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EX PARTE NORIO AKAMATSU
Appeal No. 91-3230
March 20, 1992

***1** Application for Patent filed June 23, 1989, Serial No. 07/371,673, which is a Continuation of Serial No. 07/102,637, filed September 30, 1987, now abandoned. Method And Apparatus for Generating Non-Linearly Interpolated Data in a Data Stream.

Adam C. Volentine for appellant

Supervisory Patent Examiner--Gary V. Harkcom

Examiner--Mark Zimmerman

Before Manbeck

Commissioner

Comer

Deputy Commissioner

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ON BRIEF

This is an appeal from the Examiner's decision finally rejecting

claims 5 through 8, which are the only claims remaining in this application.

The invention is directed to a method and an apparatus for generating interpolated data for use in a graphics display. More particularly, four given graphic data points are arithmetically processed to calculate the value of a new interstitial graphic data point located between the inner two graphic data points. Differences and sums of the graphic data points are multiplied by weighted coefficients which are selected in such a manner that the weighted coefficient is a power of two. The choice of coefficients permits the multiplication operations to be replaced with bit shift operations which increase the processing speed of the interpolation.

The claims on appeal read as follows:

5. A method for graphics interpolation, wherein four given graphic point data representing four graphic point locations on a display device are stored in a memory, said four given graphic point data being a first point data, a second point data, a third point data, and a fourth point data, and wherein said four given graphic point data are arithmetically processed to generate an interstitial point data representing an interstitial graphic point location on the display device in an interval between said second point data and said third point data, said method comprising the steps of:

calculating a first 4-bit-shifted difference of said first point data from said second point data;

calculating a second 4-bit-shifted difference of said fourth point data from said third point data;

calculating a one-bit-shifted summation of said second point data and said third point data;

generating said interstitial point data in an interval between said second point data and said third point data by adding said first 4-bit-shifted difference and said second 4-bit-shifted difference and said one-bit-shifted summation;

displaying the interstitial graphic point on the display device according to the interstitial point data generated during said generating step.

6. An apparatus for graphics interpolation, wherein four given graphic point data from an ordered set of four graphic point data are stored in a memory, said four given graphic point data being a first point data, a second point data, a third point data, and a fourth point data and wherein said four given graphic point data are arithmetically processed to generate an interstitial point data in an interval between said second point data and said third point data, said apparatus comprising:

***2** a means for calculating a first 4-bit-shifted difference of said first point data from said second point data;

a means for calculating a second 4-bit-shifted difference of said fourth point data from said third point data;

a means for calculating a one-bit-shifted summation of said second point data and said third point data;

a means for generating said interstitial point data in an interval between said second point data and said third point data by adding said first 4-bit- shifted difference and said second 4-bit-shifted difference and said one-bit- shifted summation.

7. A method for graphics interpolation, wherein four given graphic point data representing four graphic point locations on a display device are stored in a memory, said four given graphic point data being a first point data, a second point data, a third point data, and a fourth point data, and wherein said four given graphic point data are arithmetically processed to generate an interstitial point data representing an interstitial graphic point location on the display device in an interval between said second point data and said third point data, said method comprising the steps of:

calculating a first 4-bit-shifted difference of said first point data from said second point data using a first 4-bit-shifted wired-logic;

calculating a second 4-bit-shifted difference of said fourth point data from said third point data using a second 4-bit-shifted wired-logic;

calculating a one-bit-shifted summation of said second point data and said third point data using a one-bit-shifted wired-logic.

generating said interstitial point data in an interval between said second point data and said third point data by adding said first 4-bit-shifted difference and said second 4-bit-shifted difference and said one-bit-shifted summation;

displaying the interstitial graphic point on the display device according to the interstitial point data generated during said operating step.

8. An apparatus for graphics interpolation, wherein four given graphic point data from an ordered set of four graphic point data are stored in a memory, said four given graphic point data being a first point data, a second point data, a third point data, and a fourth point data, and wherein said four given graphic point data are arithmetically processed to generate an interstitial point data in an interval between said second point data and said third point data, said apparatus comprising:

a first means for calculating a first 4-bit-shifted difference of said first point data from said second point data, said first means including a first 4-bit-shifted wired-logic;

a second means for calculating a second 4-bit-shifted difference of said fourth point data from said third point data, said second means including a second 4-bit-shifted wired logic;

a third means for calculating a one-bit-shifted summation of said second point data and said third point data, said third means including a one-bit- shifted wired-logic;

***3** a means for generating said interstitial point data in an interval between said second point data and said third point data by adding said first 4-bit-shifted difference and said second 4-bit-shifted difference and said one-bit-shifted summation.

The following references have been relied on by the examiner or the appellant.

Irie 3,943,343 Mar. 9, 1976
Edwards 4,528,639 Jul. 9, 1976

A. Savitzky and M.J.E. Golay, "Smoothing and Differentiation of Data by Simplified Least Squares Procedures," Anal. Chem., Vol. 36, No. 8, pp.

1627- 1639 (July 1964) (Savitzky) J. Steiner, Y. Termonia and J. Deltour, "Comments on Smoothing and Differentiation of Data by Simplified Least Square Procedure," Anal. Chem., Vol. 44, No. 11, pp. 1906-1909 (Sept. 1972) (Steiner)

Claims 5 through 8 stand rejected under 35 U.S.C. § 101 as being directed to nonstatutory subject matter under the mathematical algorithm exception. In addition, claims 5 through 8 stand rejected under 35 U.S.C. § 103 as unpatentable over Edwards and Irie.

Rather than reiterate the arguments of the appellant and the examiner, reference is made to the briefs and the answer for the respective details thereof.

OPINION

We have reviewed the evidence before us and conclude therefrom that claims 5- 7 are unpatentable under 35 U.S.C. § 101 as directed to nonstatutory subject matter under the mathematical algorithm exception for the reasons stated by the examiner, as further developed below. However, we conclude that claim 8 is directed to statutory subject matter. Assuming, arguendo, that the claims are directed to statutory subject matter under § 101, we hold that the claims would not have been obvious within the meaning of 35 U.S.C. § 103.

A mathematical algorithm is defined as a procedure for solving a given type of mathematical problem. Gottschalk v. Benson, 409 U.S. 63, 65, 175 USPQ 673, 674 (1972). The proper analysis of mathematical algorithm-statutory subject matter cases is the two-part test of In re Freeman, 573 F.2d 1237, 197 USPQ 464 (CCPA 1978), as modified by 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). First, it must be determined whether the claim directly or indirectly recites a mathematical algorithm in the Benson sense. Second, it must be determined whether the mathematical algorithm is applied in any manner to physical elements or process steps.

Under the first part of the two-part test, we agree with the examiner's finding that claims 5-8 directly recite a mathematical algorithm for interpolation. The algorithm comprises the steps of calculating first and second 4-bit-shifted differences (i.e., the operations of subtraction followed by division by 16), calculating a one-bit-shifted difference (i.e., the operations of subtraction followed by division by 2) and taking the sum of the shifted differences (i.e., the operation of addition). Compare Benson, 409 U.S. at 73-74, 175 USPQ at 677 (claim 8). "[T]he presence of a mathematical algorithm or formula is only a signpost for further analysis." In re Meyer, 688 F.2d 789, 795, 215 USPQ 193, 197 (CCPA 1982).

***4** The second part of the two-part test is applied straightforwardly to process claims 5 and 7. We defer until later the treatment of claims 6 and 8, which are in means-plus-function format. Under the second part of the two-part test, we follow the CCPA's suggestion in Abele of viewing the claims without the mathematical algorithm to identify the underlying process to which the mathematical algorithm is applied. If

the remaining process steps (without the algorithm) define "otherwise statutory" subject matter, then the inclusion of the mathematical algorithm does not make the claims nonstatutory. Abele, 684 F.2d at 907, 214 USPQ at 686. As stated in Abele, id. at 907, 214 USPQ at 687:

The goal [of the two-part test] 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, whereas if the claimed invention is an application of the algorithm, § 101 will not bar the grant of a patent.

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. [In re Sarkar, 588 F.2d 1330, 1333, 200 USPQ 132, 137 (CCPA 1978) (footnote 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.

The claims define "the subject matter which the applicant regards as his invention." 35 U.S.C. § 112 ¶ 2. The claims must define statutory subject matter; it is not sufficient that the specification discloses subject matter which, if properly claimed, would be statutory. During examination before the Patent and Trademark Office (PTO), claims must be given their broadest reasonable interpretation and limitations from the specification may not be imputed to the claims. In re Zletz, 892 F.2d 319, 13 USPQ2d 1320 (Fed.Cir.1989); In re Priest, 582 F.2d 33, 37, 199 USPQ 11, 15 (CCPA 1978).

Claim 5 is directed to a method of interpolation wherein "four graphic point data are arithmetically processed to generate an interstitial point data." When claim 5 is viewed without the steps of the mathematical algorithm, the only step left is the final step of "displaying the interstitial graphic point on the display," that is, displaying the result of the calculation in a broadly stated way. The inclusion of a physical step of displaying in claim 5 does not automatically mean the claim itself is to a statutory process. See In re Grams, 888 F.2d 835, 839 n. 4, 12 USPQ2d 1824, 1827 n. 4 (Fed.Cir.1989) (sole physical step of performing clinical tests on individuals not statutory process). We agree with the examiner (Exmr's Ans. at 4-5) that the display step represents insignificant or nonessential post-solution activity which does not convert the claimed subject matter into a statutory process. See Parker v. Flook, 437 U.S. 584, 590, 198 USPQ 193, 197 (1978) ("The notion that post-solution activity ... can transform an unpatentable principle into a patentable process exalts form over substance."); Walter, 618 F.2d at 770, 205 USPQ at 409 ("If § 101 could be satisfied by mere recordation of the results of a nonstatutory process on some record medium, even the most unskilled patent draftsman could provide such a step."); In re de Castelet, 562 F.2d 1236, 1244, 195 USPQ 439, 446 (CCPA 1977) ("That the computer is instructed to transmit electrical signals, representing the result of its calculations ... does not transform the claim into one for a process merely using an algorithm."). Here, the specification focuses on the mathematical algorithm (e.g., the Summary of the Invention, specification at 7- 8); the step of display receives only incidental mention. We agree with the examiner that the display step of claim 5 is analogous to the display step in claim 5 of Abele, 684 F.2d at 909, 214 USPQ at 688: "This claim [5] presents no more than the

calculation of a number and display of the result, albeit in a particular format."

***5** The preamble of claim 5 recites "graphic point data representing four graphic point locations on a display device." That the data represents "graphic point data" suggests that the data is visually displayed, but does not expressly or impliedly limit the claim to any certain process. The data could represent data from any process. The mathematical algorithm in claim 5 recites a single calculation on four data values and does not recite a continuous process of operating on a stream of data values. The fact that data to be operated on is stored in memory does not invoke any process. The data in claim 5 is contrasted with claim 6 in Abele in which the recitation of "X-ray attenuation data produced in a two dimensional field by a computed tomography scanner" considered with the display step of claim 5 in Abele were viewed together as a statutory conventional CAT-scan process. From the appellant's specification and from claim 5 we conclude that appellant is claiming the mathematical algorithm for calculating an interpolated value, rather than an application of the algorithm to an otherwise statutory process. Therefore, we affirm the examiner's conclusion that claim 5 is directed to nonstatutory subject matter under § 101.

Appellant tries to distinguish the display step in claim 5 of the instant application from the display step in claim 5 of Abele. Appellant argues that the display step displays the location of the calculated point, in addition to the value (Brief at 5). The same argument could have been made about the display in claim 5 of Abele where the calculated value was displayed "at a point in a picture which corresponds to said data point." Id. at 908, 214 USPQ at 687. We are not here holding that a display step per se is always an insignificant post-solution activity. However, under the facts of this case, the step of displaying the result of the calculation is properly characterized as insignificant post-solution activity and does not alone constitute a statutory process.

Appellant further argues, referring to the statement in Abele that the "claim does not even attempt to 'limit the use of the formula to a particular technological environment,' ... as was done in Flook," id. at 909, 214 USPQ at 688, that "Claim 5, viewed as a whole, is clearly adequately limited to use in a particular technological environment" (Brief at 6). In our view, appellant misapprehends the statement in Abele as suggesting that a claim which is limited to a particular technological environment is statutory subject matter. As stated in Diamond v. Diehr, 450 U.S. 175, 192 n. 14, 209 USPQ 1, 10 n. 14 (1981):

> A mathematical formula does not suddenly become patentable subject matter simply by having the applicant acquiesce to limiting the reach of the patent for the formula to a particular technological use. A mathematical formula in the abstract is non-statutory subject matter regardless of whether the patent is intended to cover all uses of the formula or only limited uses.

***6** Limiting the use to a particular technological environment does not convert the claim into statutory subject matter.

Appellant still further argues that "without the 'display step' of the present Claim 5, the claimed invention would not operate as intended" (Brief at 5). The suggestion that the display step is

essential is undercut by apparatus claims 6 and 8 which contain no display limitations. The argument is further weakened by the fact that the display steps were not added to claims 5 and 7 until the amendment of April 3, 1990, in an attempt to overcome the § 101 rejection. Mathematical algorithms would be worthless if their results were not displayed or used in some manner. The case law recognizes that a token use of the result does not convert the mathematical algorithm into statutory subject matter.

Claim 7 is similar to claim 5 except that claim 7 recites that the shifted difference steps are calculated using "bit-shifted wired-logic." We agree with the examiner's conclusion and cases cited in support thereof (Exmr's Answer at 5-6) that these apparatus limitations are not entitled to patentable weight in a method claim. See also Grams, 888 F.2d at 841, 12 USPQ2d at 1829 (not persuasive that method is recited as performed with a programmed computer); In re Gelnovatch, 595 F.2d 32, 37, 210 USPQ 136, 141 (CCPA 1979) ("The determination of whether a claimed method is a 'process' within the meaning of 35 U.S.C. § 101 is unaffected by the particular apparatus for carrying out the method."). For the same reason, the memory limitations of claims 5 and 7 do not convert these claims to claims for patentable subject matter. Accordingly, for the reasons given with respect to claim 5, we affirm the examiner's conclusion that claim 7 is directed to nonstatutory subject matter under § 101.

Claims 6 and 8 are in means-plus-function ("means for") format as permitted by 35 U.S.C. § 112 ¶ 6 and require special discussion. Claims truly directed to apparatus as a "machine" or "manufacture" under § 101 do not fall within the judicially determined mathematical algorithm exception since the calculation method remains free for use by anyone not employing the specific apparatus. However, it is recognized that the form of the claim is not dispositive, especially where the claims are drafted in "means for" terms under § 112 ¶ 6. The question is one of form versus substance. We review the § 101 mathematical algorithm cases involving "means for" claims.

The CCPA's treatment of "means for" claims in § 101 mathematical algorithm-statutory subject matter determinations is discussed in the PTO notice "Patentable Subject Matter, Mathematical Algorithms and Computer Programs," 1106 Off.Gaz.Pat.Office 5, 7 (Sept. 5, 1989). As stated in In re Maucorps, 609 F.2d 481, 485, 203 USPQ 812, 815-16 (CCPA 1979):

***7** Labels are not determinative in § 101 inquiries. "Benson applies equally whether an invention is claimed as an apparatus or process, because the form of the claim is often an exercise in drafting." In re Johnson, 589 F.2d 1070, 1077, 200 USPQ 199, 206 ([CCPA] 1978). "Though a claim expressed in 'means for' (functional) terms [under 35 U.S.C. § 112 ¶ 6] is said to be an apparatus claim, the subject matter as a whole of that claim may be indistinguishable from that of a method claim drawn to the steps performed by the 'means.' " In re Freeman, 573 F.2d at 1247, 197 USPQ at 472. Moreover, that the claimed computing system may be a "machine" within "the ordinary sense of the word," as appellant argues, is irrelevant. The holding in Benson "forecloses a purely literal reading of § 101." The above position was adopted first in Freeman based on dissents in In re Johnston, 502 F.2d 765, 183 USPQ 172 (CCPA 1974), rev'd on other grounds, Dann v. Johnston, 425 U.S. 219, 189 USPQ 257 (1976) (dissent

by RICH, J.); In re Noll, 545 F.2d 141, 191 USPQ 721 (CCPA 1976), cert. denied, 434 U.S. 875, 195 USPQ 465 (1977) (dissent by LANE, J., joined by RICH, J.); In re Chatfield, 545 F.2d 152, 160, 191 USPQ 730, 737 (CCPA 1976), cert. denied, 434 U.S. 875, 195 USPQ 465 (1977) (dissent by RICH, J., joined by LANE, J.) (decided the same day as Noll) ("[G]iven an invention which is in essence a new program for a general-purpose digital computer, a competent draftsman can readily define the invention as either a process or a machine, or both."). See Johnson, 589 F.2d at 1077, 200 USPQ at 206 ("[Judge Rich's dissenting] viewpoint [in Chatfield] was adopted by this entire Court in In re Freeman....").

With regard to "means" limitations under § 112 ¶ 6, Maucorps states, 609 F.2d at 486, 203 USPQ at 816:

> As admitted by appellant at oral argument, method claims drawn to the steps performed by appellant's "means" would be non-statutory and an attempt to claim appellant's algorithms in their application to a model of a sales organization.... That 35 U.S.C. § 112 authorizes the claiming of "means for" performing a function cannot rescue appellant's claims from the requirements of § 101, because § 112 does not authorize the claiming of apparatus entirely in terms of "means for" performing a non-statutory method.

When a "means for" claim differs from a method claim only in "means for" terms before the steps, we follow the Maucorps' approach of treating the claim as indistinguishable from a method claim and analyzing whether the method is statutory subject matter. We note that the appealed claims in Maucorps did not contain a method claim. The disclosed "means" for performing the functions of claim 1 in Maucorps was a program permanently built into a computer.

***8** The treatment of "means for" apparatus claims was further considered in Walter, 618 F.2d at 768, 205 USPQ at 408:

> Both the examiner and the board refused to separately consider appellant's apparatus claims because the method and apparatus claims were deemed indistinguishable. This problem arises in computer-arts inventions when the structure in apparatus claims is defined only as "means for" performing specified functions as sanctioned by 35 USC 112, sixth paragraph. If the functionally-defined disclosed means and their equivalents are so broad that they encompass any and every means for performing the recited functions, the apparatus claim is an attempt to exalt form over substance since the claim is really to the method or series of functions itself. In 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 this burden has not been discharged, the apparatus claim will be treated as if it were drawn to the method or process which encompasses all of the claimed "means." See In re Maucorps, 609 F.2d at 485, 203 USPQ at 815-16; In re Johnson, 589 F.2d at 1247, 197 USPQ at 472. The statutory nature of the claim under § 101 will then depend on whether the corresponding method is statutory.
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> We agree with the PTO that all of appellant's claims should be treated as method claims. The apparatus claims differ from the method claims only in that the term "means for" has been inserted before each process step to convert the step into the "means" for performing it, wherefore they do not have separate meaning as apparatus claims.

The phrase "disclosed means and their equivalents" in the first paragraph above suggests that a "means" term is limited in accordance with 35 U.S.C. § 112 ¶ 6 to "the corresponding structure, material, or acts described in the specification and equivalents thereof." However, it is noted that "the burden must be placed on the applicant to demonstrate that the claims are truly drawn to specific apparatus." Therefore, the applicant is required to demonstrate that the claims define the specific apparatus.

When claims are drafted in the form of "means for" performing method steps it is difficult to tell whether the invention is to a method which has been drafted entirely in "means for" apparatus form to evade the § 101 inquiry, or whether the invention is really to a new apparatus for performing a nonstatutory process, which apparatus would be statutory subject matter. Our treatment of claims entirely in "means for" terms as indistinguishable from the method in § 101 determinations shifts the burden onto the applicant to show how the claims truly define specific apparatus. Under cases such as Maucorps and Walter, we are not required to presume that a "means" limitation under § 112 ¶ 6 is directed to specific apparatus. Such a claim interpretation would be contrary to § 112 ¶ 2, which requires that the claims particularly point out and distinctly claim the invention; during prosecution before the PTO, it should be possible to determine from the claim what apparatus is and is not within the scope of the claim. Moreover, to presume a "means" term is limited would be contrary to the rules that, during examination before the PTO, claims are given their broadest reasonable interpretation and that limitations from the specification are not imputed to the claims. Applicant must show how the "means" limits the claim to specific apparatus. Applicants are often unwilling to admit how their claims are limited and would prefer to amend the claims to avoid the rejection; this is another reason why during ex parte prosecution before the PTO "means" terms continue to be literally construed.

***9** In addition to Maucorps and Walter, claims in "means for" terms have been treated as method claims in Meyer, 688 F.2d at 795 n. 3, 215 USPQ at 198 n. 3; In re Pardo, 684 F.2d 912, 916 n. 6, 214 USPQ 673, 677 n. 6 (CCPA 1982); and Abele, 684 F.2d at 909, 214 USPQ at 688. Meyer noted the applicability of § 112 ¶ 6 to § 101 determinations, 688 F.2d at 796, 215 USPQ at 198-99:

> This court is aware of its directive in In re Bernhart, 57 CCPA 737 at 742, 417 F.2d 1395 at 1399, 163 USPQ 611 at 615, that, in accordance with 35 U.S.C. § 112, paragraph 6, claims under 35 U.S.C. § 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." [FN6] We have done so here.

FN6. Before the PTO, in the examination of claims in view of prior art, the claims are not limited by reference to the specification. See In re Reuter, 651 F.2d 751, 210 USPQ 249 ([CCPA] 1981).

Nevertheless, Meyer, like Maucorps, Walter, Pardo, and Abele, did not find § 112 ¶ 6 to be an obstacle to PTO's treatment of "means for" claims as indistinguishable from method claims. It is noted that Bernhart, which is cited in Meyer, dealt with a "mental steps" rejection under § 101, holding that under § 112 ¶ 6 "means" cannot be interpreted to extend to human means where structure is disclosed in

the specification. It is also noted that Bernhart predates the development of the form versus substance issue in mathematical algorithm § 101 cases.

A common factor in Maucorps, Walter, Pardo, Abele, and Meyer, was that the disclosed apparatus in the specification was apparently a known type of stored program digital computer; this statement is qualified because very little can be determined about the disclosed structure from the discussion in the cases, except in Maucorps. The fact that the disclosed apparatus was a known computer was apparently evidence that the invention was really in the process embodied in a computer program rather than in the apparatus. Though a digital computer structure might be presumed to have a limited range of equivalents under § 112 ¶ 6, such possibility does not prevent "means for" claims from being treated as method claims. Judge Rich stated his opinion that though a new program makes an old general purpose digital computer into a new and different machine, the apparatus form of a claim is not controlling where the invention itself is the process. See Johnston, supra. Therefore, 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.

***10** A panel of the Federal Circuit questioned (in dicta) PTO's treatment of "means for" claims in § 101 mathematical algorithm cases in In re Iwahashi, 888 F.2d 1370, 1375, 12 USPQ2d 1908, 1911-12 (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 of 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 U.S.C. § 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."1 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.

FN1. ... Section 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. The discussion can be argued to preclude treating claims entirely in "means for" terms as method claims. PTO's response is published in the "Notice Interpreting In Re Iwahashi (Fed.Cir.)." 1112 Off.Gaz.Pat.Office 16 (March 13, 1990) ("1990 Notice"). The 1990 Notice points out that the claim in Iwahashi was not entirely in "means for" terms, but had specific structure in the ROM; thus, Iwahashi is limited by its facts. The 1990 Notice further points out that Iwahashi does not mention or distinguish the treatment of "means for" claims as method claims in CCPA precedent. Finally, the notice directs the Examining Corps to continue to follow the practice of requiring applicants to demonstrate how the claims define specific structure.

Claim 6 is ostensibly directed to an apparatus. Claim 6 differs from method claim 5 mainly in that the phrase "a means for" has been added

before each calculation step of claim 5. Claim 6 also omits the display limitations of claim 5. In our opinion, claim 6 must be treated as indistinguishable from a method claim. The interposition of the phrase "a means for" before each method step does not alter the character of claim 6 to limit the claim to specific structure for performing the functions and does not define any interconnection among the "means." Under the Walter test, claim 6 is not limited to specific apparatus distinct from other apparatus capable of performing the identical functions, but encompasses any and every means for performing the recited functions. The "means" terms in claim 6 read on the configuration of functional blocks illustrated in figure 1, but claim 6 also reads on any and every other means for performing the "calculating" and "generating" functions. It would be improper claim interpretation to read limitations from figure 1 into claim 6. The fact that claim 6 reads on a programmed general purpose digital computer as the "means," and that implementation by a computer program is described in the specification at page 22, convinces us that claim 6 should be treated like the "means for" claims in Maucorps, etc., as a claim to the method.

***11** Under the second part of the two-part test, claim 6, when viewed without the mathematical algorithm, contains no steps which could be considered to be a statutory process. Unlike claim 5, no step of display is recited. For this reason and for the reasons stated with respect to claim 5, we affirm the examiner's conclusion that claim 6, properly treated as a method, is directed to nonstatutory subject matter under § 101.

Appellant argues (Brief at 6) that Iwahashi mandates that "means" limitations are to be construed to cover the "structure ... described in the specification and equivalents thereof" under 35 U.S.C. § 12 ¶ 6. The claims define the invention. 35 U.S.C. § 112 ¶ 2. During prosecution before the PTO, "means" limitations are given their broadest reasonable interpretation and limitations from the specification cannot be read into the claims. Claims will not be presumed to be limited to less than any and every means just because they include the word "means." As stated in the 1990 Notice, it is appellant's responsibility to demonstrate that the claims are truly drawn to specific apparatus.

Appellant further argues that "In re Iwahashi explicitly states that a means- plus-function claim may not be treated as though it were a method claim" (Brief at 6). In effect, appellant argues that claims in "means for" terms are per se statutory under Iwahashi. As pointed out above, the discussion in Iwahashi on this matter is non-binding dicta. As stated in the 1990 Notice, the discussion in Iwahashi did not distinguish or overrule binding CCPA precedent in which "means for" apparatus claims were treated as method claims. Until the Federal Circuit further addresses the issue, our policy is to continue to follow the practice set forth in the CCPA cases.

Claim 8 is similar to claim 6, but recites "first means," "second means," and "third means" for calculating the shifted differences, instead of the anonymous "means" of claim 6, and also recites that the first, second and third means include "bit-shifted wired-logic." The recitation of three distinct "means" whose outputs are used by the "means for generating" provides some semblance of structure and

interconnection not found in claim 6. More importantly, and dispositive here, the "wired-logic" limitations are interpreted in accordance with appellant's arguments (Brief at 8 and Attachment C) to be specific hardware limitations not in means-plus-function format, which are analogous to the ROM limitation in Iwahashi. Furthermore, we interpret the "wired-logic" limitations, especially the "4-bit-shifted wired-logic," to preclude reading claim 8 on a general purpose digital computer, because computers implement shift operations one shift at a time in a register. That the apparatus distinguishes over a general purpose digital computer is considered to be a key factor in cases involving mathematical algorithms. The combination of these factors leads us to conclude that claim 8 is directed to statutory subject matter under 35 U.S.C. § 101 as either a "machine" or "manufacture." We, therefore, reverse the examiner's rejection of claim 8 under § 101. Our conclusion relies on the "wired-logic" limitations in the claims. [FN1]

***12** Turning now to the rejection of claims 5 through 8 under 35 U.S.C. § 103, the proper approach to the issue of obviousness is whether it would have been obvious to the hypothetical person of ordinary skill in the art, familiar with the references, to make a structure or practice the method corresponding to what is claimed. The test for combining references is not what individual references themselves suggest but rather what the combination of disclosures taken as a whole would have suggested to one of ordinary skill in the art. In re Keller, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); In re Sernaker, 702 F.2d 989, 217 USPQ 1 (Fed.Cir.1983). The examiner must provide reasons why one of ordinary skill in the art would have been led to modify the prior art or to combine prior art references to arrive at the claimed invention. Compare Ashland Oil, Inc. v. Delta Resins & Refractories, Inc., 776 F.2d 281, 227 USPQ 657 (Fed.Cir.1985).

Edwards teaches a direct interpolation method and apparatus which implements the convolution formula at column 6, lines 30-44. We find that appellant's method applies the same general formula. Edwards describes a six point data set (N = 6), three points on either side of the interstitial point to be calculated. Edwards states that "the scope of the present invention is not limited to a six point data set, but rather encompasses data sets having any even number of data points" (col. 8, lines 28-30). Thus, appellant's use of four data points (N = 4) is within the teachings of Edwards. With N = 4, the data on lines L2, L1, R1 and R2 in figure 2 of Edwards correspond exactly to appellant's point data A, B, C and D, respectively. Appellant's argument that "in contradistinction to the presently claimed invention, Edwards does not suggest calculations based only on points in the local region of the point to be calculated" (Brief at 12) is in error; the six (or other even number) data points in Edwards are always taken in the local region surrounding the point to be calculated.

Edwards does not disclose the convolute integer coefficients "IC(j)" or the convolute integer normalizer coefficient "Norm" to be used in the formula in column 6 when N = 4. Figure 5 of Edwards shows a typical set of convolute integer coefficients for a six point subset (col. 7, lines 40-41); however, the coefficients will vary depending on the number of data points and the convolution function chosen. To show the similarity to Edwards, appellant's claimed interpolation formula is expressed in standard form as follows:

$$\frac{B - A}{16} + \frac{B + C}{2} + \frac{C - D}{16} = -\frac{1}{16}A + \frac{9}{16}B + \frac{9}{16}C - \frac{1}{16}D$$

***13** Using weighted sums of first order differences is apparently admitted to be prior art (specification at 10, lines 8-13). Appellant's coefficients can be summarized in the format of figure 5 of Edwards as follows:

POSITION	COEFFICIENT
A, D	-1
B, C	9
NORMALIZER	16

The preliminary obviousness question is whether the selection of the particular coefficients would have been obvious, taking into account appellant's purpose of reducing the execution time of the algorithm.

The coefficients in the convolutional formula depend on the choice of the so- called "convoluting function," which is partly arbitrary and partly determined by the function that best fits the data. Savitzky, which was submitted by appellant with his reply brief and is referenced in Edwards (col. 8, lines 37 et seq.), illustrates a few of the different types of convoluting functions in figure 2. As described by Savitzky, Edwards and Steiner, the coefficients for the convoluting function are often determined by the "method of least squares." Based on the record before us, appellant's coefficients do not correspond to those for any known convoluting function. Appellant states that "optimum value of the reciprocal of the weighted coefficients L (1 = 1/L) is determined experimentally" (specification at 17). However, appellant then selects a coefficient value to allow implementation with shift operations rather for exact mathematical accuracy. For example, the coefficient value of 16 is an approximation for the calculated optimum value of 15 (specification at 18 and figure 3) or 14 (specification at 18 and figure 4).

If appellant's coefficients corresponded to any known convoluting function, we would agree with the examiner's conclusion that it would have been obvious to implement multiplication by powers of two using shift operations as evidenced by Irie. However, the record lacks any suggestion that the coefficients should be selected to be powers of two for appellant's reason of permitting multiplication operations to be implemented by shifting. For the reasons set forth by appellant in his reply brief, we agree that the coefficient values in Edwards cannot be arbitrarily chosen to be powers of two selected values without using hindsight gained from appellant's own disclosure. Thus, we reverse the examiner's rejection of claims 5-8 under 35 U.S.C. § 103.

In summary, the rejection under 35 U.S.C. § 101 is sustained as to claims 5, 6 and 7, but is reversed as to claim 8; the rejection of claims 5 to 8 under 35 U.S.C. § 103 is reversed.

The decision of the examiner is affirmed-in-part.

***14** No time period for taking any subsequent action in connection with this appeal may be extended under 37 CFR § 1.136(a). See the final rule notice, 54 F.R. 29548 (July 13, 1989), 1105 Off.Gaz.Pat.Office 5 (August 1, 1989).

AFFIRMED-IN-PART

Harry F. Manbeck, Jr

Commissioner

Douglas B. Comer

Deputy Commissioner

Jeffrey M. Samuels

Assistant Commissioner

Saul I. Serota

Chairman

Ian A. Calvert

Vice Chairman

FN1. We here note that in any future prosecution before the PTO of this or a continuing application, the Examiner should consider whether or not a rejection under 35 U.S.C. 112, first paragraph is appropriate with respect to claims 7 and 8. It does not appear to us that the written description requirement has been satisfied with regard to the bit-shifted "wired-logic" limitations. The bit-shifted "wired-logic" limitation should be interpreted in the light of Attachment C of the appellant's brief as referring to specific apparatus for shifting where the bits of a data word are shifted one or more positions in a single step as the data is transferred from a source register to a target register by the use of wired connections. "Wired-logic" is different from ordinary shift registers used by computers to perform shift operations. The term "wired-logic", in our opinion, is not broad enough to read on any and every apparatus. The specification discusses using "bit-shifting" to replace multiplication or division operations, but does not appear to describe using one-bit or four-bit "wired-logic". It would therefore appear that the description requirement of 35 U.S.C. § 112 paragraph 1 has not been satisfied.

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