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The Demise of the Mathematical Algorithm Rejection and the Emergence of the Utility-Based Section 101 Inquiry

Michael L. Kiklis

In the recent *State Street*¹ and *AT&T*² decisions, the Federal Circuit has provided a new framework for identifying patentable subject matter for software-based inventions. Now, the focus is not on whether the claim recites a mathematical algorithm, but on whether the claim recites a "useful, concrete, and tangible result."³ This new framework provides a simple test for determining patentability and a new direction for a sometimes confusing and sometimes contradictory area of law that has developed over the past 20 years. To assess the impact of the *State Street* and *AT&T* decisions, this article places the two cases in a historical perspective and examines their significance.

The Problem

The problem courts have faced in dealing with software-based inventions stems from the difficult and inherently abstract concepts of software and mathematics. The term *software* refers to the intangible aspects of a computer, and the term *mathematics* refers merely to a language that can be used to express both patentable subject matter and unpatentable subject matter. Because software oftentimes manipulates numbers and performs mathematical operations, it possesses a mathematical basis, and math by its nature is abstract, not concrete. Although both software and mathematics are abstract⁴ concepts, their importance to our society cannot be disputed: the proliferation of software-based inventions has helped our economy reach its phenomenal heights,⁵ and mathematics serves as the building block of science.⁶

Given that software and mathematics are rather abstract concepts, patenting inventions in this area has proven difficult because of the judicially created exceptions to patentable subject matter, including laws of nature, natural phenomenon, and abstract ideas.⁷ The interrelationship between software, math, and abstract ideas serves as the root of the problem faced by the

courts, because the patent system only rewards inventors for applied inventions, not abstractions.⁸

The Road to State Street

Courts have struggled for years with software-based inventions, even though ordinary rules of statutory construction suggest a liberal interpretation of 35 U.S.C. Section 101, the statute defining statutory subject matter. A plain reading of the provision suggests that statutory subject matter casts a broad net: "any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof" may receive patent protection.⁹ Legislative intent also suggests a liberal construction, for Congress has stated that Section 101 should include "everything under the sun made by man."¹⁰ In fact, courts have recognized that Section 101 should be liberally applied to new technologies, regardless of whether Congress predicted the technological advance.¹¹ Perhaps that is why this language has remained virtually unchanged for over 200 years.¹²

Given this statutory backdrop, however, the Supreme Court in *Gottschalk v. Benson*¹³ balked when first confronted with computer-related inventions. In a rather confusing opinion, the *Benson* Court tested a process claim for statutory subject matter by determining whether it transformed or reduced an article to a different state or thing¹⁴ and ultimately left it up to Congress to decide whether programs should be patented.¹⁵

Although the Supreme Court more clearly spoke the next time it addressed computer-related inventions in *Parker v. Flook*,¹⁶ the message was somewhat baffling: the Court espoused a point-of-novelty test, rolling a novelty analysis into a Section 101 inquiry.¹⁷ In performing the inquiry, the Court ignored the mathematical aspects of the contested claim and determined whether the claim *sans* the math was otherwise novel.¹⁸ If not, it did not recite patentable subject matter.¹⁹ The Court concluded by making a very pessimistic statement regarding computer-related inventions: "Very simply, our holding today is that a claim for an improved

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method of calculation, even when tied to a specific end use, is unpatentable subject matter under § 101.²⁰

The Supreme Court concluded its treatment of computer-related inventions in *Diamond v. Diehr*, in which it indicated that the mere incorporation of an equation, program, or computer into a claim does not render it unpatentable.²¹ In concluding that the contested claims recited statutory subject matter, the Court stated that claims should be viewed as a whole during a Section 101 inquiry and also rejected the point-of-novelty analysis.²² Although *Diehr* provided more guidance, more clarity, and a better direction, confusion remained.²³

Since the Supreme Court last spoke on the subject, both the United States Court of Customs and Patent Appeals ("C.C.P.A.") and its successor, the Federal Circuit, have struggled with the Supreme Court guidance, what little there was. In fact, panels have disagreed regarding whether two of the Supreme Court cases, *Benson* and *Flook*, provided any guidance at all. For example, the C.C.P.A. stated in *In re Taner* that "*Benson* stands for no more than the long-established principle that laws of nature, natural phenomena, and abstract ideas are excluded from patent protection."²⁴ Later, however, the Federal Circuit in *In re Grams* cited *Benson* and *Flook* as creating a new exception to patentability for mathematical algorithms.²⁵

In their struggle, the C.C.P.A. and the Federal Circuit developed the *Freeman-Walter-Abele* test, which has been stated as follows:

First, the claim is analyzed to determine whether a mathematical algorithm is directly or indirectly recited. Next, if a mathematical algorithm is found, the claim as a whole is further analyzed to determine whether the algorithm is "applied in any manner to physical elements or process steps," and, if it is, it "passes muster under § 101."²⁶ As the C.C.P.A. noted in *In re Meyer*, the second step of this test is not the only way to perform a Section 101 analysis, so the court applied a different second step:

Once a mathematical algorithm has been found, the claim as a whole must be further analyzed. If it appears that the mathematical algorithm is implemented in a specific manner to define structural relationships between the physical elements of the claim (in apparatus claims) or to refine or limit claim steps (in process claims), the claim being otherwise statutory, the claim

passes muster under Section 101. *In re Meyer*, 688 F.2d 789, 796 (C.C.P.A. 1982) (citation omitted).

Since its inception, the Federal Circuit has offered clarity to this area en banc only once.

Then, in *In re Iwahashi*,²⁷ the Federal Circuit described the second step: "[T]he claim must be further analyzed to ascertain whether in its entirety it wholly preempts that algorithm."²⁸ Thus, various panels of the C.C.P.A. and the Federal Circuit have used different formulations of the test to suit their specific purposes, leading to some confusion about what the parameters of the test really are.

Since its inception, the Federal Circuit has offered clarity to this area *en banc* only once, and at that time, the court stated:

[T]he proper inquiry in dealing with the so called mathematical subject matter exception to § 101 alleged herein is to see whether the claimed subject matter as a whole is a disembodied mathematical concept, whether categorized as a mathematical formula, mathematical equation, mathematical algorithm, or the like, which in essence represents nothing more than a "law of nature," "natural phenomenon," or "abstract idea." If so, *Diehr* precludes the patenting of that subject matter.²⁹

After *Alappat*, the panels continued to use the *Freeman-Walter-Abele* test.³⁰

Most recently, however, the Federal Circuit clarified the law surrounding the mathematical-algorithm exception in *State Street* and *AT&T*. In these cases, the court criticized the use of the *Freeman-Walter-Abele* test,³¹ questioned the existence of the mathematical-algorithm rejection,³² and established a new test of whether the contested claim recites a useful, concrete, and tangible result.³³ In fact, the court even went so far as to distinguish two of its earlier decisions because in performing a Section 101 inquiry, the panels failed to determine whether such a result existed.³⁴ The new framework does not look for a mathematical algorithm and, if found, determine whether it is applied to physical elements or process steps. Instead, it only looks to whether the contested claim has utility. The new frame-

work, therefore, has the potential for expanding the scope of Section 101.

State Street and AT&T Judged in Light of the Post-Diehr and Pre-State Street Case Law

The new framework looks to the utility of the claim rather than other aspects previously identified in the *Freeman-Walter-Abele* test. Although the new framework conceivably could expand the scope of Section 101, the question arises whether *State Street* and *AT&T* are examples of such an expansion. To answer this question, the boundaries of Section 101 in the post-*Diehr* and pre-*State Street* time frame must be defined, and then both *State Street* and *AT&T* need to be examined to determine whether they fit into or extend beyond these boundaries. To define the boundaries, the remainder of this article addresses only the post-*Diehr* and pre-*State Street* case law. The Federal Circuit in *AT&T* recognized that the Supreme Court's decision in *Diehr* limited both *Benson* and *Flook*, so addressing cases that did not benefit from the instruction provided by *Diehr* does not seem worthwhile.³⁵

The new framework looks to the utility of the claim.

In defining these boundaries, one might profitably categorize the post-*Diehr* cases. They seem to fit into a number of categories based on the tangibility of the claim (*i.e.*, whether physical aspects were recited in the claim or not). They might fit into categories based on utility, but such a classification would be difficult since there is no way of quantifying the utility of a claim. It is easier to identify whether tangible aspects are recited upon a fair reading of the contested claim, so tangibility serves as the criterion in the following analysis. Using this approach, the claims appear to fall into four categories.³⁶ First, they may be directed to a machine, machine manipulation, or process within a machine. Second, they may be directed to transformation or generation of a physical entity or data representative of a physical entity. Third, they may be directed to software or mathematical algorithms in the abstract. Fourth, they may be directed to a number of steps performed by a person.

The examination of the post-*Diehr* case law indicates that claims of the first category have fared the best. The claims reciting a machine, machine manipulation, or a process within a machine were all found to recite statutory subject matter. Such claims include the claims in *Diehr* ("A method of operating a rubber-molding press" and "A method of manufacturing precision molded articles . . . in an openable rubber molding press"),³⁷ the claims in *In re Pardo* ("A process of operating a general purpose data processor" and "A general purpose data processor"),³⁸ the claims in *Iwahashi* ("An auto correlation unit"),³⁹ the claims in *Alappat*, ("A rasterizer"),⁴⁰ and claim 5 in *Warmerdam* ("A machine having a memory").⁴¹

The claims of the second category, reciting a physical transformation or generation, have also been found to recite statutory subject matter. Such claims include the claims in *In re Taner* (*e.g.*, "A method of seismic exploration . . . comprising . . . imparting the spherical seismic energy waves into the earth . . . generating a plurality of reflection signals . . . and summing the reflection signals to form . . . a signal simulating the reflection response of the earth to seismic energy"),⁴² claims 6, 33, and 36 in *In re Abele* ("data produced . . . by a computed tomography scanner," "a method of computed tomography," and "computed tomography apparatus"),⁴³ and the claims in *Arrhythmia Research Technology v. Corazonix Corp.* ("converting a series of QRS signals to time segments . . . applying a portion of said time segments . . . to high pass filter means . . . determining an arithmetic value of the amplitude of the output of said filter . . . comparing said value with said predetermined value" and "apparatus for analyzing electrocardiograph signals . . . comprising . . . means for converting X, Y, and Z lead electrocardiographic input signals to digital valued time segments").⁴⁴

All claims of category three—reciting pure algorithms without reciting any hardware—have been found to be nonstatutory. These claims include claims 5 and 7 in *Abele* ("A method of displaying data in a field comprising the steps of calculating the difference. . . and displaying the value" and "apparatus for displaying data values . . . comprising: means for calculating the difference . . . and means for displaying the value")⁴⁵ and claims 1 and 6 in *Warmerdam* ("A method for generating a data structure . . . comprising . . . first locating the medial axis of the object and then creating a

hierarchy of bubbles on the medial access" and "a data structure generated by the method of any of Claims 1 through 4").⁴⁶

The Federal Circuit has opened the door for expanding the scope of Section 101.

As to category four, a few cases contain claims that are more difficult to fit into a single category, but they appear to have a common thread. That is, a number of the steps of these claims are performed by a human. The claims of category four have been held to be nonstatutory, including claim 1 in *In re Meyer* ("A process for identifying locations of probable malfunction"),⁴⁷ claim 1 in *In re Grams* ("A method for diagnosing an abnormal condition in an individual"),⁴⁸ and the claims in *In re Schrader* ("A method of competitively bidding").⁴⁹

Admittedly, claim 55 of *Meyer* recites a machine⁵⁰ and claim 16 of *Grams* recites steps in a machine,⁵¹ but they were nonetheless found to recite nonstatutory subject matter. Possible explanations for this do exist, however. For example, claim 55 of *In re Meyer*, although directed to an apparatus, recited little more than receiving results of tests performed (e.g., on a human) and displaying the results, meaning that although there was processing in a machine, it was rather insignificant.⁵² And claim 16 of *Grams* recites that the method of claim 1 is performed by a computer.⁵³ But at least one of the steps of claim 1 (e.g., performing . . . tests on the individual) was performed by a person, not a computer.⁵⁴

Thus, from an empirical review of this case law, it appears that the more tangible the claim, the more likely it recites statutory subject matter.

Both *State Street* and *AT&T* fit comfortably within category one. The contested claim in *State Street* was directed to a machine ("A data processing system . . . comprising: (a) computer processor means . . . (b) storage means"),⁵⁵ and the contested claim in *AT&T* was directed to a method in a machine⁵⁶ ("A method for use in a telecommunications system"⁵⁷) performing more than insignificant processing. The claims in these cases do not recite an algorithm in the abstract, nor do they recite a number of steps performed by a human. Thus, although the new framework is in place, *State Street* and *AT&T* are not examples in which the scope of Section 101 has been expanded, unless one could

argue that these cases somehow involved claims with less utility, which seems doubtful.

Conclusion

By focusing on the utility of the claim and by distinguishing both *Schrader* and *Grams*, the Federal Circuit has opened the door for expanding the scope of Section 101. But neither *State Street* nor *AT&T* serves as an example of such an expansion because both contain machine or physical limitations. Thus, the computer-software boundaries of Section 101 remain undefined in this post-*State Street* era, and to define those boundaries, the Federal Circuit needs to perform a Section 101 inquiry into a claim that is purely non-physical (e.g., a process without recitation of any physical elements). When confronted with such a claim, the Federal Circuit may emphasize the concrete and tangible aspects of the new framework and find such aspects to be lacking. As a result, claiming algorithmic inventions in the abstract may still risk invalidation under Section 101 even though the claim contains sufficient utility. Thus, the patent practitioner may be wise to add a dependent claim limiting the steps of the process to a machine, which, as in the case of *Warmerdam*, may save the day.

Notes

1. *State St. Bank & Trust Co. v. Signature Fin. Group, Inc.*, 149 F.3d 1368 (Fed. Cir. 1998), cert. denied, 119 S. Ct. 851, ___ U.S. ___ (1999).
 2. *AT&T Corp. v. Excel Communications, Inc.*, No. 98-1338, 1999 WL 216234, ___ F.3d ___ (Fed. Cir. Apr. 14, 1999).
 3. *Id.* at *8.
 4. *Abstract*, in this sense, refers to being "considered apart from concrete existence," which is the first definition of the term provided by *The American Heritage College Dictionary* 6 (3d ed. 1997). It is worth noting that the second definition of *abstract* is directed to a different notion: "Not applied or practical; theoretical." *Id.*
 5. As recently reported in the *Washington Post*: "Federal Reserve Chairman Alan Greenspan [has recently stated] that an unexpected leap in technology is primarily responsible for the nation's 'phenomenal' economic performance. . . ."
- Greenspan built his case around technological innovations, most of which involve computers and other information-processing equipment. This technology has helped businesses operate more efficiently, allowing them to control their costs and increase profits without raising prices. John M. Berry, "Greenspan Credits Technology," *Wash. Post*, May 7, 1999, at A1.
6. "Pythagoras showed that the truth of mathematics could be applied to the scientific world and provide it with a logical foundation. Mathematics gives science a rigorous beginning, and

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upon this infallible foundation scientists add inaccurate measurements and imperfect observations." Simon Singh, *Fermat's Enigma* 26 (1997).

7. *Diamond v. Diehr*, 450 U.S. 175, 185 (1981) ("Excluded from such patent protection are laws of nature, natural phenomena, and abstract ideas.")

8. In re *Alappat*, 33 F.3d 1526, 1552 (Fed. Cir. 1994) (en banc) (Archer, C.J. and Nies, J., concurring in part and dissenting in part) ("[P]atent law rewards persons for inventing technologically useful applications, instead of for philosophizing unapplied research and theory.") (citations omitted); see also *Brenner v. Manson*, 383 U.S. 519, 534-535 (1966) (stating that "[u]nless and until a process is refined and developed to this point—where specific benefit exists in currently available form—there is insufficient justification for" the reward of a patent).

9. 35 U.S.C. § 101 (emphasis added); see also *Alappat*, 33 F.3d at 1542 ("The use of the expansive term 'any' in § 101 represents Congress's intent not to place any restrictions on the subject matter for which a patent may be obtained beyond those specifically recited in § 101 and the other parts of Title 35.")

10. The Committee Reports accompanying the 1952 Patent Act indicate that Congress intended statutory subject matter to "include anything under the sun that is made by man." S. Rep. No. 82-1979, at 5 (1952), reprinted in 1952 U.S.C.C.A.N. 2394, 2399; H. R. Rep. No. 82-1923, at 6 (1952).

11. As noted by Judge Newman in her concurrence in *Alappat*, 33 F.3d at 1570:

Old law is often adapted to new needs: "If Congress has made a choice of language which fairly brings a given situation within a statute, it is unimportant that the particular application may not have been contemplated by the legislators." *Barr v. United States*, 324 U.S. 83, 90, 65 S.Ct. 522, 525, 89 L.Ed. 765 (1945). In *Diamond v. Chakrabarty*, 447 U.S. 303, 100 S.Ct. 2204, 65 L.Ed.2d 144, 206 USPQ 193 (1980) the Court emphasized that the patent system is available to serve all fruits of human ingenuity.

12. The Patent Act of 1793 defined statutory subject matter as "any new and useful art, machine, manufacture or composition of matter, or any new or useful improvement." Act of Feb. 21, 1793, ch. 11, §1, 1 Stat. 318. Since then, the only change Congress made was to replace the word "art" with the word "process" in 1952. Patent Act of 1952, ch. 950, 66 Stat. 792, 797.

13. *Gottschalk v. Benson*, 409 U.S. 63 (1972).

14. *Id.* at 70.

15. *Id.* at 73.

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

17. *Id.* at 594.

18. *Id.* at 594-595.

19. *Id.* at 595.

20. *Id.* at 595 n.18.

21. *Diehr*, 450 U.S. at 187 ("[A] claim drawn to subject matter otherwise statutory does not become nonstatutory simply

because it uses a mathematical formula, computer program, or digital computer.")

22. *Id.* at 188 ("[The] claims must be considered as a whole. It is inappropriate to dissect the claims into old and new elements . . .").

23. The Federal Circuit has noted:

The Supreme Court . . . has not been clear as to exactly what kind of mathematical subject matter may not be patented. The Supreme Court has used, among others, the terms "mathematical algorithm," "mathematical formula," and "mathematical equation" to describe types of mathematical subject matter not entitled to patent protection standing alone. The Supreme Court has not set forth, however, any consistent or clear explanation of what it intended by such terms or how these terms are related, if at all."

Alappat, 33 F.3d at 1543 n.19.

24. In re *Taner*, 681 F.2d 787, 791 (citing *Diehr*, 450 U.S. at 185).

25. In re *Grams*, 888 F.2d 835, 837 (Fed. Cir. 1989) ("Thus, mathematical algorithms join the list of nonpatentable subject matter not within the scope of section 101, including methods of doing business, naturally occurring phenomenon, and laws of nature.") (citations omitted).

26. In re *Pardo*, 684 F.2d 912, 915 (C.C.P.A. 1982) (citation omitted).

27. In re *Iwahashi*, 888 F.2d 1370 (Fed. Cir. 1989).

28. In re *Iwahashi*, 888 F.2d 1370, 1374 (quoting In re *Freeman*, 573 F.2d 1237, 1245 (C.C.P.A. 1978)).

29. *Alappat*, 33 F.3d at 1544.

30. E.g., In re *Warmerdam*, 33 F.3d 1354, 1358-1360 (Fed. Cir. 1994); In re *Trovato*, 42 F.3d 1376, 1378-1380 (Fed. Cir. 1994), vacated, 60 F.3d 807 (Fed. Cir. 1995) (en banc).

31. *State St.*, 149 F.3d at 1374 ("[T]he Freeman-Walter-Abele test has little, if any, applicability to determining the presence of statutory subject matter.")

32. In *ATE&T*, the court stated, "Because § 101 includes processes as a category of patentable subject matter, the judicially-defined proscription against patenting of a 'mathematical algorithm,' to the extent such a proscription still exists, is narrowly limited to mathematical algorithms in the abstract." *ATE&T*, 1999 WL 216234, at *4 (emphasis added) (citations omitted).

33. *Id.* at *10.

34. *Id.* at *9 (distinguishing both In re *Grams* and In re *Schrader* because their focus was on the *Freeman-Walter-Abele* test and not whether the mathematical algorithm was applied in a practical manner to produce a useful result).

35. *Id.* at *5 ("In *Diehr*, the Court expressly limited its two earlier decisions in *Flook* and *Benson* . . .").

36. This classification ignores claim type, because it is an irrelevant consideration for § 101 purposes. See *id.*, at *6 ("Whether stated implicitly or explicitly, we consider the scope of § 101 to be the same regardless of the form—machine or process—in which a particular claim is drafted.") (citations omitted).


37. *Diehr*, 450 U.S. at 179 n.5.
38. *In re Pardo*, 684 F.2d 912, 913-914 (C.C.P.A. 1982).
39. *Iwahashi*, 888 F.2d at 1373.
40. *Alappat*, 33 F.3d at 1538-1539.
41. *Warmerdam*, 33 F.3d at 1357-1358. It should be noted that this claim was not facing a § 101 rejection on appeal, but the court nonetheless stated that "claim 5 is for a machine, and is clearly patentable subject matter." *Id.* at 1360.
42. *In re Taner*, 681 F.2d 787, 788 (C.C.P.A. 1982).
43. *In re Abele*, 684 F.2d 902, 908-910 (C.C.P.A. 1982).
44. *Arrhythmia Tech., Inc. v. Corazonix Corp.*, 958 F.2d 1053, 1055 (Fed. Cir. 1992).
45. *Abele*, 684 F.2d at 908-909. It should be noted that although claim 7 was drafted as an apparatus claim, the court treated this claim as a process claim because it was directed to functions instead of a specific apparatus. *Id.* at 909.
46. *Warmerdam*, 33 F.3d at 1357-1358.
47. *Meyer*, 688 F.2d at 792-793.
48. *Grams*, 888 F.2d at 836-837. It is worth noting that this claim may also be categorized as an algorithm in the abstract, category three.
49. *In re Schrader*, 22 F.3d 290, 292 (Fed. Cir. 1994).
50. *Meyer*, 688 F.2d at 793.
51. *Grams*, 888 F.2d at 841.
52. *Meyer*, 688 F.2d at 793. Further, the apparatus claim was essentially the same as the nonstatutory process claim. *Id.* at 795 n.5.
53. *Grams*, 888 F.2d at 840.
54. *Id.* at 836.
55. *State St.*, 149 F.3d at 1371-1372.
56. *AT&T*, 1999 WL 216234 at *3 ("The [lower] Court recognized that the claims require the use of switches and computers . . .").
57. *Id.* at *2.



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