PTO Perspective on Recent Developments in Patent Protection for Computer Hardware and Software

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PTO Perspective on Recent Developments in Patent Protection for Computer Hardware and Software

by

LEE E. BARRETT*

Table of Contents

I. Introduction ............................................ 628
II. Mathematical Algorithms ............................... 629
   A. Background ...................................... 629
   B. In re Grams ..................................... 630
   C. In re Schrader .................................. 632
   D. In re Warmerdam ................................ 634
III. Interpretation of Means-Plus-Function Limitations .... 637
   A. Background ...................................... 637
   B. In re Iwahashi .................................. 640
   C. In re Bond ....................................... 642
   D. Arrhythmia Research Technology, Inc. v. Corazonix Corp. ........................................... 643
   E. In re Alappat ..................................... 646
      1. The invention .................................. 646
      2. Procedural history ............................ 646
      3. PTO's arguments on appeal ................... 647
         a. PTO's interpretation of § 112 ¶ 6 ....... 648
         b. Mathematical algorithm .................... 652
      4. The outcome .................................... 654
IV. Conclusion ............................................. 655

I

Introduction

Patent protection for computer related inventions is determined during *ex parte* examination before the United States Patent and Trademark Office (PTO). The duty of the PTO is to issue valid patents. Therefore, it is essential from the PTO's perspective to have uniform and definite standards for a patent. The PTO is often the only entity in a position to set or argue for such standards. Two issues arising from computer-related inventions demonstrate how the PTO seeks consistent development of its standards.

The first issue is mathematical algorithms and statutory subject matter under 35 U.S.C. § 101. Mathematical algorithms are a major issue in PTO practice and computer law, due to the nature of computers and the rising importance of mathematical techniques in computer science and electrical engineering. Mathematical algorithms per se are not eligible for patent protection; however, their application to physical elements or process steps may be.

The second issue is the interpretation of means-plus-function limitations under 35 U.S.C. § 112 ¶ 6 during examination before the PTO. This article traces the development of this issue from its beginning in the context of its rejection as a mathematical algorithm under 35 U.S.C. § 101, to a general issue of PTO claim interpretation, and to two *in banc* decisions by the United States Court of Appeals for the

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1. Patents are issued if it appears that the applicant is entitled to a patent under the law. 35 U.S.C. §§ 131, 151 (1984).

2. Keystone Bridge Co. v. Phoenix Iron Co., 95 U.S. 274, 278 (1877) ("[In the Patent Office, an applicant's] claim is, or is supposed to be, examined, scrutinized, limited, and made to conform to what he is entitled to."); Burns v. Meyer, 100 U.S. 671, 672 (1879); Graham v. John Deere Co., 383 U.S. 1, 18 (1966) ("[T]he primary responsibility for sifting out unpatentable material lies in the Patent Office. To await litigation is—for all practical purposes—to debilitate the patent system.").


4. *In re* Walter, 618 F.2d 758, 764, 205 U.S.P.Q. (BNA) 397, 404 (C.C.P.A. 1980) ("In the computer arts, § 101 problems tend to center around the use of mathematics in the claims, which define the invention for which patent protection is sought. This is a natural consequence of the nature of computers.").

5. A "means-plus-function" (or "means for") limitation is a method of claiming permitted under 35 U.S.C. § 112 ¶ 6. Section 112 ¶ 6 permits claiming one element of a combination of elements as a "means" or "step" for performing a specified function (e.g., means for fastening) instead of reciting the actual "structure, materials, or acts" (e.g., a rivet). This method of claiming is often simpler than claiming the detailed structure and has the advantage that the claim covers "equivalents" of the disclosed structure.
Federal Circuit,\textsuperscript{6} one of which involves mathematical algorithms and computers.

\section*{II
Mathematical Algorithms}

\subsection*{A. Background}

Inventions are eligible for patent protection only if they fall within one of the four statutory classes of subject matter of 35 U.S.C. § 101: process, machine, manufacture, or composition of matter. Congress intended this provision to be construed broadly to "include anything under the sun that is made by man."\textsuperscript{8} Nevertheless, judicially determined exceptions exist for "laws of nature, natural phenomena, and abstract ideas,"\textsuperscript{9} which embrace loose categories of cases such as mathematical algorithms, methods of doing business\textsuperscript{10} and printed matter. Due to their abstract, nonphysical nature, computer programs and data structures are considered to be nonstatutory subject matter. "Software" in patents refers to computer programs included in the statutory categories of "process" or "machine."\textsuperscript{11}

In 1972, the Supreme Court held mathematical algorithms to be nonstatutory subject matter because they did not fall within the 35 U.S.C. § 101 statutory class of a "process."\textsuperscript{12} From 1972 to 1982, a series of twenty-five decisions by the Court of Customs and Patent Appeals (CCPA) and two more Supreme Court cases resolved much of the uncertainty regarding the patentability of mathematical algorithms and computer programs. These decisions also developed an analytical framework for treatment of cases in this area. "Thus computers came to be generally recognized as devices capable of performing or implementing process steps, or serving as components of an

\textsuperscript{9} Diamond v. Diehr, 450 U.S. 175, 185 (1981).
\textsuperscript{10} See discussion infra part II.C.
\textsuperscript{11} In re Chatfield, 545 F.2d 152, 159, 191 U.S.P.Q. (BNA) 730, 737 (C.C.P.A. 1976), cert. denied, 434 U.S. 875 (1977) (Rich, J. dissenting) ("It has never been otherwise than perfectly clear to those desiring patent protection on inventions which are new and useful programs for general purpose computers (software) that the only way it could be obtained would be to describe and claim (35 U.S.C. § 112) the invention as a 'process' or a 'machine.'").
apparatus, without negating patentability of the process or the apparatus."\(^{13}\)

In 1989, the PTO was criticized for issuing patents involving mathematical algorithms and software.\(^{14}\) In response to this public concern, the PTO published an analysis of case law in the area of mathematical algorithms and computer programs.\(^{15}\) The analysis was designed to clarify and state the existing practice for PTO examiners and the public rather than to change policy. The analysis confirmed the PTO’s adherence to the two-step protocol for determining whether a mathematical algorithm qualifies as statutory subject matter. This two-step protocol was originally developed by the CCPA in *In re Freeman*,\(^ {16}\) *In re Walter* and *In re Abele*,\(^ {17}\) known as the Freeman-Walter-Abele test. The first step is to determine whether a mathematical algorithm is recited directly or indirectly in the claim.\(^ {18}\) If so, the second step is to determine whether the claimed invention as a whole is directed to a mathematical algorithm that is not applied to or limited by physical elements or process steps.\(^ {19}\) The goal is to answer the following question: “What did applicants invent?”\(^ {20}\)

**B. *In re Grams***

In its first published decision involving mathematical algorithms, *In re Grams*,\(^ {21}\) the Federal Circuit Court of Appeals affirmed a decision of the Board holding that mathematical algorithm process claims were nonstatutory subject matter under 35 U.S.C. § 101. The independent claim in *Grams* was a method for testing a complex sys-

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17. 684 F.2d 902 (C.C.P.A. 1982).
18. *Id.* at 905. The claim is that portion of the patent application which “points out and distinctly claim[s] the subject matter which the applicant regards as his [or her] invention.” 35 U.S.C. § 112 ¶ 2 (1984).
19. *Id.* at 907.
tem to determine whether the system condition was normal or abnormal. The first step required performing a series of clinical laboratory tests on an individual to measure the values of chemical and biological constituents. The remainder of the steps operated on this data to determine which tests were abnormal. Although no symbolic equations or formulae were recited in the claim, the specification disclosed that the measured data values were formed in a vector, and used to compute a “Mahalanobis or weighted distance quantity D2” with mathematical vector operations. The calculated “distance” was compared to a known predetermined value to determine whether the individual’s condition was abnormal. Claim 16, the only dependent claim to be argued separately, required that the method be performed with a programmed computer.

The Federal Circuit Court of Appeals applied the two-step test in a straightforward manner and held the claims nonstatutory. First, it found that all the steps were mathematical algorithm except the initial step of performing the clinical laboratory tests on individuals to obtain data. Second, it determined that only the physical process step of performing laboratory tests involved gathering data for the algorithm, which was not sufficient to render the claim statutory. The court observed that a claim that may contain statutory matter without the algorithm is not dispositive. The algorithm must operate on the claimed physical step. Thus, although performing clinical laboratory tests is a physical step that might be considered a statutory process, the court of appeals noted the mathematical algorithm did not change any physical aspects of this step.

From the PTO’s perspective, several points are important about Grams. First, the decision applied the mathematical algorithm analysis in a straightforward manner consistent with previous cases, which is useful for analyzing similar claims; it undoubtedly helped that the claim was a process claim, the usual form for mathematical algorithm analysis. Second, it confirmed that it is proper to look to the specific...
cation to see if a mathematical algorithm is indirectly recited. Third, it clarified that the mere presence of a physical step does not automatically transform a claim into statutory subject matter. Fourth, and most important in computer process cases, Grams held that performing the method on a programmed computer is not dispositive of the statutory subject matter inquiry.

C. In re Schrader

The Federal Circuit Court of Appeals affirmed a section 101 mathematical algorithm rejection of a method of auctioning in In re Schrader. According to the method, bidders may bid on one, some, or all of the items offered in any combination, and the bids are entered into a “record.” The entered bids are then assembled into a “completion.” Thus, all items to be sold appear in the completion either as a bid on an individual item or on a group of items (i.e., the completion completes the sale of all items), and each item appears only once in the completion because the same item cannot be sold twice. Unlike a conventional auction, the auction under the claimed method is not finished and no items are sold until the very end of the bidding. No hardware, such as a computer, was disclosed in the specification for performing the steps of the process.

The Board affirmed an examiner’s rejection under section 101 as a method of doing business. More generally, the Board held that the claimed method did not fit within the section 101 definition of a “process” because it did not transform or reduce subject matter to a different state or thing. The Board further found that the claims contained a mathematical algorithm. The majority held that the claims were nonstatutory subject matter as a mathematical algorithm. The claimed step of “assembling a completion” implicitly contained a mathematical algorithm under the first step of the Freeman-Walter-Abele test because it determines the optimal combination of bids. The claims did not recite or imply suf-

31. 888 F.2d at 837.
32. Id. at 839 and n.4.
33. Id. at 841.
34. 22 F.3d 290 (Fed. Cir. 1994).
35. Id. at 291.
36. A completion is a combination of bids that “would complete a sale of all of the items being offered at the highest offered total price.” Id.
37. Id. at 292.
38. Id.
39. Id. at 293.
icient physical activity to qualify under the second step of the test. The court noted that physical activity such as "the notion of bidders assembled in a single location in front of a display, or in several locations interconnected by closed-circuit television through a large screen display is not recited in the claim." The only physical effect required by the claim was entering the bids in a "record." The court stated that such activity was indistinguishable from the data gathering steps in *Grams*, and was implicit in any application of a mathematical algorithm. The court agreed that the term "process" in section 101 included a requirement that there be a transformation or reduction of subject matter.

In making statutory subject matter determinations under section 101, the PTO has often relied upon the definition of "process" as transformation and reduction of subject matter to a different state or thing. The court's acceptance of this definition should be considered in future section 101 analyses. Unfortunately, there is no clear definition of what is meant by "subject matter." The court states that "changes to intangible subject matter representative of or constituting physical activity or objects are included in the definition." The PTO argued that the subject matter, whether tangible matter or intangible energy (e.g., heat, light, or electricity), had to be physical. Thus the PTO argued that transformation of property ownership from one person to another, or transformation of goods for money, in Schrader's method was not what was meant by transformation and reduction of subject matter. Likewise, transformation of abstract subject matter, such as numerical data, is not what was meant.

The term "method of doing business," one ground of the rejection, is not mentioned in the majority opinion. In her dissent, Judge Newman agreed with the Board's remark that the "method of doing business" ground is a "fuzzy" concept and stated that "since it also an unwarranted encumbrance to the definition of statutory subject matter in section 101, my guidance is that it be discarded as error-prone, redundant, and obsolete." Although it is often mentioned as an ex-

40. *Id.* at 294.
41. *Id.*
42. *Id.*
43. *Id.* at 295.
44. *Id.* at 295 n.12.
45. See *In re Gelnovatch*, 595 F.2d 32, 42 (C.C.P.A. 1979). "[W]here, as here, the claims solely recite a method whereby a set of numbers is computed from a different set of numbers by merely performing a series of mathematical computations, the claims do not set forth a statutory process." *Id.*
46. *Id.* at 298.
exception to section 101. Few, if any, cases have ever been decided on a method of doing business rationale. The proper approach to such cases is to apply the definition of a section 101 "process," which may indeed be the original rationale for the exception.

D. In re Warmerdam

In re Warmerdam involved an invention in the field of automation and robotics, specifically, in the area of collision detection. Geometric representations of objects are used to calculate whether two objects will collide. Collision calculations using precise representations of the object are time consuming, and fast calculation is usually more important than geometric accuracy. Therefore, objects are modelled as larger and more regular in shape using simple geometric solids.

A known prior art method simplifying solid modelling was used to represent the objects as a hierarchy of imaginary intersecting spheres or "bubbles" whose surfaces bound the object. The hierarchy was stored in a tree data structure. A tree data structure is a special kind of mathematical graph having a collection of nodes connected by pointers. Each node contains the following data about a bubble: the x-, y- and z-locations of its center and the radius. The root of the tree is a unique node representing a single bubble encompassing the whole object. The next lower level of the tree breaks the single bubble into multiple bubbles of smaller diameter, represented by pointers from the root node to two or more nodes at the next lower level. The representation continues with each succeeding level of nodes representing bubbles of progressively finer levels of detail; thus, the term bubble hierarchy. The union of all bubbles at a particular level bounds the entire object. Collisions between two objects can be de-

48. See WILLIAM C. ROBINSON, THE LAW OF PATENTS FOR USEFUL INVENTIONS § 166 (1890). "Hence a plan or theory of action which, if carried into logical practice, could produce no physical results proceeding directly from the operation of the theory or plan itself, is not an art within the meaning of the Patent Law, however greatly it may promote the comfort or the welfare of mankind." Id.
49. 31 U.S.P.Q.2d (BNA) 1754 (Fed. Cir. 1994).
50. Id. at 1755. The prior art was represented by the article by G. Sawatzky and H. El-Zorkany, Using an Efficient Collision Detector in the Solution of the Find-Path Problem of Industrial Robots, 579 SPIE PROC. 131 (Sept. 16-20, 1985).
51. A data structure is a "physical or logical relationship among data elements, designed to support specific data manipulation functions." Warmerdam, 31 U.S.P.Q.2d (BNA) at 1760 (quoting IEEE STANDARD COMPUTER DICTIONARY (1991)).
52. Id. at 1755.
53. Id.
tected using bubbles on respective trees by comparing the distance between their centers and the sum of their radii.54

Warmerdam’s improvement was to locate the center of the bubbles along the “medial axis.”55 The medial axis (or skeleton) is an abstract representation of a two- or three-dimensional region by curve segments.56 Another mathematical property of the medial axis is that every point on the medial axis is the closest point to two or more points on the boundary of the region. The disclosed method for locating the medial axis was a mathematical procedure known as the Hilditch Skeletonization method.57

In Warmerdam’s application, claims one through four were to a method for generating a data structure comprising the steps of locating the medial axis of the object and then creating a hierarchy of bubbles on the medial axis.58 The Board determined that the claims were nonstatutory subject matter under section 101 because they recited no more than a mathematical algorithm in the abstract.59 Warmerdam argued that the step of locating the medial axis was broad enough to cover methods which involve physically measuring the contour of the object.60 The court, however, agreed with the PTO that the disclosed preferred embodiment was mathematical in nature in the sense that “the preferred, and it appears the only practical, embodiment of claimed method involves steps which are essentially mathematical in nature, i.e., utilization of the Hilditch Skeletonization method to locate the medial axis, followed by utilization of a top-down or bottom-up procedure for creating the bubble hierarchy.”61 Nevertheless, the court did not resolve the question of statutory subject matter in mathematical algorithm terms, stating that “the dispositive issue for assessing compliance with § 101 in this case is whether the claim is for a process that goes beyond simply manipulating ‘abstract ideas’ or ‘natural phenomena.’”62 The appellate court affirmed the Board’s rejection of claims one through four, and six, under 35 U.S.C. § 101. The court further held that the “steps describe nothing more than the ma-

54. Id. at 1755-56.
55. Id. at 1756.
56. “The medial axis of an object is defined in the specification to be ‘a line with the same topology as the object itself connecting points which lie midway between boundary centers of the object.’” Id.
57. Id. at 1758.
58. Id. at 1756.
59. Id. at 1757.
60. Id. at 1758.
61. Id.
62. Id. at 1758-59.
nipulation of basic mathematical constructs, the paradigmatic 'ab-

Claim six was to a data structure generated by any of the method claims, i.e., to a data structure *per se*. The PTO argued that this claim was also nonstatutory because the claimed data structure "is not one of the categories of subject matter listed in section 101, or improvements thereof." Furthermore, the PTO argued, a data structure is not a process under section 101 because it contains no steps. The three product classes of patentable subject matter under section 101, "machine, manufacture, or composition of matter," deal with physical things, not abstractions. A data structure *per se* is not a physical thing; it is an abstract relationship among data elements which themselves have no physical substance. The court agreed with the PTO's reasoning and affirmed the section 101 rejection. The court stated that "[s]ince the 'data structure' of claim 6 is nothing more than another way of describing the manipulation of ideas contained in claims 1-4, it suffers from the same fatal defect they do." Warmerdam's impact on data structure claims may be influenced by the recent decision, *In re Lowry*, which involved an obviousness rejection under 35 U.S.C. § 103 of a "data structure stored in memory." As of this writing, it is too soon to determine what effect Lowry will have on PTO practice.

Warmerdam applied the approach that nonstatutory subject matter should be described in terms of the statute and "the Supreme Court's basic principles as enunciated in Diehr," i.e., that only things excluded from patent protection are "laws of nature, natural phenomena, and abstract ideas." It is not known whether Warmerdam rep-

63. *Id.* at 1759.
64. *Id.* at 1760.
66. See *supra* note 51.
67. 31 U.S.P.Q.2d (BNA) at 1760.
69. *Id.*
71. *Id.* at 1757 (quoting *Diamond v. Diehr*, 450 U.S. 175, 185 (1981)).
resists a shift away from the two-step *Freeman-Walter-Abele* test for mathematical algorithm—statutory subject matter. The PTO will continue to apply the two-step test. The second step of the test, whether the mathematical algorithm is applied to an otherwise statutory process, examines whether the claim is merely to an abstract idea. This is consistent with the *Warmerdam* analysis.

**III**

**Interpretation of Means-Plus-Function Limitations**

A major controversy in the last three years has been the PTO’s interpretation of claims drafted in means-plus-function format as permitted by 35 U.S.C. § 112, last paragraph (¶ 6). The Federal Circuit Court of Appeals recently decided two cases which address this issue, one in the context of patentability rejections under 35 U.S.C. §§ 102 and 103, *In re Donaldson Company, Inc.*, and the other in the context of nonstatutory subject matter rejections under 35 U.S.C. § 101, *In re Alappat*. The PTO was reversed in both cases. Nevertheless, the developments leading up to the decisions are of interest because they illustrate how the PTO tries to maintain consistent developments in the law and because many of the PTO arguments are not found outside the briefs. Sections A through D below discuss the background leading up to *Donaldson* and *Alappat*. Section E discusses the arguments made by the PTO in both cases, as well the decisions by the court.

**A. Background**

The last paragraph of 35 U.S.C. § 112 was enacted in 1952 to legislatively overrule *Halliburton Oil Well Cementing Co. v. Walker*. Claims in means-plus-function format had been around since the mid-1800s, but there was uncertainty over interpreting such limitations.

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72. See supra note 6.


An element of 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.

74. 16 F.3d 1189 (Fed. Cir. 1994).


77. 2 *ANTHONY N. DELLER, DELLER'S WALKER ON PATENTS* §§ 166-168 (1937).
In *Halliburton*, the Supreme Court held a combination claim invalid under Rev. Stat. § 4888 (the predecessor to 35 U.S.C. § 112 ¶ 2) in an infringement context. The first reason was that the claim described the crucial element at the exact point of novelty in terms of a means-plus-function limitation "rather than in terms of its own physical characteristics or its arrangement in the new combination apparatus." The second reason was that the means-plus-function limitation was not limited to covering an "actual equivalent" of the means disclosed, but would give "broad rights to bar the use of all devices now or hereafter known which could [perform the function]." The Supreme Court feared that such broad functional claims would frighten subsequent inventive genius from the course of experimentation.

The Supreme Court's analysis of the second problem of "undue breadth" under the predecessor of section 112, paragraph two, was common at the time. However, more recently it has been appreciated that the statutory basis is, more accurately, the enabling disclosure requirement of section 112, paragraph one. That is, the enabling disclosure of the specification is not commensurate with the broad scope of the claims.

In its last paragraph, section 112, overcame the two problems in *Halliburton* in the following specific ways. The first clause sanctioned means-plus-function limitations "without the recital of structure, material, or acts in support thereof." Therefore, "[i]t would appear that Congress clearly intended that paragraph 3 would 'permit combination claims to be expressed functionally at the exact point of novelty.'" The second clause provides a statutory construction of combination claims means-plus-function limitations narrow enough to avoid the problem of undue breadth forbidden by section 112, paragraph 1. This was the construction imposed by courts in infringements prior to *Halliburton*. Thus, section 112, paragraph six,

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78. 329 U.S. at 9.
79. *Id.* at 12, 13.
80. *Id.* at 12.
82. See *In re Hyatt*, 708 F.2d 712, 714 (Fed. Cir. 1983) (citing *In re Borkowski*, 422 F.2d 904, 909 (C.C.P.A. 1970)).
84. Blaustein, *supra* note 81, at 618.
85. *Hyatt*, 708 F.2d at 714.
86. See *In re Fuetterer*, 319 F.2d 259, 264 n.11; Ford Motor Co. v. Gordon Form Lathe Co., 87 F.2d 390, 392 (6th Cir. 1937) (citations omitted) ("An inventor cannot by the mere use of the word 'means' appropriate any and all kinds of mechanism or devices which may perform the specified function, or any other mechanism or device than that which is de-
operates like the reverse doctrine of equivalents to restrict the scope of the literal claim language.\textsuperscript{87}

Section 112, paragraph six, has several effects in examination. The PTO accepts the more convenient means-plus-function form, regardless of whether it is at the point of novelty, and regardless of whether such means-plus-function limitation is broader than the enabling disclosure. The PTO relies on the reverse doctrine of equivalents effect of section 112, paragraph six to protect future innovators.\textsuperscript{88} However, prior to Donaldson\textsuperscript{89} and Alappat,\textsuperscript{90} in the PTO’s view, section 112, paragraph six, was not intended to limit the scope of claims during examination.\textsuperscript{91} Ex parte determinations of statutory subject matter under section 101, novelty under section 102, nonobviousness under section 103, and definiteness under section 112, paragraph two, were determined according to the literal language of the claims.

There is an interesting relationship between claims drafted in means-plus-function format and mathematical algorithms. Mathematical algorithms usually involve process claims.\textsuperscript{92} Claims directed to the section 101 classes of “machine” or “manufacture” are statutory subject matter because the calculation method remains free for use by anyone not employing the specific apparatus.\textsuperscript{93} Means-plus-function claims are said to be apparatus claims.\textsuperscript{94} However, it was recognized by the CCPA that the form of the claim is not determinative of statutory subject matter and that a claim, though drafted in means-plus-function “apparatus” terms, may be treated in certain circumstances prescribed in the patent or which is its mechanical equivalent."); Harris, supra note 81, at 687-688.

\textsuperscript{87} Johnston v. IVAC Corp., 885 F.2d 1574, 1580 (Fed. Cir. 1989).

\textsuperscript{88} Cf. In re Hogan, 559 F.2d 595, 607 (C.C.P.A. 1977) (footnotes omitted) (emphasis added):
The business of the PTO is patentability, not infringement. Like the judicially-developed doctrine of equivalents, designed to protect the patentee with respect to later-developed variations of the claimed invention, the judicially-developed “reverse doctrine of equivalents,” requiring interpretation of claims in light of the specification, may be safely relied upon to preclude improper enforcement against later developers. The courts have consistently considered subsequently existing states of the art as raising questions of infringement, but never of validity.

\textsuperscript{89} 16 F.3d 1189 (Fed. Cir. 1994).

\textsuperscript{90} 31 U.S.P.Q.2d (BNA) 1545 (Fed. Cir. July 29, 1994).

\textsuperscript{91} See discussion infra part III.E.3.a.

\textsuperscript{92} See supra note 30.

\textsuperscript{93} In re Freeman, 573 F.2d 1237, 1247 n.11 (C.C.P.A. 1978); In re Bernhart, 417 F.2d 1395, 1399 (C.C.P.A. 1969) (“[A] member of the public would have to do much more than use the equations to infringe any of these [apparatus] claims.”).

\textsuperscript{94} Freeman, 573 F.2d at 1247.
as indistinguishable from a process. If "the claims are truly drawn to specific apparatus distinct from other apparatus capable of performing the identical functions," the claims will not be treated as processes. Prior to Donaldson and Alappat, the PTO did not read implicit limitations of structure or interconnection into means clauses. The Federal Circuit Court of Appeals' decision in Alappat affects the way claims in means-plus-function format are interpreted for purposes of section 101.

B. In re Iwahashi

The week after deciding Grams, the Federal Circuit Court of Appeals decided In re Iwahashi. The invention in Iwahashi was an auto-correlation unit for providing auto-correlation coefficients for use in pattern recognition. Underlying the unit was a mathematical theory showing that approximated values of the coefficients could be obtained without multipliers using the square of the sum of two factors. The specification disclosed specific electronic circuitry for performing the steps of the calculations. The sole claim recited all elements in mean-plus-function format, except for a read only memory (ROM) which served as an electronic look-up table to deliver the square of a number fed to it as an input. The claim recited a formula for calculating the auto-correlation coefficient.

95. This position was adopted based on a line of dissenting opinions in the CCPA by Judge Rich and Judge Lane beginning in 1974. See Ex parte Alappat, 23 U.S.P.Q.2d (BNA) 1340, 1342 (Bd. Pat. App. & Inter. 1992). This interpretation was not new. See (Proposed) Guidelines to Examination of Programs, 829 Off. Gaz. Pat. Office 865, 866 (Aug. 16, 1966):

Apparatus may be defined in many instances in terms of a paraphrase of a process definition, i.e., in terms of "means for" carrying out the "function" of each step of that process. . . . A claim to a series of means for carrying out the successive steps of a mathematical algorithm tells nothing of the structure of a machine capable of so operating as to result in solving the algorithm, but merely claims, in effect, the non-statutory algorithm.

Cases which have treated claims in "means for" language as process claims are In re Maucorps, 609 F.2d 481 (C.C.P.A. 1979); In re Walter, 618 F.2d 758, 768 (C.C.P.A. 1980); In re Meyer, 688 F.2d 789, 795 n.3 (C.C.P.A. 1982); In re Pardo, 684 F.2d 912, 916 n.6 (C.C.P.A. 1982); and In re Abele, 684 F.2d 902, 909 (C.C.P.A. 1982).

96. Walter, 618 F.2d at 768.
97. See discussion infra part III.E.3.a.
98. See discussion infra part III.E.1-4.
100. Id. at 1371.
101. Id.
102. Id. at 1371-72.
103. Id. at 1375.
The PTO argued that the term "read only memory" was as broad as a means-plus-function recitation of means for squaring, with the result that the claim was entirely in means-plus-function format and indistinguishable for 35 U.S.C. § 101 purposes from a process claim. The PTO deemed such a corresponding method claim to be nonstatutory subject matter by applying the two-step test.

The Federal Circuit Court of Appeals reversed.\(^{104}\) The court stated that the ROM was not in means-plus-function form and found that the term ROM was understood by those skilled in the art to refer to a specific piece of apparatus.\(^ {105}\) The court discussed the claimed relationship between the ROM and the means and concluded that "[t]he claim as a whole certainly defines apparatus in the form of a combination of interrelated means . . .,"\(^ {106}\) and held that the claim was directed to statutory subject matter.\(^ {107}\) After so holding, the court went on to state that 35 U.S.C. § 112 ¶ 6 precluded the Solicitor's interpretation of means-plus-function limitations as encompassing every means for performing the function.\(^ {108}\) The court stated that "[s]ection 112 ¶ 6 cannot be ignored when a claim is before the PTO any more than when it is before the courts in an issued patent."\(^ {109}\)

In a notice interpreting \textit{Iwahashi}, the PTO stated that the result was consistent with previous cases.\(^ {110}\) Once it is determined that a claim involving a mathematical algorithm is drawn to specific apparatus, rather than encompassing any and every means for performing the recited functions, it necessarily follows that the apparatus is statutory subject matter under section 101.\(^ {111}\) However, the court's statement regarding section 112, paragraph 6, was considered dicta because it followed the holding of statutory subject matter. In particular, the notice points out that the Federal Circuit Court of Appeals did not mention or attempt to distinguish the line of CCPA cases where claims in means-plus-function format were treated as process claims, leaving the status of these cases in question.\(^ {112}\) Patent examiners were in-
structured to continue to apply CCPA precedent, especially where the claims were entirely in "means for" format.\textsuperscript{113}

Unfortunately, because \textit{Iwahashi} does not mention the CCPA cases, it is not apparent why the PTO sought to have the claim treated as a process claim. The notice was intended to clear up this confusion and to provide guidance to patent examiners and practitioners.\textsuperscript{114} In view of the court of appeals' decision in \textit{Alappat} regarding treatment of means-plus-function claims, the \textit{Iwashi} notice will no longer be followed by the PTO.\textsuperscript{115}

C. \textit{In re Bond}

It was only a matter of time before a case more on all fours with the means-plus-function cases involving mathematical algorithms was presented. In the meantime, the Federal Circuit Court of Appeals relied on the language of \textit{Iwahashi} in the case of \textit{In re Bond},\textsuperscript{116} which concerned an ordinary patentability determination under 35 U.S.C. § 102.

The invention in \textit{Bond} was a telephone answering machine with remote turn-on feature.\textsuperscript{117} The machine owner who forgot to set the machine to answer could call the machine and set it to answering mode remotely by ringing the phone a certain number of times.\textsuperscript{118} The claims recited a delay means, which would prevent the machine from answering the owner's initial call for a predetermined period of time after it has set itself to answer, so that the owner would not incur toll charges.\textsuperscript{119} Claim one was rejected as anticipated under 35 U.S.C. § 102 because of a prior patent granted to Curtis.\textsuperscript{120} Curtis taught a remote turn-on circuit where the machine activates after a set number of rings, and after activating, it answers on the first ring.\textsuperscript{121}

The court noted that the disclosed and prior art structures are not identical, but the claim may well be anticipated.\textsuperscript{122} The court stated that a means-plus-function limitation will cover equivalents, citing the footnote in \textit{Iwahashi}, but that the Board had failed to make a finding of structural equivalence between the delay means in claim one and

\begin{itemize}
  \item \textsuperscript{113} \textit{Id}.
  \item \textsuperscript{114} \textit{Id}.
  \item \textsuperscript{115} See discussion \textit{infra} part III.E.1-4, IV.
  \item \textsuperscript{116} 910 F.2d 831 (Fed. Cir. 1990).
  \item \textsuperscript{117} \textit{Id}.
  \item \textsuperscript{118} \textit{Id.} at 832.
  \item \textsuperscript{119} \textit{Id}.
  \item \textsuperscript{120} \textit{Id}.
  \item \textsuperscript{121} \textit{Id.} at 833.
  \item \textsuperscript{122} \textit{Id}.
\end{itemize}
the circuitry in Curtis. The Federal Circuit Court of Appeals vacated the anticipation rejection and remanded the case to the Board for findings regarding structural equivalence.

Following Bond, the Commissioner issued a directive to the examining corps concerning means-plus-function limitations. Thereafter, the Commissioner issued a notice stating reasons why the PTO is not required to make determinations of equivalents under section 112, paragraph six, in patentability determinations. The PTO declined to follow Iwahashi and Bond because it believed that these cases represent a departure from settled law and binding precedent on the Federal Circuit Court of Appeals.

D. Arrhythmia Research Technology, Inc. v. Corazonix Corp.

In Arrhythmia Research Technology, Inc. v. Corazonix Corp., the Federal Circuit Court of Appeals reversed a district court judgment of invalidity which declared the patent claims to be mathematical algorithms and did not confer statutory subject matter under 35 U.S.C. § 101. The claims were directed to a process and apparatus (in means-plus-function format) "for analyzing electrocardiograph signals to determine the presence or absence of a predetermined level of high frequency energy in the late QRS signal." The presence of such high frequency energy waves in the QRS portion of the electrocardiograph signal indicated that the patient was subject to ventricular tachycardia.

The court of appeals applied the Freeman-Walter-Abele test to the process claims. Certain steps of the invention were described in the specification as performed by mathematical formulae programmed in a digital computer. Therefore, under the first step of the two-step test, the court accepted for purposes of its analysis that the claims in-

123. Id.
124. Id. at 835.
127. Id.
129. Id. at 1054.
130. Id. at 1055.
131. Id.
132. Id. at 1057-58.
133. Id. at 1055.
directly recited a mathematical algorithm.\textsuperscript{134} For the second step, the court proceeded "to determine whether the process is otherwise statutory; that is, we determine what the claimed steps do, independent of how they are implemented."\textsuperscript{135} The court found that the electrocardiograph signals which were transformed from analog to digital form were not abstractions, but real physical signals of a patient's heart function.\textsuperscript{136} Likewise, the court determined the claimed steps of "converting", "applying", "determining", and "comparing" to be "physical process steps that transform one physical, electrical signal into another."\textsuperscript{137} The \textit{Freeman-Walter-Abele} standard was met because the method was "an otherwise statutory process whose mathematical procedures were applied to physical process steps."\textsuperscript{138}

The court of appeals analyzed the statutory nature of the apparatus claims according to the interpretation of 35 U.S.C. § 112 \textsuperscript{6} with reference to the patent specification, citing \textit{Iwahashi}.\textsuperscript{139} The means in the claims were described as specific electronic devices in the specification, a conventional analog-to-digital converter, a programmed minicomputer, and disc memory unit.\textsuperscript{140} The court concluded that the apparatus claims defined a combination of interrelated means for converting a particular input signal to a different output signal which constituted statutory subject matter.\textsuperscript{141} With regard to arguments that the final output of the claimed apparatus (and process) was simply a number, the court of appeals noted that "the number obtained is not a mathematical abstraction; it is a measure in microvolts of a specified heart activity, an indicator of the risk of ventricular tachycardia."\textsuperscript{142}

\textit{Arrhythmia} was often cited as overruling the PTO's position on mathematical algorithms and mathematical algorithms claimed in means-plus-function language. The fact that \textit{Arrhythmia} involved the validity of an issued patent did affect the analysis; since patents are presumed valid, the standard for claim interpretation is different for patents than for applications, and section 112, paragraph six, clearly applies to patents. Nevertheless, the PTO believed its position was consistent with \textit{Arrhythmia}. The most important factor was that both process and apparatus claims recited physical signals in the body of

\begin{itemize}
  \item 134. \textit{Id.} at 1058-59.
  \item 135. \textit{Id.} at 1059.
  \item 136. \textit{Id.}
  \item 137. \textit{Id.}
  \item 138. \textit{Id.}
  \item 139. 888 F.2d 1370, 1375 (Fed. Cir. 1989).
  \item 140. 958 F.2d at 1060.
  \item 141. \textit{Id.} at 1060-61.
  \item 142. \textit{Id.} at 1060.
\end{itemize}
RECENT DEVELOPMENTS IN PATENT PROTECTION

1994

the claim. Once it could be determined that the mathematical steps of
the algorithm were applied to transform a physical electrical signal
representing a patient's heart function from one state to another state,
the holding of statutory subject matter was not in doubt. Transformation
of signals from one state to a more useful state is what much of
electrical engineering is about. Consistent with Grams, the court
accepted the presence of a mathematical algorithm because some of
the claimed steps were described in the specification by mathematical
formulae. Many claims indirectly involve mathematical algorithms
but easily pass the second step of the test.

The problem with claims involving mathematical algorithms is
identifying the underlying statutory process or structure, which is
often more difficult than in Arrhythmia. The rule is that the claims
define the invention. Manifestly, a claim may be drawn to the abstract
mathematical algorithm even though the specification discloses spe-
cific apparatus or physical process. The PTO's job is to determine
whether the claim defines statutory subject matter. It is often impos-
sible to say whether a "signal" is necessarily physical as opposed to an
abstract quantity, especially where an applicant chooses to use
equivocal language such as "data representing a signal" or to put limi-
tations in the preamble rather than the claim body. Where the
claim meaning is unclear, examiners will reject; applicants have the
opportunity to traverse the rejection or to amend. Practitioners can
help their cause by pointing out words of physical elements or process
steps in the claims. The Federal Circuit Court of Appeals' decision in
Alappat indicates that claims in means-plus-function format are inter-
preted by the PTO in the same manner as the patent claims were in
Arrhythmia.

143. 888 F.2d 835 (Fed. Cir. 1989).
144. 958 F.2d 1053, 1059 (Fed. Cir. 1992).
145. Compare In re Walter, 618 F.2d 758, 770 (C.C.P.A. 1980) ("The 'signals' processed
by the inventions of claims 10-12 may represent either physical quantities or abstract quan-
tities; the claims do not require one or the other.") with Arrhythmia, 958 F.2d at 1059
("These input signals are not abstractions; they are related to the patient's heart
function.").
146. It is often debatable whether a preamble is a limitation on the claim. See Kropa v.
Robie, 187 F.2d 150, 152 (C.C.P.A. 1951); 2 DONALD S. CHISUM, PATENTS § 8.06[1][d]
(1993). A preamble is usually treated as merely setting forth the environment and is not
given substantive weight. See In re de Castelet, 562 F.2d 1236, 1244 n.6 (C.C.P.A. 1977)
("The potential for misconstruction of preamble language requires that compelling reason
exist before that language may be given weight."). The uncertainty can be removed by
putting the limitations in the body of the claim.
E. *In re Alappat*

The Federal Circuit Court of Appeals recently decided the appropriate interpretation of 35 U.S.C. § 112 ¶ 6 in the companion *in banc* cases of *In re Alappat* and *In re Donaldson Company, Inc.* This discussion examines the issues in the computer-related case of *Alappat*.

1. *The invention*

The invention in *Alappat* is a "rasterizer for converting vectors in a data list representing sample magnitudes of an input waveform into anti-aliased pixel illumination intensity data to be displayed on a display means." Raster display devices use a rectangular grid of pixels to display images on a screen. The pixels have selective illumination intensity (brightness). Due to the discrete size of the pixels, straight lines or curves cannot be drawn smoothly, but have a jagged staircase or sawtooth appearance. Ripples may also appear to run along the line as the position of the line changes on the screen. These effects are known as "aliasing." The disclosed rasterizer takes two end points of data representing a vector (a directed line) and calculates which pixels to turn on to display the line. The intensity of the pixels is calculated to provide "anti-aliasing" or smoothing of the line appearance. The sole independent claim fifteen recites four "means for" limitations for carrying out the conversion, all of which are disclosed as mathematical calculations. The specification discloses special structure for performing the calculations including two arithmetic logic units, barrel shifters and ROM look-up; in effect, a special purpose computer.

2. *Procedural history*

In the PTO, a first Board panel reversed an examiner’s rejection of independent claim fifteen as nonstatutory subject matter under section 101; dependent claims sixteen through nineteen were argued to stand or fall with claim fifteen. The Board held that while claim fifteen recited a mathematical algorithm, the claim must be considered to recite statutory subject matter because the "means for" limitations in claim fifteen correlated to "conventional structure" in the specification, relying on *Walter*.

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148. 16 F.3d 1189 (Fed. Cir. 1994).
150. *Id.* at 1348 (dissenting opinion).
151. *Id.* at 1349 (dissenting opinion).
reconsideration on the basis that the decision was inconsistent with the Commissioner's *Iwahashi* notice. An expanded seven-member panel, which included the Commissioner and Deputy Commissioner, reversed on reconsideration, with the three original panel members entering a dissent. The majority stated that claim fifteen should be treated as a process claim for the purpose of applying the statutory subject matter analysis under section 101 in accordance with the line of CCPA cases. The majority noted that claim fifteen did not contain a specific piece of apparatus like the ROM in *Iwahashi*, nor did it expressly recite a specific interrelationship among the various means. The claim was deemed broad enough to read on "a general purpose digital computer 'means' to perform the various steps under program control," not just the disclosed special apparatus. The claim so treated as a process claim was held to be nonstatutory subject matter as a mathematical algorithm.

Applicant appealed to the Federal Circuit Court of Appeals. Appellant filed a suggestion for hearing *in banc* and for the case to be decided together with *Donaldson*. The PTO concurred. The Federal Circuit Court of Appeals granted the suggestion for hearing both *Alappat* and *Donaldson in banc*. The court of appeals further directed that three additional issues be addressed in *Alappat* concerning the Commissioner's authority to constitute a new panel for purposes of reconsideration. Amicus curiae briefs were filed by the American Intellectual Property Law Association, Seagate Technologies, Inc., the Federal Circuit Bar Association, and the Intellectual Property Owners, Inc. The cases were argued *in banc* on March 11, 1993.

3. **PTO's arguments on appeal**

*Alappat* presented three main issues. First, whether 35 U.S.C. § 112 ¶ 6 requires the PTO to interpret means-plus-function limitations during prosecution as limited to disclosed structure and its equivalents. The same issue was presented in *Donaldson*. Second, whether CCPA authority for treatment of means-plus-function claims as process claims is still valid; if so, whether the claim is properly treated as a process; finally, if so, whether the claim passes the *Free-
test for statutory subject matter. Third, whether the Commissioner has authority to designate an expanded panel on reconsideration. Only the first two issues will be considered.

a. PTO’s interpretation of § 112 ¶ 6

Both prior to and after the adoption of the 1952 Patent Act, the PTO interpreted means-plus-function limitations to include all means for performing a recited function. Thus, a means-plus-function limitation is considered to be met by any prior art means which performs the identical function, without regard to whether the prior art means is an “equivalent.” This interpretation comports with (1) the principle that the claims measure the invention; (2) the rule that during examination claims are given the broadest reasonable interpretation; and (3) the rule that limitations are not read into the claims.

A fundamental principle of patent law is that the claims measure the invention. The claims are the legally operative part of the patent. Moreover, the doctrine of “integration” of a written instrument requires that the claims be self-contained and the meaning be ascertainable without reference to applicants’ arguments and interpretation. Claims should mean what they say.

During prosecution before the PTO, when the claims may be amended, claim language is given its broadest reasonable interpretation, and limitations appearing in the specification are not to be read

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160. Additional background on the § 112 ¶ 6 issue may be found at 2 PATENT LAW PERSPECTIVES, § 2.9[5], at 2-1171 to 2-1172.8 (2d ed. 1992).


163. As Judge Learned Hand stated in Catalin Corp. of America v. Catalazuli Mfg. Co., 79 F.2d 593, 594 (2d Cir. 1935):

In each aspect they [the claims] should be self-contained; that is the very purpose of their embodiment in a formal grant, which is all that is accessible to the public without much trouble and vastly more uncertainty. If the doctrine of the “integration” of a written instrument has any basis at all, surely it should apply to such a document, for if a patent can be construed only by threading one’s way through all the verbal ingenuities which casuistical solicitors develop to circumvent the objections of examiners, a labyrinth results, from which there is no escape.

See also 1 Deller, supra note 162, § 70 (“While an application is pending in the Patent Office, undue breadth of a claim must be cured by amendment, not by interpretation.”).
RECENT DEVELOPMENTS IN PATENT PROTECTION

into the claims. The broadest reasonable interpretation is a judicially sanctioned mechanism for maximizing the possibility that the PTO will issue patent claims which are valid. Means-plus-function limitations, read literally, “encompass any means for performing the recited function.” Therefore, the PTO argued that its interpretation of means-plus-function limitations as having the same scope as the literal language was inherently consistent with the principle of broadest reasonable interpretation.

Applicants are not required to disclose all possible equivalents of the disclosed structure or even to know of their existence. Therefore, it is reasonable for the PTO to presume that applicants intend means-plus-function limitations to cover all means for performing the function known to those skilled in the art. If a means-plus-function limitation literally reads on a known prior art means which performs the identical function that the applicant regards as “non-equivalent” or “accidental” anticipation of the claim language, applicant cannot argue that the claim particularly points out and distinctly claims the “subject matter which the applicant regards as his invention” under section 112, paragraph two. Applicant can amend the claims using express language.

It is proper to read a claim in light of the specification to interpret what is meant by an express word or phrase in the claim, but it is improper to narrow the scope of the claim by implicitly reading in disclosed limitations from the specification which have no express ba-

164. See In re Prater, 415 F.2d 1393, 1404-05 (C.C.P.A. 1969); In re Zletz, 893 F.2d 319, 321-22 (Fed. Cir. 1989); Podlesak v. McInerney, 1906 Dec. Comm'r Pat. 265, 268 (Comm'r Pat. 1906). On the other hand, in patent infringement litigation, where a patentee cannot amend the claims and where claims are entitled to a statutory presumption of validity, a court may construe a claim more narrowly so as to sustain its validity if possible. Prater, 415 F.2d at 1404 n.30.

165. See Prater, 415 F.2d at 1404-05; In re Etter, 756 F.2d 852, 858-59 (Fed. Cir.) (en banc), cert. denied, 474 U.S. 828 (1985); ROBERT L. HARMON, PATENTS AND THE FEDERAL CIRCUIT 152-54 (2d ed. 1991); Prater, 415 F.2d at 1404 n.30.


167. See D.M.I., Inc. v. Deere & Co., 755 F.2d 1570 (Fed. Cir. 1985) (“There is and can be no requirement that applicants describe or predict every possible means of accomplishing that function.”); S.R.I. Int'l v. Matsushita Elec. Corp., 775 F.2d 1107, 1121 (Fed. Cir. 1985) (in banc) (plurality opinion) (“The law does not require the impossible. Hence, it does not require that an applicant describe in his specification every conceivable and possible future embodiment of his invention.”).

sis in the claims. 169 “Means” is a broad but definite term and does not require resort to the specification.

The PTO interpreted the language “construed to cover” in section 112, paragraph six, as referring to post-issuance claim “construction” by a court, not to claim “interpretation” by the PTO. At the time of the 1952 Patent Act, there was a distinction between claim “construction” by a court and claim “interpretation” by the Patent Office. 170 Further, the PTO argued that “equivalents” in section 112, paragraph six, was a codification of the “reverse doctrine of equivalents” which involves later developers and infringement, not patentability. Section 112, paragraph six, was never intended to permit claims which read literally on prior art.

The PTO relied on In re Lundberg 171 and In re Henatsch, 172 since neither had been overruled. In Lundberg, the CCPA squarely addressed the issue of whether section 112, paragraph six (then paragraph 3), allowed limitations from the disclosure to be read into means limitations to distinguish the claimed invention from the prior art. The CCPA held that the last paragraph of section 112 was subordinate to the requirement of section 112, paragraph two, that the claim define the invention, without limitations imported from the specification to impart patentability. 173 This position was reiterated in

169. See Prater, 415 F.2d at 1404; In re Priest, 582 F.2d 33, 37 (C.C.P.A. 1978) (inferential limitations are not to be read into the claims); In re Self, 671 F.2d 1344, 1348 (C.C.P.A. 1982) (“Many of appellant’s arguments fail from the outset because . . . they are not based on limitations appearing in the claims.”).

170. Cf. 2A SUTHERLAND STAT. CONST. § 45.04 (5th ed. 1992) (“There are numerous judicial and juridical expressions which distinguish between interpretation and construction on the ground that interpretation determines the meaning of words and construction determines the application of words to the facts.”).

171. 244 F.2d 543 (C.C.P.A. 1957).

172. 298 F.2d 954 (C.C.P.A. 1962).

173. Lundberg, 244 F.2d at 547-48:

Congress did not intend, by incorporating the third paragraph into section 112, to destroy certain basic precepts of patent law. Thus, though appellants’ arguments would necessarily lead to the opposite conclusion, it is still true that “the claim is the measure of the invention.” The requirement in the second paragraph of section 112 that “the specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention” has not been at all diminished by the addition of the third [now sixth] paragraph; the latter paragraph must be read in the light of the first and second paragraphs and given an interpretation consistent with their clear meaning. In re Arbeit, [206 F.2d 927 (C.C.P.A. 1953)].

... [N]otwithstanding the third paragraph of section 112, it is the language itself of the claims which must particularly point out and distinctly claim the subject matter which the applicant regards as his invention, without limitations imported from the specification, whether such language is couched in terms of means plus
Henatsch. Statutes must be construed as a whole. Following both cases there have been reenactments of section 112. The PTO argued that it must be presumed that Congress was aware of and approved the judicial pronouncements in Lundberg and Henatsch when it reenacted section 112 without changing the substance of the last paragraph.

The main argument against the PTO's position was that section 112, paragraph six, does not distinguish between infringement and ex parte prosecution. However, in the PTO's view, that argument does not address the point that "construed to cover" coupled with "equivalents" limits the applicable portion of section 112, paragraph six, to infringement. Nor does that argument deal with Lundberg and Henatsch, or analyze section 112, paragraph six, in terms of the statute as a whole. It was also argued that language in the later CCPA case of In re Knowlton sub silentio overruled Lundberg. The language relied upon in Knowlton stated that section 112, paragraph six (then paragraph three), does not impose any additional disclosure requirements to that in section 112, paragraph 1, which is merely consistent with the intent of section 112, paragraph six, to allow claiming in means-plus-function format that exceeds the scope of the enabling disclosure. Knowlton did not hold that section 112, paragraph six, permits disclosed structure and equivalents to be read into a means clause to distinguish over prior art.

The CCPA's and PTO's interpretation of section 112, paragraph six, was unchallenged after Lundberg, until the creation of the Federal Circuit Court of Appeals. Equivalents were not used to limit the scope of claims during examination. Until Bond, there was no known case reversing the PTO on the basis that a prior art means was "non-equivalent" to structure disclosed in the specification. The PTO argued that if its interpretation was reversed, it would be possible for the PTO to issue two "non-interfering" patents containing identically worded claims to patentably different inventions. Manifestly, the PTO argued that this was not what Congress intended.

function or consists of a detailed recitation of the inventive matter. Limitations in the specification not included in the claim may not be relied upon to impart patentability to an otherwise unpatentable claim.

174. 298 F.2d at 957-58.
175. 2A SUTHERLAND, supra note 170, § 46.05 ("Thus, it is not proper to confine interpretation to the one section to be construed." (footnote omitted)).
177. 481 F.2d 1357 (C.C.P.A. 1973).
178. Id. at 1366.
179. See supra note 81.
b. Mathematical algorithm

The CCPA recognized that the subject matter of a claim, though drafted in means-plus-function "apparatus" terms, may be indistinguishable from a process. Therefore, although claim fifteen was nominally to a "rasterizer," it was argued that the apparatus title was not determinative.

Naturally, as the PTO pointed out, it would be administratively simpler to have a per se rule that claims in means-plus-function format are statutory subject matter. However, the PTO is not writing on a clean slate. The Federal Circuit Court of Appeals' failure to address the CCPA's treatment of "all means" claims in Iwahashi created uncertainty in the law which needed to be clarified in Alappat.

The Walter test applied by the PTO is whether "the claims are truly drawn to specific apparatus distinct from other apparatus capable of performing identical functions," as evidenced by the claim language itself, not by limitations of structure and equivalents read in under section 112, paragraph six. The public is entitled to know what specific apparatus the claims are limited to so it knows how it can practice the mathematical algorithm without infringing. The interpretation of section 112, paragraph six, is especially critical under section 101 since the claims are not compared against prior art. It would be problematic at best to try to determine equivalents in the abstract.

There are certain common factors among the five CCPA cases, which treat means claims as process claims. All claims were in the simple form of a series of "means for" performing steps. Part of the disclosed apparatus in each specification was apparently a known general purpose digital computer operating on a stored program; that the claims read on old apparatus performing programmed method steps was an indication that the applicant was really trying to patent the process embodied in the computer program, rather than some specific new and nonobvious apparatus. It is not clear from the statements of facts in the cases what other physical structure was disclosed. However, the PTO was unaware of any case where the PTO was reversed on the basis that the CCPA read disclosed structure or equivalents into the means terms.

It was argued by Alappat that Meyer requires the PTO to interpret means-plus-function limitations as corresponding to structure disclosed in the specification in a section 101 determination. Meyer

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180. See supra note 95.
itself treated a means-plus-function claim as a process claim. The claims in *Meyer* involved a mental process that a neurologist might follow in making a diagnosis, although rejection was based on mathematical algorithms. The reference to section 112, paragraph six, in *Meyer* is based on a holding of *Prater* and *Bernhart*, that claims are not nonstatutory subject matter, where structure is disclosed, because the means-plus-function limitations are capable of being carried out by nonstatutory methods, such as by a human being. Thus, the PTO argued that the specification is used to determine whether applicant is trying to claim "mental steps," not to read structure into the means clauses.

As far as the PTO could determine, claim fifteen in *Alappat* fit the profile of the CCPA cases. All limitations were in "means for" form. There was no language either indicating the means must be separate means or connecting the means together to form a spacial arrangement of means. Importantly, *Alappat* admitted that claim fifteen reads on a general purpose digital computer running a computer program. The fact that claim fifteen was admitted to read on two such diverse apparatus as a known computer and the disclosed special apparatus, is evidence that claim fifteen is not limited to specific apparatus under the *Walter* test and should be treated as a process claim.

In the PTO's view, assuming claim fifteen could be treated as a process claim, it failed the two-step test of *Freeman-Walter-Abele*. Under the first step, every paragraph in claim fifteen was found to indirectly recite a mathematical equation or operation disclosed in the specification as part of an overall algorithm or procedure to calculate illumination intensity data values. In addition, the PTO considered *Alappat*'s arguments that no mathematical formula was expressly recited and that there might be other equivalent, undisclosed, ways of obtaining the recited quantities in claim fifteen without using a mathematical computation, to be unpersuasive and inconsistent with cases like *Grams* and *Arrhythmia*. Under the second step, the mathematical steps were not applied to an "otherwise statutory process." Claim fifteen defines mathematical operations which convert numbers from one form, numerical vectors in a data list, into another form, numerical illumination intensity data. Mathematical manipulation of abstract data is not statutory subject matter. The preamble stated that the

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183. Id. at 795 n.3.
vector list input data represents sample magnitudes of an input waveform; however, this was considered data abstract from any real physical process or signals. There is no question that the specification disclosed statutory apparatus in addition to the nonstatutory mathematical algorithm. The issue was whether the claim defined the apparatus or was so broad as to preempt the mathematical algorithm itself.

4. The outcome

Donaldson was decided before Alappat. In a unanimous decision, the Federal Circuit Court of Appeals held that the "plain and unambiguous meaning of paragraph six is that one construing means-plus-function language in a claim must look to the specification and interpret that language in light of the corresponding structure, material, or acts described therein, and equivalents thereof, to the extent that the specification provides such disclosure." The court also held "that paragraph six applies regardless of the context in which the interpretation of means-plus-function language arises, i.e., whether as a part of a patentability determination in the PTO or as part of a validity or infringement determination in a court." Moreover, "[t]o the extent that In re Lundberg ... or any other precedent of this court suggests or holds to the contrary, it is expressly overruled." The PTO has issued guidelines to its patent examiners about how to follow Donaldson.

In Alappat, the Federal Circuit Court of Appeals followed its interpretation of section 112, paragraph six, announced in Donaldson and reversed the PTO on the merits. The majority held that the "Board majority therefore erred as a matter of law in refusing to apply § 112 ¶ 6 in rendering its § 101 patentable subject matter determination." The court further held that when claim fifteen was properly construed in accordance with section 112, paragraph six, by substituting the structure disclosed in the specification, or an equivalent thereof, for each means-plus-function limitation, "claim 15 unquestionably recites a machine, or apparatus, made up of a combination of known electronic circuitry elements." The court acknowledged that this did not end the section 101 inquiry since precedent suggests that the mathematical algorithm exception may apply to true

185. See supra note 146.
187. Id. (footnote omitted).
188. Id. at 1193-94.
190. Id. at 1555.
apparatus claims. The court announced that "the proper inquiry in dealing with the so called mathematical algorithm 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.'" The court concluded that under such a test claim fifteen was directed to a machine, not a disembodied mathematical concept.

The PTO is in the process of drafting guidelines to follow Alappat. One remaining question is whether the court has created a rule that claims in means-plus-function format are statutory subject matter. The court seemed to leave open the possibility that under appropriate circumstances, e.g., as in Abele, Pardo, and Walter where there was "apparent lack of any supporting structure in the specification corresponding to the claimed 'means' elements," it might still be proper to treat claims as "in effect nothing more than process claims in the guise of apparatus claims," since the statement of facts in Abele, Pardo, and Walter are uninformative about the disclosure in the specification. It may be that a purely software disclosure (e.g., program code and flowcharts), may be one circumstance where a means-plus-function claim could be treated as a process claim, but even this is in doubt given the court's reliance on statements that a computer program in effect creates a new machine. It is clear though that Maucorps and Meyer are not to be followed, since the court found that the CCPA did not properly apply section 112, paragraph six, in those cases.

IV
Conclusion

Mathematical algorithms under 35 U.S.C. § 101 and the interpretation of means-plus-function limitations under section 112, paragraph six, during ex parte prosecution are two major issues affecting patenting of computer software and hardware. The PTO's perspective is that of the Government agency charged with the duty of issuing valid

191. Id. at 1555-56.
192. Id. at 1557.
193. Id.
194. 684 F.2d 902 (C.C.P.A. 1982).
195. 684 F.2d 912 (C.C.P.A. 1982).
196. 618 F.2d 758 (C.C.P.A. 1980).
198. Id. at 1558.
199. Id. at 1554-55.
patents. The PTO requires consistent developments of the law if it is to maintain uniform and definite standards for a patent.

Analysis of mathematical algorithms and statutory subject matter in the computer process area is in a relatively mature stage of development, with a history of cases going back over 20 years. Nevertheless, the Freeman-Walter-Abele test for statutory subject matter can be subtle and difficult to apply. The court of appeals' decision in In re Grams demonstrates that the PTO can apply the analysis objectively. In view of the importance of mathematical algorithms in the computer area, it is not expected that the issue will disappear. The PTO's goal is to make sure that issued patent claims define statutory subject matter.

The Federal Circuit Court of Appeals' in banc decisions in Donaldson and Alappat on the interpretation of means-plus-function limitations during ex parte prosecution will affect examination in all art areas, not just in computers. The exact nature of the impact on general PTO practice cannot be predicted. However, the direction for interpreting means-plus-function language is now set.