

# **Appellant's Brief**

**CORRECTED BRIEF FOR APPELLANT IN RE KURIAPPAN P. ALAPPAT,  
EDWARD E. AVERILL and JAMES G. LARSEN**

**FILED**  
U.S. COURT OF APPEALS FOR  
THE FEDERAL CIRCUIT

**FEB 16 1993**

**IN THE  
UNITED STATES COURT OF APPEALS  
FOR THE FEDERAL CIRCUIT**

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**Appeal No. 92-1381**

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**IN RE KURIAPPAN P. ALAPPAT,  
EDWARD E. AVERILL and JAMES G. LARSEN**

**ON APPEAL FROM A DECISION OF THE BOARD OF  
PATENT APPEALS AND INTERFERENCES IN  
SERIAL NO. 07/149,792 DATED APRIL 22, 1992.**

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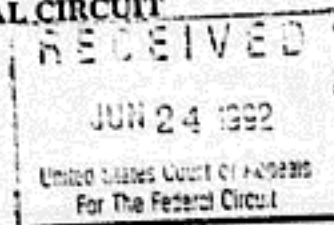
## **STATUTES**

35 USC § 101  
 35 USC § 102  
 35 USC § 103  
 35 USC § 112 ¶ 1  
 35 USC § 112 ¶ 2  
 35 USC § 112 ¶ 6

UNITED STATES COURT OF APPEALS FOR THE FEDERAL CIRCUIT

Certificate of Interest

In Re Alappat  
No. 92-1381



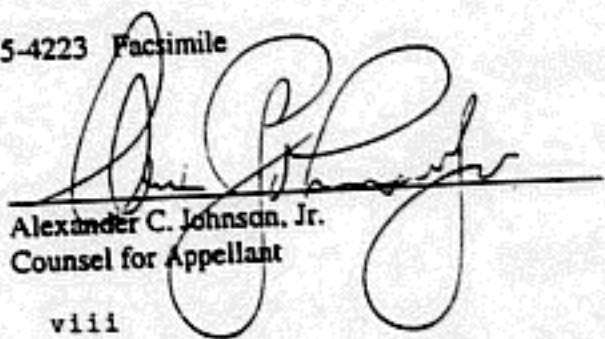
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1. The full name of every party or amicus represented by me is: Kuriappan P. Alappat; Edward E. Averill; and James G. Larsen.
2. The name of the real party in interest (if the party named in the caption is not the real party in interest) represented by me is: Tektronix, Inc.
3. The parent companies, subsidiaries (except wholly-owned subsidiaries), and affiliates that have issued shares to the public, of the party or amicus curiae represented by me are: None.
4. The names of all law firms and the partners or associates that appeared for the party or amicus now represented by me in the trial court or agency or are expected to appear in this court are:

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**STATEMENT OF RELATED CASES**

None.

**STATEMENT OF JURISDICTION**

The U.S. Court of Appeals for the Federal Circuit has exclusive jurisdiction over this appeal pursuant to 28 USC § 1295(a)(4)(a). This appeal was timely filed in accordance with 28 USC § 2107.

### **STATEMENT OF THE ISSUES**

1. Does claim 15, otherwise allowable, recite patentable subject matter under 35 USC § 101 where the claim is written in "means plus function" format pursuant to 35 USC § 112 ¶ 6 based on a hardware disclosure of digital circuitry?
2. Does claim 15 recite a mathematical algorithm in the *Benson* sense? More specifically, is a "means plus function" apparatus claim deemed necessarily to incorporate an algorithm merely because it is claiming digital circuitry?
3. Does claim 15 solely claim an algorithm? More specifically, in determining whether the "claim as a whole" in its entirety merely claims an algorithm, is it proper under 35 USC § 112 ¶ 6 to ignore the fact that the claim covers a "machine" in both form and substance where the disclosed best mode of the invention is digital circuitry?

### **STATEMENT OF THE CASE**

#### **A. Nature of the Case**

This is an appeal from a decision of the U.S. Patent and Trademark Office Board of Patent Appeals and Interferences affirming, on reconsideration, the Examiner's final rejection of claims 15-19 as being directed to nonstatutory subject matter under 35 USC § 101.

#### **B. Course of Proceedings and Disposition in the Patent and Trademark Office**

In the decision on reconsideration, an expanded PTO Board of Appeals overturned (5-3) the Board's original decision, which held (3-0) that Appellants' claim 15 defines statutory subject matter, i.e. a machine, outside the mathematical



algorithm exception under 35 USC § 101. (A-29)

1. The first Board Decision

The original panel held that claim 15, claiming a rasterizer entirely in "means plus function" terms, is statutory even though it recites a mathematical algorithm because the claim as a whole is directed to apparatus. (A-29) In reaching the § 101 decision, the panel construed the means recited in the claim pursuant to 35 USC 112, ¶ 6, as corresponding to the hardware structure disclosed in the specification. (A-26 to A-27)

The panel relied on a lengthy string of prior CCPA and Federal Circuit decisions involving the § 101 issue (*Abele, Meyer, Johnson, Bernhart, Iwahashi, Walter, Arrhythmia*)<sup>1</sup> as authority for interpreting the claims as a whole in light of the corresponding structure described in the specification. (A-27 to A-30) The panel expressly distinguished the PTO practice, followed in examining the scope of claims vis-a-vis prior art under §§ 102/103, of viewing the claims as not limited to the specification, citing *Reuter*. (A-28)

The panel further held that Appellants had met their burden under *Walter* of showing that the claims are drawn to specific apparatus distinct from other apparatus capable of identical functions. (A-29) Referring to the specification, the Board panel found that

[A]ppellants' claims on appeal, as a whole, do in fact recite plural means for performing various functions..." (A-27)

"Appellants have certainly met their burden set forth in *Walter* and demonstrated 'that the claims are truly drawn to specific apparatus

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<sup>1</sup> For brevity, citations to cases cited in the Board's decisions are omitted in this section.



distinct from other apparatus capable of performing the identical functions.'"(A-29)

[C]onventional structure in the art is the basis for the 'means for' language recitation in the body of claim 15 on appeal." (A-29)

"Not only is structure involved in the instant claims on appeal, the apparatus recited therein does operate according to an algorithm." (A-30)

"[T]he fact that an apparatus operates according to an algorithm does not make it nonstatutory." (A-29)

"In this claim, the means, as disclosed, may not be construed as equivalent to a method. We do not have here, for example, rectangular block diagrams disclosed to define each of the means recited ... the means for determining, for example, is not disclosed in a very broad, generic sense ..." (A-30)

In the second decision on reconsideration, these Board members unanimously joined in dissenting from the expanded Board's majority decision. (A-25 to A-30)

## 2. The second, expanded Board Decision

Overturning the original panel, the expanded Board held it proper to treat claim 15 as a method claim (A-13) by interpreting the "means" literally as encompassing "any and every means for performing the function" and that, so interpreted, claim 15 is nonstatutory (A-19). Reaching this result, the Board asserted that "Claim 15 differs from a method claim only in its recitation of 'means for' before each functional step and is indistinguishable from a method claim." (A-13)

The expanded Board said that Appellants may rely on § 112 ¶ 6 in demonstrating that the claims are truly drawn to specific apparatus as required under *Walter*. (A-13) But then the Board held that this determination is subject to the PTO rule of construction applied in examining claims for patentability under §§ 102/103

over prior art. "[I.]e. claims are given their broadest interpretation and limitations from the specification will not be imputed to the claims." (A-13)

The Board noted that claim 15 reads on a programmed general purpose computer and, agreeing with the Examiner that the claim does not positively recite structural limitations (A-15), interpreted the recited means of claim 15 as reading "on any and every means for performing the functions." (A-16) The Board stated that a common factor in *Maucorps*, *Walter*, *Pardo*, *Abele* and *Meyer* was that the disclosed apparatus was really a process embodied in a computer program and that, since claim 15 can be read so broadly, it should be similarly treated. (A-10)

The expanded Board majority argued that it is improper to presume that "conventional structure in the art," as disclosed in the specification, and its equivalents, limit the claimed means to less than any and every means in view of § 112, ¶ 2. (A-8 and A-17) The majority distinguished *Iwahashi* as reciting a ROM in the claims. (A-12) The Board agreed "that a combination of interrelated means may, in appropriate cases, define statutory subject matter." It found no claimed interrelationship in claim 15, however, only a series of method steps. (A-18)

After holding that claim 15 amounts to a method, the expanded Board majority held the claim nonstatutory under § 101. (A-19) The Board imputed mathematical formulas from the specification to the claim, referring to the specification four times to find an indirect recital of a mathematical algorithm and three times to find equations for the operation of each "means" element (a), (b) and (d), and once for the operation of the barrel shifter used for element (c). (A-20) The expanded Board then held that claim 15 failed part two of the *Freeman-Walter* test.

In reaching this conclusion, the Board stated, "Each step in claim 15 recites a mathematical operation ...." The Board majority concluded that "the algorithm is not 'applied in any manner to physical elements or process steps' because when the claim is viewed without the steps of the mathematical algorithm, no other elements or steps are found." (A-21)

The expanded Board declined to follow the *Iwahashi* Court's approach to resolving the § 101 issue, by referring to the specification to interpret "means plus function" elements pursuant to § 112 ¶ 6, calling it dictum, and limited the holding in *Iwahashi* to its facts (recital of a ROM in the claim). The dissent cited *Arrythmia* as reinforcing its reliance on *Iwahashi*. The majority, however, dismissed *Arrythmia* as differing both in claim language and context, stating that the rules of claim construction in infringement actions differ from the rules for claim interpretation during prosecution. (A-22 to A-23)

The majority said that *Iwahashi* conflicts with prior CCPA cases, in failing to mention or distinguish the treatment of "means for" claims as method claims. As for the CCPA cases (*Maucorps*, *Walter*, *Meyer*, *Pardo*, and *Abele*), the majority acknowledges that § 112 ¶ 6 was held to apply to the § 101 issue but asserts that that was not an obstacle to reading the "means for" claims in those cases as method claims. (A-10) The majority observed that the claims in these cases were based on the disclosure of a programmed general purpose computer, and extended this rationale to claims which do not distinguish from a programmed computer. (A-11) The majority stated that the decisions in the cited CCPA cases are binding precedent until overruled *en banc* or by the Supreme Court. (A-12)

C. Statement of the Facts

1. Summary of the Invention

The present invention is an apparatus for creating a smooth waveform display from a sampled input signal on a raster scan display device in a digital display system as shown in FIG. 1 of the patent (A-38), the apparatus also being known as a rasterizer. The smooth waveform display is created by selectively illuminating pixels adjacent a vector created by data samples from the input signal with variable intensity illumination. The intensity of the pixel illumination is determined by the distance of the center point of the pixel to the input signal vector. In this way, although the output waveform image is constructed of discrete pixels, the entire waveform display appears to be smooth. (A-44, line 16 through A-45, line 5)

The input to the rasterizer 40 is data from a vector list output from a digitizer 12. (A-46, lines 8-22 and A-49, line 32 through A-50, line 6) The output from the rasterizer 40 is a serial stream of illumination intensity data that is further processed by the pixel processor 42 and frame buffer 32 for providing the appropriate location in a bit map for final display on a raster scan display device 20. (A-50, lines 6-24) The structure of the rasterizer that enables this waveform display to be created is shown as a block 40 in FIG. 2 (A-38) and detailed in FIG. 3 (A-39). An arithmetic logic unit (ALU) 74 determines the vertical distance between the endpoints of each vector created by successive data points of the input signal (A-53, line 30 through A-54, line 6). A counter 78 and ALU 80 determine the "elevation" or location of a row of pixels with respect to the input signal vector, (A-54, line 23 through A-55, line 2). Barrel shifters 84 and 88 under control of priority encoder 86 normalize the



vertical distance and elevation determined by the arithmetic logic units 74 and 80. (A-55, lines 3-20) The normalized vertical distance and elevation are used to address read only memories (ROM) 92 and 100, which contain lookup tables that provide illumination intensity data. (A-55, line 27 through A-57, line 16)

Overall, the claimed rasterizer controls the display 20, connecting the digitized samples of the waveform by giving a greater illumination intensity for pixels lying squarely on the waveform trace and a lesser intensity for pixels lying along an edge of the trace. The physical effect is to create the visual appearance of a smooth continuous waveform. It accomplishes this by operation of a novel combination of conventional electronic circuits which, as functionally defined in the claims, is patentably distinct from prior art rasterizers which perform the same overall function.

## **2. Claims on Appeal**

The original claims 1-14 (A-62 to A-67) were initially rejected under 35 USC § 103 but, after amendment and argument, this rejection was expressly withdrawn. Then, claims 1-14 were rejected under 35 USC § 101. Applicant cancelled claims 1-14 and submitted claims 15-19. These claims were again rejected under § 101 and § 112, and the rejection was made final. (A-225 to A-231) The claims were amended to remove the § 112 rejections and now stand as set forth below:

15. A rasterizer for converting vector list data representing sample magnitudes of an input waveform into anti-aliased pixel illumination intensity data to be displayed on a display means comprising:

- (a) means for determining the vertical distance between the endpoints of each of the vectors in the data list;
- (b) means for determining the elevation of a row of pixels



that is spanned by the vector;

(c) means for normalizing the vertical distance and elevation;  
and

(d) means for outputting illumination intensity data as a predetermined function of the normalized vertical distance and elevation.

16. A rasterizer as in claim 15 wherein the means for determining the vertical distance between the endpoints of each of the vectors in the data list comprises an arithmetic logic circuit configured to perform an absolute value function.

17. A rasterizer as in claim 15 wherein the means for determining the elevation of a row of pixels that is spanned by the vector comprises an arithmetic logic circuit configured to perform an absolute value function.

18. A rasterizer as in claim 15 wherein the means for normalizing the vertical distance and elevation comprises a pair of barrel shifters.

19. A rasterizer as in claim 15 wherein the means for outputting comprises a read only memory containing illumination intensity data.

#### SUMMARY OF THE ARGUMENT

The Examiner in this case, and the expanded Board, have pushed the envelope of the mathematical algorithm exception to its farthest limits in every dimension. First, the Board has moved from treating as method claims, claims which are apparatus claims in form but, in substance, are based on the disclosure of a process, to so treating apparatus claims based on a disclosure which, in substance, is apparatus. Now, the Board will treat an apparatus claim as a method claim if the claim is deemed broad enough to read on a programmed computer, regardless of whether the underlying disclosure is hardware or software, and without applying § 112 ¶ 6.

Next, in step 1 of the two-step *Freeman-Walter* analysis, the concept of "mathematical algorithm" has been expanded from the tightly-defined equation or formula of *Freeman* to the much broader, generalized concept of algorithm. The expanded Board has moved beyond the requirement that an algorithm be recited directly in algebraic form, or indirectly in a prose recital of the equation. Step 1 is now met either by inferring an equation from the specification where only the outcome of the computation is used in the claim or, where no equation at all can be found, by dismissing the claim element as a mere "number crunching" element or recognized mathematical step. In other words, the mere presence of mathematical operations in the preferred embodiment disclosed in support of the claims is sufficient basis to find recital of an algorithm.

Finally, in step 2 of the *Freeman-Walter* analysis, the expanded Board has moved far beyond the question of whether a claim preempts an algorithm, or solely attempts to patent the algorithm, to an inquiry merely into the presence of mathematical operations: "What the means do in this case is perform mathematical operations on data, how they do it is also mathematical." (A-21) The Board has not considered that the claim as a whole, as it is written, is directed to an apparatus that converts digitized waveforms, which would be jagged if represented directly, into waveforms that appear as smooth, continuous waveforms when displayed. The obvious and well-established technologic utility of the invention is ignored, as is the fact that what is claimed is, in substance as well as form, a machine, squarely within 35 USC § 101.

These extensions of the "mathematical algorithm" exception to § 101 are

virtually unbounded. The Board's rationale can readily be applied to all digital circuits and systems, which inherently perform mathematical operations, and could readily be extended to many kinds of analog or mixed analog/digital circuits or systems that use, or can be defined by, mathematics. This is a case which, if the Board's decision is allowed to stand, will result in the exception swallowing up the statutory rule.

### **ARGUMENT**

**ISSUE 1.** Does claim 15, otherwise allowable, recite patentable subject matter under 35 USC § 101 where the claim is written in "means plus function" format pursuant to 35 USC § 112 ¶ 6 based on a hardware disclosure of digital circuitry?

#### **I. Treatment of "Means Plus Function" Claims for 35 USC § 101 Statutory Subject Matter Purposes**

##### **A. The Expanded Board's Analysis Essentially Ignores the Hardware Disclosure Underlying the Claims**

The Board's analysis treats apparatus claims written in "means plus function" language as method claims and ultimately holds that they claim nonstatutory subject matter under 35 USC § 101. This analysis begins by giving the claims at issue the "broadest reasonable interpretation" and interpreting the "means" as "literally as encompassing any and every means" without looking to the specification for any guidance as to the nature or scope of those claims. (A-13)

[T]he usual rules of claim interpretation apply, i.e., claims are given their broadest reasonable interpretation and limitations from the specification will not be imputed to the claims. This is PTO

policy and practice which we affirm as appropriate under the precedential case law discussed above. (A-13)

The analysis of the Appeals Board follows the PTO's official position stated in the Notice Interpreting *In Re Iwahashi* (1134 OG 474) at 475:

[E]xaminers should give "means for" limitations their broadest reasonable interpretation and then it is applicant's burden to show that the functionally-defined disclosed means do not encompass any and every means for performing the recited functions.

B. Case Law Does Not Support the Board's Claim Interpretation for § 101 Purposes

None of the cases cited in the expanded Board's Decision state any such rule of law with respect to examining claims to determine statutory subject matter under § 101. The one case cited by the Board as setting forth the "broadest reasonable interpretation" rule, *In re Reuter*, 651 F.2d 751, 210 USPQ 249 (CCPA 1981), is applied only when examining claims in view of the prior art under §§ 102/103, and not when determining statutory subject matter. The dissenting members of the Board point this out:

[T]he new decision majority insists on giving claim 15 the broadest reasonable interpretation, a test which under *Reuter* is applied when examining claims in view of the prior art. [Footnote 2 omitted.] Accordingly, the new decision majority opinion is internally inconsistent in first acknowledging that "means for" claims ought to be construed in accordance with the sixth paragraph of 35 USC 112 for 35 USC 101 statutory subject matter purposes and then proceeding to apply the prior art broadest reasonable interpretation test to claim 15. We know of no case holding that the broadest reasonable interpretation test for applying prior art should be used for determining statutory subject matter under 35 USC 101, and the new decision majority has cited none. (A-31 to A-32, emphasis added.)



C. "Means For" Claims Must Be Interpreted According to 35 USC § 112

¶ 6 When Determining Statutory Subject Matter under 35 USC § 101

Several cases have dealt directly with the issue of statutory subject matter. These cases positively recite a rule of law that claims drafted in "means for" format are to be examined in light of the specification according to 35 USC § 112¶ 6 and not given their "broadest reasonable interpretation" without regard to the underlying disclosure. In determining whether or not "means for" claims are statutory subject matter under 35 USC § 101, one must look to the disclosed means in the specification for performing the functions and the equivalents thereof.

The Court of Customs and Patent Appeals in *In re Meyer*, 688 F.2d 789, 796, 215 USPQ 193, 199 (CCPA 1982), holding software-based claims to be unpatentable under § 101, cited with approval *In re Bernhart*, 417 F.2d 1395, 163 USPQ 611 (CCPA 1969):

This Court is aware of its directive in *In re Bernhart*, 57 CCPA at 742, 417 F.2d at 1399, 163 USPQ at 615, that, in accordance with 35 USC 112, paragraph 6, claims under 35 USC 101 drafted in means plus function format are to be examined in light of the "corresponding structure, material, or acts described in the specification and equivalent [sic] thereof."

Other cases stating this rule specifically in regard to § 101 interpretation of "means for" apparatus claims such as those now on appeal include *In re Prater*, 415 F.2d 1378, 1389, 159 USPQ 583, 593 (CCPA 1968); On rehearing, 415 F.2d 1393, 1406, 162 USPQ 541, 551-552 (CCPA 1969) and *In re Foster*, 438 F.2d 1011, 1014, 169 USPQ 99, 102 (CCPA 1971). More recently, *In re Abele*, 684 F.2d 902, 214 USPQ 682 (CCPA 1982) followed this without restating it, as further discussed



below. These cases have not been overruled.

D. Current Case Law Supports Applying § 112 ¶ 6 in § 101 Examination

The Court of Appeals for the Federal Circuit also clearly set forth this rule in *In re Iwahashi*, 888 F.2d 1370, 1375, 12 USPQ 2d 1908, 1911-1912 (Fed. Cir. 1989):

In the Solicitor's brief the summary of argument states that the claim "encompasses any and every means for performing the functions recited therein." We point out that the claim is a combination of means all but one which is a means-plus function limitation, the one exception being the ROM, clause [d], which is a specific piece of apparatus. The claim is therefore subject to the limitation stated in 35 USC 112(6) that each means-plus-function definition "shall be construed to cover the corresponding structure, material, or acts described in the specification and equivalents thereof."<sup>1</sup> This provision precludes the Solicitor's interpretation of the claim. The Solicitor's summary also contends that since the claim should be interpreted as he does, we should regard it as though it were a method claim. Since he is wrong on the first score, he is wrong on the second.

The rule was emphasized in footnote 1 of *Iwahashi*, *Id.* at 1375 n.1, 1912 n.1:

Section 112, paragraph 6 cannot be ignored when a claim is before the PTO any more than when it is before the courts in an issued patent.

*Iwahashi* was cited with approval in *Arrhythmia Research Technology, Inc. v. Corazonix Corp.*, 958 F.2d 1053, 1060, 22 USPQ 2d 1033 (Fed. Cir. 1992), holding claims valid under § 101, and the same rule of law regarding "means plus function" claims was set forth:

The Simson apparatus for analyzing electrocardiographic signals is claimed in the style of 35 USC § 112, paragraph 6, whereby functionally described claim elements are "construed to cover the corresponding structure, material, or acts described in the

specification and equivalents thereof." Thus the statutory nature *vel non* of Simson's apparatus claims is determined with reference to the description in the '459 patent specification. *In re Iwahashi*, 888 F.2d 1370, 1375, 12 USPQ 2d 1908, 1911-12 (Fed. Cir. 1989).

The invention in *Iwahashi* was a low cost auto-correlation unit that evaluates auto-correlation coefficients for use as parameters in voice or pattern recognition. The simple circuit configuration of the auto-correlation unit in *Iwahashi* replaced more expensive multipliers and complicated associated circuitry, and also did the job of calculating the coefficients faster. The function of the claimed auto-correlation circuit could easily be performed on a general purpose computer, as contemplated by the Solicitor, but a bona fide digital circuit other than a programmed computer was disclosed in the specification as being the preferred embodiment.

E. Under *Iwahashi*, Claim 15 Covers Patentable Subject Matter

Appellant deems *Iwahashi* to be controlling in this appeal, given almost identical facts. There are numerous factual similarities between *Iwahashi* and the present appeal and only one minor difference in the manner of claiming a read-only memory (ROM). Both the auto-correlation unit of *Iwahashi* and the rasterizer of the present invention are digital circuits which convert signals in the form of sampled digital input values into a new form of output signal also in the form of digital data that is used in a larger system (voice or pattern recognition in *Iwahashi*; raster scan display of oscilloscope waveforms in the present case).

The transformation functions in both circuits can be easily performed on a programmed general purpose computer. In both instances, however, the preferred embodiment of the invention is not a general purpose computer, but is an actual

digital circuit with commonly-used digital circuit elements (analog to digital converter, adder, ROM, and calculating circuit in *Iwahashi*; arithmetic logic units, barrel shifter, and ROM in the present case.) In *Iwahashi*, the benefits provided over other means of performing the data reformatting function are cost savings and increased operating speed. In the present invention, the benefits are also cost savings and operating speed. The equivalent function performed on a general purpose digital computer (as now available) is not generally desirable for use in high resolution raster scan display devices because the illumination intensity data cannot be generated fast enough.

The one minor difference is found in the exact format of element (d) in each of the appealed independent claims, which both relate to a memory device. The memory device in *Iwahashi* is a ROM, which is used to store squares of numbers as a look-up table (rather than actually calculating the squares each time a new input address is presented to the memory). In *Iwahashi*, element (d) is not literally stated in "means plus function" language as provided for in 35 USC § 112 ¶ 6, but is claimed as a specific piece of hardware, viz. "(d) a read only memory associated with said means for calculating." (Note, however, that a random access memory (RAM) or other memory device for storing a lookup table in a general purpose computer would perform the same function in the same way, i.e. be an obvious equivalent.)

In the present application, there is an equivalent ROM memory element that stores the illumination intensity data and (as in *Iwahashi*) is also used as a look-up table. The look-up table eliminates the need to calculate the illumination intensity values each time a new input address is presented. It is clear from the specification

that the memory element in appealed claim 15 refers to ROMs 92 and 100 shown in Figure 3 of the specification. (A-39) The memory element in claim 15 is defined in "means plus function" language, viz. "(d) means for outputting illumination intensity data as a predetermined function of the normalized vertical distance and elevation." In element (d), the normalized vertical distance and elevation is presented as an input address to the ROM and the corresponding output data of the ROM is illumination intensity data according to a predetermined function. (A-55)

Although the format of element (d) in each of the claims is different, the holding of *Iwahashi* did not turn on the fact that the claim recites one specific hardware element, a ROM, but rather that each of the "means plus function" elements contained specific identifiable hardware elements in the specification. The Court in *Arrhythmia* cited the latter proposition as the holding of *Iwahashi*, and not the proposition that one specific hardware element renders statutory an otherwise non-statutory claim containing numerous "means plus function" elements.

The Board continues with its comment on *In re Iwahashi*:

"The above quoted portion of the Federal Circuit panel's *Iwahashi* decision could be the basis for an argument that it is improper to treat claims which are entirely in 'means for' terms as method claims where there is corresponding structure in the specification." (A-12)

This is exactly what Appellants want the Court to hold.

## II. Treatment of "Means Plus Function" Claims for Any Purpose

### A. The PTO Position is to Treat Claims the Same for § 101 Purposes as for §§ 102/103 Purposes



The Patent Office purports to treat "means plus function" claims the same during prosecution, whether for prior art, statutory subject matter, or other purposes, i.e. the claims are given their "broadest reasonable interpretation" without looking to the specification for guidance. The Notice Interpreting *In Re Iwahashi* (1134 OG 474) at 475 states:

In the opinion of the PTO, means-plus-function limitations should be not treated differently for § 101 purposes than for § 102 and § 103 purposes for rejections over prior art. Indeed, during prosecution claims should be given their broadest reasonable interpretation.

B. Case Law Contradicts the PTO Position on § 112 ¶ 6

A number of cases not concerned with statutory subject matter, but dealing with prior art or other issues, have instructed the Patent Office to examine "means plus function" claims in light of the structure disclosed in the specification and the equivalents thereof, and not to use the "broadest reasonable interpretation" or "any and all means" test.

1. In the §§ 102/103 Context

Most recently, the Court of Appeals for the Federal Circuit in *In re Bond*, 910 F.2d 831, 833, 15 USPQ 2d 1566, 1568 (Fed. Cir. 1990) cited *Iwahashi* and *Johnston v. Ivac Corp.*, 885 F.2d 1574, 12 USPQ 2d 1382 (Fed. Cir. 1989) with approval and restated the rule regarding the examining of "means plus function" claims:

While a "means-plus-function" limitation may appear to include all means capable of achieving the desired function, the statute requires that it be "construed to cover the corresponding structure, material, or acts described in the specification and equivalents thereof." 35 USC § 112(6) (emphasis added); see *In re*



*Iwahashi*, 888 F.2d 1370, 1375 n.1, 12 USPQ 2d 1908, 1912 n.1 (Fed. Cir. 1989) (applying § 112(6) to PTO proceedings, and harmonizing prior case law); *Johnston v. Ivac Corp.*, 885 F.2d 1574, 1580, 12 USPQ 2d 1382, 1386 (Fed. Cir. 1989) ("section 112, paragraph 6 operates to *cut back* on the types of *means* which could literally satisfy the claim language," (emphasis in original)). However, the Board made no finding that the delay means of claim 1 and that embodied in the [prior art] are structurally equivalent. (emphasis in original)

## 2. In the § 112 ¶ 1 and ¶ 2 Context

The rule stated in *Bond* is not new. It is also found in precedent of the Court of Customs and Patent Appeals in *In re Knowlton*, 481 F.2d 1357, 1366, 178 USPQ 487, 492 (CCPA 1973), which involved the issue of the sufficiency of the disclosure in the specification:

The last sentence [of 35 USC § 112 ¶ 6] contains no language which states or implies a further burden on the *applicant*. It allows the applicant to use claim language which recites a claim element in terms of "means or step for performing a specified function." If the applicant chooses to use such language, the statute instructs the interpreter of the claims, e.g., the Patent Office or the courts, as to how such language shall be interpreted. It states that such language "shall be construed to cover the corresponding structure, material, or acts *described in the specification* and equivalents thereof." The emphasized language does not add any *additional* description requirement to that set forth in the first paragraph of the section. On the other hand, while the sentence is clearly permissive, it cannot be read as creating an exception either to the description requirement of the first paragraph, discussed *supra*, or to the definiteness requirement found in the second paragraph of section 112. Means-plus-function language can be used in the claims, but the claims must still accurately define the invention. Such is the plain meaning of the statutory language. What meager legislative history of section 112 exists, supports our interpretation. (Footnotes omitted) (emphasis in original)

The Patent Office position that 35 USC § 112 ¶ 6 does not apply during examination of patent applications for prior art purposes is based on its interpretation of *In re Lundberg*, 244 F.2d 543, 548, 113 USPQ 530, 534 (CCPA 1957), which stated:

[N]otwithstanding the third [now sixth] 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 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.

Appellants do not agree with the Patent Office's expansive interpretation of *Lundberg*. Appellants deem the holding in *Lundberg* to stand for the proposition that, in assessing the patentability of claims over the prior art, the Applicant is bound by the full range of equivalents if the "means plus function" claim format is used. Limitations from the specification will not be imputed into the claims to selectively narrow this range to overcome prior art. The claim language itself must literally distinguish over the prior art. "Means plus function" claims include the embodiment described in the specification, as well as a range of equivalents provided by 35 USC § 112 ¶ 6. *Lundberg* does not hold that "means plus function" claims do not at least encompass the embodiment disclosed in the specification. *Lundberg* is silent regarding § 101 statutory subject matter determinations.

C. To the Extent *Lundberg* Might Apply Outside the §§ 102/103 Context, *Knowlton* is Superseding Authority Under *Gosteli*

The Patent Office, in a notice in the Official Gazette entitled Applicability

of the last paragraph of 35 USC § 112 to patentability determinations before the Patent and Trademark Office 1134 OG 631 at 634, ignored *In re Knowlton* and cited *Lundberg* as "binding precedent" according to the ruling in *South Corp. v. United States*, 690 F.2d 1368, 215 USPQ 657 (Fed. Cir. 1982) (*en banc*). The *South Corp.* rule, however, was later refined in *In re Gosteli*, 872 F.2d 1008, 1011, 10 USPQ 2d 1614, 1617 (Fed. Cir. 1989). The *Gosteli* Court held that since the CCPA always sat *en banc*, later CCPA decisions control earlier ones and inconsistencies are deemed *sub silentio* removed. Appellants therefore deem *In re Knowlton* to be the proper CCPA precedent and that 35 USC § 112 ¶ 6 applies to the Patent Office for all purposes, including examining patent applications in light of the prior art.

D. Literally, § 112 ¶ 6 Applies in Examination

A plain reading of 35 USC § 112 ¶ 6 forbids the "any and all means" test used by the Patent Office. The decision by a patent applicant to use the "means plus function" claim form provided by the statute is optional. Once an apparatus claim element is written in this form, however, the sixth paragraph of § 112 contains a mandatory provision of what that element "shall be construed to cover" - at least the corresponding disclosed structure, and other structures if equivalent to that disclosed.

No distinction is made in § 112 ¶ 6 between prosecution in the Patent Office or enforcement in the courts, or between validity and infringement. And no distinction is made in the statute regarding patentability determinations under 35 USC §§ 101, 102, 103, or 112. Further, paragraph 6 does not specifically exempt the Patent Office.

**E. Use of "Means plus Function" Claims is Essential in Electrical Art**

The "any and all" test used by the Patent Office has the practical effect of denying an applicant the use of functional definition of disclosed structure having a range of equivalents contemplated by § 112 ¶ 6. Using a specific structural limitation such as two ALUs for claim 15 elements (a) and (b); a "barrel shifter" instead of a "means for normalizing"; or a "ROM" instead of a "means for outputting illumination intensity data" may avoid a rejection for non-statutory subject matter, but deprives the applicant from much of the full range of equivalents permitted under the statute. Any employable circuit designer could readily design around claims so limited.

Moreover, the Examiner in this case specifically rejected the dependant claims 16–19 directed to such limitations, saying "the use of physical elements to provide 'number crunching' is not considered patentable." (A-229 to A-230) The Board similarly dismissed clause (c) of claim 15 stating that "shifting the distance and elevation information to the left in barrel shifters ... is recognized as a mathematical step." (A-20) Plainly, claiming the present invention more narrowly was fruitless in this case.

**III. The Board's "Broad Enough to Read on a Programmed Computer Equals Method Claim" Rule is Not Supported by the Case Law**

**A. The Cases on Which the Board Relies All Claimed Apparatus Based on Software Disclosures**

The Board cites the cases analyzed below as support for the following rule



of law for use in examining patent applications:

"Therefore, where a 'means for' claim does not distinguish over a digital computer operating on a stored program, in our view, it is proper to treat the claim as indistinguishable from a method claim." (A-11)

A proper reading of the decisions in these cases, however, does not support this rule of law. Rather, it shows that the courts were applying the mandatory statutory provision of 35 USC § 112 ¶ 6, and in some cases said exactly that.

This does not mean that "apparatus" claims in "means plus function" format were not treated as method claims. They were, when the essence of the invention was in a method which amounted to a mathematical algorithm and the Court could not find any disclosed hardware or structure, other than a programmed general purpose computer, for carrying out the method. In these instances, the Court held that the invention rested mainly in the method described in the program and, accordingly, treated the purported apparatus claims as method claims. A common feature of the cases relied on by the Board majority was the absence of bona fide hardware supporting the "means plus function" recitals.

1. *In re Maucorps*, 609 F.2d 481, 203 USPO 812 (CCPA 1979)

In *Maucorps*, the Applicant tried to patent a method of doing business by specifically creating apparatus using dedicated digital, computer-related hardware to determine the optimum number of times a sales representative for a business should visit each customer over a period of time, the optimum number of sales representatives the organization should have, and the optimum organization of sales representatives.

The preamble of appealed claim 1 in *Maucorps* at 609 F.2d 482, 203 USPQ 813, states that the purpose of the invention is to solve an equation or a mathematical algorithm:

A computing system for processing data to determine an optimum "coding", defined as the number of regular visits over a predetermined period of time, Pd, by a business representative to a client, to be selected for such client, comprising:

The fifth means element selected the optimum value, defined as being "above the minimum sales line and the saturation curve and as close to the latter as possible...." 609 F.2d at 483, 203 USPQ at 814 (element (e)). The claim as a whole set forth a series of mathematical equations and recited means for solving these equations, and nothing more.

The exact hardware set forth for solving the equations was, in fact, a general-purpose microprocessor with conventional peripheral devices. There was no correlation between the means elements and any specific apparatus other than the computer.

2. *In re Walter*, 618 F.2d 758, 205 USPQ 397 (CCPA 1980).

Both method and apparatus claims were presented in this seismic prospecting and surveying patent application. The examiner did not distinguish between the method and apparatus claims noting that "the only mode of practicing [the] invention is disclosed by way of an algorithm for use in a computer program." 618 F.2d at 762, 205 USPQ at 403.

There was no correlation between specific structure in the specification and the means elements in the claims. The Court stated that

In computer-related inventions, the recited means often perform the function of "number crunching" (solving mathematical algorithms and making calculations. 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.

If the burden is not met the "apparatus claim" will be treated as a method claim. 618 F.2d at 768, 205 USPQ at 408.

Appellants have met that burden. They have pointed out specific structure in the specification, which was corroborated by the independent analysis of the original Board of Appeals (A-27), and have claimed that structure using the statutory sanctioned "means plus function" format permitted by 35 USC § 112 ¶ 6. The present invention is not a general purpose computer as it was in *Walter*, but rather a specific set of dedicated hardware blocks, such as a "barrel shifter", ROM, and ALUs that have a precise meaning in the art and an ascertainable range of equivalents.

3. *In re Meyer*, 688 F.2d 789, 215 USPQ 193 (CCPA 1982)

The invention at issue in *Meyer* was a diagnostic system for doctors. An elaborate system of mathematical steps are performed on input data and an answer given to help the doctor with the diagnosis. The Board of Appeals, affirming the rejection under 35 USC § 101, characterized the invention this way: "The claims are drawn to a technique of statistical analysis. Data is accumulated from a series of test operations and conclusions are drawn in accordance with a mathematical algorithm." *Meyer* at 196. No apparent structure was set forth in the specification, but apparatus claims in "means plus function" language were presented.

The Court upheld the Board decision, stating that "in accordance with 35 USC § 112 paragraph 6, claims under 35 USC § 101 drafted in means plus function format are to be examined in light of the "corresponding structure, material, or acts described in the specification and equivalents thereof. We have done so here." 688 F.2d at 796, 215 USPQ at 199. The *Meyer* Court clearly applied § 112 ¶ 6 to the § 101 analysis, and has stated so.

The *Meyer* Court did not find 35 USC § 112 ¶ 6 "to be an obstacle" for treating apparatus claims as method claims (A-10) because, after reviewing the specification, the Court found that the disclosed invention was in the method and could not find any corresponding structure or apparatus. The holding in *In re Meyer* stands for the proposition, by the CCPA, that § 112 ¶ 6 is applicable in § 101 determinations.

The invention in *Meyer* is easily distinguished from the present invention, which, in the best mode of the invention, is not a programmed general purpose computer, but rather a bona fide digital circuit.

4. *In re Pardo*, 684 F.2d 912, 214 USPQ 673 (CCPA 1982).

The invention in this case appears to be another programmed general purpose computer. "Appellants characterize their invention as a method for controlling the internal operations of a computer." 684 F.2d 913, 214 USPQ at 674. The specification describes the invention as involving an algorithm of a compiler program. Footnote 6 of *Pardo* cited *In re Walter* with approval, stating that

Although some of appellants' claims are drawn to a "general purpose data processor of known type operating under the control of a stored program", such claims are treated as indistinguishable from the method claims for purposes of section 101 unless it is



demonstrated that the claims are drawn to specific apparatus distinct from other apparatus capable of performing the identical functions.

684 F.2d at 916, 214 USPQ at 677.

However, since the appealed claims were not written in "means plus function" format, the *Pardo* Court did not specifically address this issue. Further, the Court held that the appealed claims, even when treated as method claims, were statutory under 35 USC § 101 because the "appealed claims do not fall within any [judicially determined] exception." *Id.*

5. *In re Abele*, 684 F.2d 902, 214 USPQ 682 (CCPA 1982).

The invention in this case was in the field of CAT scans, and used a computer to improve an X-ray image while reducing the amount of X-ray exposure to the patient. Again, the novel aspect of the invention in *Abele* appears to be in the instructions for a general purpose computer and the means in the apparatus claims had no correlation to any specific structure in the specification other than the general purpose computer. In fact, this was stipulated by the Appellants. The Court stated that "Appellants do not argue and, in any event, we see no basis for treating their apparatus claims differently from their method claims." 684 F.2d at 909, 214 USPQ at 688.

The Court nevertheless appears to have interpreted the claims in accordance with § 112 ¶ 6. The § 101 rejection of claim 6 was reversed while the rejection of claim 5 was affirmed. Claim 6 specified that the data operated on by the method of claim 5 is X-ray attenuation data from a CAT scanner. Claim 5 merely defined the mathematical computation. As to claim 6, the Court expressly inferred the steps of

producing and detecting the CAT scan data even though not positively recited in the claim, and found that, even without the algorithm of claim 5, there would still be a CAT scan process which is statutory. 684 F.2d at 905, 214 USPQ at 687-688. Apparatus claim 36 in "means plus function" form was held statutory on the same basis. 684 F.2d at 910, 214 USPQ at 689.

**B. Appellants' Apparatus Claims Are Based on a Bona Fide Hardware Disclosure**

In contrast to the foregoing cases, Appellants in the present case see a clear basis for treating the appealed apparatus claims differently than a method claim. Specific interconnected digital circuit elements corresponding to the "means" elements of claim 15 are set forth in the specification. Under the plain meaning of § 112¶ 6, the "means" elements of claim 15 "shall be construed to cover" at least the disclosed circuit elements.

It cannot reasonably be argued that the claims so interpreted do not embrace a "machine" squarely within the meaning and intent of § 101. Rather, the Board objects to the scope of claim 15, even though the claim has been found patentable under §§ 102/103 over the prior art of record, when given its broadest reasonable construction as applied by the PTO.

**C. The Board's Decision to Treat Apparatus Claim 15 as a Method Claim Because it Could Cover a Programmed Computer is Contrary to Reason and Law**

The rule stated in the Decision on Reconsideration that "where a 'means for' claim does not distinguish over a digital computer operating on a stored program...

it is proper to treat the claim as indistinguishable from a method claim" (A-11) is too broad. It is applicable to all digital electrical systems claimed in "means plus function" form.

The rule is unsupported by existing case law. The Board cites no authority for such a rule when the claims are based on a hardware disclosure. The cases the board relies on are all based on software disclosures so, of course, the claims cover a programmed computer.

The rule is logically opposed to the plain language of § 112 ¶ 6. Instead of looking for "corresponding structure, material, or acts described in the specification and equivalents thereof" according to the plain meaning of the statute, as followed in *Meyer*, the Board uses an "any and every means" test without any reference to the subject matter disclosed in the specification.

Taken to its logical conclusion, the rule would prevent all digital circuits from being claimed in "means plus function" format as provided in 35 USC § 112 ¶ 6. This is especially true in the field of signal processing where a claimed circuit is likely to have a first set of data as an input and reformatted second set of data as an output. The function of all digital signal processing blocks can be described in terms of a set of instructions to program a general purpose computer. And all digital circuits operate, by definition, by performing mathematical operations. The general purpose computer itself is a digital circuit. The list of circuit blocks whose function can be described mathematically and programmed on a computer obviously includes "number crunching" circuits such as multipliers and adder circuits, but can easily be extended to other circuit blocks such as amplifiers, filters, logic gates, and numerous

other commonly used circuit blocks and combinations thereof. This point was made by the dissent:

If the new decision majority view were to prevail, we seriously doubt that any electrical invention could ever be defined in "means for" format. Taking radio and television as examples, every component operates on an electrical signal that can be described mathematically. If these components were claimed in "means for" format, the new decision majority would likely come to the absurd result that these claims are nonstatutory under 35 USC 101. (A-32 to A-33)

#### IV. The Board's treatment of claim 15

In an effort to distinguish appealed claim 15 from the appealed claim in *Iwahashi*, in which the claimed elements were properly interconnected as required by 35 USC § 112 ¶ 2, the new decision majority argued that there is no interconnection between the claimed elements. "Claim 15 ... does not claim the disclosed interrelationship among the means." (A-14) This assertion lacks any merit. If true, the claims could have been (but were not) rejected under 35 USC § 112 ¶ 2 as indefinite, but not under 35 USC § 101 as lacking statutory subject matter.

A quick reading of claim 15 shows that elements (a) and (b) are indeed independent as recited (although utilizing the same inputs), but that each element is connected to element (c), and in turn element (c) is connected to element (d). Means element (a) determines the vertical distance between endpoints of the vector and means element (b) determines the elevation of a row of pixels spanned by the vector. Means element (c), however, is connected to elements (a) and (b) since it normalizes the outputs of means (b) and (c), *viz.* the "vertical distance and elevation." Means



(c) and (d) are interconnected because the memory element (d) outputs illumination data in response to an input from means (c), i.e. the "normalized vertical distance and elevation." This interconnectivity is consistent with the circuit diagram of FIG. 3 in the application. (A-39)

Accordingly, the Board's argument about lack of interrelationship of the claimed means is no sound basis for affirming the § 101 rejection.

#### V. Development of Two-Step Analysis of Claims For Statutory Subject Matter

In the foregoing sections we considered whether a "means plus function" claim based on a bona fide apparatus disclosure should be construed under 35 USC § 112 ¶ 6 as claiming a "machine" that is statutory subject matter under 35 USC § 101, regardless of whether the claim recites an algorithm. We now consider the statutory character of the claims on appeal, whether treated as apparatus or method claims.

**ISSUE 2.** Does claim 15 recite a mathematical algorithm in the *Benson* sense? More specifically, is a "means plus function" apparatus claim deemed necessarily to incorporate an algorithm merely because it is claiming digital circuitry?

**ISSUE 3.** Does claim 15 solely claim an algorithm? More specifically, in determining whether the "claim as a whole" in its entirety merely claims an algorithm, is it proper under § 112 ¶ 6 to ignore the fact that the claim covers a "machine" in both form and substance where the disclosed best mode of the invention is digital circuitry?

#### A. The Statute and Applicable Supreme Court Cases

35 USC § 101, provides that:

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, . . .

The Supreme Court said, citing the Congressional Record, that this language includes "anything under the sun that is made by man." *Diamond v. Diehr*, 450 U.S. 175, 182, 209 USPQ 1, 6 (1981). The Supreme Court listed some exceptions: "[P]henomena of nature, though just discovered, mental processes, abstract intellectual concepts are not patentable...." *Gottschalk v. Benson*, 409 U.S. 63, 67, 175 USPQ 673, 675 (1972)

The seminal Supreme Court case on the patentability of digital computer processes was *Gottschalk v. Benson*. The claim was directed to a method for converting a binary coded decimal (BCD) number to a binary number. The question was whether the method described and claimed is a process within the meaning of the Patent Act, 409 U.S. at 65, 175 USPQ at 674. In deciding the case, the Court defined an "algorithm" as "[A] procedure for solving a given type of mathematical problem." 409 U.S. at 65, 175 USPQ at 674. The Court characterized the *Benson* claim as the "mathematical problem of converting one form of numerical representation to another." *Id.* The Court concluded that the claimed process was "so abstract and sweeping as to cover both known and unknown uses of the BCD to pure-binary conversion" (409 U.S. at 68, 175 USPQ at 675); had "no substantial practical application except in connection with a digital computer," and that "the patent would wholly pre-empt the mathematical formula and in practical effect would be a patent on the algorithm itself." 409 U.S. at 71-72, 175 USPQ at 676. Thus, the Court essentially held that the method claimed by *Benson* was an abstract intellectual concept that is not patentable.

In *Parker v. Flook*, 437 U.S. 584, 198 USPQ 193 (1978), the Supreme Court considered whether a method using a novel mathematic formula for updating an alarm limit having conventional post-solution application is a process eligible for patent protection. The Court noted that the patent application did not describe any practical aspects of the use of the new method. All it described was a new algorithm for computing an updated alarm limit, 437 U.S. at 586, 198 USPQ at 195. Post-solution adjustment of an alarm limit (a number) was deemed insufficient to transform an unpatentable principle into a patentable process, 437 U.S. at 590, 198 USPQ at 197. The claim considered as a whole contained no patentable invention, 437 U.S. at 594, 198 USPQ at 199. The dissent objected to the majority treating the new algorithm used in the claimed method as a part of the prior art, as "importing into its inquiry under 35 USC § 101, the criteria of novelty and inventiveness [sic: nonobviousness]." 437 U.S. at 600, 198 USPQ at 201.

Subsequently, the Supreme Court made it clear in *Diamond v. Diehr*, 450 U.S. 175, 187, 209 USPQ 1, 8 (1981) that merely the fact of using a mathematical equation and a programmed digital computer in a process curing synthetic rubber does not take a claim out of the ambit of statutory subject matter. A process was defined as "a mode of treatment of certain materials to produce a given result. It is an act, or series of acts, performed upon the subject matter to be transformed and reduced to a different state or thing." 450 U.S. at 183-184, 209 USPQ at 6 quoting *Cochrane v. Deener*, 94 U.S. 780, 787-788 (1876). The Court affirmed that "a claim drawn to subject matter otherwise statutory does not become nonstatutory simply because it uses a mathematical formula, computer program or digital computer".

450 U.S. at 187, 209 USPQ at 8. The application of a mathematical formula to a known structure or process may be patentable.

The Court held that the "claims must be considered as a whole. It is inappropriate to dissect the claims into old and new elements and then to ignore the presence of the old elements in the [§ 101] analysis." 450 U.S. at 188, 209 USPQ at 9. The question therefore of whether a particular invention is novel is "fully apart from whether the invention falls into a category of statutory subject matter. *In re Bergey*, 596 F.2d 952, 961, 201 USPQ 352, 361 (CCPA 1979)." *Id.*

The Court rejected the view that *Flook* required the mathematical algorithm not to be considered as part of the claim when making the § 101 determination. *Id.* at footnote 12. The Court recognized that "when a claim recites a mathematical formula (or scientific principle or phenomenon of nature), an inquiry must be made into whether the claim is seeking patent protection for that formula in the abstract." It then defined this inquiry:

when a claim containing a mathematical formula implements or applies that formula in a structure or process which, when considered as a whole, is performing a function which the patent laws are designed to protect (e.g., transforming or reducing an article to a different state or thing), then the claim satisfies the requirements of § 101.

450 U.S. at 192, 209 USPQ at 10.

Taken as a whole, these decisions by the Supreme Court teach that, to be held nonstatutory, the claim must (1) recite a mathematical algorithm, and (2) in practical effect be a patent on the algorithm itself. Merely reciting a mathematical formula in a claim, or a step that requires mathematical manipulation, however, does not in



itself indicate that the claim as a whole recites a mathematical algorithm or tends to be a patent on the algorithm itself. The claim is not to be dissected but must be considered as a whole. Patentable subject matter is to be determined apart from patentability under § 102 and § 103. Also, the § 101 patentable subject matter determination is separate from compliance with the § 112 ¶ 2 requirement to distinctly claim the invention. *In re Foster*, 438 F.2d 1011, 1014, 169 USPQ 99, 100 (CCPA 1971).

**B. CCPA Development of Freeman-Walter-Abele Two-Step Test**

The CCPA introduced a two-part analysis that attempted to formalize the determination of whether or not a method claim contains statutory subject matter under *Benson*. This analysis was first enunciated in *In re Freeman*, 573 F.2d 1237, 197 USPQ 464 (CCPA 1978). In *Freeman*, the Court rejected the view that computer programs, or inventions wherein the novelty resides in a programmed computer, are not patentable. The Court stated:

The fundamental flaw in the board's analysis in this case lies in a superficial treatment of the claims. . . In the present case, it is not the claims but the *specification* that discloses implementation of the claimed invention with computer programs. (footnote omitted) (emphasis in original.)

573 F.2d at 1245, 197 USPQ 470.

In an effort to rein in this mode of analysis, the Court stated:

As a bare minimum, application of *Benson* in a particular case requires a careful analysis of the claims, to determine whether, as in *Benson*, they recite "a procedure for solving a given type of mathematical problem." 409 U.S. at 65, 175 USPQ at 674. (emphasis added by CCPA). *Id.*

Then, the Court set forth a two-step analysis, as follows:

First, it must be determined whether the claim directly or indirectly recites an "algorithm" in the *Benson* sense of that term, for a claim which fails even to recite an algorithm clearly cannot wholly preempt an algorithm. Second, the claim must be further analyzed to ascertain whether in its entirety it wholly preempts that algorithm.

573 F.2d at 1245, 197 USPQ at 471.

1. Step 1: Is there an Algorithm?

In applying the foregoing analysis, the Court found that the *Freeman* method and apparatus claims did not directly or indirectly recite an algorithm, and held the claims statutory. The Court made clear that "algorithm" under § 101 and *Benson* is much narrower than the broader meaning used in the computer arts. *Id.* Accord *Diamond v. Diehr*, 450 US at 186, 209 USPQ at 8, footnote 9. Specifically, the Court defined when an algorithm is directly or indirectly recited. An algorithm is indirectly recited when a mathematical equation or formula is expressed in prose rather than algebraic form. The Court held:

The method claims here at issue do not recite process steps which are themselves mathematical calculations, formulae or equations. *Id.*

Similarly, the Court held:

The apparatus claims do not directly or indirectly recite any mathematical equation, formula or calculation, and thus do not preempt the use of any mathematical problem solving algorithm.

573 F.2d at 1247, 197 USPQ at 472.

The Court deemed it unnecessary to consider the effect of apparatus limitations in the claims. *Id.* Nor was it necessary to apply step 2 of the test, since

no algorithm was recited in the claims.

2. Step 2: Is an Algorithm Claimed as the Invention?

Later cases faced the problem of determining whether a claim as a whole claims an algorithm in the *Benson* sense, i.e., merely recites a "procedure for solving a given type of mathematical problem." If a claim recites a mathematical formula as one of its steps, does that mean that the claim is reciting a *Benson* algorithm or is applying the formula to a known structure or process? Or is the claim wholly preempting an algorithm in the *Benson* sense? The result of this uncertainty resulted in several progeny to *Freeman*, most notably *In re Walter*, 618 F.2d 758, 205 USPQ 397 (CCPA 1980) and *In re Abele*, 684 F.2d 902, 214 USPQ 682 (CCPA 1982). In both *Walter* and *Abele*, the claims recited a mathematical algorithm. The issue in each case was whether the claims were directed solely to the algorithm.

After the *Flook* decision, the *Walter* Court restated the second step of the *Freeman* test:

Once a mathematical algorithm has been found, the claim as a whole must be further analyzed. If it appears that the mathematical algorithm is implemented in a specific manner to define structural relationships between the physical elements of the claim (in apparatus claims) or to refine or limit claim steps (in process claims), the claim being otherwise statutory, the claim passes muster under Section 101. If, however, the mathematical algorithm is merely presented and solved by the claimed invention, as was the case in *Benson* and *Flook*, and is not applied in any manner to physical elements or process steps, no amount of post-solution activity will render the claim statutory; nor is it saved by a preamble merely reciting the field of use of the mathematical algorithm. (emphasis in original) (Footnote omitted)

618 F.2d at 767, 205 USPQ at 407.

In *Walter*, the claimed invention was based on programming of a computer process, so the apparatus claims in "means plus function" form were treated as method claims, 618 F.2d at 768, 205 USPQ at 408. In the claims, what was found to be positively recited was an improved method of computation, i.e. improved mathematical methods for interpreting the results of seismic prospecting. The Court distinguished *Walter* from *In re Johnson*, 589 F.2d 1070, 200 USPQ 199 (CCPA 1978) as follows:

There [in *Johnson*] the claims were drawn to the enhancement of digital data in seismic records by removing the noise from the physical signals representing physical phenomena. Mathematics were employed to this end. The inventors in that case did not attempt to claim a mathematical exercise or method of calculation. Operation of the claimed process in *Johnson* converted the noise-containing physical seismic record present at the start to a new record minus the noise component. Here, appellant claims only an improved mathematical method for cross-correlation.

618 F.2d at 770, 205 USPQ at 409-410.

In footnote 10, the *Walter* Court also explained, with reference to *Johnson*, the need to process the signals in the form of digital data derived from sampled amplitudes, and that this should not be the basis for holding an invention nonstatutory. 618 F.2d at 768, 205 USPQ at 407.

In *Abele*, *supra*, the Court acknowledged that *Walter* only sets forth two ends of the spectrum—what is and is not statutory—and sought to better define the gray area, stating:

...the *Walter* analysis quoted above does not limit patentable subject matter only to claims in which structural relationships or process steps are defined, limited or refined by the application of the algorithm.



Rather, *Walter* should be read as requiring no more than that the algorithm be "applied in any manner to physical elements or process steps," provided that its application is circumscribed by more than a field of use limitation or non-essential post-solution activity. Thus, if the claim would be "otherwise statutory," *id.*, albeit inoperative or less useful without the algorithm, the claim likewise presents statutory subject matter when the algorithm is included.

684 F.2d at 907, 214 USPQ at 686.

The *Abele* Court stated that "the purpose of the two-part analysis supports the view taken here. The goal is to answer the question 'What did applicants invent?' If the claimed invention is a mathematical algorithm, it is improper subject matter for patent protection."

In answering that question, [e]ach invention must be evaluated as claimed; yet semantogenic considerations preclude a determination based solely on words appearing in the claims. In the final analysis under § 101, the claimed invention as a whole, must be evaluated for what it is. (cite omitted)

Hence the analysis "requires careful interpretation of each claim in light of its supporting disclosure ." *In re Johnson*, 589 F.2d at 1079, 200 USPQ at 208.

684 F.2d at 907, 214 USPQ at 687.

The *Meyer* case makes clear that *Walter* must be interpreted in light of the *Abele* opinion. 688 F.2d at 796, 215 USPQ at 198.

## VI. Application of Two-Step Analysis to Claim 15

### A. Step 1 - Claim 15 Does Not Recite a Mathematical Algorithm

Applying the principles of *Freeman* to this case shows that claim 15 does not recite an algorithm. Clearly, an algorithm is not directly recited. Nor does claim 15 indirectly recite an algorithm, as the Board asserts (A-19). None of the claim

elements recite, in prose form, an equation, formula or other mathematical algorithm as in *Benson*. *In re Grams*, 888 F.2d 835, 837 n.1, 12 USPQ 2d 1824, 1826 n.1 (Fed. Cir. 1989), cited by the Board, merely refers to the *Freeman* case and does not change or expand the definition of mathematical algorithm.

Elements (a) and (b) of claim 15 operate to determine a vertical distance and an elevation on the display. These are physical dimensions. That they are preferably implemented by means detailed in the specification that perform an arithmetic operation or could be implemented in a computer program is irrelevant because, as in *Freeman*, the alleged algorithms appear in the specification, not in the claims. The claimed invention only needs the dimensions; it does not matter how they are ascertained. They can be measured spatially or by timing, as easily as by the subtraction steps disclosed in the specification.

The Board proclaims that it will not impute limitations to the claims (A-13), but has done just that by reading difference equations from the specification into claim elements (a) and (b). (A-20) Moreover, the Board has done so selectively, imputing the arithmetic operations but omitting the electrical structure that implements it. Either the implementing structure must be considered together with the unrecited operation in interpreting the "means plus function" claim elements under § 101 (according to 35 USC § 112 ¶ 6), or neither of them should be imputed to the claim. Regardless, the rule of *Freeman* precludes imputing a mathematical algorithm not recited in the claim from the specification.

As for element (c) of claim 15, the normalizing means, the Board could not even ascertain a corresponding mathematical equation. Instead, the Board found this

element to be implemented by a barrel shifter and, like the Examiner in rejecting claims 15 and 18 (A-229) by calling it a mere "number crunching" element, the Board passed element (c) off as performing a mathematical operation like the recirculating shift register in *Benson*. (A-20) This superficial treatment fails to find a mathematical algorithm for element (c) anywhere in the claim or the specification, but in effect concludes there must be one somewhere.

Element (d), "outputting illumination intensity data as a predetermined function of the normalized vertical distance and elevation" is dismissed, again by referring to the specification, as a mathematical operation performed on the data of step (c). (A-20) The Board does not identify the mathematical operation. Is it in the operation of the read only memory (ROM) used to implement the preferred embodiment of this element? Or is it in the "predetermined function." The ROM implements a look-up table, as in *Iwahashi*, not usually considered a "mathematical operation." The claim does not identify any particular equation or formula. In fact, Applicants expressly seek to avoid limiting the invention to a particular function. Applicants merely cite an example in the specification. (A-56) A pseudogaussian function could be used as in U.S. Pat. No. 4,715,414 (A-69), but so could another. The particular function is not the claimed invention. So where does element (d) recite a mathematical algorithm?

If the Board's analysis of step 1 in this case is the law, then *Freeman* must be overruled in order to find that claim 15 recites an algorithm. The Board in this case reached into the specification to find equations to plug into the claims (without success for element (c)). This is contrary to *Freeman*, wherein the Court noted, "In

the present case, it is not the claims but the *specification* that discloses implementation of the claimed invention with computer programs." 573 F.2d at 1245, 197 USPQ at 470.

Also in this case, the Board held that claim 15 would cover a programmed computer and so should be treated as a method claim. The *Freeman* Court observed that [the Board's] approach would appear to be that every implementation using a programmed computer is an "algorithm" in the *Benson* sense. If that rubric is the law, every claimed method that can be so implemented could be nonstatutory subject matter under 35 USC § 101. That reasoning sweeps too wide and is without basis in law. *Id.*

So too in this case. Therefore, Applicants contend that claim 15 does not recite a mathematical algorithm under the *Freeman* test.

**B. Step 2 - Claim 15 Claims a Statutory Machine**

In the present case, the crucial question is what did the Appellants invent? The expanded Board did not really answer this question. Reading the specification, it should be clear that what the Appellants invented is a new and improved "rasterizer" 40 (Fig. 3) which is part of a display processor circuit 18 (Fig. 2) used to reproduce a digitally sampled input waveform on a display screen 20 of a test instrument (Fig. 1). The display is a raster-type display in which images are formed by rows of pixels, as in a television. The pixels represent picture elements in the form of an  $M \times N$  array. The instrument described in the particular embodiment described is a digital storage oscilloscope (DSO). Such an oscilloscope digitizes a waveform by sampling the amplitude of the waveform periodically. Each



waveform data sample represents one pixel having a maximum intensity value.

The purpose, or function, of a rasterizer is to change data samples representing the input waveform, which are in amplitude and time coordinates, into pixel intensity values, such as grey scale or color, to provide a smooth (anti-aliased) reproduction of the input waveform on the display screen. If only the waveform data samples are directly displayed, a discontinuous dotted line representation of the input waveform is shown rather than a smooth line representation of the waveform. A rasterizer converts the dotted line into a continuous series of connected lines or vectors and removes jagged corners to smooth the displayed waveform. This is done by selectively illuminating pixels associated with the vectors.

The claimed invention, a rasterizer, has no use in an analog oscilloscope or other analog system that has a continuous or analog display. Its only use is in a digital system having a raster display composed of discrete picture elements (rows of pixels). Rasterizers are well known in the prior art, as exemplified by the patents cited by the Examiner in this application. Those specifically directed to rasterizers include U.S. Pat. Nos. 4,215,414; 4,540,938, 4,586,037 and 4,672,369. (A-69, A-82, A-143) These patents describe the problems of smooth display of waveforms on a raster display and different ways to solve the problems.

The rasterizer claimed in the present application has a different structure and operates differently from the prior art rasterizers. Applicant's original claims were rejected under 35 USC § 103. After amendment of the claims, the Examiner expressly withdrew the § 103 rejection. The sole ground for rejection remaining in this case is § 101 statutory subject matter.

The rasterizer invented by Appellants determines pixel intensity values by using consecutive samples as endpoints that define a vector. The vertical, or amplitude, difference between the two data samples is determined. Also, the elevation of the current row of pixels being scanned for display is determined. These values are normalized and used to address look-up tables to access appropriate intensity values for the pixels between the two samples as the pixels are being scanned. The intensity values are output to be displayed along the current row of pixels. Cost and speed advantages result from applicant's approach.

Unlike *Benson*, which merely claimed converting a BCD number into a binary number, the present invention converts discrete waveform data samples into pixel intensity values which are displayed to reproduce a continuous waveform. This is not an "abstract concept" as in the *Benson* situation, but is a specific implementation of a machine to produce a useful result. Even though some, or even all, of the elements of claim 15 are implemented by circuitry that may perform mathematical manipulations (which is true for ALL digital electrical circuits), the "algorithm" that is recited is not a *Benson* algorithm. The claimed invention transforms an electrical signal in the form of digitized data samples into a visual view on a display in terms of pixel intensity values. Therefore, when the claim is considered as a whole, no *Benson* algorithm is claimed.

When the *Abele* Court viewed claim 6 without the algorithm but including the steps inferred from the recital of "X-ray attenuation data," it found that the production, detection and display steps would be present. Accordingly, the Court held the claim statutory. 684 F.2d at 907, 214 USPQ at 687-688.

*In re Johnson*, 589 F.2d 1070, 200 USPQ 199 (CCPA 1978) held patentable under § 101 claim(s) to a machine process for comparing digitized seismic traces to define multiple reflections, a form of noise, to be removed by a subtraction process. The Court followed the two-step mathematical algorithms analysis of *Freeman*, concluding:

Even assuming arguendo that the "computing" step recited in the claim entails performing mathematical calculations, the process is explicitly claimed within the framework of a method for producing an output seismic trace which is different from, and an enhancement of, an input seismic trace. Thus, any calculations which may be performed in practicing the process of claim 1 are but a part of that process which includes the other recited steps.

589 F.2d at 1079-1080, 200 USPQ at 209.

*In re Taner*, 681 F.2d 787, 214 USPQ 678 (CCPA 1982) is another § 101 case involving seismography. In this case, claims to a seismographic method involved conversion signals from conventional seismic reflections to a planar or cylindrical form by summing the reflection signals. Holding these claims patentable under *Diehr*, the Court distinguished *Walter*:

... the claims [in *Walter*] were drawn to "an improved method of correlating" and to "an improved method of cross-correlating." i.e., not to "methods of or apparatus for seismic prospecting \*\*\* [but rather] to improved mathematical methods of interpreting the results of seismic prospecting. (cite omitted)

681 F.2d at 790, 214 USPQ at 681.

*In re Noll* 545 F.2d 141, 191 USPQ 721 (CCPA 1976), *cert. den.* 434 U.S. 875, 195 USPQ 465 (1977) is another post-*Benson* § 101 case. This case is particularly pertinent in that it pertains to subject matter related to the Appellant's

invention — a scan converter for a raster-type display system. The rejected claims, e.g., claim 9, were apparatus claims written in "means plus function" format. The claim was readable on a programmed computer; indeed the novelty was in the programming used in hardware that was otherwise considered old. 545 F.2d at 144, 191 USPQ at 723. Except for the recital of "N-bit storage devices" the remainder of claim 9 is virtually identical in form to Appellants' claim 15, including a preamble that identifies the apparatus and its input and output signal, and several recited means that operate on the input signals to generate the output signals and store them in the N-bit storage location. The Court recognized the form vs. substance issue but rejected its applicability in this case, holding:

The instant claims, however, are drawn to physical structure and not to an abstract "law of nature, a mathematical formula or an algorithm." [cites omitted] There is nothing abstract about the claimed invention. It comprises physical structure, including storage devices and electrical components uniquely configured to perform specified functions through the physical properties of electrical circuits to achieve controlled results. Appellant's machine is structurally different from a machine without that program. It thus broadly corresponds to the combination held to be statutory subject matter in claim 18 of *In re Bernhart*, supra. (footnote omitted)

545 F.2d at 148, 191 USPQ at 726.

Neither of the Board decisions in this case discuss *Diamond v. Diehr*, 450 U.S. 175, 209 USPQ 1 (1981) which is controlling authority, or how the § 101 issue was decided in that case. The case is discussed, however, in the PTO Notice, *Patentable Subject Matter, Mathematical Algorithms and Computer Programs*, 1106 OG 5, (cited by the Board at A-5) and Diehr claim 1 is cited as an example of a claim that recites statutory subject matter. Following is a pertinent portion of the



PTO Notice:

As stated in *Abele*, 684 F.2d at 907, 214 USPQ at 686:

In *Diehr*, were the claim to be read without the algorithm, the process would still be a process for curing rubber, although it might not work as well since the in-mold time would not be as accurately controlled.

The steps in the process, 450 U.S. at 187, 209 USPQ at 8:

include installing rubber in the press, closing the mold, constantly determining the temperature of the mold, constantly recalculating the appropriate cure time through the use of the formula and a digital computer, and automatically opening the press at the proper time.

The statutory nature of the claim is not based on the post-solution activity of opening the press, but on the application of the mathematical algorithm to the whole process.

1106 OG at 10.

The steps of "installing rubber in the press, closing the mold," were not positively recited in *Diehr* claim 1 but were inferred from the specification or claim 11. The Board majority fails to explain or distinguish its different approach in this case.

Claim 15, as a whole, as in *Diehr*, *Abele*, *Johnson* and *Taner*, recites a statutory process or apparatus. Even if viewed as reciting a mathematical algorithm, the claim as a whole claims the conversion of a waveform from one form to another. This conversion has technological utility in a defined application - raster scan display of waveforms.

The Board rejected the Appellant's argument that the claims "do not preempt every possible means of converting a vector list to anti-aliased intensity data"

(A-18). The Board's position, however, is inconsistent with the allowance of the claims under §§ 102/103 over the cited prior art, which covers other rasterizers. The prior art rasterizers all convert sampled digitized waveforms (i.e. a vector list) into anti-aliased intensity data, but do so in a different way from that recited in claim 15. Since the Patent Office has already acknowledged that the appealed claims patentably distinguish over prior art apparatus that performs the same function, it follows that "the claims are truly drawn to specific apparatus distinct from other apparatus capable of performing the identical functions." *Walter*, 618 F.2d at 768, 205 USPQ at 408.

C. That Claim 15 Could Cover a Computer Programmed to Perform Rasterization Does Not Make It Nonstatutory

Finally, Appellants would like to comment briefly on the Board's apparent position that a method (software program) performed, or capable of being performed, by a general purpose digital computer is *per se* a *Benson* algorithm. The Board determined that claim 15 is broad enough to cover a programmed computer. Appellants do not disagree, although such an implementation would be noncompetitively slow and expensive. The important point, however, is that this is not a legal basis for holding the claimed subject matter unpatentable. The *Benson* Court specifically did not preclude "a patent for any program servicing a computer. 409 U.S. at 71, 175 USPQ at 676. Nor should it be precluded.

In today's technological environment virtually every machine, from cars to washing machines to instruments, uses digital processing, either with specific digital circuitry and/or a microprocessor executing a program. Before the advent of

powerful, inexpensive microprocessors, signal processing was performed using discrete digital components, such as AND, OR, NOR, NAND, etc. gates, registers, latches and the like. Prior to that, the same signal processing was performed in an analog environment, using analog components, such as transistors, operational amplifiers, and resistors. However, even in the analog environment, the circuit or function was first defined mathematically. Since no hardware, or software for that matter, can both efficiently and precisely solve complex mathematical formulae, compromises are made to produce a result commensurate with desired performance characteristics and cost considerations. An input to such a circuit or processing function is converted into a different thing at the output (otherwise why have the circuit or function in the first place?). If the process is new, useful and nonobvious, does it really matter whether the implementation is in the form of analog components, digital components, programs for a computer, or a combination thereof? Isn't such a differentiation actually exalting form over substance? A programmed digital computer becomes a special purpose digital computer to perform the function specified by the software. The special purpose computer can be implemented likewise by digital components, or even by analog components.

Appellants submit that, so long as the process uses some defined machine, rather than just being an "abstract concept," patentable subject matter is defined. The real issues are whether there is enablement in the specification for the claims and whether the claims are definite under 35 USC § 112, first and second paragraphs. From this perspective, Federico's comment that 35 USC § 112, last paragraph, is useful in determining infringement in courts and not as useful to the PTO during

prosecution is consistent. Federico, P.J., *Commentary on The New Patent Law*, 35 USCA §§ 1-110, pp. 24-26. Appellants submit that Mr. Federico, in saying this, was not even thinking about the use of 35 USC § 112, last paragraph, in determining whether a claim recited patentable subject matter.

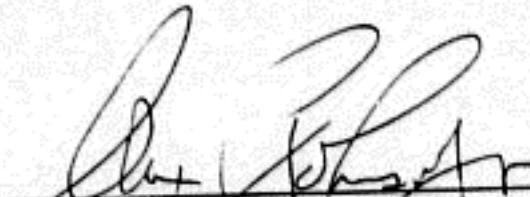
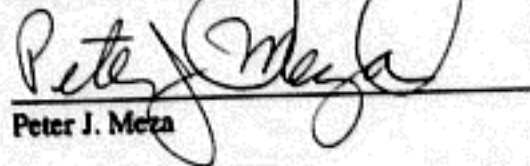
Thus Appellants urge that, even if the apparatus claim is treated as a method claim, and whether or not the claim recites a *Benson* algorithm, i.e., abstract concept, claim 15 interpreted as a whole recites a useful process performed by a machine.

### CONCLUSION

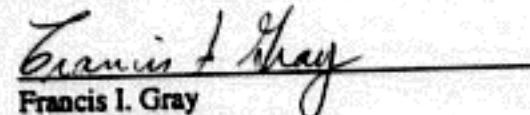
The Court should hold that claims 15-19 recite statutory subject matter under 35 USC § 101. Case law holds and the plain meaning of the statute provides that 35 USC § 112 ¶ 6 applies to the determination of statutory subject matter during prosecution in the Patent Office. A claim that recites structure in "means plus function" format based on a hardware disclosure should be accepted as claiming a statutory "machine" under § 101, whether or not an algorithm is recited and whether or not the claim is broad enough to encompass a programmed digital computer. Finally, to be consistent with the holding in *Freeman*, the Court should hold that a claim directed to a machine or process that employs the outcome of mathematical computations or the use of "number crunching" circuitry in its operation shall not be deemed thereby to recite an algorithm. Claim 15, interpreted as a whole, as it is



written, defines statutory subject matter. Appellants request that the Board's decision in this case be reversed.

  
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**CERTIFICATE OF SERVICE**

I hereby certify that on September 1, 1992, twelve copies of the Corrected Brief for Appellant were hand delivered to the Clerk, U.S. Court of Appeals for the Federal Circuit, 717 Madison Avenue, Washington, D.C. 20439, and two copies were served by hand delivery upon Mr. Lee E. Barrett, Office of the Solicitor, U.S. Patent and Trademark Office, at Crystal Park Building 2, Room 918, 2121 Crystal Drive, Arlington, Virginia 22202.

  
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