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A Brief Note on Blocking Patents and Reverse Equivalents: Biotechnology as an Example*

*Robert P. Merges*¹

The doctrine of equivalents helps the patentee by expanding the scope of her claims beyond its literal boundaries. In a roughly symmetrical way, two similar devices are available to the accused infringer: blocking patents and the reverse doctrine of equivalents. Recent cases on biotechnology, as well as recently-issued patents in this field, illustrate the relationship between these two legal devices, and the way they might be applied in particular cases. The recent case of *Scripps Clinic & Research Foundation v. Genentech* is a good example; this is discussed below.

Two patents are said to block each other when one patentee has a broad patent on an invention and another has a narrower patent on some improved feature of that invention. The broad patent is said to “dominate” the narrower one. In such a situation, the holder of the narrower (“subservient”) patent cannot practice her invention without a license from the holder of the dominant patent. At the same

* This article is adapted from a longer article that touches on some of the same issues, Merges & Nelson, *On the Complex Economics of Patent Scope*, 90 Columbia Law Review 839 (1990).
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time, the holder of the dominant patent cannot practice the particular improved feature claimed in the narrower patent without a license.²

It is of course preferable for an inventor to have her own patent free and clear of anyone else's claims. An inventor will therefore not often voluntarily characterize her invention as subservient.³ But a court may do so in the course of litigation. Where the court upholds the validity of an accused infringer's patent on some enhanced feature, but nevertheless finds that the accused product infringes a prior, broad patent, it is in effect making the accused infringer's patent subservient to the broad patent.⁴ In addition, of course, it is possible that an infringing product will not qualify for its own patent, and hence this avenue will not be open.

Even where a court finds a patent subservient to another—thus creating blocking patents—the holder of the subservient patent is still better off than if she had never filed a patent at all, for two reasons.

² Two aspects of this situation may seem counterintuitive: that the narrower (subservient) patent could ever be issued by the Patent Office, given the existence of the broad patent in the prior art; and that once the subservient patent were issued the holder of the dominant patent would be prevented from practicing an invention that clearly falls within the scope of her claims. Subservient patents may be issued, however, when they disclose an improved feature which meets the statutory tests of novelty and nonobviousness. *See, e.g., Atlas Powder Co. v. E.I. du Pont & Co.*, 750 F.2d 1569, 224 U.S.P.Q. 409 (Fed. Cir. 1984). (The fact that the subservient patentee has invented a nonobvious variant of a device covered by a broad patent does not mean that the broad patent is invalid for lack of enabling disclosure under 35 U.S.C. § 112); *B.G. Corp. v. Walter Kidde & C.*, 79 F.2d 20, 22 (2d Cir. 1935) (L. Hand, J.) ("It is true that [the inventor of the spark plug] did not foresee the particular adaptability of his plug to the airplane. . . Nevertheless, he did not shoot in the dark; he laid down with perfect certainty what he wished to accomplish and how. . . He is not charged with a prophetic understanding of the entire field of its usefulness."); *Amerace Corp. v. Ferro Corp.*, 532 F.Supp. 1188, 1202, 213 U.S.P.Q. 1099, 1202 (D. Tex. 1982)). And a subservient patent can prevent a dominant patent holder from practicing the particular improved feature claimed in the subservient patent. This stems from the fact that the patent grant is a right to *exclude*, not an affirmative right to practice an invention. *See* 35 U.S.C. § 154. Thus the dominant patentee can exclude the subservient patentee from practicing her invention at all; and the subservient patentee can exclude the dominant patentee from practicing her specific improved feature. *See Atlas Powder, supra; Ziegler v. Phillips Petroleum Co.*, 483 F.2d 858, 177 U.S.P.Q. 481 (5th Cir. 1973). *Cf. Cochran v. Deener*, 94 U. S. 780, 787 (1856); *Cantrell v. Wallick*, 117 U. S. 689, 694 (1886).

³ One example of patents that are so characterized is an improvement patent whose claims are drafted in a special format called "Jepson claims." *See, e.g., Pentec, Inc. v. Graphic Controls Corp.*, 776 F.2d 309, 227 U.S.P.Q. 766 (Fed. Cir. 1985). *See generally* R. Ellis, Patent Claims § 197 (1949). Improvement patents are specially provided for in the patent code, *see* 35 U.S.C. § 101 (1988). A Jepson claim has the same effect as a judicial finding that a patented invention is "dominated" by another invention. Strictly speaking only a patent drafted in Jepson format is an improvement patent. But in this article we use "improvement patent" more loosely, to describe both consciously drafted improvement claims *and* patents later found to be dominated by an earlier patent.

⁴ *See Ziegler v. Phillips Petroleum Co.*, 483 F.2d 858, 177 U.S.P.Q. 481 (5th Cir. 1973); *Bryan v. Richardson*, 254 F.2d 191 (5th Cir. 1958).

First, she can exclude the holder of the broad patent from practicing her improvement. Although the improver may literally infringe the broad patent, she may gain some bargaining leverage by obtaining the subservient patent.⁵ Second, because of this, she may be able to reduce the “lost profits” component of the dominant patentee’s damages in an infringement action; the dominant patentee would not have replaced all the infringer’s sales, presumably, because the infringer’s sales were based at least in part on her improved feature.⁶

But another doctrine can much more effectively mitigate the impact of literal infringement: the “reverse” doctrine of equivalents. Courts have long recognized that, “[c]arried to an extreme, the doctrine of equivalents could undermine the entire patent system.”⁷ Scope could be enlarged so far beyond the literal language of claims that patents would take on unlimited power. To check the potentially destructive impact of the doctrine, and to preserve symmetry in the rules on infringement,⁸ the Supreme Court long ago ruled that while

a charge of infringement is sometimes made out, though the letter of the claims be avoided. . . . The converse is equally true. The patentee may bring the defendant within the letter of his claims, but if the latter has so far changed the principle of the device that the claims of the patent, literally construed, have ceased to represent his actual invention, he is as little subject to be adjudged an infringer as one who has violated the letter of a statute has to be convicted, when he has done nothing in conflict with its spirit and intent.⁹

An example, drawn from the case just quoted, may help to illuminate the doctrine. In 1869 George Westinghouse invented a train brake that used a central reservoir of compressed air for stopping

⁵ There are limits to the bargaining power an improvement patent confers, however, as described below.

⁶ See *Water Technologies Corp. v. Calco, Ltd.*, 850 F.2d 660, 7 U.S.P.Q.2d 1097 (Fed. Cir. 1988). Cf. *Oil Well Improvements Co. v. Acme Foundry & Mach. Co.*, 31 F.2d 898, 901 (8th Cir. 1929) (“Obviously, there could be no recovery of such lost profits on account of sales to those who bought because of supposed superiority of the infringing device.”) Note that the subservient patentee would, however, be liable for damages as measured by the value of royalties to the patentee under a license agreement. See D. Chisum, *Patents* § 20.03[3] (1989), at 20-135 through 20-136 (“In a case of blocking industrial property rights, the reasonable royalty would have to reflect an appropriate apportionment of the expected economic benefits. On the other hand, the patent owner’s valid claim may have stood as a sole but complete legal obstacle to the manufacture of the product by the infringer.”)

⁷ *Borg-Warner Corp. v. Paragon Bear Works, Inc.* 355 F.2d 400, 404, 147 U.S.P.Q. 1 (1st Cir. 1965).

⁸ The “reverse doctrine of equivalents” is not the only check on potentially sweeping claims. The doctrine of prosecution history estoppel is another.

⁹ *Westinghouse v. Boyden Power-Brake Co.*, 170 U.S. 537, 562 (1898).

power. Further advances in his design, primarily the addition of an air reservoir in each brake cylinder, resulted in a brake that was patented in 1887. An improvement on this 1887 brake, invented by George Boyden, added an ingenious mechanism for pushing compressed air into the brake piston from both the central reservoir *and* a local reservoir in each brake cylinder. (Westinghouse's brake required a complicated series of passageways to supply air from the two sources.)¹⁰ With the added stopping power of the Boyden brake, engineers could safely operate the increasingly long trains of the late nineteenth century.

The Westinghouse patent included a claim for

the combination of a main air-pipe, an auxiliary reservoir, a brake-cylinder, a triple valve [the device that coordinated the airflows from the main reservoir and the individual brake reservoir] and an auxiliary-valve device, actuated by the piston of the triple-valve. . . for admitting air in the application of the brake. . .¹¹

The Court noted that the literal wording of the Westinghouse patent could be read to cover Boyden's brake, since it included what could be described as a "triple valve."¹² But it refused to find infringement, on the ground that Boyden's was a significant contribution that took the invention outside the equitable bounds of the patent:

We are induced to look with more favor upon this device, not only because it is a novel one and a manifest departure from the principle of the Westinghouse patent, but because it solved at once in the simplest manner the problem of quick [braking] action, whereas the Westinghouse patent did not prove to be a success until certain additional members had been incorporated in it.¹³

¹⁰ *Id.*

¹¹ *Id.* at 592-593

¹² *Id.* at 568. See also Piggott, *Equivalents in Reverse*, 48 J. Pat. Off. Soc'y 291, 295 (1966) (noting that in *Westinghouse*, "the claims literally read upon [i.e., cover] the accused structure.").

¹³ 170 U.S. 537 at 572. On the application of this standard to specific cases, see *Jacoby-Bender, Inc. v. Foster Metal Products, Inc.*, 152 F.Supp. 289, 114 U.S.P.Q. 534 (D.Mass. 1957), *aff'd* 255 F.2d 869, 17 U.S.P.Q. 373 (1st Cir. 1958) ("I am disposed to regard [the accused] device as . . . an equivalent unless what it accomplished was a marked improvement. . . In such event it would be appropriate to judge equivalency by the extent of the improvement—the significance of the departure in relation to the remaining basic concept."); Piggott, *Equivalents in Reverse*, 48 J. Pat. Off. Soc'y 291, 295-299 (1966).

The *Westinghouse* decision has influenced a number of cases.¹⁴ In *SRI International v. Matsushita Electric Corporation of America*¹⁵ the Federal Circuit reaffirmed the availability of the reverse doctrine of equivalents as a defense to literal infringement. The case involved a patent on a filter used to encode color information in a color television camera. The patent claimed a filter with two sets of parallel stripes of equal width “relatively angularly superimposed” over one another.¹⁶ The image to be televised is placed behind the filter. When a scanning beam passes over the image the stripes on the filter encode three distinct output signals corresponding to the three-primary-color content of the image.¹⁷ The stripes must be at different angles with respect to the vertical for the filter to work. The accused device used a similar design to achieve the same result, but the stripes in its filters must be at forty-five degree angles to one another. The resulting pattern of overlapping stripes causes a different type of signal to be encoded by the scanning beam. By using a different device to decode these signals, defendant’s camera filter ultimately achieves the same output signal as the patentee’s.¹⁸

The court unanimously recognized the validity of a reverse equivalents defense:

The law. . . acknowledges that one may only appear to have appropriated the patented contribution, when a product precisely described in a patent claim is in

¹⁴ See e.g., *Leesona Corp. v. United States*, 530 F.2d 896, 905–906, 192 U.S.P.Q. 672 (Ct. Cl. 1976); *Precision Metal Fabricators, Inc. v. Jetstream Systems Co.*, 6 U.S.P.Q.2d 1704, 1708 (N.D.Cal. 1988) (no infringement where plaintiff’s “machines do not operate on the same principle as defendant’s. . . This appears to be a case where the defendants are not gaining the benefit of plaintiff’s patents, but their equipment could fall within the literal language of the patents.”); *Mechanical Plastics Corp. v. Unifast Indus., Inc.*, 657 F.Supp. 502, 504, 4 U.S.P.Q.2d 1734 (E.D.N.Y. 1987) (“Where a device serves the same or a similar purpose to the patented invention, but functions in a substantially different way, the fact that it falls within the literal language of the claim does not warrant a finding of infringement.”); *Brenner v. Recognition Equip., Inc.*, 593 F.Supp. 1275, 1278, 225 U.S.P.Q. 1068, 1070 (S.D.N.Y. 1984) (alternative holding: “[E]ven assuming *arguendo* that the literal language of plaintiffs’ claims can be said to read upon [the defendant’s] systems, those systems do not infringe because they accomplish the [claimed] functions in a substantially different manner.”); see also Piggott, *Equivalents in Reverse*, 48 J. Pat. Off. Soc’y 291 (1966) (collecting many cases on two related issues: narrowing claims by reference to the specification to save the claims from invalidity, and “narrowing” claims to excuse infringement under the reverse doctrine of equivalents).

¹⁵ 775 F.2d 1107, 227 U.S.P.Q. 577 (Fed. Cir. 1985) (in banc).

¹⁶ 775 F.2d at 1111.

¹⁷ *SRI Int’l v. Matsushita Elec. Corp. of America*, 591 F.Supp. 464, 465–469 224 U.S.P.Q. 70 (N.D.Cal. 1984), *rev’d in part and remanded*, 775 F.2d 1107, U.S.P.Q. 577 (Fed. Cir. 1985).

¹⁸ *Id.*

fact 'so far changed in principle' that it performs in a 'substantially different way' and is not therefore an appropriation (reverse doctrine of equivalents).¹⁹

But the court divided sharply on the issue of whether the defendant's camera filter was "so far changed in principle" that it was excused from infringement without more factual proof.²⁰ It remanded the case with explicit instructions for the trial court to consider the accused infringer's reverse equivalents defense.

More recently, the Federal Circuit in *Scripps Clinic & Research Foundation v. Genentech*²¹ remanded the case with specific instructions to explore the reverse equivalents issue. There Genentech, the accused infringer, had argued that even if its recombinant version of the Factor VIII:C protein infringed plaintiff's product patent on the purified natural protein, it was "different in principle" from plaintiff's version and so should escape infringement. The court suggested this might be a viable argument in this case, since "the application of the doctrine requires that facts specific to the accused device be determined and weighed against the equitable scope of the claims. . ."

These cases demonstrate the potential use of the reverse equivalents doctrine by the courts to limit the reach of a patentee's claims in the face of substantial technological improvements. However, use

¹⁹ 775 F.2d at 1123, 227 U.S.P.Q. 577 at 580 (emphasis in original) (lead opinion, five judges joining); *Id.*, at 1132 (Davis, J., concurring); *Id.* at 1132, 1133 (Kashiwa, J., dissenting, five judges joining). See 4 D. Chisum, Claims § 18.03[1] (1978 rev. 1988).

²⁰ Compare 775 F.2d at 1125 (genuine issues of material fact still unresolved) (lead opinion, five judges joining); with *Id.*, at 1132 (reverse equivalents is always a matter of fact, not law) (Davis, J., concurring) and *Id.* at 1132, 1133 (no genuine factual issues left to resolve; one of two alternative legal findings is that reverse equivalents defense is valid here as a matter of law) (Kashiwa, J., dissenting, five judges joining). See 4 D. Chisum, Claims § 18.03[1] (1978 rev. 1988).

²¹ 1991 U.S. App. LEXIS 3925 (Fed. Cir. Mar. 11, 1991).

of the doctrine is fairly rare.²² Issuance of an improvement patent, or a holding that a patent is valid but subservient to another patent, is much more common.²³

At first blush, the technical merits of the allegedly infringing device might seem to be irrelevant where literal infringement is concerned. After all, a patent is the right to exclude; an astoundingly meritorious improvement, while no doubt deserving a patent of its own, ought not escape infringement. The improver can patent the improvement, but this should not affect the original patentee's rights.

This is an appealing argument. An economic rationale for improvement patents would stress their tendency to encourage bargaining between improvers and original patentees. To the extent the improver has a very significant cost-saving technology, it would be in the interest of the original patentee to cross-license with the improver, to gain access to the improved technology.

Unfortunately, the original patentee may use her patent as a "holdup" right, in an attempt to garner as much of the value of the

22 *Ethyl Molded Prods. Co. v. Betts Package, Inc.*, 9 U.S.P.Q.2d 1001, 1026 (E.D.Ky. 1988) ("The reverse doctrine of equivalents, although frequently argued by infringers, has never been applied by the Federal Circuit.") See *Kalman v. Kimberly-Clark Corp.*, 713 F.2d 760, 218 U.S.P.Q. 781, 788 (Fed. Cir. 1983) ("Because application of 'reverse equivalents' is a legal question, we conclude on this record, as a matter of law, that the [accused] devices do the same work, in substantially the same way, to accomplish substantially the same result."); *Studiengesellschaft Kohle, m.b.H. v. Dart Industries, Inc.*, 726 F.2d 724, 220 U.S.P.Q. 841, 843 (Fed. Cir. 1984) ("The so-called 'reverse doctrine of equivalents' does not apply in this case because Dart's catalyst is not so dissimilar to those contemplated by Ziegler and his co-inventors that it would be inequitable to regard the former as being within the scope of the claims."); *Del Mar Avionics, Inc. v. Quinton Instrument Co.*, 836 F.2d 1320, 1325, 5 U.S.P.Q.2d 1255 (Fed. Cir. 1987) (the accused infringer "has not carried the burden of its argument, invoking the 'reverse doctrine of equivalents'"); *Smithkline Diagnostics, Inc. v. Helena Laboratories Corp.*, 859 F.2d 878, 890, 8 U.S.P.Q.2d 1468 (Fed. Cir. 1988) (rejecting reverse equivalents defense); *Phillips Petroleum Co. v. U.S. Steel Corp.*, 673 F.Supp. 1278, 1350, 6 U.S.P.Q.2d 1065 (D. Del. 1987) (pointing out that reverse equivalents is rarely successfully asserted).

23 See *United States Steel Corp. v. Phillips Petroleum Co.*, 865 F.2d 1247, 9 U.S.P.Q.2d 1461 (Fed. Cir. 1989) (" 'Dominating' patents are not uncommon.") According to traditional doctrine, significant technical improvements in a device accused of infringement do not excuse the infringement. See, e.g., *Herman v. Youngstown Car Mfg. Co.*, 191 F. 579, 584-585 (6th Cir. 1911); *Bendix Corp. v. United States*, 199 U.S.P.Q. 203 (Ct. Cl. Trial Div. 1978), *aff'd* 600 F.2d 1364, 204 U.S.P.Q. 617 (Ct. Cl. 1979) ("Improvement if plaintiff's invention by defendant's modifications, while possibly affording a basis for a separate patent on the improvement, does not constitute a defense of noninfringement."). See also *Atlas Powder Co. v. E.I. du Pont De Nemours*, 750 F.2d 1569, 224 U.S.P.Q. 409 409 (Fed. Cir. 1984) (issuance of patent to accused infringer is irrelevant to question of infringement under the doctrine of equivalents).

improvement as possible.²⁴ The chances of this being successful depend on the relative contributions of the original patented invention and the improvement to the “original plus improvement” combination. Where the original invention contributes most of the value,²⁵ or where the original and improvement inventions contribute roughly equal value, issuing an improvement patent may be a reasonable solution. But where the original patent contributes very little value compared to the improvement, the holdup problem may be significant. That is, the holder of the original patent may use it to extract much of the value of the “original plus improvement” combination from the improver.

To see why this would be bad from society’s point of view, consider this example. An original patent has a value of \$100; an improvement, also worth \$100, is invented, and its inventor wishes to obtain the right to use it by bargaining with the holder of the original patent. Here the parties may well reach a bargain whereby the original patentee gains \$50 of the value of the improvement, and the improver keeps \$50 of this gain, for a total allocation of \$150 for the original patentee and \$50 for the improver. (Of course, the gain may be greater if the original patentee is especially “strategic”; or it may be lower if she is exceptionally “fair”; or the parties might not reach any agreement at all, and the improvement will have to wait until the original patent expires; but the 50-50 allocation is a

²⁴ The “holdup” problem was originally applied to situations where one buyer needs to acquire complementary assets from a number of sellers; some of the sellers may raise their prices to capture some of the value the buyer attributes to holding all the assets. See, e.g., Calabresi & Malamed, *Property Rules, Liability Rules, and Inalienability: One View of the Cathedral*, 85 *Harv. L. Rev.* 1089, 1106-1107 (1972) (example of sale of small parcels of land to buyer who needs all parcels, e.g., to build a highway; used as illustration of the necessity for a “liability rule” such as eminent domain, as opposed to an absolute or “property rule”). It has been extended to two-party contracts, see Klein, Crawford & Alchian, *Vertical Integration, Appropriable Rents, and the Competitive Contracting Process*, 21 *J.L. & Econ.* 21 (1978); Klein, *Transaction Cost Determinants of “Unfair” Contractual Arrangements*, 70 *Am. Econ. Rev. Pap. & Proc.* 356 (1980), reprinted in *Readings in the Economics of Contract Law* 139 (V. Goldberg, ed. 1988) (describing post-contract formation opportunities to assert holdup rights). The paper by Klein, Crawford and Alchian presents the best analogy to the improver-original patentee bargaining situation. This paper describes the opportunities for exerting holdup rights where one firm, after investing in an asset with a low salvage value and a rent stream that is highly dependent on an asset owned by another firm, can be held up by the other firm’s attempt to capture a large proportion of the rent stream of the combined assets. The owner of an improvement that contributes a very significant part of the value of the “original patent plus improvement” combination—i.e., an improvement that represents a major technical advance—is subject to same sort of “holdup” by the original patent holder.

²⁵ If the improvement would have been obvious to one skilled in the art, it will not be patentable at all. See 35 U.S.C. §103 (1988).

good approximation, based on empirical findings. See H. Raiffa, *The Art and Science of Negotiation* 48 (1982) (describing experiments conducted by the author where the best predictor of final agreement price was the midway point between the opening offers of sellers and buyers.) While this may tend to reduce the incentives to invent improvements below the optimal level—since the improver keeps only \$50 of the \$100 in extra value generated by the improvement—it is a reasonable result in this case given the strong policy in favor of preserving the reward for the original patentee, and thus incentives for future original patentees. But where the improvement adds value of \$900 compared to the original patent's value of \$100, the holdup problem becomes acute. Here if the parties bargain for an equal allocation of the improvement's value, the improver keeps only \$450 of the total value of the improvement, \$900. The reduced incentives to invent such substantial improvements are obvious from this example; not even the strong policy favoring incentives for the original patentee to invent can justify such a "windfall" to the original patentee at the expense of the improver. Note also that the social cost in those cases where the parties cannot agree, and where the very significant improvement therefore sits on the shelf for the life of the original patent, is by definition great. Note too that such "deadlocks" do occur, and in fact a certain number of them are predictable, even where the bargaining parties are acting rationally.²⁶

The reverse doctrine of equivalents solves the problem, by in effect excusing the improver from infringement liability—and therefore removing the original patentee's holdup right. Reverse equivalents, of course, did not evolve in explicit recognition of this problem.²⁷

26. See Cooter, Marks & Mnookin, *Bargaining in the Shadow of the Law: A Testable Model of Strategic Behavior*, 11 *J. Leg. Stud.* 225, 226 (1982) (even optimal bargaining strategies imply a positive probability of deadlock).

27. In fact, the most efficient way to deal with the problem would probably be a system of compulsory licensing, whereby the improver would pay a "fair" royalty to the original patentee. This is not part of U.S. patent law, however. Current patent law in fact leaves us with two "second-best" alternatives, finding infringement or finding no infringement. Thus the account of the reverse doctrine of equivalents given here is meant to be an explanation of how to work with our admittedly second-best system.

But the fear of the inefficient²⁸ use of holdup power does provide a rational account of the doctrine, and might even assist courts in applying it. Note too that the same rationale could be applied to analysis of infringement under the doctrine of equivalents; the more significant the technological advance represented by the allegedly infringing device, the less willing the courts should be to find it an equivalent of the patentee's device.²⁹

To see when reverse equivalents might make sense, consider the problem of broad claims encompassing embodiments that can be made only after significant additional research is performed. The *Westinghouse* case is an example; Boyden's brake involved a triple-valve, and was therefore within the boundaries of the Westinghouse patent. The court nevertheless refused to find infringement, since Boyden's invention was "a manifest departure from the principle of the patent. . ."³⁰

28. Assertion of a holdup right may be inefficient for three reasons: first, it may prevent the improvement from being introduced until the original patent expires; second, it may cause a delay shorter than the full patent term, e.g., because of litigation or bargaining time; and third, it may lead to higher cost to the consumer. In this connection, it is worth noting that many studies find that the social returns to particular innovations far exceed the private returns; thus society as a whole may well bear the greatest efficiency lost. See Griliches, *Research Expenditures, Education and the Aggregate Agricultural Production Function*, 44 *Am. Econ. Rev.* 961 (1964) (social rate of return on agricultural research is at least 150% greater than the private rate of return to the researchers); Evenson & Kislev, *Research and Productivity in Wheat and Maize*, 81 *J. Pol. Econ.* 1309 (1973) (social return up to 300% greater than private return); Mansfield, et al., *Social and Private Rates of Return from Industrial Innovations*, 91 *Q.J. Econ.* 221 (1977) (concluding that social rate of return on 17 major product innovations was between 77% and 150% greater than the private rate of return); Bresnahan, *Measuring the Spillovers from Technical Advance: Mainframe Computers in Financial Services*, 76 *Am. Econ. Rev.* 742, 753 (1986) (very large social gain from mainframe computers, 1.5 to 2.0 orders of magnitude above cost of inventing them); Bernstein, *The Structure of Canadian Inter-Industry R&D Spillovers, and the Rates of Return to R&D*, 37 *J. Ind. Econ.* 315 (1989) (social rates of return at least twice private rates for industries studied).

29. Perhaps it is even more useful in that context. Because reverse equivalents applies only where there is *literal* infringement, the improvement at issue has to be very significant to qualify for infringement immunity under the reverse doctrine of equivalents. If literal infringement were often excused, the original patentee would not have much faith in the value of her patent; this might significantly reduce her incentive to invent in the first place. But where the improvement allegedly infringes only under the doctrine of equivalents — a less certain area of the original patentee's scope — there will likely be less of an impact on the original inventor's incentives. So doctrine can be more sensitive to the degree of advance represented by the improvement where it allegedly infringes under the doctrine of equivalents. In terms of the model given in this section, the doctrine of equivalents — as opposed to reverse equivalents — can be used to remedy a greater number of potentially inefficient "holdups" by original patentees.

30. *Westinghouse*, *supra*, 170 U.S. 537, 572. Judge Newman of the Federal Circuit has acknowledged that the reverse equivalents doctrine "is invoked when claims are written more broadly than the disclosure warrants." *Texas Instruments, Inc. v. United States Int'l Trade Comm'n*, 846 F.2d 1369, 1372 (Fed. Cir. 1986), *denying rehearing of* 805 F.2d 1558, 231 U.S.P.Q. 833, 835 (Fed. Cir. 1986).

The “Harvard mouse” patent may someday give rise to a similar situation. If subsequently-developed technology falling within its claims requires very substantial additional research, the reverse doctrine of equivalents might be relevant. If, for instance, a latter-day Boyden comes along and invents a recombinant cow after very substantial research well beyond that of Leder and Stewart, a court should find that technique noninfringing.³¹

Likewise, in the *Scripps* case, the trial court might consider the “value-added” of the accused recombinant protein as compared to that of the patentee’s natural, purified protein. This would be consistent with Judge Newman’s direction to “weigh[]” the “facts specific to the accused device” against “the equitable scope of the claims. . .,” and might even be seen as an appropriate method to carry out those directions. In any event, *some* content must be given to the reverse doctrine of equivalents, since the Supreme Court has indicated that this doctrine does form part of patent law. This paper simply attempts to find one rational account for the doctrine.

³¹ See Bozicevic, *The “Reverse Doctrine of Equivalents”*; in *the World of Reverse Transcriptase*, 71 J. Pat. & Trademark Off. Soc’y 353, 360-69 (1989) (arguing that the Leder and Stewart patent ought to be narrowed under reverse equivalents if, for example, a subsequent inventor discloses a “substantially different” method of introducing foreign genetic material into a mammal’s genome). Despite the Federal Circuit’s unwillingness to use the reverse doctrine of equivalents so far, there is nothing in its statement of the doctrine that would preclude its application in such a case. See, e.g., *United States Steel Corp. v. Phillips Petroleum Co.*, 865 F.2d 1247, 9 U.S.P.Q.2d 1461, 1466 n.9 (Fed. Cir. 1989) (approving of trial court’s treatment of reverse equivalents as question of whether “the ‘principle’ of the contribution made by the inventor [is] . . . unchanged in the accused product”).

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