegal when it was done.”⁷⁶ Allowing infringement would therefore undermine the values of notice to competitors, since liability would be contingent on later events, while granting a patent holder control over acts that occurred before she held a valid right.

The temporal scope of the grant supports the goal of encouraging inventors because it grants the potential for years of market exclusivity (depending on how the market is defined). The twenty-year boundary supports the goal of moving things into the public domain at the conclusion of the patent term. Moreover, the limit is relatively clear and knowable to third parties because the filing date is there on the face of the patent.⁷⁷ In addition, a patent holder must pay maintenance fees or risk losing the patent rights.⁷⁸ This ensures that patents that are not valuable to their owners do not hold up future innovation.

While central to the balance of patent rights and seemingly a clear and bright line, this temporal boundary has been changed various times⁷⁹ and may be stretched. For example, when the USPTO takes an inordinate amount of time to examine a patent application or when patented goods are delayed from market entry due to administrative review at the Food and Drug Administration, the law provides for a patent term adjustment or extension.⁸⁰ These extensions are aimed at fairness to patent holders. In the case of delays by the USPTO, patent holders may miss out on some of the market exclusivity to which they are entitled through

75. *Nat'l Presto Indus. v. West Bend Co.*, 76 F.3d 1185, 1196 (1996) (“[A]s a matter of law § 271(b) does not reach actions taken before issuance of the adverse patent.”).

76. *Id.*

77. ROBERT P. MERGES & JOHN F. DUFFY, *PATENT LAW AND POLICY* 29 (7th ed. 2017).

78. Fees must be paid upon issuance of the patent in addition to payments at 3.5 years, 7.5 years, and 11.5 years. 35 U.S.C. § 41(b)(1)(A)–(C).

79. Under the 1790 Act, for example, the patent term could not exceed 14 years. Patent Act of 1790 § 1, 1 Stat. 109–112 (1790). Later amendments provided that the term could be extended by another seven years for a total of 21 years. Patent Act of 1836, ch. 357, § 18, 5 Stat. 117, 125 (1836). In 1861, the term was changed again, this time to 17 years from the date of issue of the patent. Patent Act of 1861, ch. 88, § 16, 12 Stat. 246, 49 (1861). In 1994 patent terms took on their current bounds. Applying to applications filed after June 7, 1995, patents now have a term of 20 years to be measured from the filing date. *See Uruguay Round Agreements Act*, Pub. L. No. 103-465, § 532, 108 Stat. 4809, 4894 (1994).

80. Patent term adjustment allows for an adjustment of the patent term to compensate for delays in the application process. 35 U.S.C. § 154(b); 37 C.F.R. § 1.7021.705 (2018). For discussions of patent term extension to make up for the long process of drug approval, see Arti K. Rai, *The Information Revolution Reaches Pharmaceuticals: Balancing Innovation Incentives, Cost, and Access in the Post-Genomics Era*, 2001 U. ILL. L. REV. 173, 182 (2001); Emily Michiko Morris, *The Myth of Generic Pharmaceutical Competition Under the Hatch-Waxman Act*, 22 *FORDHAM INTELL. PROP. MEDIA & ENT. L.J.* 245 (2012) (explaining and critiquing the Hatch-Waxman Act).

no fault of their own.⁸¹ Moreover, the fault is that of the government, which promises the patent to start with, and so extensions are a way to hold the government to its promise. However, allowing a term extension cuts into the interests of the public in access to inventions, including the interests of follow-on innovators, and so the act limits the potential patent term extension to five years.⁸² The potential for patent term extensions also diminish the clarity that goes along with patent terms. While the filing date⁸³ may be clearly printed on the face of the patent, changes to the term and questions of whether the maintenance fees were paid may make it more difficult for third parties to learn information about whether a relevant patent is enforceable. While it is worthwhile to mention that the costs of determining the temporal boundaries are non-zero for third parties, they are still relatively low.⁸⁴

Another boundary limits the subject matter that is even eligible for patent protection. This boundary is much more difficult to define with certainty than the twenty-year patent term limit. The Supreme Court has interpreted the patent statute to apply fairly broadly, suggesting that patent protection ought to be available for “anything under the sun that is made by man.”⁸⁵ However, this broad interpretation has limits, excluding patent protection for “[l]aws of nature, natural phenomena, and abstract ideas.”⁸⁶ These boundaries — excluding ideas and fundamental truths from protection — are meant to combat preemption of “the basic tools of scientific and technological work,” which otherwise would “inhibit future innovation.”⁸⁷ In recent cases, the Court has reinvigorated those

81. See *ARIAD Pharm., Inc. v. Matal*, 283 F. Supp. 3d 503, 505 (E.D. Va. 2018) (explaining that when the patent term was changed to run from the date of filing rather than the issue date, “Congress noted that PTO delays in the processing of applications would now consume some portion of the patent term” and that patent term adjustment was enacted to mitigate the effects of PTO delays on patent holders).

82. 35 U.S.C. § 156(d)(5)(E)(i).

83. If the applicant claims priority to an earlier date, for example if the application is a continuation of a prior application or the application was previously filed abroad, that is also listed on the face of the patent, see *MERGES & DUFFY*, *supra* note 77, at 29, though there can be some difficulty if only some claims can claim the benefit of an earlier date.

84. In addition, the USPTO website offers a “patent term calculator,” in the form of a downloadable excel spreadsheet programmed to determine a patent term based on a number of relevant inputs. *Patent Term Calculator*, UNITED STATES PATENT AND TRADEMARK OFFICE, <https://www.uspto.gov/patent/laws-and-regulations/patent-term-calculator> [<https://perma.cc/SGH3-WKWN>].

85. *Diamond v. Chakrabarty*, 447 U.S. 303, 309 (1980) (quoting S. REP. NO. 82-1979, at 5 (1952) and H.R. REP. NO. 82-1923, at 6 (1952)).

86. See, e.g., *Alice Corp. v. CLS Bank Int’l*, 573 U.S. 208, 215 (2014); *Ass’n for Molecular Pathology v. Myriad Genetics, Inc.*, 569 U.S. 576, 590 (2013); *Mayo Collaborative Servs. v. Prometheus Labs., Inc.*, 566 U.S. 66, 70 (2012); *Bilski v. Kappos*, 561 U.S. 593, 594 (2010); *Diamond v. Diehr*, 450 U.S. 175, 185 (1981); *Diamond v. Chakrabarty*, 447 U.S. 303, 309 (1980); see also *O’Reilly v. Morse*, 42 U.S. (15 How.) 62, 112–120 (1854).

87. *Mayo Collaborative Servs. v. Prometheus Labs., Inc.*, 566 U.S. 66, 86 (2012) (internal citation omitted); see also *Andres Sawicki, Better Mistakes in Patent Law*, 39 FLA. ST. U. L.

boundaries. In *Mayo v. Prometheus*, for example, the Court laid out a framework for patents on processes that are drawn towards unpatentable laws of nature, suggesting that if the steps used to apply a law of nature are not a “well-understood, routine, [and] conventional” activity, an applicant may receive a patent.⁸⁸ A similar framework is applied to unpatentable abstract ideas as well.⁸⁹ The sentiment running through these opinions is the concern that broad claims over scientific discoveries will preempt whole fields of inquiry without a patent holder necessarily having fully explored the field and explained all the applications of the discovery.⁹⁰

Critics of these decisions — often those in industry — have argued that they hinder innovation by diminishing incentives in specific fields of endeavor, such as personalized medicine.⁹¹ In addition to the critique that the boundaries are keeping out important types of inventions, there are those who argue that the lack of clarity of these boundaries are the real problem. Thus, potential inventors — and their investors — will not know whether a field is patent-eligible *ex ante*. As a result of this uncertainty, more disputes may require court resolutions to determine the validity of the underlying patents, in contrast to the licensing and settlements that often result from disputes among competitors in a regime with more certain rights. This particular concern is one of certainty for both inventors and potential third-party users of technologies.

Ultimately, the Supreme Court has refused to impose subject matter restrictions based on technological areas.⁹² As a result, the patentable

REV. 735, 742 (2012) (“The point of these rules is to withhold patents when inventors seek them so early in the innovation process that they would permit control over too broad a range of follow-on innovation.”).

88. *Mayo*, 566 U.S. at 82 (“[S]imply appending conventional steps, specified at a high level of generality, to laws of nature, natural phenomena, and abstract ideas cannot make those laws, phenomena, and ideas patentable.”).

89. *See Alice Corp.*, 573 U.S. at 215–16.

90. *Id.* (inventions which “claim the ‘building blocks’ of human ingenuity” should not be patent eligible because they “would risk disproportionately tying up the use of the underlying’ ideas.”) (quoting *Mayo*, 566 U.S. at 73, 89)).

91. *See, e.g., Roy Zwahlen, Myriad Supreme Court Decision: BIO’s Statement*, BIOTECHNOW (June 13, 2013), <http://www.biotech-now.org/public-policy/patently-biotech/2013/06/myriad-supreme-court-decision-bios-statement> [https://perma.cc/CCN2-XRKP]. *See also* Christopher M. Holman, *Mayo, Myriad, and the Future of Innovation in Molecular Diagnostics and Personalized Medicine*, 15 N.C. J. L. & Tech. 639, 673 (2014) (suggesting that courts’ interpretations of *Mayo* threatens innovation in diagnostic medicine); Bernard Chao and Amy Mapes, *An Early Look at Mayo’s Impact on Personalized Medicine*, 2016 PATENTLY-O PATENT L.J. 10 (noting the increase of rejections at the PTO due to patent ineligible subject matter following the Supreme Court’s rulings).

92. The Supreme Court cases that have addressed subject matter jurisdiction have universally refused to impose limitations based on the scientific field of the invention, although it is clear that the holdings are more relevant for some fields than others. *See, e.g., Diamond v. Chakrabarty*, 447 U.S. 303, 315 (1980) (stating there is no “principle that inventions in areas not contemplated by Congress when the patent laws were enacted are unpatentable”); *Bilski v.*

subject matter requirement does serve to bound patent rights, but the boundary does not always provide clear notice to third parties, who are left unsure of the validity of patents until litigation.⁹³ The law of patentable subject matter theoretically does not discriminate among scientific fields. In addition, it is meant to encourage patent claims with concrete and tangible applications and discourage more theoretical claims that would preempt great swaths of future activity without delivering tangible benefits. In this sense, though third parties may not be able to rely on the boundaries of patentable subject matter, the doctrine does try to generally ensure the freedom of third parties to engage in research that will spur future innovation.

Some of the same work done by patentable subject matter in limiting patent claims is more visible in the law and doctrine covering disclosure requirements for patents.⁹⁴ Section 112 of the Patent Act requires an inventor to describe her invention, limiting the patent grant to what was invented.⁹⁵ It also includes a teaching requirement that the inventor explain the invention such that one skilled in the art can practice the invention,⁹⁶ which serves the purpose of informing third parties of how to make and use the invention. The section further requires that the invention be described in clear and precise terms, which means that third parties who seek to avoid infringement will be able to do so.⁹⁷ Sitting en banc to adjudicate the disclosure requirement of § 112, the Federal Circuit explained the three purposes of requirements on patent disclosure as:

(1) That the government may know what they have granted and what will become public property when the term of the monopoly expires. (2) That licensed persons desiring to practice the invention may know, during the term, how to make, construct, and use the invention. (3) That other inventors may know what part of the field of invention is unoccupied.⁹⁸

Kappos, 561 U.S. 593, 606 (2010) (patent law “precludes the broad contention that the term ‘process’ categorically excludes business methods”).

93. Presumably some of this uncertainty will diminish as district courts and the United States Court of Appeals for the Federal Circuit — the circuit court with exclusive jurisdiction over patent disputes — decide more cases under the Supreme Court’s recent holdings.

94. *See* 35 U.S.C. § 112 (2018).

95. *Id.*; *see* *Ariad Pharm., Inc. v. Eli Lilly & Co.*, 598 F.3d 1336, 1345 (Fed. Cir. 2010) (explaining that the written description is “part of the quid pro quo of a patent; one describes an invention, and, if the law’s other requirements are met, one obtains a patent”).

96. 35 U.S.C. § 112(a).

97. *Id.*

98. *Ariad Pharm.*, 598 F.3d at 1346 (quoting *Gill v. Wells*, 89 U.S. (22 Wall.) 1, 25–26 (1874)).

The novelty and non-obviousness requirements also serve to protect the public domain⁹⁹ and ensure that patent rights are limited to inventions. The administrative process and publication of applications and patents then provide notice to third parties. The USPTO examines patent applications to ensure that the inventions contained therein meet the standards for patentability. These include the requirements that the invention be new,¹⁰⁰ non-obvious, and useful.¹⁰¹ In addition, there are disclosure requirements ensuring that those skilled in the art will be able to make and use it and that the patent will end with claims that “particularly point[] out and distinctly claim[]” the invention.¹⁰² These requirements serve functions of teaching and notice. The USPTO has always published and now makes searchable online most patent applications eighteen months after their filing and all granted patents.¹⁰³ The public nature of the patent gives notice to those skilled in the art of the scope of what is protected, allowing them to avoid infringement by designing around the patent, waiting out the patent term, or contracting with the rights holder.¹⁰⁴ Whether an observer wishes to avoid infringement or to negotiate with the patent holder, the claims delineate the boundaries of the right granted to the patent holder and thus provide notice to third parties of what it is they must avoid during the patent term in order to avoid infringement — or what it is they will be entitled to by virtue of licensing or purchasing rights from the patent holder.

99. *See, e.g., City of Elizabeth v. Am. Nicholson Pavement Co.*, 97 U.S. 126, 137 (1877) (“[A]n inventor acquires an undue advantage over the public by delaying to take out a patent, inasmuch as he thereby preserves the monopoly to himself for a longer period than is allowed by the policy of the law . . .”).

100. Competing claims among dueling claimants are resolved by priority rules that determine whose application — if anyone’s — embodies a “new” invention. Previously, the United States operated on a first-to-invent system, so that an inventor could challenge a patent applicant under 35 U.S.C. § 102(g) and be awarded priority if she showed she had invented prior to the applicant and diligently pursued the invention from the time of conception. Following the passage of the America Invents Act, the United States has brought its laws in line with those of other countries and now follows a first-to-file system, under which it is filing of the patent application that entitles one to priority over other inventors, all other requirements for patentability being met. Leahy-Smith America Invents Act, Pub. L. No. 112-29, § 3, 125 Stat. 285–88 (2011).

101. 35 U.S.C. §§ 101–103 (2018).

102. *Id.* § 112(a)–(b).

103. *Id.* § 122(b).

104. *See Fromer, supra* note 4, at 541 (“[P]atent disclosure indirectly stimulates future innovation by revealing the invention’s design so that others can use it fruitfully when the patent term expires and design around, improve upon, or be inspired by the invention, even during the patent term.”); Henry E. Smith, *Intellectual Property As Property: Delineating Entitlements in Information*, 116 *YALE L.J.* 1742, 1797 (2007) (“The range of possible actions that a patent holder can take to develop inventions further — and especially to commercialize them — is subject to high delineation costs, making property-like rough rights of exclusion based on simple informational variables more attractive.”).

The patentability standards and claim construction doctrines that determine the boundaries of patent rights serve to balance the purposes underlying patent law. All of these boundaries are also subject to loosening under certain circumstances, when they fail to serve the purposes of the patent balance.

2. Direct Infringement and Clear Boundaries: The All Elements Rule

Infringement determinations, like patent scope determinations, are constrained by boundaries, which are generally motivated by the same policy purposes. In other words, the boundaries applied to infringement liability also balance the economic and social interests served by patents. In particular, imposing boundaries on infringement satisfies the notice function of patents. If third parties could be liable for performing some-but-not-all the steps of a claim or assembling some-but-not-all the components of a patented machine, there would be a chilling effect, and the public would not know what was allowed or prohibited by the grant of a patent. Similarly, if United States patent rights applied to acts and goods circulating abroad, foreign third parties would have to know about rights granted in a different country (the United States) in order to engage in business abroad. In addition, allowing enforcement to apply to acts and goods abroad would over-deliver to patent holders. The patent balance promises exclusivity on the United States market. Broader application would allow patent holders to use their domestic rights to govern behavior abroad. This may explain the requirement for a finding of direct infringement that all elements of a patent be met by an accused product and all steps of a method attributable to a single entity within the United States.¹⁰⁵

After scope determinations surrounding the patent grant are made through administrative processes and then clarified early in litigation, courts proceed to determine if there has been infringement.¹⁰⁶ This is a determination of whether an accused process or product infringes the patent claims, properly construed.¹⁰⁷ Because much of the patent scope determination is made *ex ante* — and *ex parte*¹⁰⁸ — patent grants are

105. See *infra* Part III.B.2.

106. Sarah R. Wasserman Rajec, *Patents Absent Adversaries*, 81 BROOK. L. REV. 1073, 1087 (2016) (“[T]he contours of patent rights are often determined in post-grant litigation, either in federal district courts or through administrative procedures that redetermine the scope and validity of patents.”).

107. See *Festo Corp. v. Shoketsu Kinzoku Kogyo Kabushiki Co.*, 535 U.S. 722, 741 (2002).

108. *Lear, Inc. v. Adkins*, 395 U.S. 653, 670 (1969) (“[T]he Patent Office is often obliged to reach its decision in an *ex parte* proceeding, without the aid of the arguments which could be advanced by parties interested in proving patent invalidity.”); see also Rajec, *supra* note 106, at 1090–91 (critiquing the process by which claim construction proceedings occur at the Unit-

“skewed” towards patent applicants.¹⁰⁹ This skew can be tempered by claim construction proceedings during patent litigation, which are adversarial and proceed in the context of eventual comparison to an accused product.¹¹⁰ Litigation brings boundary questions of patent grants and appropriate scope into greater relief because of the presence of third parties who practice in the relevant art.¹¹¹

Patent infringement determinations, in contrast to those of patent grant and scope, are always adversarial because they occur in the context of litigation. As a result, courts are confronted by the interests of third parties when considering the proper scope of infringement liability — and while these third parties are generally competitors, they are stand-ins for the public’s interest in constraining the scope and enforcement of patents.¹¹² As the Supreme Court explained in *Festo Corp. v. Shoketsu*, “[a] patent holder should know what he owns, and the public should know what he does not.”¹¹³ While much focus has been paid to claim interpretation, infringement determinations are as important when it comes to actual disputes — after all, each stage can be dispositive. Therefore, properly cabinning the reach of infringement is important to the integrity of a system that balances the private interests and motivations of patent holders and future inventors with the public interest in consumer access to innovation.

For patented products, the rule is that there is only direct infringement when every element of a claim is present in the accused device.¹¹⁴ This ensures that a patent holder is not able to extend her exclusivity to something more than she invented. The boundaries of the patent cannot be loosened to impose liability on products that do not fully occupy its bounds. The Supreme Court addressed infringement of patented combinations in the 1861 case of *Vance v. Campbell*,¹¹⁵ holding that there

ed States International Trade Commission outside the adversarial context and suggesting that this harms the public’s interest in robust patent grant boundary disputes).

109. Reilly, *supra* note 20, at 560 (2017); *see also* Melissa F. Wasserman, *The Changing Guard of Patent Law: Chevron Deference for the PTO*, 54 WM. & MARY L. REV. 1959, 2014 (2013) (arguing because the PTO’s role is to grant patents, there are “constant one-way demands to issue patents”).

110. *See Rajec, supra* note 106, at 1091 (“In claim-construction hearings, patents are generally narrowed in the context of accused infringers’ arguments that the patent does not cover their accused products.”).

111. *See id.* at 1074.

112. *See id.* at 1092 (“[T]he parties to a patent lawsuit play a crucial role in determining the contours of patents — contours that impact the interests of nonparties.”).

113. *Festo Corp. v. Shoketsu Kinzoku Kogyo Kabushiki Co.*, 535 U.S. 722, 731 (2002).

114. *London v. Carson Pirie Scott & Co.*, 946 F.2d 1534, 1539 (Fed. Cir. 1991), (citing *Becton Dickinson & Co. v. C.R. Bard, Inc.*, 922 F.2d 792, 798 (Fed. Cir. 1990)); *see also* *Litton Sys., Inc. v. Honeywell, Inc.*, 140 F.3d 1449, 1454 (Fed. Cir. 1998) (“Literal infringement requires that the accused device contain each limitation of the claim exactly; any deviation from the claim precludes a finding of literal infringement.”).

115. *Vance v. Campbell*, 66 U.S. (1 Black) 427, 428–29 (1861).

could be no infringement of a patent on a stove if the accused product did not include a front flue as claimed in the patent. The Court did not allow the patent holder's argument that the element was immaterial and useless to the invention, holding that "unless the combination is maintained, the whole of the invention fails. The combination is an entirety; if one of the elements is given up, the thing claimed disappears."¹¹⁶ In other words, without all the elements of the claimed invention, an accused product does not occupy the bounds of the patent. This rule allows third parties to rely on the claims of the patent in determining whether their acts will infringe, serving the notice function of patents. The Court recognized the importance of this notice function, stating that if elements could later be omitted from infringement proceedings, "a patent would furnish no distinct evidence of the thing invented, as that would depend upon what part of the specification and claim the jury might think material or essential."¹¹⁷ More recently, the Federal Circuit has followed this rule, explaining that "[t]here can be no infringement as a matter of law if a claim limitation is totally missing from the accused device."¹¹⁸

The rule for method patents demonstrates perhaps even more wariness towards imposing liability for behavior that does not fully occupy the patent claim than the "all-elements" rule for product patents. The Federal Circuit has held that method patents are only infringed when all of the steps are performed by a single entity.¹¹⁹ This rule has required clarification in recent years to determine how far agency principles stretch in patent law to allow attribution of one entity's acts to another. In *Muniauction, Inc. v. Thomson Corp.*, the court held that processes that are carried out by multiple parties may still constitute direct infringement by a single party if it "controls or directs" the actions of others.¹²⁰ And more recently, following remand of a case from the Supreme Court, the Federal Circuit held that there may be direct infringement not only where an entity directs or controls others' performance, but also where the actors form a joint enterprise.¹²¹ Moreover, the court suggested that "direction and control" can be found "when an alleged infringer conditions

116. *Id.* at 429; see also *Schumacher v. Cornell*, 96 U.S. 549, 554 (1877) ("If more or less than the whole of [the patent holder's] ingredients are used by another, such [a] party is not liable as an infringer, because he has not used the invention or discovery patented.")

117. *Vance*, 66 U.S. (1 Black) at 430.

118. *London*, 946 F.2d at 1539 (citing *Becton Dickinson & Co.*, 922 F.2d at 798).

119. *BMC Res., Inc. v. Paymentech, L.P.*, 498 F.3d 1373, 1380 (Fed. Cir. 2007), *overruled by Akamai Techs., Inc. v. Limelight Networks, Inc.*, 797 F.3d 1020, 1023 (Fed. Cir. 2015).

120. *Muniauction, Inc. v. Thomson Corp.*, 532 F.3d 1318, 1329 (Fed. Cir. 2008) ("[W]here the actions of multiple parties combine to perform every step of a claimed method, the claim is directly infringed only if one party exercises 'control or direction' over the entire process such that every step is attributable to the controlling party . . .") (internal quotation omitted).

121. *Akamai Techs., Inc. v. Limelight Networks, Inc.*, 797 F.3d 1020, 1023 (Fed. Cir. 2015).

participation in an activity or receipt of a benefit upon performance of a step or steps of a patented method and establishes the manner or timing of that performance.”¹²² When the parties can be said to have entered a joint enterprise, the court explained, each party can be “charged with the acts of the other,” such that each party may be liable for direct infringement.¹²³ This doctrinal development contains the seeds of infringement-boundary-loosening movement.¹²⁴ Nevertheless, the rule that all steps must be attributable to a single entity is a limiting doctrine. The boundary shields third parties from liability for acts that amount to “less than” the claimed steps, thereby strengthening notice safeguards and encouraging activity that does not infringe.

Territorial rules restricting infringement liability to acts that occur within the physical borders of the United States also serve bounding and notice purposes. The traditional formulation of the limitations on U.S. patent law is that the law is territorial.¹²⁵ In fact, the Supreme Court has said that territoriality “applies with particular force in patent law.”¹²⁶ This means that acts “wholly done in a foreign country” cannot lead to infringement liability in the United States.¹²⁷ This strict boundary rule led to the Supreme Court’s holding — later reversed by statutory amendment¹²⁸ — in *Deepsouth Packing Co. v. Laitram Corp.* that it was *not* infringement to manufacture all of the components of a patented shrimp-deveining machine in the United States, package the components together with instructions for assembly, and then ship the kits abroad for assembly.¹²⁹ The patent claimed a combination of components, and thus the claim was not met until all these components were combined. The logic of *Deepsouth* was that the machine that met the patent claims was assembled abroad, and that while domestic assembly would have constituted infringement, the Patent Act does not have extraterritorial reach; thus, if the assembled combination of components was not completed in the United States, there was no infringement.¹³⁰ Territoriality limits inventors to the grant of U.S. market exclusivity that they are promised and also ensures that unsuspecting third parties carrying out their business

122. *Id.*

123. *Id.*

124. See *infra* discussion in Part III.

125. See, e.g., *Dowagiac Mfg. Co. v. Minnesota Moline Plow Co.*, 235 U.S. 641, 650 (1914) (holding that patent rights are “confined to the United States and its Territories . . . and infringement . . . cannot be predicated of acts wholly done in a foreign country”); *Microsoft Corp. v. AT&T Corp.*, 550 U.S. 437, 454–55 (2007).

126. *Microsoft Corp.*, 550 U.S. at 454–55 (“The presumption that United States law governs domestically but does not rule the world applies with particular force in patent law.”).

127. *Dowagiac Mfg. Co.*, 235 U.S. at 650.

128. See *infra* Part III.

129. See *Deepsouth Packing Co., Inc. v. Laitram Corp.*, 406 U.S. 518, 518 (1972).

130. *Id.* at 526–27.

abroad are not caught by claims of U.S. patent infringement. Another statutory change addresses the importation to the United States of products made by patented processes abroad. Absent statutory revisions, processes that occur outside of the United States may meet the claims of a patent, but they cannot infringe under the main provision governing infringement, § 271(a).¹³¹ These are examples of how rules of territoriality impose boundaries on liability for the import and export of goods that do not formally infringe at the moment of completion within the United States. Other cross-border infringement issues arise when infringing acts are divided between the United States and other countries or some-but-not-all components of a system used in the United States exist outside of its borders.¹³² In these cases, courts again interpret infringement strictly with regard to method claims where steps of the patented method are outside of the geographic boundary. In the indirect infringement cases described above, the strict boundary is around a single entity, whereas territoriality cases address steps that are performed outside the geographical boundary of the United States. In these cases, a single step performed outside of the United States results in a finding that there is no direct infringement of a United States patent.¹³³

III. INFRINGEMENT OUT OF BOUNDS

Like the patent grant boundaries, infringement boundaries can also be loosened. Also, like patent scope-loosening doctrines, infringement boundary-loosening targets situations when strict interpretation of the law undercompensates patent holders. Statutory provisions and doctrinal developments address these situations, imposing liability for indirect infringement and certain cross-border acts that, if occurring within the United States, would infringe. These provisions have become much more attractive to patent holders because of changes in technology and business structures that make it more difficult to target a single, responsible party for patent infringement. This section describes the ways that infringement boundaries may fail to serve patent policy objectives, the circumstances under which they traditionally are loosened, and reasons that new technologies and increasing globalization increase pressure to expand the doctrines.

131. See *infra* Part III for discussion of § 271(g).

132. See, e.g., *NTP, Inc. v. Research in Motion, Ltd.*, 418 F.3d 1282, 1290 (Fed. Cir. 2005) (relay located in Canada).

133. See *id.* at 1317–18.

A. Strict Enforcement Boundaries and Their Drawbacks

Strict interpretations of patent infringement boundaries sometimes operate in ways that appear unfair to patent holders. Early cases that extended infringement boundaries did so when a third party was deliberately circumventing a patent while producing goods that embodied the heart of the invention. In addition to circumvention, early indirect infringement cases addressed the difficulties some patent holders had enforcing their patents against end users when manufacturers and distributors were the least cost avoiders (and easiest to sue). This happens for inventions where infringement is likely to be more diffuse — it only occurs when consumers use a product, making it difficult for patent holders to enforce their rights. It can be difficult to find consumers, and individual lawsuits are an inefficient way to stop widespread infringement. Sometimes this delay of infringement is inadvertent and results merely from how technology is implemented, though it can also occur when third parties deliberately leave one claim element for later completion or addition. Foreign activity can also take acts and components outside the boundaries of infringement in ways that seem unfair — whether because of normal design and manufacturing considerations or deliberate circumvention of patents. Because these acts appear to deprive patent owners of the benefits of their exclusive rights, doctrinal and legal changes have developed to allow for boundary-loosening in some circumstances. These provisions have become increasingly attractive to patent holders in response to the rise of technologies that are easily and widely distributed and used in ways that may be difficult for patent holders to detect and the increase in businesses that manufacture in global and diffuse ways, with global supply chains that are designed to increase efficient manufacture of goods.

Technological and business structure changes that have resulted in attempts by patent owners to expand infringement doctrines operate together to make it harder for patent holders to enforce their rights. The high cost of detection greatly increases with the interplay of two factors: (1) technological developments that change the nature of innovative goods from tangible to intangible¹³⁴ and (2) the globalized and increas-

134. The purchase of digital music files as opposed to vinyl records, cassette tapes, or CDs is one example of technological innovation that has moved consumers from tangible goods embodying intellectual property rights to intangible goods. See Mark P. McKenna & Lucas S. Osborn, *Trademarks and Digital Goods*, NOTRE DAME L. REV. 101, 103 (2017) (“[A] variety of goods consumers once would have purchased in physical form are increasingly beamed to computers and phones as digital files.”); see, e.g., *Am. Online, Inc. v. St. Paul Mercury Ins. Co.*, 207 F. Supp. 2d 459, 462 (E.D. Va. 2002) (“The plain and ordinary meaning of the term ‘tangible’ is property that can be touched. Computer data, software and systems are incapable of perception by any of the senses and are therefore intangible.”).

ingly diffuse nature of all facets of business, from production to distribution.

The incredible growth of intangible technologies (primarily software) and the ability to distribute it widely and cheaply on the internet, coupled with the globalization of businesses and their supply chains, has led to increasing difficulty in rights enforcement.¹³⁵ That is because these technological advances coupled with globalization make it difficult to draw meaningful boundaries around protected goods and processes or — once drawn — to attribute the entirety of an infringement to any one person or locate it in any one jurisdiction. The legal uncertainty of where a right resides and where and when it will be considered infringed increases precisely those characteristics that chip away at the investment justification for exclusionary rights in the first place.

Scholars have long discussed the impact the internet and modern computing have had on modern commerce and the complications these changes have introduced to intellectual property law theory and application. More recently, other disruptive technological advances, such as 3D printing, have shown their potential to put pressure on traditional means of intellectual property rights protection.¹³⁶ These changes are due to near-costless copying and distribution of goods that are intangible. The technological changes allow for distribution to end users in a way that often means there is either no detectable infringement or no infringing middle man. And production may be structured in such a way that infringement is only completed upon receipt or use of the information. These changes make it difficult for rights holders to identify or enforce their rights against infringers effectively. It is difficult for rights holders to locate infringing acts because they are difficult to detect. Even if infringement is detected, it is difficult to enforce rights effectively against end users in contrast to repeat players who are sensitive to enforcement actions and willing to take licenses to avoid them. But technological changes are only part of the story.

The other change is globalization and the internationalization of corporations and their supply chains.¹³⁷ However difficult it may be to identify infringing activity and bring enforcement actions against internet users or 3D printer users within the United States, it is more difficult to

135. See Deven R. Desai, *The New Steam: On Digitization, Decentralization, and Disruption*, 65 HASTINGS L.J. 1469, 1470 (2014) (“[T]ransaction[] costs related to safety, quality, property rights, contracting, and knowledge may be more acute in a digitized, decentralized world.”).

136. See Lemley, *supra* note 27, at 461 (“[N]ew technologies promise to do for a variety of physical goods and even services what the Internet has already done for information.”).

137. Trevor W. Nagel & Elizabeth M. Kelley, *The Impact of Globalization on Structuring, Implementing, and Advising on Sourcing Arrangements*, 38 GEO. J. INT’L L. 619, 620 (2007) (discussing the global sourcing of services in addition to goods).

locate and enforce infringement when activities take place across borders. Many of the physical goods that we use contain patented components that are made in a number of different countries, each with its own set of intellectual property laws that apply territorially. Thus, transactions that would infringe if undertaken entirely within the United States might escape infringement if spread out among different countries sufficiently. These two factors, taken together, put further pressure on the notion of intellectual property rights and infringement as things that can be located.

The WTO Agreement has led to greater international trade in goods and increasingly multinational corporations.¹³⁸ As trade barriers such as tariffs and regulatory hurdles to trade have been reduced, companies operate more easily across borders than ever before, manufacturing goods where it is cheapest and shipping them to markets from the place of manufacture.¹³⁹ Moreover, it has led to increased globalization of supply chains, so that companies manufacture different parts of their products in different countries, later assembling goods for sale in their chosen markets.¹⁴⁰ This type of supply chain management is consistent with free trade principles that suggest that absent barriers to trade, different countries will specialize in the manufacture of different goods according to their competitive advantages.¹⁴¹ However, it takes those principles a step further — instead of leading to the production of cars in one country and bananas in another, global supply chains mean that countries specialize in the production of different components of goods, and the comparative advantage may arise simply from the size of the operation rather than characteristics that are particular to a given country.

Both of these modernizing forces have resulted in innovation — and therefore rights — that cannot always be located within geographical boundaries. The language of the patent statute describes the exclusive rights it grants — namely, the right to exclude others from making, us-

138. See DOUGLAS A. IRWIN, INTERNATIONAL TRADE AGREEMENTS, in THE CONCISE ENCYCLOPEDIA OF ECONOMICS 298 (David R. Henderson ed., 2008), available at <http://www.econlib.org/library/Enc/InternationalTradeAgreements.html> [<https://perma.cc/K7LF-82F2>] (explaining that the “annual gain from removal of tariff and nontariff barriers to trade as a result of the Uruguay Round Agreement ... has been put at about \$96 billion, or 0.4 percent of world GDP”).

139. For a discussion on the theory of free trade and its application in the realm of patents, see Sarah R. Wasserman Rajec, *Free Trade in Patented Goods: International Exhaustion for Patents*, 29 BERKELEY TECH. L.J. 317, 328–29 (2014).

140. Richard Baldwin, *Trade and Industrialization after Globalization's Second Unbundling: How Building and Joining a Supply Chain Are Different and Why It Matters*, in GLOBALIZATION IN AN AGE OF CRISIS: MULTILATERAL ECONOMIC COOPERATION IN THE TWENTY-FIRST CENTURY 171 (2014) (“Once feasible, scale economies and comparative advantage made separation inevitable — especially unskilled labor- intensive stages given the vast international wage differences.”).

141. *Id.*

ing, offering to sell, selling, or importing goods that embody the patented product or process.¹⁴² Patent rights under this formulation would manifest themselves in multiple places along the chain from manufacture to use. That is, tangible forms of technology manufactured under traditional business structures before globalization would offer a number of points at which relevant actors can make the choice to contract with a rights holder or work around patented technology. Modern manufacturing is splintered and spread across countries, so that “making” a good is done by many different actors, none of whom may bear responsibility for intruding upon a patent right within the territory where a good is put into use. In such a situation, the boundaries of the patent may only be fully performed or constructed when an end user performs a method or combines various components into a final product.

Consider the traditional structure of a single firm that conducts its research and development and all of its manufacturing internally. If the manufacturing process — or the finished product — infringes a patent, then the location of the rights violation is where the manufacturing takes place, where sales or offers to sell take place, and wherever the product is used by consumers. A patent holder, in such a world, may enforce rights against a number of different entities — although most likely she will choose the place of manufacture or sale rather than targeting consumers or end users. This practice reflects what is practical, efficient, and fair. Consumers and end users often rely on retailers to sell noninfringing goods.

Compare this to the situation that confronts many patent holders now. Manufacturing processes are separated across countries and the physical location of data bears little relation to the location of people who use it. It is also costless to move and easy to distribute digital technologies widely in ways that are difficult to detect. Messages sent between electronic devices within the United States may be transmitted through a relay in Canada — having no impact on the experience of the users but moving a claim element outside of the geographic boundaries that govern patent enforcement. Moreover, goods or processes may be constructed in such a way that only an end user infringes. For example, a software user may be a direct infringer by using software that operates according to a patented process. In such a case, the developers and sellers never perform the process and therefore do not infringe. As a result, there are many entities involved in infringement but none that is alone responsible for infringement. These newer technologies and business models eschew traditional notions of infringement, resulting in challenges for patent holders trying to enforce their exclusionary rights.

142. 35 U.S.C. § 271(a) (2018).

B. Loosening Enforcement Boundaries

Patent holders have increasingly turned to doctrines that loosen the bounds of infringement liability when facing newer technologies and increased cross-border manufacture and trade. The typical patent infringement case requires that an accused device or process meet every element of a claimed invention in order to directly infringe the patent.¹⁴³ As a result, direct infringement cannot be found where a device is missing even one claimed component. However, this boundary can be subject to some loosening to solve the problem of diffuse, end-user infringement, either through indirect infringement provisions or through provisions allowing for infringement in cross-border transactions.

1. The Rise of Indirect Infringement

In patent law, in addition to direct infringement of a patent, a strict liability tort, a patent holder may sue under a theory of indirect infringement.¹⁴⁴ Under this theory, liability derives from tort law's recognition of secondary liability for actors who assist or encourage others in the commission of a tort.¹⁴⁵ Indirect infringement has its roots in common law, applying when "although not technically making, using or selling, the defendant displayed sufficient culpability to be held liable as an infringer."¹⁴⁶ This occurs if an actor "intentionally caused, or aided and abetted, the commission of a tort by another," thus allowing for joint and several liability with the "primary tortfeasor."¹⁴⁷ The common law rule thus contained requirements of intent and a "primary" act of infringement.¹⁴⁸ The doctrine was codified in the 1952 Patent Act ("1952 Act") alongside direct infringement and allows for liability under separate theories of inducement or contribution.¹⁴⁹

Under contributory infringement, there is liability for knowingly offering for sale, selling, or importing a material part of an invention that does not have substantial noninfringing uses;¹⁵⁰ this was the most com-

143. *See supra* Part II.B.

144. 35 U.S.C. § 271(b)-(c).

145. DAVID W. BARNES & JOHN M. CONLEY, *INTEGRATED INTELLECTUAL PROPERTY* 699 (2016).

146. *Hewlett-Packard Co. v. Bausch & Lomb Inc.*, 909 F.2d 1464, 1469 (Fed. Cir. 1990).

147. *Id.*

148. Here, a "primary" act of infringement refers to an act of direct infringement. *Id.* (discussing the difference between indirect and direct infringement).

149. *See* Timothy R. Holbrook, *The Supreme Court's Quiet Revolution in Induced Patent Infringement*, 91 NOTRE DAME L. REV. 1007, 1010 (2016) (citing *Hewlett-Packard Co.*, 909 F.2d at 1468-69 (Fed. Cir. 1990)).

150. 35 U.S.C. § 271(e) (2018).

mon pre-1952 basis for indirect infringement liability.¹⁵¹ Inducement infringement was not a separate theory of liability before the 1952 Act, but rather a type of evidence for contributory infringement. As a result, there is a great deal of overlap in the assertion of the two theories and in doctrinal application of their requirements.¹⁵²

a. Contributory Infringement

Contributory infringement allows for secondary liability for a manufacturer or seller of fewer than all the components in a patent claim, when there is later, direct infringement. The doctrine tracks tort law theories about liability for providing substantial assistance to an infringer, often through the provision of a component that is necessary to an infringing machine or through provision of a good that can be used in an infringing process. This form of liability has become more attractive due to changes in technology that result in diffuse manufacture and distribution of goods and the potential delay of infringement until technology is in the hands of end-users (consumers).

The roots of indirect infringement doctrine are consistent with protecting patent holders' investments and ability to enforce their exclusive rights. At the same time, early cases contain language — often overlooked — suggesting that consumers and end users may deserve more protection against the imposition of indirect infringement than they are afforded under patent law's direct infringement doctrine. In particular, early indirect infringement cases justified expansion of infringement to other actors when a direct infringement claim would only be viable against “innocent purchasers who technically were responsible for completing the infringement.”¹⁵³ The Court discussed the pre-statute history and purpose of contributory infringement extensively in *Dawson Chemical Co. v. Rohm & Haas Co.*, a 1980 Supreme Court case finding contributory infringement under the 1952 Act for the manufacture and sale of an unpatented herbicide for use on rice fields, sold together with explicit instructions for a method of application that infringed Rohm and Haas Co.'s (“Rohm's”) patent.¹⁵⁴ In its discussion, the Court referred to a case from 1871 as a “classic example” of common law contributory

151. *Hewlett-Packard Co.*, 909 F.2d at 1469.

152. See *Global-Tech Appliances, Inc. v. SEB S.A.*, 563 U.S. 754, 764–66 (2011) (induced infringement under § 271(b) has the same knowledge requirement as contributory infringement under § 271(c)); see also *Commil USA, LLC v. Cisco Sys., Inc.*, 135 S. Ct. 1920, 1928 (2015) (holding that the knowledge requirement for inducement infringement is satisfied regardless of defendant's belief of a patent's validity); *Limelight v. Akamai Techs., Inc.*, 134 S. Ct. 2111, 2115 (2014) (holding that a defendant may only be liable for inducing infringement if someone has committed direct infringement).

153. *Dawson Chem. Co. v. Rohm & Haas Co.*, 448 U.S. 176, 188 (1980).

154. *Id.* at 176–78.

infringement that frames such claims as an alternative to the near-impossible task of suing end users.¹⁵⁵ In such a case, the Court suggested a patentee should be permitted “to enforce his rights against the competitor who brought about the infringement, rather than requiring the patentee to undertake the almost insuperable task of finding and suing” the end users.¹⁵⁶

In addition to the difficulty for a patent holder to sue end users, the *Dawson Chemical* Court explained the importance of an alleged infringer’s knowledge and intent — suggesting that an attempt to evade liability by encouraging customers to undertake the prohibited acts should lead to liability. The Court thus explained that the reason for allowing contributory infringement liability was “to protect patent rights from subversion by those who, without directly infringing the patent themselves, engage in acts designed to facilitate infringement by others.”¹⁵⁷ Returning to the difficulty of bringing suit against individual end users instead of manufacturers or retailers, the Court stated: “This protection is of particular importance in situations . . . where enforcement against direct infringers would be difficult, and where the technicalities of patent law make it relatively easy to profit from another’s invention without risking a charge of direct infringement.”¹⁵⁸ This description focuses less on the difficulty of enforcing patents against end users and more on the potential for nefarious circumventions of rights by third-party manufacturers or sellers who seek to escape liability by designing products and business interactions in such a way that only downstream purchasers or users infringe.

The difficulty with the doctrine of contributory infringement is the same as its strength: it allows the exclusion of behavior that does not rise to direct infringement itself. The *Dawson Chemical* Court recognized the danger that the doctrine could allow a patent owner to expand the scope of her protection and suggested that “[t]he difficulty that the doctrine has encountered stems . . . from a desire to delimit its outer contours.”¹⁵⁹ Indeed, in that case, the contributory infringement claim was conceded by both parties, and the issue before the Court was one of patent misuse — that is, whether Rohm’s infringement claim, based on its patented method of application of an unpatented herbicide, unfairly expanded its right to exclude to encompass the herbicide itself.¹⁶⁰ The Court found that the enforcement did not constitute misuse and allowed the claim of

155. *Id.* at 188 (citing *Wallace v. Holmes*, 29 F. Cas. 74 (C.C.D. Conn. 1871) (No. 17,100)).

156. *Id.*

157. *Id.*

158. *Id.*

159. *Id.* at 189.

160. *Id.* at 185–87.

contributory infringement,¹⁶¹ but the case shows that there is a thin line between what is considered a “fair” desire to protect patent rights and the potential for patent holders to use indirect infringement as a tool for an “unjustified” expansion of those rights. In this sense, the pre-1952 cases — like their more recent progeny — discuss the need to loosen patent enforcement boundaries but fail in providing tools to constrain the expansion of liability.

In fact, many of the pre-1952 contributory infringement cases show the Court struggling to draw the line between behaviors that “ought” to be prohibited despite not amounting to direct infringement and behaviors that patent holders might like to control but that would require extension of patent protection to ordinary articles of commerce.¹⁶² These cases focused on how much of the patented good was embodied in the allegedly infringing goods that were sold. In *Morgan Envelope Co. v. Albany Paper Co.*, the sale of toilet paper rolls adapted for use with a patented combination of toilet paper dispenser-and-roll was not infringing because it would extend infringement “to an article of manufacture perishable in its nature, which . . . must be renewed periodically,” a characteristic which led the Court to note “the difficulty of treating the paper as an element of the combination at all.”¹⁶³ Other cases that faced the question whether a patent was being extended to goods that ought to be beyond its scope used as the determining factor whether the goods were amenable to other uses. Largely, the Court seemed to find that contributory infringement claims were inappropriate to address commodity goods used as supplies for patented machines.¹⁶⁴ In *Carbice Corp. of America v. American Patents Development Corp.*, for example, the Court explained that patent infringement, “whether direct or contributory, is essentially a tort, and implies invasion of some right of the patentee.”¹⁶⁵ However, the Court explains, there is no right for a patent holder

161. *Id.* at 184–85, 223.

162. See, e.g., *Morgan Envelope Co. v. Albany Perforated Wrapping Paper Co.*, 152 U.S. 425 (1894) (refusing to allow contributory infringement liability against supplier of toilet paper rolls that were to be used with a patent on the combination of a toilet paper dispenser and roll, reasoning that it would extend patent to ordinary articles of commerce); *Leeds & Catlin Co. v. Victor Talking Mach. Co.*, 213 U.S. 325 (1909) (upholding injunction against sale of phonograph disc designed for use in a patented disc-and-stylus combination where disc was only capable of use in the patented combination), *overruled in part* by *Mercoide Corp. v. Mid-Continent Inv. Co.*, 330 U.S. 661 (1944); *Henry v. A. B. Dick Co.*, 224 U.S. 1 (1912) (allowing contributory infringement principles to enforce a licensing agreement over supplies used in connection with a printing machine), *overruled in part* by *Motion Picture Patents Co. v. Universal Film Mfg. Co.*, 243 U.S. 502, 517–18 (1917).

163. *Morgan Envelope Co.*, 152 U.S. at 433.

164. *Carbice Corp. of Am. v. Am. Patents Dev. Corp.*, 283 U.S. 27, 33–34, *supplemented by* 283 U.S. 420 (1931) (“Dry Ice Corporation is attempting, without sanction of law, to employ the patent to secure a limited monopoly of unpatented material used in applying the invention.”).

165. *Id.* at 33.

to “be free from competition in the sale of [an unpatented material used in applying the invention].”¹⁶⁶ In other words, the right to exclude cannot be extended to exclude others from making, using, or selling commercial goods that are used with the invention.

This formulation of what acts the doctrines should capture does not explain exactly how the lines should be drawn, but it is a formulation that stuck.¹⁶⁷ The 1952 Act reflects the rules and concerns as described by courts,¹⁶⁸ with a balance between punishing an alleged infringer’s knowledge or ill intent on the one hand and limiting patent holders from expanding their exclusive rights to unpatented commodities that are components of patented combinations or used with patented machines on the other. The statute provides three limitations to contributory infringement: (1) the component must constitute “a material part of the invention,” (2) the infringer must “know[] the same to be especially made . . . for use in an infringement of such patent,” and (3) it cannot be “a staple article or commodity of commerce suitable for substantial noninfringing use.”¹⁶⁹ The first and third requirements about materiality of the component to the patented device and the exclusion for staple articles of commerce derive from the pre-1952 Act cases addressing contributory infringement. The knowledge requirement also derives from prior case law,¹⁷⁰ and the statutory requirements have been read to apply to both contributory and inducement liability, though recent case law has addressed the intent standard in the context of inducement cases.¹⁷¹

In *Sony Corp. of America v. Universal City Studios*,¹⁷² the Court ruled on a claim of contributory copyright infringement for sales of VCRs. The Court used language from the Patent Act that eliminated liability for sales of goods that have substantial noninfringing uses and found that there was no contributory copyright infringement where customers could use the VCR for recording and watching content at another

166. *Id.*

167. *See id.*; *Motion Picture Patents Co. v. Universal Film Mfg. Co.*, 243 U.S. 502, 515 (1917).

168. It provides: “Whoever sells a component of a patented machine, manufacture, combination or composition, or a material or apparatus for use in practicing a patented process, constituting a material part of the invention, knowing the same to be especially adapted for use in an infringement of such patent and not a staple article or commodity of commerce suitable for substantial noninfringing use, shall be liable as a contributory infringer.” 35 U.S.C. § 271(c) (1952).

169. *Id.*

170. Mark A. Lemley, *Inducing Patent Infringement*, 39 U.C. DAVIS L. REV. 225, 236 (2005) (arguing that indirect patent infringement “derives from the common law origin of indirect infringement in accessory liability, which requires that the defendant know that the behavior she aids is wrongful”).

171. *See id.*

172. 464 U.S. 417 (1984).

time — an act that was a noninfringing fair use.¹⁷³ In a second copyright case, *Metro-Goldwyn-Mayer Studios Inc. v. Grokster, Ltd.*,¹⁷⁴ the Court again borrowed from and interpreted the indirect infringement provisions of the Patent Act. In *Grokster*, the Court ruled on whether a music-sharing service was liable for infringement by its users and discussed the staple article of commerce doctrine, explaining that it “was devised to identify instances in which it may be presumed from distribution of an article in commerce that the distributor intended the article to be used to infringe another’s patent, and so may justly be held liable for that infringement” whereas the sale of goods that have substantially noninfringing purposes cannot give rise to that presumption.¹⁷⁵ This language casts the substantially noninfringing uses limitation as part of the intent requirement for indirect infringement — an area to which the Court has turned increasing attention in recent years.¹⁷⁶

In the wake of *Sony* and *Grokster*, courts have interpreted the substantial noninfringing use requirement fairly strictly, requiring a strong showing from patent holders.¹⁷⁷ The language of when infringement liability is appropriate, however, is still focused on the behavior of third parties and the intent to circumvent patent rights.

In *Ricoh Co. v. Quanta*,¹⁷⁸ the Federal Circuit interpreted the doctrine as extending liability to a company that made a component specially adapted for use in a patented product and embedded it in a larger product. In finding that contributory liability infringement was appropriate, the court focused on the defendant’s behavior, suggesting that denying liability for sale of a product when sales of a component alone would constitute contributory infringement would allow unfair circumvention of liability.¹⁷⁹ The court explained its holding with reference to the Supreme Court’s holdings in *Sony* and *Grokster* and its focus on indirect infringers’ circumvention of intellectual property rights, reasoning that “Quanta should not be permitted to escape liability as a contributory infringer merely by embedding that microcontroller in a larger product with some additional, separable feature before importing and selling it.”¹⁸⁰

173. *Id.* at 440–42.

174. 545 U.S. 913 (2005).

175. *Id.* at 932.

176. *See infra* Part III.B.

177. *See, e.g.*, *Superior Indus., LLC v. Thor Global Enters. Ltd.*, 700 F.3d 1287, 1296 (Fed. Cir. 2012) (affirming district court’s dismissal of induced and contributory infringement claims for failure to allege the goods were “especially made or especially adapted for use in an infringement of such patent, and not a staple article or commodity of commerce suitable for substantial noninfringing use” under § 271(c)).

178. *Ricoh Co. v. Quanta Comput. Inc.*, 550 F.3d 1325 (Fed. Cir. 2008).

179. *Id.* at 1337.

180. *Id.*

In this way, the requirement that the component be specially adapted for infringement and that there not be a substantially noninfringing purpose has been recast. Instead of requiring a patent holder to demonstrate that enough of the claimed invention has been made that it is fair to impose infringement liability, the courts allow evidence of the actor's intent to cause infringement by someone else to supply what is missing from the claims. A formulation that is focused on the behavior and intent of third-party actors leads to questions about just what it is the indirect infringer must intend. And this is where courts have turned their attention in recent years — first with respect to contributory infringement and more recently in cases of alleged induced infringement.

b. Induced Infringement

Inducement is defined as “actively and knowingly aiding and abetting another’s direct infringement.”¹⁸¹ Induced infringement is an attractive theory to rights holders who are unable to enforce their patents through contributory infringement, often because there are substantial noninfringing uses for the distributed goods.¹⁸² In these circumstances, the alleged inducer can be found liable for distributing instructions on using goods according to a patented method.¹⁸³ When addressing the intent factor of inducement for copyright law in *Grokster*,¹⁸⁴ the Court found relevant the requirement under the Patent Act that the acts of inducement be actively and knowingly undertaken by the infringer. The Court based its determination of inducement liability on evidence that the defendants sought out customers of the previously-infringing Napster service who wanted to use the infringing capabilities of their new software, finding that this was evidence of “purposeful, culpable expression and conduct” with an “intent . . . to bring about infringement.”¹⁸⁵

The intent requirement for indirect infringement applies to both contributory and induced infringement and focuses explicitly on the alleged infringer’s state of mind, in contrast to the substantial noninfringing use

181. *C.R. Bard, Inc. v. Advanced Cardiovascular Sys., Inc.*, 911 F.2d 670, 675 (Fed. Cir. 1990) (explaining § 271(b)).

182. See Lemley, *supra* note 170, at 227 (“[W]here the defendant sells a dual-use product — one that could be used for either an infringing or a noninfringing purpose — courts were unwilling to hold that the sale of the product is itself illegal [under a theory of contributory infringement]. They sought evidence that the defendant intended to help infringement.”).

183. See, e.g., *Metabolite Labs., Inc. v. Lab. Corp. of Am. Holdings*, 370 F.3d 1354, 1365 (Fed. Cir. 2004) (finding inducement when defendant published articles suggesting use of drug according to patent); *Chiuminatta Concrete Concepts, Inc. v. Cardinal Indus., Inc.*, 145 F.3d 1303, 1311–12 (Fed. Cir. 1998).

184. *Metro-Goldwyn-Mayer Studios Inc. v. Grokster, Ltd.* 545 U.S. 913, 936–37 (2005).

185. *Id.* at 937–39.

requirement.¹⁸⁶ The Supreme Court and Federal Circuit have struggled with interpreting the knowledge requirement for induced and contributory infringement in recent years. Although the statutory language for the two sections differs on intent,¹⁸⁷ the Court has held that because induced infringement was historically treated as evidence of contributory infringement rather than a separate theory of infringement,¹⁸⁸ the same standard of intent should be applied to both forms of infringement.¹⁸⁹ Recent cases interpreting the intent requirement have been brought in the context of inducement liability, and particularly for patents that claim exclusive rights in processes.¹⁹⁰

The intent prong of indirect infringement has become complicated, however, by questions about what it is the indirect infringer must know and intend. In the 1964 case *Aro Manufacturing Co. v. Convertible Top Replacement (Aro II)*, the Supreme Court held that “a majority of the Court is of the view that § 271(c) does require a showing that the alleged contributory infringer knew that the combination for which his component was especially designed was both patented and infringing.”¹⁹¹ However, this requirement — knowledge of the patent and knowledge of infringement — was by no means a unanimous understanding of the Court at the time, and it has taken some time for the law with respect to inducement to be settled.¹⁹² The Federal Circuit faced the question of whether an inducer must intend to induce acts that are later determined to constitute infringement or must know that the induced acts constitute infringement.¹⁹³ In an en banc decision, the court held that liability for induced infringement requires that “the inducer must have an affirmative intent to cause direct infringement.”¹⁹⁴ However, the possibility that ig-

186. As discussed above, the no substantial noninfringing use requirement is used as evidence of intent to infringe in contributory infringement.

187. *Compare* 35 U.S.C. § 271(b) (2018) (“Whoever actively induces infringement of a patent shall be liable as an infringer.”), *with id.* § 271(c) (“Whoever . . . sells within the United States . . . a component of a patented machine . . . constituting a material part of the invention, knowing the same to be especially made or especially adapted for use in an infringement of such patent . . . shall be liable as a contributory infringer.”).

188. *Global-Tech Appliances, Inc. v. SEB S.A.*, 563 U.S. 754, 764 (2011).

189. *See id.* at 765–66.

190. *See* Holbrook, *supra* note 149, at 1015.

191. *Aro Mfg. Co. v. Convertible Top Replacement Co.*, 377 U.S. 476, 488 (1964).

192. Four justices dissented, arguing that a rule requiring knowledge of the patent was contrary to the direct infringement statute and the understanding of Congress when it passed the statute. *Id.* at 488 n.8.

193. *See* Holbrook, *supra* note 149, at 1013 (discussing the internal circuit split before the Supreme Court decided *Grokster*); *compare* *Hewlett-Packard Co. v. Bausch & Lomb Inc.*, 909 F.2d 1464, 1469 (Fed. Cir. 1990) (“[P]roof of actual intent to cause the acts which constitute the infringement is a necessary prerequisite to finding active inducement.”), *with* *Manville Sales Corp. v. Paramount Sys., Inc.*, 917 F.2d 544, 553 (Fed. Cir. 1990) (“It must be established that the defendant possessed specific intent to encourage another’s infringement and not merely that the defendant had knowledge of the acts alleged to constitute inducement.”).

194. *DSU Med. Corp. v. JMS Co.*, 471 F.3d 1293, 1304–06 (Fed. Cir. 2006) (en banc).

norance of a patent might be a defense raised the potential of a disincentive to search and read patents. The Federal Circuit approach to this problem was to infer knowledge when the inducer showed deliberate indifference of a known risk of an existing patent exists.¹⁹⁵

The Supreme Court addressed intent for inducement in *Global-Tech Appliances, Inc. v. SEB S.A.*, holding that the *Aro II* ruling for contributory infringement was controlling for induced infringement as well.¹⁹⁶ The Court therefore overruled the Federal Circuit's deliberate indifference rule, requiring knowledge of the existence of the patent that is infringed. However, the Court held that this could be shown by "willful blindness" similar to theories under criminal law, thus allowing for something less than actual knowledge to be the basis for indirect infringement, albeit with a higher bar than the appellate court rule.¹⁹⁷ A showing of willful blindness, the Court explained, requires that the inducer "must subjectively believe that there is a high probability that a fact exists" and "must take deliberate actions to avoid learning of that fact."¹⁹⁸ The cases weighing the knowledge requirement demonstrate the same balancing act as is evident in all of the indirect infringement cases. Thus, much like the "substantial noninfringing use" cases, Holbrook explains the knowledge requirement in induced infringement liability as a balance of "the interest in preventing parties from burying their heads in the sand to avoid liability with a concern of ensnaring arguably innocent parties."¹⁹⁹

In addition to requiring knowledge of the patent, the Court in *Global-Tech* held that induced infringement required "knowledge that the induced acts constitute patent infringement."²⁰⁰ As a result, a good faith (but erroneous) belief of noninfringement removes the requisite intent with respect to indirect infringement. However, the question remained whether a good faith (but erroneous) belief of invalidity of a patent also shields an actor from indirect infringement liability. The Federal Circuit applied the rationale of *Global-Tech*, reasoning that a belief that a patent was invalid meant that there could be no intent to infringe it.²⁰¹ The Supreme Court disagreed, holding in *Commil USA, LLC v. Cisco Systems, Inc.* that a good-faith belief of invalidity cannot shield an actor from a charge of induced infringement.²⁰²

195. *SEB S.A. v. Montgomery Ward & Co.*, 594 F.3d 1360, 1376–77 (Fed. Cir. 2010), *aff'd on other grounds sub nom.* *Global-Tech Appliances, Inc. v. SEB S.A.*, 563 U.S. 754 (2011).

196. *Global-Tech Appliances, Inc. v. SEB S.A.*, 563 U.S. 754, 763–64 (2011).

197. *Id.* at 769–70.

198. *Id.*

199. Holbrook, *supra* note 149, at 1016.

200. *Global-Tech.*, 563 U.S. at 766.

201. *Commil USA, LLC v. Cisco Sys., Inc.*, 720 F.3d 1361, 1366, 1368–69 (Fed. Cir. 2013), *vacated in part*, 135 S. Ct. 1920 (2015).

202. *Commil USA.*, 135 S. Ct. at 1928.

Aside from the boundary of intent, induced infringement has been invoked as a potential solution to bind together acts performed by separate entities for the purposes of finding liability. One reason that inducement theories of infringement became more prevalent in courts was that inducement appeared to be the most useful tool for patent holders who faced divided performance of their method patents, although the case law has not developed to address many such cases.²⁰³ This is because there can be no indirect infringement without an underlying act of direct infringement.²⁰⁴ And the Federal Circuit has held that method patents are only infringed when all of the steps are performed by a single entity.²⁰⁵ This is somewhat tempered by the fact that acts of another may be attributable to one entity if it “directs or controls” the other’s actions or if the actors have formed a “joint enterprise.”²⁰⁶ This direction and control can be found “when an alleged infringer conditions participation in an activity or receipt of a benefit upon performance of a step or steps of a patented method and establishes the manner or timing of that performance.”²⁰⁷ However, if the steps are not all attributable to a single entity, there is no direct infringement and therefore there can be no induced infringement. In other words, if an entity merely induces its customers or others to perform some of the steps of a patented method — rather than directing them to do so — there is no direct infringement by anyone and there can be no indirect infringement, either.²⁰⁸

2. Cross-Border Infringement

In addition to indirect infringement, patent law faces boundary questions with respect to cross-border activities. These cross-border cases include the import and export of information and goods at various stages of production. When acts take place in separate locations or the claim elements are not satisfied entirely within one country, U.S. courts are left trying to decide whether domestic rights have in fact been infringed.²⁰⁹

203. Karshtedt, *supra* note 8, at 586 (“[T]he difficulty of establishing [secondary] liability can prevent patentees from vindicating their rights even in cases in which it seems intuitively clear that the non-performer is truly responsible for the infringement.”); Timothy R. Holbrook, *Method Patent Exceptionalism*, 102 IOWA L. REV. 1001, 1047 (2017) (arguing that method claims are “treated exceptionally — and afforded less protection — in the context of what has come to be known as ‘divided infringement’ scenarios of infringement”); *see also* Mark A. Lemley et al., *Divided Infringement Claims*, 33 AIPLA Q.J. 255 (2005).

204. *Limelight Networks, Inc. v. Akamai Techs., Inc.*, 134 S. Ct. 2111, 2116 (2014).

205. *BMC Resources, Inc. v. Paymentech, L.P.*, 498 F.3d 1373, 1380 (Fed. Cir. 2007).

206. *Akamai Techs., Inc. v. Limelight Networks, Inc.*, 797 F.3d 1020, 1022 (Fed. Cir. 2015); *see also* *Muniauction, Inc. v. Thomson Corp.*, 532 F.3d 1318, 1329 (Fed. Cir. 2008).

207. *Akamai Techs.*, 797 F.3d at 1023.

208. *Limelight Networks, Inc. v. Akamai Techs., Inc.*, 134 S. Ct. 2111, 2117 (2014).

209. There are other important questions raised by cross-border trade in information goods, such as whether a court has jurisdiction over the acts and what damages are attributable and

Like arguments for indirect infringement in the domestic context, arguments for expansion of liability for cross-border manufacturing and trade in patented goods often use the language of circumvention. Cross-border infringement expansion is also similar to indirect infringement doctrines because fairness interests for patent holders conflict with the interests of bounding patent infringement.

a. Infringement by Export Under § 271(f)

Imagine a manufacturer makes all the components of a patented shrimp deveining machine in the United States, but the combination is not assembled or sold domestically; rather, the components are sent abroad to be combined and sold elsewhere.²¹⁰ Should this company be liable for infringement of a U.S. patent? A company that manufactured and combined the components in the United States would infringe the U.S. patent, even if the goods were subsequently exported, because it is direct infringement to “make” a patented invention without authority in the United States.²¹¹ But the Supreme Court in *Deepsouth* held that uncombined, the components did not infringe the United States patent, based on the theory that U.S. laws do not apply extra-territorially, and the fact that the combination only happened outside of the country.

The outcome in *Deepsouth* was criticized as allowing manufacturers to circumvent the patent law — taking all the steps to “make” infringing goods in the United States but avoiding liability by assembling the goods abroad.²¹² Congress moved to remedy this seeming loophole in the patent law in 1984, enacting § 271(f) of the Patent Act, the first paragraph of which declared it an act of patent infringement to “suppl[y] . . . in or from the United States all or a substantial portion of the components of a patented invention, where such components are uncombined in whole or in part, in such manner as to actively induce the combination of such components outside the United States.”²¹³ Section 271(f) has a second paragraph that is targeted to the export of any component (rather than “all or a substantial portion of the components”) of a patented invention “that is especially made or especially adapted for use in the invention

recoverable when much of the infringement is located somewhere different from where effects are felt. See, e.g., Timothy R. Holbrook, *Boundaries, Extraterritoriality, and Patent Infringement Damages*, 92 NOTRE DAME L. REV. 1745, 1746, 1771–72 (2017); Sapna Kumar, *Patent Damages Without Borders*, 25 TEX. INTEL. PROP. L.J. (forthcoming); Bernard Chao, *Patent Imperialism*, 109 NW. U. L. REV. ONLINE 77 (2014).

210. See *Deepsouth Packing Co. v. Laitram Corp.*, 406 U.S. 518, 523–24 (1972).

211. See *id.* at 528–29.

212. *Microsoft Corp. v. AT&T Corp.*, 550 U.S. 437, 457 (2007).

213. 35 U.S.C. § 271(f)(1) (2018).

and not a staple article or commodity of commerce suitable for substantial noninfringing use”²¹⁴

The Court again declined to expand infringement boundaries beyond the dictates of the statute in *Microsoft v. AT&T*,²¹⁵ when it addressed whether intangible software code — absent a physical embodiment — could constitute a “component” of a patented invention. Because the Court found that software code was not a “component,” its creation in the United States for installation abroad could not be the basis for infringement.²¹⁶ In that decision, the Court explained that any ambiguity in § 271(f) would be resolved in accordance with the presumption against extraterritorial application of U.S. law.²¹⁷

Most recently, in *Life Technologies*,²¹⁸ the Court once again interpreted liability under § 271(f) as limited. The patent at issue in that case covered a five-component kit used for analysis of a DNA sample.²¹⁹ Life Technologies manufactured the second of these components (Taq polymerase) in the United States and shipped it to the United Kingdom where it was incorporated in genetic testing kits sold worldwide.²²⁰ The Supreme Court reversed the Federal Circuit’s ruling that the manufacture and export of a single component may be the basis for a finding of infringement under the statute.²²¹ Instead, the Court held “that a single component does not constitute a substantial portion of the components that can give rise to liability under § 271(f)(1).”²²² In its determination of the meaning of “substantial portion of the components,” the Court distinguished the first and second paragraphs of the section, noting that the second paragraph addresses the export of a single component but limits liability to situations where the component is not a commodity.²²³ The first paragraph — at issue in the case — refers to “a substantial portion of the components of a patented invention.”²²⁴ The Court declined to

214. *Id.* § 271(f)(2).

215. 550 U.S. 437 (2007).

216. *Id.* at 451–52.

217. *Id.* at 454.

218. 137 S. Ct. 734 (2017).

219. *Promega Corp. v. Life Techs. Corp.*, 773 F.3d 1338, 1344 (Fed. Cir. 2014), *rev’d*, 137 S. Ct. 734 (2017) (“(1) a mixture of primers; (2) a polymerizing enzyme such as Taq polymerase; (3) nucleotides for forming replicated strands of DNA; (4) a buffer solution for the amplification; and (5) control DNA.”).

220. *Id.* at 1344.

221. *Life Techs. Corp. v. Promega Corp.*, 137 S. Ct. 734, 743 (2017).

222. *Id.* at 737.

223. This was consistent with the position of the Solicitor Generals’ office, which filed a brief on behalf of the United States suggesting that § 271(f)(1) — the section at issue in this case — does not cover a single component of an invention because the second paragraph of § 271 determined when infringement liability is appropriate for shipment of a single component abroad. Brief for the United States as Amicus Curiae Supporting Petitioners at 9, *Life Techs. Corp. v. Promega Corp.*, 137 S. Ct. 734 (2017).

224. 35 U.S.C. § 271(f)(1) (2018).

find that this required a qualitative determination of how important a single component was to the invention, instead finding that the context of the provision showed that it referred to the export of multiple components, and that a single component could not satisfy the statutory provision.²²⁵

The Court was cognizant of the importance of notice to third parties of the limits of liability, asking how, under Promega's suggested test for the importance of components, "market participants attempting to avoid liability . . . [are] to determine the relative importance of the components of an invention?"²²⁶ In contrast to *Microsoft*, the Court in *Life Technologies* did not focus on extraterritoriality as a limiting factor. Instead, the Court looked to the history and purpose of the statutory language and what type of acts the statute seeks to capture. In tandem, it appears that the two paragraphs of the section expand liability to reach acts that are close to infringement "makings" that would be direct infringement, but that don't fully meet the patent claims, with the first paragraph reaching the *Deepsouth* situation of manufacturing all (or a substantial portion) of the components in the United States for foreign assembly²²⁷ and the second paragraph reaching situations where a single component may so fully embody the invention that it only requires the addition of fairly insignificant other components abroad.

b. Infringement by Import

Importation of infringing products is direct infringement under the patent statute.²²⁸ However, unbound infringement becomes relevant in a few other situations in which goods are entering the country. One is when goods are made abroad, for import, by methods that would infringe if they occurred in the United States.²²⁹ Another is when importation constitutes indirect infringement.²³⁰ Last, there are instances where components of inventions or steps of patented methods are spread among different continents.

One potential circumvention of patent protection is accomplished through practicing patented methods abroad then importing the resulting product. Because all of the steps of the process were performed abroad,

225. *Life Techs. Corp.*, 137 S. Ct. at 740, 742.

226. *Id.*

227. *See, e.g., id.* at 743 (Alito, J., concurring) ("It is clear from the text of 35 U.S.C. § 271(f) that Congress intended not only to fill the gap created by [*Deepsouth*] — where all of the components of the invention were manufactured in the United States — but to go at least a little further.").

228. 35 U.S.C. § 271(a).

229. *Id.* § 271(g).

230. *Id.* § 271(c) (including importation of components in its list of infringing acts).

this was a potential means of avoiding U.S. patent infringement and still selling the resulting products in the United States. In 1988, Congress amended the patent statute, adding § 271(g) which provides that importation of a product made by a patented method is considered infringement.²³¹ This rule allows an act that is entirely performed abroad to be “brought” to the United States for the purposes of assigning liability. The Federal Circuit has limited this provision’s application, holding in a recent case that a product manufactured abroad that was tested by use of a patented testing process did not infringe under the statute when it was imported to the United States.²³² In so holding, the court held that the product was not “made by” the patented process, but rather tested through that process, and therefore fell outside the scope of the statute. In an earlier case, the Federal Circuit also held that use of a patented screening process to identify proteins eventually used in a drug did not satisfy the statutory requirement that the import be “made by” a patented process.²³³

Because the contributory infringement provisions mention importation, infringement through the importation of a substantial portion of an infringing product depends on the rules governing that provision. Courts have expanded import infringement to also include inducement. Thus, in *Suprema v. International Trade Commission*, the Court of Appeals for the Federal Circuit, sitting en banc, held that the United States International Trade Commission (“ITC”) properly excluded imports of goods that, after importation, were combined with software and sold so as to induce infringement of method patents.²³⁴ The court thus expanded inducement infringement to importation, allowing for exclusion of goods that did not infringe but could be used to infringe.²³⁵

While tangible goods produced abroad through patented processes are covered by § 271(g), that leaves the question of how the law treats

231. *Id.* § 271(g); Process Patent Amendments Act of 1988, Pub. L. No. 100-418, 102 Stat. 1107; see discussion in Holbrook, *supra* note 149, at 1015 (“The legislative history makes clear that the intent was to protect U.S. patent holders from overseas uses of patented methods, where the resulting product enters the United States’ markets.”); see also *Quanta Comput., Inc. v. LG Elecs., Inc.*, 553 U.S. 617, 628–30 (2008) (holding “methods . . . may be ‘embodied’ in a product” for purposes of exhaustion and to avoid “an end-run around exhaustion” that would allow patent holders “seeking to avoid patent exhaustion [to] simply draft their patent claims to describe a method rather than an apparatus.”).

232. *Momenta Pharm., Inc. v. Teva Pharm. USA Inc.*, 809 F.3d 610, 613–14 (Fed. Cir. 2015), *cert. denied sub nom.* *Amphastar Pharm., Inc. v. Momenta Pharm., Inc.*, 137 S. Ct. 68, 68 (2016); see also *Phillip M. Adams & Assocs., LLC v. Dell Comput. Corp.*, 519 F. App’x 998, 1004–05 (Fed. Cir. 2013). *But see* *Bio-Tech. Gen. Corp. v. Genentech, Inc.*, 80 F.3d 1553, 1560–61 (Fed. Cir. 1996) (stating hGH is “made by” Genentech’s process, even though “the plasmid product of the claimed process and hGH are entirely different materials.”).

233. *Bayer AG v. Housey Pharm., Inc.*, 340 F.3d 1367, 1368–70 (Fed. Cir. 2003).

234. See *Suprema, Inc. v. ITC*, 796 F.3d 1338, 1340–41 (Fed. Cir. 2015) (en banc).

235. *Id.*

patented processes — or complex goods — that are entirely intangible and contain a cross-border component.²³⁶ For example, in *NTP v. Research In Motion*, the Federal Circuit addressed patents on mobile email systems that routed messages through a relay located in Canada, even when both the sender and recipient were in the United States.²³⁷

As to the method claims, the court held that each of the steps of a method claim had to be performed in the United States for a finding of direct infringement.²³⁸ The court explained that process claims are different from systems claims because “the use of a process necessarily involves doing or performing each of the steps recited,” as compared to “use of a system as a whole, in which the components are used collectively, not individually.”²³⁹ As a result, the court refused to find that practicing a method amounts to infringement in the United States when one of the steps is performed outside of the United States. Such an act is not located “within the United States” for purposes of infringement analysis. This ruling is in line with the strict interpretation for method claim infringement that courts offer for domestic infringement as well, refusing to locate infringement with a single entity if some of the steps have been performed by another. However, there is no equivalent to the “direction and control” rule from indirect infringement that would allow an act to be connected with the United States if it were performed in a way that was directed or controlled from the United States.

IV. EVALUATING INFRINGEMENT, UNBOUND

The previous Parts explained the principles underpinning the patent grant and described how boundaries on patent scope doctrines and patent enforcement doctrines further those principles, before demonstrating how a set of different laws and doctrines “unbind” patent enforcement. This Part applies patent principles developed in Part II to the different types of unbounded infringement described in Part III, asking first, whether the unbinding is justified in order to fairly protect patent holders’ exclusive rights, and second, whether the limiting principles on these unbinding doctrines themselves satisfy the patent law principles of encouraging third parties to engage in all acts that do not fall within the boundaries of patents and giving proper notice to encourage this behavior. While unbinding infringement may raise concerns about notice and

236. For a discussion (and critique) of the treatment of method claims, see Holbrook, *supra* note 149, at 1052–59 (arguing that method patent treatment should be harmonized with treatment of patented products).

237. *NTP, Inc. v. Research in Motion, Ltd.*, 418 F.3d 1282, 1290 (Fed. Cir. 2005).

238. *Id.* at 1318 (“We therefore hold that a process cannot be used ‘within’ the United States as required by Section 271(a) unless each of the steps is performed within this country.”).

239. *Id.*

preemption, it may be justified by patent principles in some circumstances — particularly when the principles used to limit its application are responsive to the patent balance.

A. Evaluating Unbound Infringement Liability

Indirect infringement and rules allowing liability for cross-border acts are similar in that they open the boundaries of patent enforcement and allow infringement for acts that do not fully occupy the bounds of the patent alone. The justification for these rules is generally that strict application of direct, domestic rules of infringement — that is, strict adherence to enforcement boundaries — would undermine the purposes of the patent grant. The concern is that patent holders are not compensated consistently with what they have been promised or can fairly expect.²⁴⁰ It bears consideration of what that fair expectation should be. While patent holders might find it preferable to file suits in the United States for any and all acts that have any connection to the forum and a jurisdictional hook, a broad interpretation of patent holder interests fails to note the other side of the patent balance that safeguards third parties who are engaging in behavior that falls outside the scope of a patent. However, it is fair to say that a patent holder can generally expect to be the only one marketing her invention — as claimed in the patent — within the United States. Like doctrines expanding scope, infringement doctrines should be unbound only if that helps capture the exclusivity to which the patent holder is entitled — and nothing more.

In these terms, indirect infringement doctrines broadly make sense as a means of targeting the entity that is most responsible for infringement when its acts harm a patent holder's market exclusivity interests. Scholars generally agree that such liability makes sense,²⁴¹ though they disagree on how to appropriately limit it. The liability itself is not problematic because it indeed looks to reward patent owners who otherwise cannot enforce their patents, often because the nature of the technology is such that it is easy to distribute widely. Moreover, it requires an act of direct infringement, meaning that indirect infringement is only available when a patent owner's interests have been invaded.

The difficulty, as discussed below, is in finding limits that take into account the other side of the patent balance. In particular, it is important to find a proxy for notice that can distinguish acts of inventing around

240. See *supra* Part III for discussions on circumvention purposes of various doctrines.

241. For example, Dmitry Karshedt has suggested that a theory of causation would allow the law to impose liability on those who design a device enabling infringement, rather than the end users whose use of the machine is a performance of the steps of the method. See *generally* Karshedt, *supra* note 8.

from acts designed to appropriate the core of a patented invention but technically circumvent liability. It is possible that there is no such proxy or that it is impossible to articulate a standard, *ex ante*, that can be applied to all potential expansions of infringement. That is not unheard of in our common law-based system, and developing rules from a series of cases can point us in a helpful direction, provided the rules do not devolve into a mechanical application of a standard. Moreover, when articulation of a clear standard is difficult (or impossible), there are costs to certainty for rights holders and third parties. For this reason, it is particularly important for courts to have a presumption that constrains the use of unbound infringement doctrines. It is also important that any proxies — such as intent — are used only as proxies and with an eye towards the costs that they may impose on third parties.

The more difficult first-order questions arise in determining which forms of cross-border infringement satisfy the general purposes of patent law. In particular, it is difficult to support expansion of infringement to cover manufacture of components for export under § 271(f) under the basic patent law principles discussed above. The idea that there ought to be infringement is based on the direct infringement provision that a patent holder has the exclusive right to “make” an invention within the United States. However, “making” a good does not have an obvious impact on the United States market. If an invention is made but never used or sold, it likely does not compete with the patent holder’s goods on the market.

Moreover, the scenarios in which making a patented product in the United States adversely affects the commercial interests of a patent holder result when there is another form of infringement. Take for example an infringing machine that produces goods more efficiently than other known machines. An infringer can unfairly compete with the patent holder by producing the goods as efficiently. Of course, this is a “use” of a patented machine and so would be an infringement even without the making provision. However, by including “making” in the patent statute, Congress has ensured that patent holders can enforce their rights upstream, against manufacturers, rather than waiting for infringing uses and sales. As an evidentiary and practical matter, then, infringement for “making” has some purchase. However, as the basis for expanding patent infringement liability to goods that are ultimately assembled and sold abroad, it is on shakier ground.

Section 271(f) and patent law purposes clash because the statute allows recovery for acts that do not affect the United States market and therefore should have no effect on the reward a patent is meant to give the patent holder. While a patent holder can expect some form of market

exclusivity,²⁴² that exclusivity — for United States patents — is limited to the United States market. To be sure, many innovators have multinational interests, but the choice to seek patent protection is one that must be made jurisdiction-by-jurisdiction. As a result, it is difficult to justify § 271(f). Indeed, the Supreme Court recently addressed the difficulty of assigning damages for infringement under this provision.²⁴³ In making its determination on foreign lost profits, the Court held that the damages were attributable to a domestic act of infringement. That is, because § 271(f) imposes liability for “supplying” components from the United States for assembly abroad, there is infringement in the United States once those components have been supplied.

The *WesternGeco* decision illustrates the far-reaching effects of statutorily allowing infringement, unbound. While that case reached conduct on the high seas, other cases could apply the same reasoning to award damages when the claims of a patent are not fully met in the United States and the harms to the rights holder are entirely separate from the U.S. market. Because damages of reasonable royalties and lost profits flow from the act of infringement, liability under § 271(f) has the potential to exclude third parties from actions in markets that U.S. patents are typically thought not to reach.

In contrast to § 271(f), provisions that allow infringement liability for importation of goods made by patented methods abroad find justification under patent law principles safeguarding the interests of patent holders. This is because the ultimate sales of these goods will compete on the U.S. market and thus threaten the patent holder’s market position as well. Similarly, the inclusion of importation as a potential source of indirect infringement also finds support as a means of safeguarding a patent holder’s legitimate expectations.

The general adherence of unbounding doctrines to patent law principles — with the exclusion of § 271(f) liability — is not a surprise. The indirect infringement provisions have deep roots in common law and thus percolated for years before their statutory implementation.²⁴⁴ Cross-border infringement provisions are more likely to have resulted from patent holder dissatisfaction with the territorial assumptions applied to patent law enforcement and may therefore have had less time to fully evolve into balanced doctrines. Nonetheless, the provisions were generally enacted in response to concerns borne of increasingly globalized trade and thus sought to include within patent enforcement acts that re-

242. Depending on the value and scope of her invention, the efficiency and legality of producing and selling the invention, and the ready availability of substitutes.

243. *WesternGeco LLC v. ION Geophysical Corp.*, 138 S. Ct. 2129 (2018) (holding that a patent holder is entitled to lost profits for foreign service contracts on the basis of the domestic act of infringement of § 271(f)).

244. *See supra* Part III.B.1.

sult in competition similar to that a patent holder would face from infringement in the U.S. market.

B. Evaluating Limiting Principles

The second step of evaluation focuses on the boundaries that have been loosened by laws and doctrines. Clear boundaries are desirable because they give notice to third parties of what is covered by the patent rights — and what is not. Therefore, even if there is good reason to loosen the boundaries that generally constrain patent enforcement, this loosening comes with a corresponding increase in information costs. In addition, there are costs associated with unclear rules because of the chilling effect they have on acts that are technically not encompassed by the patent right but that nonetheless are too risky for third parties to pursue. This means that limiting principles should serve patent goals by constraining a patent holder to what she can expect from the patent grant — some level of (U.S.) market exclusivity commensurate with the contribution of her invention. However, it should also provide relatively predictable results so that third parties will be able to avoid infringement.

Courts have limited indirect infringement doctrines through very strict interpretations of the language. For example, contributory infringement is strictly limited by the “substantial component” language and the requirement that an article not be a “staple of commerce.” In addition to the requirement that there be an underlying act of direct infringement that is then attributed to the alleged infringer, these limitations seek to ensure that only third parties who are closely connected with the eventual infringement should be liable. In some sense, notice concerns are less present for developers and distributors (of software, for example) than they are for the end users, who can be found liable for their unknowing infringement.²⁴⁵ As a result, some indirect infringement raises fewer notice concerns than direct infringement cases.

Inducement infringement has also been interpreted fairly strictly. In *Eli Lilly*, the court allowed a finding of induced infringement because the patent holder showed that the alleged infringer conditioned the receipt of benefit upon performance of a patented method.²⁴⁶ However, the line of cases governing the intent requirement in indirect infringement cases

245. See Saurabh Vishnubhakat, *An Intentional Tort Theory of Patents*, 68 FLA. L. REV. 571, 575 (2016) (“[T]he manufacturer has the lowest information cost for avoiding infringement; the end user, the highest cost. It is therefore unsound policy to treat all of these actors as interchangeable potential infringers.”). Vishnubhakat also argues that patent infringement is an intentional tort, rather than strict liability. My use of the word “unknowing” as opposed to “unintentional,” is for this reason. *Id.* at 574.

246. See *Eli Lilly & Co. v. Teva Parenteral Meds., Inc.*, 845 F.3d 1357, 1367–68 (Fed. Cir. 2017).

appears to hew so carefully to notice requirements that they overlook the importance of encouraging third parties to do all that which is not prohibited by a patent. Thus, for example, the fact that a good faith belief in noninfringement is a defense is in line with these values. By allowing third parties to research patents and determine that they do not infringe before selling products to others, the limitation encourages other actors to do that which is not prohibited. However, by failing to allow good faith belief in invalidity as a defense, courts are chilling third parties from acts that may well be desirable.²⁴⁷ Courts have suggested that third parties can bring cases to invalidate patents, and that is true. Of course, parties can also bring declaratory judgment actions of noninfringement, and yet courts allow the defense of a good faith belief in noninfringement.²⁴⁸

It is also impossible to discuss indirect infringement without discussing the rules governing direct infringement for method patents. The Supreme Court made it clear that there could be no induced infringement absent direct infringement,²⁴⁹ thereby refusing to allow for unbound infringement of method claims through indirect infringement. This is combined with the Federal Circuit's fairly strict interpretation of direct infringement of method patents, refusing to allow for unbound infringement when methods are spread among various people (absent direction and control). Each of these limiting principles on its own makes sense. Allowing for indirect infringement absent an underlying claim of direct infringement would result in the possibility of third parties being held liable for infringement when the invention is never put into use. Thus, sale of a potentially-infringing machine with instructions on how to infringe could result in liability even if the end-user never intended to use the machine in an infringing manner and never did. With the potential for a permanent injunction, this type of unbounded infringement could do damage to competition with no corresponding social benefit derived. Similarly, if divided infringement is allowed without clear boundaries, separate entities, acting entirely independently of each other, could unwittingly be caught up in an infringement action when one performs half of the claimed steps of an invention and the other performs the other half. However, when taken together, the two sets of boundaries may be too strict. The likely culprit here is the strict interpretation of direct infringement. A number of potential fixes to this problem have been pro-

247. See Holbrook, *supra* note 149, at 1030, 1035.

248. Granted, given administrative review of patent validity, it may be cheaper to challenge patent validity than it is to seek a noninfringement judgment.

249. *Limelight Networks, Inc. v. Akamai Techs., Inc.*, 134 S. Ct. 2111, 2115 (2014).

posed, such as bringing the standards for direction and control more in line with tort principles.²⁵⁰

For cross-border infringement, the main limiting principle applied to unbound infringement doctrines is that of territoriality. In some situations, this makes sense. The scope of the U.S. patent is the United States, and the expectations associated with the grant of a U.S. patent ought also to be limited to the United States. However, territoriality alone fails to capture acts that may greatly affect the ability of a patent holder to exploit her U.S. market exclusivity. Moreover, territoriality principles allow the imposition of infringement liability on acts that ultimately have no effect on the U.S. market, as in the case of exports of components for sale and assembly abroad. Timothy Holbrook has suggested that conflicts of law rules can supply a test governing when to apply patent law to extraterritorial acts.²⁵¹ Under this idea, courts would take into account whether there was a foreign patent and whether the acts would be considered infringing under foreign law when deciding whether to allow for a ruling of infringement of a U.S. patent.²⁵² This approach would limit cross-border unbound infringement. However, while appealing, and a useful tool for its purposes, this approach does not focus on the purpose of the U.S. patent grant itself. Therefore, it would often allow for infringement claims under § 271(f) when a foreign infringement claim better fits the facts and relevant economic harm. Nothing in the analysis suggested here would prohibit a patent holder from enforcing her rights abroad, of course. Indeed, because of the harm to her market interests abroad, I would hope that she would be entitled to relief in the foreign jurisdiction where her invention is put into use or sold. Additionally, this approach might not solve the problems with divided method claims, instead allowing some acts to escape enforcement by virtue of being split between jurisdictions.

Ultimately, just like scope-limiting provisions, the provisions that limit unbound infringement ought to be strictly and explicitly tied to the patent balance. The provisions are intended to help patent holders who would otherwise be unable to recover do so. However, this recovery should not be at the expense of notice to third parties or a robust public domain.

250. See, e.g., Karshtedt, *supra* note 8, at 571 (“[T]his principle holds that one is responsible for the actions of others that one has caused, leading to the legal effect of imputing the act of the ‘causee’ (in patent cases, often the end user) to the causer (e.g., the manufacturer).”).

251. Holbrook, *supra* note 209, at 1788–89 (“[A]ny U.S. patent should only cover extraterritorial conduct if there would also be infringement in the foreign jurisdiction.”).

252. *Id.*

V. CONCLUSION

Patent rights are often described with respect to their boundaries. The exclusive nature of the rights lends itself to analysis that focuses on the scope of the patent right. However, the boundaries that constrain imposition of infringement liability serve the same purposes as patent scope constraints and their expansion should not deviate from those purposes. Therefore, the doctrines that allow for expansion of patent enforcement boundaries should only be applied when a strict interpretation of the boundary would unfairly deprive a patent holder of the exclusive right — to the United States market — that the patent is meant to confer. Moreover, such expansion should account for the other side of the patent law balance, by ensuring that third parties have sufficient notice of what acts may result in liability and ensuring that acts properly outside the scope of the patent are not overly constrained.

The boundary framework suggested in this article brings together different statutory provisions and doctrines that serve to expand patent enforcement boundaries — domestic doctrines of indirect infringement and also cross-border rules of infringement. Applying the analysis developed in the article to different types of boundary expansion yields insights on the value of these provisions and on a number of recent Supreme Court cases. Ultimately, in some cases there may be serious questions about expanding liability when limiting doctrines for that expansion are not clear, or not clearly tied to third party notice concerns.