DRAFTING PATENT APPLICATIONS ON COMPUTER-IMPLEMENTED INVENTIONS

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INTRODUCTION

Case law handed down recently has altered the test for determining what types of computer-implemented inventions are subject to patenting. New law has evolved signifying changes in the breadth afforded to patent claims formulated by statutory means-plus-function language, a claim format particularly well suited to computer patent applications. The cases also signal changes in the form of disclosure necessary to support patent applications on program-implemented devices and processes.

This Note explores the statutory requirements for patent applications as they have been applied by the courts to computer-implemented inventions. Recent developments affecting issues of statutory subject matter, disclosure, and claim interpretation are reviewed. The Note concludes with ten rules for drafting patent applications in light of the case law.

I. STATUTORY SUBJECT MATTER

A. Algorithms

In *Gottschalk v. Benson*,[1] *Parker v. Flook*,[2] and *Diamond v. Diehr*,[3] the Supreme Court began to elaborate the statutory requirements under 35 U.S.C. § 101[4] for patentability of computer-implemented inventions. *Benson* involved a method of converting binary-coded decimal numerals directly into binary numerals for use with a general purpose digital computer. The Supreme Court held the claims in *Benson* to be non-statutory

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1. 409 U.S. 63 (1972).
2. 437 U.S. 584 (1978).
3. 450 U.S. 175 (1981).
4. 35 U.S.C. § 101 (1988) states:

   Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

as they recited mathematical formulas in process steps that were considered to have no application except in connection with a computer. The rationale was that any patent containing such claims would wholly preempt the mathematical formula, and in practical effect, would be a patent on the algorithm itself. *Flook* involved a method for updating alarm limits during catalytic conversion processes. The inventor claimed the solution of a mathematical algorithm, followed by a step of "setting alarm limits" as a result of the mathematical computation. The Court, setting forth a "point of novelty" test, held that conventional or obvious post-solution activity is not sufficient to transform an unpatentable principle into a patentable process.

However, just prior to the *Flook* case in *In re Freeman*[5] the Court of Customs and Patent Appeals ("CCPA")[6] had rejected the "point of novelty" approach, setting forth a two-step analysis to determine whether a claim preempts non-statutory subject matter as a whole. In the first part of the test, it must be determined whether the "claim directly or indirectly recites an 'algorithm' in the *Benson* sense of the term, for a claim which fails even to recite an algorithm clearly cannot wholly preempt an algorithm."[7] Second, if the claim contains an algorithm, the claim "must be further analyzed to ascertain whether in its entirety the claim wholly preempts that algorithm."[8] If it does not wholly preempt the algorithm, the claim is statutory. In *Freeman*, the court did not reach the second step of this analysis.

Following *Flook*, the CCPA in *In re Walter*[9] restated the second step of the *Freeman* test: "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."[10]

In *Diehr*, the Supreme Court finally upheld program patentability under the *Freeman-Walter* test. The case involved claims drawn to a process for curing synthetic rubber; the Court held that computer-related inventions, when properly disclosed and claimed, are patentable subject matter under 35 U.S.C. § 101.

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5. 573 F.2d 1237 (C.C.P.A. 1978).

6. The Federal Circuit Court of Appeals replaced the CCPA in 1982.

7. 573 F.2d at 1245.

8. *Id.*

9. 618 F.2d 758 (C.C.P.A. 1980).

10. *Id.* at 767.

Following the decision in *Diehr,* the CCPA, in *In re Abele,*[11] further refined the *Freeman-Walter* test by applying an "otherwise statutory" test. The court held that if the claims read without the algorithm would be "otherwise statutory," albeit inoperative or less useful, the claims present statutory subject matter when the algorithm is included.

According to *Abele,* the "otherwise statutory" test is carried out as follows. As a first step, the court determines whether the claim directly or indirectly incorporates a mathematical algorithm, i.e., whether it specifically recites a mathematical formula or calculation or uses words which mean the same thing.[12] Second, to pass muster under 35 U.S.C. § 101, a claim deemed to incorporate a mathematical algorithm must apply that algorithm to physical elements or process steps in some manner other than simply by a field-of-use limitation or by reference to non-essential post-solution activity.[13]

In *Abele* itself, the court held a method of displaying information unpatentable because what was claimed was "no more than the calculation of a number and display of the result, albeit in a particular format."[14] Similarly, the court rejected a means-plus-function apparatus claim of the same sort. However, the court found a very similar method claim to be statutory because it referred to physical elements.[15]

The "otherwise statutory" test embodied in *Abele* was adopted by the U.S. Patent and Trademark Office ("PTO") in a recent Analysis.[16] The Analysis adopts the first step of *Freeman-Walter-Abele,* and clarifies the second step, implementing the "otherwise statutory" test. As framed, the test is whether the "algorithm is 'applied in any manner to physical elements or process steps.'"[17] To carry out the second step, one first considers the claim without the algorithm. If what remains is "otherwise statutory," the claim may be statutory under 35 U.S.C. § 101. The PTO distinguished this second step from the "point of novelty" test (which has been "consistently rejected by the CCPA"[18]), because the "point of

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11. 684 F.2d 902 (C.C.P.A. 1982).

12. *See id.* at 905.

13. *See id.* at 907.

14. *See id.* at 909.

15. *See id.* at 908. The court accepted a claim dependent on an invalid claim which further recited that the displayed data "is X-ray attenuation data reduced in a two dimensional field, i.e., computer tomography scanner." *Id.*

16. *See* Barrett, *Patentable Subject Matter: Mathematical Algorithms and Computer Programs,* 1106 Official Gaz. Pat. Off. 5 (1989).

17. *Id.* at 8 (quoting without citation *In re* Walter, 618 F.2d 758, 767 (C.C.P.A. 1980)).

18. *Id.* at 7.

novelty" test requires what remains to be *novel* and *non-obvious*, not merely *statutory*.[19]

To determine if the claim without the algorithm is otherwise statutory, five "guidelines" are employed by the PTO:

1) Post-solution activity;
2) Field-of-use limitations;
3) Data-gathering steps;
4) Transformation of something physical; and
5) Structural limitations in process claims.

Each is discussed in turn.

1. Post-Solution Activity

Post-solution activity may render a claim statutory if, in cooperation with other elements of the claim, it limits the claim to a specific application or range of applications. However, post-solution activity in a claim usually is insufficient to create a statutory process if the activity is "insignificant." For example, in *Flook,* the final step of the claim, "adjusting an alarm limit," was found insufficient.[20] Similarly, in *Abele,* the court considered a result displayed as a shade of gray equivalent to a number and not a physical limitation that would limit the range of applications encompassed by the claim.[21]

2. Field-of-Use Limitations

A mathematical algorithm in a claim is not made into a statutory process merely by incorporating into the claim, language that attempts to "limit the use of the mathematical algorithm to a particular technological environment."[22] Field-of-use limitations often are included in the preamble of a claim, but can be incorporated at the end or elsewhere in the

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19. *See id.*

20. *See* 437 U.S. 584 (1978).

21. *See* 684 F.2d 902 (C.C.P.A. 1982). *See also* Barrett, *supra* note 16, at 9. Under the reasoning in the Analysis, virtually no post-solution activity in the form of a number or equivalent physical representation will convert an otherwise nonstatutory claim to a statutory claim. This may adversely affect technological areas such as speech recognition and image processing wherein physical signals are converted to data, mathematically manipulated, and then displayed on a video screen. *See* A. RATNER, COMPUTER SOFTWARE COMMITTEE REPORT BY SUBCOMMITTEE ON PATENT AFFAIRS 11 (1989) (Presented at American Intellectual Property Law Association 1989 Meeting).

22. Barrett, *supra* note 16, at 9 (citing Diamond v. Diehr, 450 U.S. 175, 191 (1981)).

claim. Like post-solution activity, a field-of-use limitation will render a claim statutory if the limitation is combined with other elements of the claim to restrict the range of applications to which the algorithm is applied. On the other hand, a claim having a preamble that sets forth a specific field of use, followed by claim elements describing mathematical computations that themselves are not limited to the field of use, will not render the claim statutory.

3. Data-Gathering Steps

A claim defining mathematical computations will not be changed to a statutory process merely by reciting steps of gathering data and substituting values for variables used in the calculations.[23] Otherwise, every mathematical equation, formula, or algorithm having a practical use would be patentable.[24] However, a claim may incorporate statutory subject matter if the claim presents data-gathering steps limited by means other than computations. A statutory process may also result from the particular manner by which values used in the computations are acquired.[25] In the *Abele* case, claim six, which provided that data operated on is obtained from a tomographic scanner, was considered statutory. Claim five, though identical in other respects, was considered non-statutory because the data was obtained through more conventional means.[26]

4. Transformation of Something Physical

Transformation of physical quantities in a claim usually will render the claim statutory. The PTO Analysis compares cases involving mathematical manipulation of seismic signals, considered statutory,[27] with other cases concerning signals representing either physical or abstract quantities.[28] Whether the subject matter is statutory does not depend on the label "signals" or "data"; rather, what the signals or data being transformed represent appears controlling. If signals or data expressed in a claim represent physical phenomena, the claims may be

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23. *See id.*

24. *See id.* (citing *In re* Sarkar, 588 F.2d 1330, 1335 (C.C.P.A. 1978)).

25. *See id.* (citing *In re* Abele, 684 F.2d 902, 908 (C.C.P.A. 1982)).

26. *See supra* notes 14–15 and accompanying text.

27. *See, e.g., In re* Sherwood, 613 F.2d 809 (C.C.P.A. 1980), *cert. denied*, 450 U.S. 994 (1981).

28. *E.g., In re* Walter, 618 F.2d 758 (C.C.P.A. 1980).

statutory.[29] However, if the signals or data being transformed either represent an abstraction or can be construed broadly enough to encompass the abstract, the claim (if otherwise non-statutory) will not become statutory as a result of signal or data transformation.[30]

5. Structural Limitations in Process Claims

Structural limitations in process claims do not have statutory weight unless the structure forms an essential part of the process. Accordingly, making reference to a computer or to computer elements in a claim, without more, will not convert a non-statutory process to a statutory one.[31]

Recent Federal Circuit cases involving algorithms include *In re Grams*[32] and *In re Iwahashi*.[33] The claims in *Grams* were held to be non-statutory, while it held the claims in *Iwahashi* were found to be statutory. *Grams* involved chemical and biological constituent testing on individuals. Claim one called for performing a series of clinical laboratory tests on individuals to measure values of chemical and biological constituents, such as blood sodium level. The claim included a mathematical algorithm for assessing interdependencies among parameters by means of statistics. The specification stated that the invention was applicable to any complex system, whether electrical, mechanical, biological, or a combination thereof.

The Brief presented by the Commissioner on behalf of the PTO was based on the "otherwise statutory" test outlined above.[34] The Brief concluded that the claim, read without the steps of the algorithm, did not represent an "otherwise statutory" process.[35] The court held the claim to be non-statutory, using the *Freeman-Walter-Abele* test. The only "physical step" in the claim was that of performing laboratory tests on individuals to measure parametric values. The court appears to have been influenced by the specification which did not limit the invention to a specific utilization. The court noted, "From the specification and the claim, it is clear to us that applicants are, in essence, claiming the

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29. *See, e.g., In re* Abele 684 F.2d 902 (C.C.P.A. 1982) (claim six); *In re* Sherwood, 613 F.2d at 809.

30. *See* Barrett, *supra* note 16, at 9.

31. *See id.* at 9–10.

32. 888 F.2d 835 (Fed. Cir. 1989).

33. 888 F.2d 1370 (Fed. Cir. 1989).

34. In fact, the author of the Brief, Associate Solicitor Lee E. Barrett, had also prepared the PTO Analysis and guidelines.

35. *See* A. RATNER, *supra* note 21, at 3 (discussing PTO Brief in *Grams*).

mathematical algorithm, which they cannot do under *Gottschalk v. Benson*. The presence of a physical step in the claim to derive data for the algorithm will not render the claim statutory."[36]

The application in *Iwahashi* concerned a low-cost auto-correlation unit which evaluates coefficients for use as parameters in voice or pattern recognition. The unit was said to be low-cost because simple circuitry replaced expensive multiplier circuitry previously used in the art. The approximate value of the desired coefficient is derived according to a stated mathematical formula. The claim contained eight elements.[37] All elements except one were recited in means-plus-function language. The single exception recited a read-only memory associated with a calculating means.[38]

The court applied the first part of the *Freeman-Walter-Abele* test to determine whether a mathematical algorithm was directly or indirectly recited in the claim, and if so, whether the claim as a whole recited an algorithm. Finding that an algorithm was recited,[39] the court then applied the second part of the test to determine whether the algorithm was implemented in a specific mar er to define structural relationships

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36. 888 F.2d at 840.

37. Claim one read as follows:

[a] An auto-correlation unit for providing auto-correlation coefficients for use as feature parameters in pattern recognition for N pieces of sampled input values X_n ($n = 0$ to $N - 1$), said unit comprising;

[b] means for extracting N pieces of sample input values X_n from a series of sample values in an input pattern expressed with an accuracy of optional multi-bits;

[c] means for calculating the sum of the sample values X_n and X_{n-r} ($t = 0 - P$, $P \leq N$);

[d] a read only memory associated with said means for calculating;

[e] means for feeding to said read only memory the sum of the sampled input values as an address signal;

[f] means for storing in said read only memory the squared value of each sum, $(X_n + X_{n-r})^2$;

[g] means for fetching and outputting the squared values of each such sum of the sample input values from said read only memory when said memory is addressed by the sum of the sample input values; and

[h] means responsive to the output $(X_n + X_{n-r})^2$ of said read only memory for providing an auto-correlation coefficient for use as a feature parameter according to the following formula:

$$\frac{\sum_{n=0}^{N-1} (X_n + X_{n-r})^2}{2 \sum_{n=0}^{N-1} X_n^2} - 1$$

888 F.2d at 1373.

38. *See supra* note 37 (Element [d]).

39. *See* 888 F.2d at 1374–75.

between physical elements or to refine or limit claim steps.

Significantly, the court reviewed the specification to determine the form of circuitry disclosed for carrying out the means recited in the claim. In footnote one of the opinion, the court observed that, under 35 U.S.C. § 112, sixth paragraph,[40] a means clause is not interpreted to cover all means to perform a function, but to cover only the means disclosed and equivalents thereof.[41] Noting that the claim elements disclosed in the specification clearly defined apparatus in the form of a combination of interrelated means, including a read-only memory, the court held that the claim was directed to statutory subject matter.

The PTO asserts that *Iwahashi* is consistent with precedent and PTO policy.[42] The office maintains, "*Iwahashi* does not hold that the mere presence of apparatus language in a claim will, of itself, save the claim from rejection as non-statutory."[43] The issue still is "whether the apparatus encompasses any and every means for performing the recited functions and, if this appears to be the case, the burden is on the applicant to show that it does not."[44]

However, the PTO took issue with footnote one of the *Iwahashi* decision, arguing that "means-plus-function limitations should be not [*sic*] treated differently for [35 U.S.C.] § 101 purposes than for Section 102[45]

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40. Paragraph six of 35 U.S.C. § 112 (1988) provides:

An element in a claim for a combination may be expressed as a means or step for performing a specified function without the recital of structure, material, or acts in support thereof, and such claim shall be construed to cover the corresponding structure, material, or acts described in the specification and equivalents thereof.

41. *See* 888 F.2d at 1375 n.1.

42. *See* Denny, *Notice Interpreting In Re Iwahashi (Fed. Cir. 1989)*, 1112 Official Gaz. Pat. Off. 16 (1990) (citation omitted). Prior to *Iwahashi*, the PTO policy on whether means-plus-function claims will be construed to encompass a method as well as an apparatus had been dictated by *In re Walter*:

If the functionally-defined disclosed means and their equivalents are so broad as to encompass any and every means for performing the recited functions, the apparatus claim is an attempt to exalt form over substance since the claim is really to the method or series of functions itself. . . . In such cases the burden must be placed on the applicant to demonstrate that the claims are truly drawn to specific apparatus distinct from other apparatus capable of performing the identical functions.

618 F.2d 758, 768 (C.C.P.A. 1980).

43. Denny, *supra* note 42, at 16–17.

44. *Id.* at 17.

45. 35 U.S.C. § 102 (1988) prevents an inventor from obtaining a patent on subject matter which has been described in the prior art.

and Section 103[46] purposes for rejections over prior art. Indeed, during prosecution claims should be given their broadest reasonable interpretation."[47] Thus, the PTO position, that claims be given their broadest reasonable meaning for determining whether they are statutory, is in conflict with the court's position that claims be limited only to those features actually disclosed. This conflict over the role of 35 U.S.C. § 112, sixth paragraph, in determining whether a claim is statutory remains to be settled.

B. Methods of Doing Business

Methods of doing business generally are not patentable. A business method is not a process under 35 U.S.C. § 101.[48] Interestingly, early cases involving computer-implemented methods of doing business (*In re Johnston*,[49] *In re Maucorps*,[50] and *In re Meyer*[51]) showed a reverse tendency. In *Johnston*, claims directed to an automatic finance/record-keeping system, and drawn in apparatus form, were held to be statutory subject matter. The CCPA emphasized that the invention is an apparatus, not a business method. The apparatus claims were noted not to "encompass a law of nature, a mathematical formula, or an algorithm."[52]

Maucorps involved a computer-implemented system for modeling a sales organization and determining the optimum number of sales representatives to be assigned to various units within the organization.[53] In *Meyer*, a computer-implemented medical analysis system useful in making medical diagnoses by producing output values indicative of function and malfunction factors was described.[54] Although objections to the claims in both *Maucorps* and *Meyer* were sustained, they were sustained not on a "business method" ground but on the ground that the claims were too broadly drafted; that is, they recited merely a series of mathematical manipulations leading to calculation of values.[55] More-

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46. 35 U.S.C. § 103 (1988) prevents an inventor from obtaining a patent on an invention which is so similar to an invention described in the prior art as to have been obvious to one skilled in the art.

47. Denny, *supra* note 42, at 17.

48. *See, e.g.,* Hotel Security Checking Co. v. Lorraine Co., 160 F. 467 (2d Cir. 1908).

49. 502 F.2d 765 (C.C.P.A 1974), *rev'd on other grounds*, 425 U.S. 219 (1976).

50. 609 F.2d 481 (C.C.P.A. 1979).

51. 688 F.2d 789 (C.C.P.A. 1982).

52. 502 F.2d at 771.

53. 609 F.2d at 481.

54. 688 F.2d at 789.

over, in later cases, machine implemented methods of doing business have been held to be patentable subject matter if the application properly describes the program and associated computer operations, and the claims required computer implementation. For example, in *Paine Webber, Jackson and Curtis, Inc. v. Merrill Lynch, Pierce, Fenner and Smith, Inc.*,[56] apparatus claims supported in the disclosure by a computer program to maintain customer account records in a cash management account system were held to be statutory. The District Court found that the method would be unpatentable if carried out by hand, but the apparatus claims require machine implementation and so did not preempt the general method. The court stated that the focus of analysis should be on the operation of the program on the computer, and whether or not the claim wholly preempts a mathematical algorithm, not on the statutory nature of the application itself.

However, in a more recent case, *Ex parte Murray*,[57] the Board of Patent Appeals and Interferences rejected claims directed to an accounting method having steps of entering, sorting, correlating, debiting, subtotalling, totalling, and printing and issuing. Although the Board declined to define what constitutes a "method of doing business," it held that *Murray* claimed one in the context of providing a banking service. The Board noted that whereas *Merrill Lynch* concerned patent claims drafted to a "system" for managing a cash account, the *Murray* application claimed a method.[58] Although the substance of the claims in *Murray* does not appear to be substantially different from that in *Merrill Lynch*, the Board characterized the claim in *Murray* as being "on its very face" a "vivid example" of an unpatentable business method.[59] Apparently, the form of the claims may be determinative in establishing patentability of computer-implemented business methods.

C. Mental Steps

Mental processes are not patentable. Before the advent of computers, courts heard a number of cases involving inventions where human involvement and judgment played a major role. In *In re Abrams*,[60] a human operator was required to perform measuring and comparing steps in carrying out a claimed method to detect petroleum deposits. Because

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55. *Maucorps*, 609 F.2d at 485–86; and *Meyer*, 688 F.2d at 796.
56. 564 F. Supp. 1358 (D. Del. 1983).
57. 9 U.S.P.Q.2d 1819 (Bd. Patent App. Interferences 1988).
58. *See id.* at 1821.
59. *See id.* at 1820.
60. 188 F.2d 165 (C.C.P.A. 1951).

the measuring and comparing steps required human judgment, and were critical to novelty, the method claims were considered to be directed to "mental steps," and therefore were non-statutory.

Eighteen years later, the CCPA considered an application which disclosed both a method and apparatus for analyzing spectrographic data.[61] The claims recited means-plus-function elements, but the disclosure precluded mental steps. The court held the apparatus claim to be statutory, as it was supported in the specification by machine implementation.[62] Method claims failed, however, because they were broad enough to cover implementation by pencil and paper and thus were not limited to a machine implemented process.[63]

The mental steps doctrine thus does not preclude apparatus claims supported in the specification with adequate descriptions of hardware and software. A method claim containing an algorithm will be considered non-statutory under the mental steps doctrine if the claim contains no physical elements sufficient to avoid a finding that the claim wholly preempts a mathematical algorithm or encompasses mental action.

D. Printed Matter

It is fundamental to patent law that printed matter is not proper subject matter for patent protection. An exception exists where the printed matter has physical significance. For example, layout marks on a headband[64] or optical demarcations on code disks[65] have been held to constitute statutory subject matter.

The Manual of Patent Examining Procedure ("MPEP") sets forth the rationale for rejecting as non-statutory a claim reciting the text of a computer program. It is a "mere idea or abstract intellectual concept of a programmer, or . . . a collection of printed matter."[66] The PTO position that such a claim is non-statutory on the ground that it is mere printed matter has not yet been tested in court.[67] Even if the PTO's position

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61. *See In re* Prater, 415 F.2d 1393 (C.C.P.A. 1969).

62. *See id.* This appears consistent with footnote one of the *Iwahashi* decision, which holds a claim having a means-plus-function limitation to be statutory if the function is carried out by physical elements rather than by hand according to the disclosure. *See In re* Iwahashi, 888 F.2d 1370, 1375 n.1 (Fed. Cir. 1989).

63. *See* 415 F.2d at 1393.

64. *In re* Gulack, 703 F.2d 1381 (Fed. Cir. 1983).

65. *In re* Jones, 373 F.2d 1007 (C.C.P.A. 1967).

66. MANUAL OF PATENT EXAMINING PROCEDURE § 2106 (1987).

67. *See* R. SMITH, E. YOCHES & S. ANZALONE, COMPUTER PROGRAM PATENTS 12 (1988) (American Intellectual Property Law Association, Continuing Legal Education Institute on the Law of Computer-Related Technology).

were rejected, the breadth of a printed matter claim would be narrow; its scope would, in practical effect, be commensurate with that of a copyright registration.[68]

II. DISCLOSURE

An adequate specification must satisfy two tests under paragraph one of 35 U.S.C. § 112.[69] The first requirement is a written description of the claimed invention sufficient to "enable" a skilled artisan both to make and to use the invention. Second, the description of the embodiment must represent the "best mode" for practicing the invention known to the inventor at the time of filing the application. Disclosure that satisfies the enablement and best mode requirements usually is not easily drafted for electronic and computer-implemented inventions. The following guidelines for satisfying the enablement and best mode requirements are based on several recent court decisions.

A. Enablement

To satisfy the enablement requirement, the description of the invention must be commensurate with the scope of the subject matter claimed.[70] If it is not, either the specification is too narrow or the claim is too broad. In *In re Hyatt*, a single means-plus-function claim was considered too broad because it encompassed every possible means of carrying out the recited function of the claim.[71]

The amount of detail required generally is the same for support of both method and apparatus claims. Acceptable disclosure may be in the form of block diagrams or computer flowcharts. The block diagrams must allow one skilled in the art to practice the invention using no more

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68. In fact, the scope of protection of a claim reciting the text of a program might be less than that of a copyright which has been enlarged by recent cases to cover the structure, sequence, and organization as well as the text of the program. *See, e.g.,* Whelan Assocs., Inc. v. Jaslow Dental Laboratory, Inc., 797 F.2d 1222 (3d Cir. 1986), *cert. denied,* 479 U.S. 1031 (1987).

69. 35 U.S.C. § 112, first paragraph (1988) states:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same, and shall set forth the best mode contemplated by the inventor of carrying out his invention.

70. *See In re* Hyatt, 708 F.2d 712 (Fed. Cir. 1983).
71. *See id.*

than reasonable and routine experimentation.[72] Typically, a reasonable-experimentation analysis is unnecessary if the inventor can specify a commercially available computer sufficient to execute the program described.[73]

In *In re Knowlton*,[74] the specification referred to a commercially available data processing system and disclosed certain general and specific hardware elements. The application also contained a listing of various computer programs to implement the invention. In holding this disclosure to be sufficient, the court noted that complex interrelationships among the hardware and software elements were adequately presented.[75] In fact, the court emphasized that the disclosure should not be more detailed than necessary. It is not necessary to disclose circuit details that constitute routine circuit design.

With regard to software elements, it is sufficient to make reference to a commercially available program. However, if a program is not commercially available, and suitable substitutes cannot easily be obtained, a program should be described.[76] No exact standard has been fixed by the courts, but the experimentation required to implement an invention must not be unduly complicated or time-consuming. In one case, the amount of experimentation involved was considered reasonable where a skilled programmer was able to write the required computer program within four hours.[77] In another case, where the period required for skilled programmers to develop a necessary program would have been one and one-half to two years, the disclosure was found inadequate. Expecting that degree of experimentation would be "unreasonable."[78]

B. Best Mode

To satisfy the best mode requirement, the disclosure must describe the best form and formation of each element of the invention known to the inventor. Several cases involving computer-implemented inventions have turned on the ability of the disclosure to satisfy the best mode requirement.

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72. *See In re* Ghiron, 442 F.2d 985, 991 (C.C.P.A. 1971).

73. *See In re* Comstock, 481 F.2d 905 (C.C.P.A. 1973).

74. 481 F.2d 1357 (C.C.P.A. 1973).

75. *See id.* at 1367.

76. White Consol. Indus. v. Vega Servo-Control, Inc., 713 F.2d 788 (Fed. Cir. 1983).

77. *See* Hirschfeid v. Banner, 462 F. Supp. 135 (D.D.C. 1978), *aff'd*, 615 F.2d 1368 (D.C. Cir. 1980), *cert. denied*, 450 U.S. 994 (1981).

78. *White Consol. Indus.*, 713 F.2d at 791.

In *In re Sherwood*,[79] the CCPA reversed the rejection of an application by the Board of Patent Appeals. The Board had maintained that the best mode requirement was not met because the applicant had not described a certain computer program. However, the CCPA decided that the specification provided general mathematical equations and some mathematical "tricks," leaving only routine programming to produce a workable digital computer program.[80]

Spectra-Physics Inc. v. Coherent, Inc.[81] involved patents directed to an ion laser and to a method of fabricating the laser's structure. The laser used heat from tungsten discs, conducted via copper cups inside a ceramic laser discharge tube. A claim recited "both means for attaching the tungsten discs ... to the center opening of each copper cup and means for attaching the cups to the inside wall of the ceramic tube."[82] Attachment by pulse soldering was disclosed as one method, although brazing was preferred. Titanium-copper-silver was the preferred brazing material because it requires only one step. However, a six-stage cycle was known by the inventors to produce the most reliable brazed joint between the copper cups and the ceramic tube. This was not disclosed. The court held that whereas the specification was enabling, the patents failed to satisfy the best mode requirement, as the best mode was actually known but concealed by the inventors at the time the applications were filed.[83] This "concealment" rule has been followed in several cases since *Spectra-Physics*.[84]

The best mode requirement is assessed not by reference to level of skill in the art, but by comparing the facts known to the inventor at the time the application was filed, with the disclosure in the application. In *Christianson v. Colt Industries Operating Corp.*,[85] Colt did not disclose in its patent applications the specifications and tolerances that would permit parts of its M-16 rifle to be interchangeable with those of other M-16 rifles. Colt did not include this information in its patents because it considered the information to be a trade secret.[86] The court held the patent

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79. 613 F.2d 809 (C.C.P.A. 1980), *cert. denied,* 450 U.S. 994 (1981).

80. *Id.*

81. 827 F.2d 1524 (Fed. Cir. 1987).

82. *Id.* at 1528.

83. *See id.* at 1524.

84. *See* Dana Corp. v. IPC Ltd. Partnership, 860 F.2d 415 (Fed. Cir. 1988), *cert. denied,* 490 U.S. 1067 (1989); Consolidated Aluminum Corp. v. Foseco Int'l, 716 F. Supp. 316 (N.D. Ill. 1989), *aff'd,* 910 F.2d 804 (Fed. Cir. 1990).

85. 870 F.2d 1292 (7th Cir.), *cert. denied,* 110 S.Ct. 81 (1989).

86. Note that if a patentee actually fails to disclose the best mode for practicing his invention, it is not a defense that he considered the best mode to be a trade secret. *Cf.* White Consol. Indus, Inc. v. Vega Servo-Control, Inc., 713 F.2d 788 (Fed. Cir. 1983) (deciding that failure to disclose a trade secret which lacked adequate substitutes violated the enablement requirement).

disclosure both to be enabling and to satisfy the best mode requirement. Because the court found the claims to be directed to rifles generally, and to have nothing to do with interchangeability of the disclosed rifles with other rifles, best mode was satisfied.[87] The best mode requirement is limited to the invention claimed, not the subject matter disclosed.

More recently, the Federal Circuit considered a case in which allegedly infringing products were manufactured in Japan and imported to the U.S. by Samsung.[88] Samsung alleged invalidity of the patents for failure to state in the specification the best mode for boosting word line voltage. No evidence was produced showing that the inventor considered any particular form of word line boosting to be of importance. The court held for Texas Instruments on the ground that a specification will fail to satisfy the best mode requirement *only* if at the time of filing the inventor *knew of and concealed* a mode better than the one disclosed.[89] This is true even if the commercial embodiment is different from, or even better than, the mode in the specification.

In *Northern Telecom, Inc. v. Datapoint Corp.*,[90] the court found failure to disclose the best mode. The claims in question specified the use of standard audio tape, while testimony indicated that the inventors were not using standard tape. In fact, the inventors knew that a different tape was needed. Since this knowledge predated the patent application, the claim was rendered invalid.

III. CLAIM INTERPRETATION

Patent infringement can be proven in two ways. Literal infringement involves an accused device or process which incorporates each and every element of a claim.[91] Under infringement via the doctrine of equivalents, each and every claim element need not be found identical in the accused device or process. The difference may be considered so small as to allow a finding of infringement as a matter of policy.[92]

In *Hughes Aircraft Co. v. United States*,[93] the doctrine of equivalents was applied to claims having elements in means-plus-function language. The court found no literal infringement of the claims by a computer-

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87. 870 F.2d at 1292.

88. Texas Instruments Inc. v. U.S. Int'l Trade Comm'n, 871 F.2d 1054 (Fed. Cir. 1989).

89. *See id.* at 1061.

90. 9 U.S.P.Q.2d 1577 (N.D. Tex. 1988), *aff'd in part and rev'd in part on other grounds*, 908 F.2d 931 (Fed. Cir.), *cert. denied*, 111 S.Ct. 296 (1990).

91. *See* Mannesmann Demag Corp. v. Engineered Metal Prods. Co., 793 F.2d 1279 (Fed. Cir. 1986).

92. *See* Graver Tank & Mfg. Co. v. Linde Air Products Co., 339 U.S. 605 (1950).

93. 717 F.2d 1351 (Fed. Cir. 1983).

implemented system for transmitting signals from a ground station to a satellite. However, infringement under the doctrine of equivalents was found because the accused system performed "'substantially the same function in substantially the same way to obtain the same result' as the claimed product or process."[94] Recent cases have limited the scope afforded claims in means-plus-function language.

A. Pioneer Technologies

Texas Instruments, Inc. v. U.S. International Trade Commission[95] concerned the importation of pocket calculators in alleged violation of the Tariff Act of 1930.[96] The International Trade Commission ("ITC") had found that the Tarriff Act had not been violated because the calculators in question did not infringe Texas Instruments' patent. Texas Instruments appealed. The patent, issued in 1974, had been recognized in the industry as covering a pioneer invention. Claim one of the patent recited each of the major elements of the calculator in means-plus-function language. The specification contained a detailed description of apparatus used at the time the application was filed implementing each recited means.

As the invention was a pioneer, prosecution of the application had been essentially procedural. However, in the period between the filing of the application and the filing of the complaint with the ITC, technology in the field had advanced significantly. Although each element of the claim corresponded to a function carried out by the infringing devices, the patent specification disclosed an implementation different from the implementation of the accused devices.

After comparing the accused devices with the device disclosed in the Texas Instruments patent, the court held that the claim was not infringed on the ground that the accused devices reflected more than mere substitution of an embellishment on the disclosed embodiment made possible by improved technology. Taken together, the accumulated differences were considered to distinguish the accused calculators, considering the "invention as a whole."[97]

This outcome is troubling because an "invention as a whole" analysis will be very difficult to apply to cases in general; however, the reasoning appears to be limited to the circumstances of the *Texas Instruments* case. In other words the "invention as a whole analysis" applies only to cases

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94. *Id.* at 1361 (citations omitted).
95. 805 F.2d 1558 (Fed. Cir. 1986), *aff'd on rehearing,* 846 F.2d 1369 (Fed. Cir. 1988).
96. 19 U.S.C. § 1337 (1988).
97. 805 F.2d at 1564.

which satisfy the criteria set out by the Federal Circuit in *Texas Instruments*: (1) the invention is a pioneer, (2) there is virtually no substantive prosecution, (3) the technological field is rapidly emerging, (4) all principal elements are claimed in means-plus-function language, and (5) corresponding functions carried out by the accused device are implemented by means substantially different from those disclosed in the patent.

B. The "All-Limitations" Rule

Pennwalt Corp. v. Durand-Wayland, Inc.[98] concerned a patent directed to an apparatus for sorting fruit based on color or weight. The claim elements were in means-plus-function language. The disclosure described hard-wired circuitry and discrete electrical components. The accused infringing product implemented microprocessor-controlled components to perform certain of the functions set forth in the claims.

Analyzing the claims element by element, the court held the claims to be infringed neither literally nor under the doctrine of equivalents. The court stated: "[T]o determine whether a claim limitation is met literally, where expressed as a means for performing a stated function, the court must compare the accused structure *with the disclosed structure,* and must find equivalent structure as well as identity of claimed function for that structure."[99] To determine whether the claim is infringed under the doctrine of equivalents, the court must find an equivalent function carried out by the same or equivalent means.

Applying the test to the facts in *Pennwalt,* the court found that the claims required position-indicating means responsive to a clock, and a comparator for continuously indicating the position of an item on a conveyor belt. However, the accused device, controlled by a program, performed the same function in an entirely different, non-equivalent manner using software pointers. There was no continuous indication of the position of fruit on the belt using registers in the manner disclosed in the patent. As this element of the claim was not found in the accused device, there was no infringement.

The so-called "all-elements rule" of *Pennwalt* is difficult to apply because it frequently is not possible to identify one-to-one correspondence between "elements" in the claim and in the accused device.[100] In a series of decisions culminating in *Corning Glass Works v. Sumitomo*

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98. 833 F.2d 931 (Fed. Cir. 1987), *cert. denied,* 485 U.S. 961 and 485 U.S. 1009 (1988).
99. *Id.* at 934 (emphasis in original).
100. *See* D. CHISUM, PATENTS § 18.03(4) n.3 (1990).

Electric USA, Inc.,[101] the *Pennwalt* analysis was revised: Where there is an identical or equivalent counterpart for each claim limitation, rather than each functional element, there is infringement. The court stated that "[a]n equivalent must be found for every limitation of the claim somewhere in an accused device, but not necessarily in a corresponding component . . . ."[102] Under this "all-limitations" rule, several limitations may be required to define one "element."

The all-limitations rule can be better understood after reviewing the factual background of the *Corning Glass* case. The claimed invention was an optical waveguide with an inner core and an outer cladding layer, both made of silica. The index of refraction of the silica forming the core was greater than that of the silica forming the cladding layer. According to the claims, the core and cladding layer were formed of silica with a positive dopant; extra dopant was added to the core to increase its index of refraction.

Sumitomo's optical waveguide was similarly formed with core and cladding of silica with dopant. However, Sumitomo used a negative dopant and added extra dopant to the cladding layer, to cause the index of refraction of the core to be greater than that of the cladding. Sumitomo's waveguide did not literally infringe the patent because it used a negative dopant to reduce the index of refraction of the core, whereas the claimed invention used a positive dopant added to the cladding.

Sumitomo, relying on *Pennwalt*, argued that there could be no infringement, either literally or under the doctrine of equivalents, because the requirement in the claim of a positively doped core was omitted in its waveguide.[103] The Federal Circuit disagreed, arguing that in the "all-elements" rule used in *Pennwalt*, the term "element" refers to "limitations."[104] The issue, then, with respect to meeting the "all-limitations" rule was whether the claim requirement that the index of refraction of the cladding layer be less than that of the core had been met. The court concluded that the limitation was equivalently met and confirmed a finding of infringement.

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101. 868 F.2d 1251 (Fed. Cir. 1989).
102. *Id.* at 1259.
103. *See id.*
104. *See id.*

IV. GUIDELINES FOR DRAFTING THE
SPECIFICATION AND CLAIMS OF
COMPUTER-IMPLEMENTED INVENTIONS
UNDER RECENT U.S. CASE LAW

The cases discussed above provide guidance for patent attorneys. The following is an attempt to distill those cases into ten useful guidelines.

1) Ensure that the functional aspect of each claim element is as broad as possible because, as *Pennwalt*[105] shows, literal infringement requires exact identity of the claimed function in the accused device. However, the breadth of a means-plus-function element should not be so broad as to encompass every means for performing the recited function. Otherwise, under *In re Walter,*[106] the court may treat the claim in substance as a method rather than an apparatus.

2) Clearly recite means-plus-function elements in the disclosure and make them readable on the drawings. Alternative implementations for the recited function should be described, and preferably also shown in the drawings. This is because determination of equivalence under *Pennwalt* requires comparison of the accused structure and that disclosed in the application.

3) Include claims reciting specific hardware elements with elements in means-plus-function language to avoid failure in an "invention as a whole" analysis under *Texas Instruments.*[107]

4) Provide a wide variety of claim formats, including means-plus-function claims and hardware-specific claims as well as method claims. The claims must recite more than mere mathematical manipulation or business methodology that can be carried out without machine implementation.

5) Draft claims unambiguously on the disclosure. Therefore include a block diagram showing elements of the broadest claim, together with diagrams showing more detailed layers of the system or method claimed in dependent claims. It must be clear what structure performs each recited function.

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105. 833 F.2d 931 (Fed. Cir. 1987), *cert. denied,* 485 U.S. 961 and 485 U.S. 1009 (1988).
106. 618 F.2d 758 (C.C.P.A. 1980).
107. 805 F.2d 1558 (Fed. Cir. 1986).

6) Include at least a flowchart of programming or pseudo-code for carrying out the invention. If there are any steps that require special know-how, such as a mathematical "trick," disclose them. It is not a good idea to disclose the entire program unless (a) there is no time to prepare a thorough specification or (b) it is not certain that the flowchart or pseudo-code disclosure will be adequate. There are several reasons for this:

A. The program listing may contain an error that cannot be corrected without adding new matter. This may be discovered only during litigation when it is too late to make a correction.

B. The scope of means-plus-function claims supported in the specification only by a program listing is very narrow, and probably is not broader than that of a copyright registration.

C. Disclosure of the program listing may give an infringer a head-start on duplicating or improving the invention and may reveal trade secrets.

7) Include method claims in every case, if possible. This is particularly important if the invention essentially is a programmed computer, and all novelty resides in the program. Furthermore, method claims generally are more easily readable on the disclosure than are apparatus claims.

8) Describe a specific field of use. Avoid overly broad statements in the disclosure that might suggest the invention in essence to be merely an unrestricted implementation of a mathematical algorithm.

9) Confirm with the inventor the best mode for practicing the invention just before the application is filed. Add to the specification any new details which may be important.

10) Include disclosure in the specification that not only teaches how to practice the invention from the standpoint of a person skilled in the art, but also teaches an ordinary reader why the invention is important. The specification should include a strong background portion that will give the ordinary reader enough technical background to appreciate what the invention is designed to achieve, what the prior art has attempted to do, and how the prior art has failed. Introductory and summary statements of aspects of the invention, understandable to the ordinary reader, should be distributed liberally throughout the disclosure. This is particularly important for a highly technical computer-implemented invention. The judge and jury, not persons skilled in the art, will decide whether a patent is to be enforced.