Commissioner of Patents and Trademarks
Patent and Trademark Office (P.T.O.)

EX PARTE KURIAPPAN P. ALAPPAT, EDWARD E. AVERILL, AND JAMES G. LARSEN
Appeal No. 91-1277
April 22, 1992

***1** Application for Patent filed January 29, 1988, Serial No. 07/149,792, for Raster Scan Waveform Display Rasterizer With Pixel Intensity Gradation.

Peter J. Meza et al. for appellants

Supervisory Patent Examiner--Gary V. Harkcom

Examiner--Heather R. Herndon

Before Manbeck

Commissioner

Comer

Deputy Commissioner

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Examiners-in-Chief

Serota

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ON BRIEF

DECISION ON RECONSIDERATION

This is a decision on the examiner's request for reconsideration of the Board of Patent Appeals and Interferences's decision entered June 26, 1991, and request for expansion of the panel on reconsideration. [FN1] The request for reconsideration and for an expanded panel is granted.

Background

The examiner held claims 15-19 to be unpatentable under 35 U.S.C. § 101 as directed to non-statutory subject matter under the mathematical algorithm exception. Claims 15-19 were stated to stand or fall together.

The Board in its original opinion analyzed the claims under the two-part test for mathematical algorithm-statutory subject matter in 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). Under the first part of the two-part test, the Board panel found that the claims recited a mathematical algorithm, which indicated the need for further analysis. The panel did not reach the second part of the two-part test. Instead, the panel held that because the claims were drafted in terms of "means for" limitations as permitted by 35 U.S.C. § 112 ¶ 6, and that because conventional structure in the art correlated to each "means" in claim 15, the claims were directed to statutory subject matter under 35 U.S.C. § 101 as an apparatus. The panel further concluded that the disclosed means in the specification and their equivalents are not so broad as to encompass any and every means for performing the functions in claim 15 and, so, the claims may not be treated as method claims for the purposes of applying the two-part § 101 test.

Claims

Appellants have stated that claims 15-19 stand or fall together. Thus, claims 16-19 stand or fall together with independent claim 15 from which they all depend. See 37 CFR § 1.192(c)(5); In re Kaslow, 707 F.2d 1366, 1376, 217 USPQ 1089, 1096 (Fed.Cir.1983). [FN2]

Claim 15 is reproduced below:

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

***2** (a) means for determining a vertical distance between the endpoints of each of the vectors in the data list;

(b) means for determining an 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.

Issues on appeal

Whether claim 15, which is in "means for" format as permitted by 35 U.S.C. § 112 ¶ 6, can be treated as a method claim for the purpose of the statutory subject matter analysis under 35 U.S.C. § 101. And, if so, whether claim 15 defines statutory subject matter under 35 U.S.C. § 101.

Discussion

The two-part Freeman-Walter test for mathematical algorithm-statutory subject matter applies straightforwardly to "process" claims. 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-plus-function ("means for") terms as sanctioned by § 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):

> 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 position above 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.").

***3** 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 Maucorps' approach of treating the claim as indistinguishable from a method claim and analyzing whether the method is statutory subject matter. We note that none of the claims involved in the Maucorps appeal was directed to a method. The disclosed "means" for performing the functions of claim 1 in Maucorps was a program permanently built into a computer.

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.
>
> 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.

***4** The phrase "disclosed means and their equivalents" in the first paragraph quoted above from Walter could be urged to suggest 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 court stated that "the burden must be placed on the applicant to demonstrate that the claims are truly drawn to specific apparatus."

Therefore, it is our view that in these circumstances, the applicant is required to demonstrate that the claims define specific apparatus, as opposed to "other apparatus capable of performing identical functions."

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, without more, 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; what apparatus is and is not within the scope of the claim must be determinable from the claim. Moreover, to presume a "means" term is limited to what is disclosed in the specification 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. It is the applicant's responsibility to establish how the "means" limits the claim to specific apparatus. Applicants may be unwilling to admit how their claims are limited and may prefer to amend the claims to avoid the rejection; this is another reason why we continue to literally interpret "means" terms. We also here note that during ex parte prosecution before the PTO, the PTO literally interprets "means" limitations for purposes of examination over prior art. See "Applicability of the last paragraph of 35 U.S.C. § 112 to patentability determinations before the Patent and Trademark Office," 1134 Off.Gaz.Pat.Office 631 (Jan. 7, 1992). Nevertheless, this claim interpretation does not prevent applicants from defining over the prior art with "means" limitations; similarly, nothing stops applicants from defining statutory subject using only "means" limitations.

***5** In addition to Maucorps and Walter, claims in "means for" terms have been treated as method claims in In re Meyer, 688 F.2d 789, 795 n. 3, 215 USPQ 193, 198 n. 3 (CCPA 1982); In re Pardo, 684 F.2d 912, 916 n. 6, 214 USPQ 673, 677 n. 6 (CCPA 1982); and In re Abele, 684 F.2d 902, 909, 214 USPQ 682, 688 (CCPA 1982). 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." [FN4] We have done so here. 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, in our view, it is proper to treat the claim as indistinguishable from a method claim.

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):

***6** 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 limitations, 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." [FN3] 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 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 disclosed in the specification. However, we note that the claim in Iwahashi was not entirely in "means for" terms, but recited specific structure, a ROM; thus, Iwahashi is limited by its facts. Inasmuch as the statements regarding § 112 ¶ 6 were made following the court's holding that the claim was directed to statutory subject matter, and go beyond the facts before the court, which were limited to a claim including a specific piece of apparatus, the ROM, the court's statements are considered dicta. We also note that Iwahashi does not mention or distinguish the treatment of "means for" claims as method claims in the CCPA cases discussed above, whose decisions are binding precedent until overruled by the Federal Circuit in banc or by the Supreme Court. See Johnston v. IVAC Corp., 885 F.2d 1574, 1579, 12 USPQ2d 1382, 1386 (Fed.Cir.1989); UMC Electronics Co. v. U.S., 816 F.2d 647, 652 n. 6, 2 USPQ2d 1465, 1468 n. 6 (Fed.Cir.1987). We also again note that the above referred to CCPA cases, especially Walter, require the applicant to demonstrate how the claims define

specific structure.

Opinion

Treatment of claim 15 as a method claim

Claim 15 differs from a method claim only in its recitation of "means for" before each functional step. In accordance with Maucorps, etc., we interpret the "means" literally as encompassing any and every means for performing the function and treat claim 15 as indistinguishable from a method claim. Under Walter, the burden "is 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." Appellants may rely on § 112 ¶ 6 in making such a showing. However, the 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. Also see the notice entitled "Notice Interpreting In re Iwahashi (Fed.Cir.)", 1112 Off.Gaz.Pat.Office 16 (March 13, 1990), the contents of which notice we endorse.

***7** We conclude that appellants have not carried their burden of showing that claim 15 is directed to specific apparatus and, therefore, that it is proper to treat claim 15 as a method claim. The disclosed structure for claim 15, illustrated in figure 3, comprises arithmetic logic units (ALUs) 74 and 80, which perform the steps of "determining" in paragraphs (a) and (b), respectively, a pair of barrel shifters 84 and 88 for "normalizing" as stated in paragraph (c), and read only memories (ROMs) 92 and 100 which output data as stated in paragraph (d). However, while the disclosed apparatus can be correlated to the individual "means" of claim 15, the "means" of claim 15 do not read on only the disclosed apparatus; they read on any and every means capable of performing the recited function. Claim 15 does not claim the specific disclosed apparatus and does not claim the disclosed interrelationship among the means. Claim 15 does not recite that the means in paragraphs (a) and (b) are separate means, or that the means in paragraph (c) is a pair of means, or that the outputs of the separate means of paragraphs (a) and (b) are connected to the pair of means of paragraph (c) which is connected to the means of paragraph (d). Claim 15 does not recite that the means of paragraph (c) is limited to a barrel shifter means or that the means of paragraph (d) is limited to a table lookup means. In our view it would be improper claim interpretation to read the structures and connection interrelationships disclosed in the specification into claim 15. By contrast, the claim in Iwahashi expressly recited how each of the means was interconnected with the other means and with the ROM. We agree with the examiner that "the claim language ... does not positively recite structural limitations" (Examiner's Answer at 6) and, thus, we conclude that the examiner properly treated claim 15 as if it were a method claim.

The treatment of claim 15 as a method claim is also supportable based on other facts in the record. The specification discloses the invention as "a method and apparatus for displaying a continuous waveform"

(specification at 3, lines 6-7). In addition, originally filed claim 6 was directed to a method which incorporated some of the same computational steps as claim 15. This disclosure must be evaluated in determining what the invention is. The fact that appellants do not have both method claims and "means for" claims as in Walter, Pardo, Abele and Meyer does not mean that claim 15 must be considered an apparatus as argued by appellants (Reply to Exmr's Req. for Recon. at 2). Maucorps had only a "means for" claim. The claimed invention must be evaluated for what it is. Abele, 684 F.2d at 907, 214 USPQ at 687. The claimed invention is a mathematical algorithm for computing pixel information.

It is further significant that claim 15, as drafted, reads on a general purpose digital computer "means" to perform the various steps under program control. In such a case, it is proper to treat the claim as if drawn to a method. We will not presume that a stored program digital computer is not within the § 112 ¶ 6 range of equivalents of the structure disclosed in the specification. The disclosed ALU, ROM and shift registers are all common elements of stored program digital computers. Even if appellants were willing to admit that a stored program digital computer were not within the range of equivalents, § 112 ¶ 2 requires that this be clearly apparent from the claims based upon limitations recited in the claims.

***8** We cannot agree that claim 15 is directed to specific apparatus because the means to perform the function are disclosed to be "conventional structure in the art". To so hold would require us to improperly read limitations into claim 15. See In re Priest, 582 F.2d 33, 37, 199 USPQ 11, 15 (CCPA 1978) (inferential limitations are not to be read into the claims). As previously noted, while the disclosed apparatus can be correlated to the individual "means" of claim 15, the "means" of claim 15 do not read on only the disclosed apparatus. The "means" of claim 15 read on any and every means for performing the functions. The disclosure of apparatus for performing the means does not imply that the claim is directed only to that apparatus. It is improper to presume that "conventional structure in the art" and its equivalents limit the claimed means for performing the functions to less than any and every means. Even if the range of equivalents could be determined at the time of examination or applicant were willing to admit to a range of equivalents under § 112 ¶ 6, § 112 ¶ 2 requires that the claim particularly point out and define the apparatus, i.e., what is and is not within the scope of the claim.

In our view, it is also improper to read limitations of the dependent claims into claim 15. While dependent claims 16-19 recite specific structure corresponding to the structure disclosed in the specification, it is legal error to read such limitations into the "means" terms in claim 15. See Palumbo v. Don-Joy Co., 762 F.2d 969, 977, 226 USPQ 5, 10 (Fed.Cir.1985) (legal error to read into an independent claim a limitation set forth in another claim). See also In re Zletz, 892 F.2d 319, 13 USPQ2d 1320 (Fed.Cir.1989). The scope of the disclosed structure and its equivalents corresponds roughly to the scope of dependent claims 16-19. At best, appellants can only show that the limitations of claims 16-19 correspond to specific apparatus. The "means" in independent claim 15 are indeterminately broader than the disclosed structure and its equivalents.

It is inappropriate to here rely on Iwahashi for its statement that a combination of interrelated means may recite statutory subject matter. As pointed out above, the claim in Iwahashi contained more than just a combination of means; it contained a specific piece of apparatus, the read only memory (ROM). Nevertheless, we agree that a combination of interrelated means may, in appropriate circumstances, define statutory subject matter. New computer structures are statutory subject matter even though they may perform nonstatutory processes. However, in this case, as we have noted, there is no claimed interrelationship among the means in claim 15 or limitation of the means to that disclosed in the specification. If the "means for" words are removed from claim 15, the only thing remaining is a series of method steps.

***9** We find no legal basis for a test that the treatment of "means for" claims as a method is limited only to the case where the disclosure is in terms of rectangular block diagrams and where such rectangular block diagrams may not be ascertained to be disclosed as conventional structure in the art. Certainly, where the disclosure is only in terms of block diagrams or flow charts this may indicate that the invention is really the method, and claimed "means" might be treated as if to the method step. However, such a test would allow an applicant to evade the § 101 inquiry merely by providing the required § 112 ¶ 1 written description and a best mode hardware disclosure for the method, without limiting the claims to the disclosed apparatus.

Lastly, appellants argue that the claims "do not preempt every possible means of converting a vector list to anti-aliased intensity data" (Reply to Exmr's Req. for Recon. at 2). It seems that appellants are relying on a presumption that the "means" in the claims are limited by the apparatus shown in the specification and its equivalents. Appellants have not shown that the claims define specific apparatus.

Mathematical algorithm

Therefore, treating the claims as being drawn to a method, we hold that claims 15-19 fail to define statutory subject matter under § 101.

We agree with and adopt the Board's previous finding under the first part of the two-part test that the claims indirectly recite a mathematical algorithm. See In re Grams, 888 F.2d 835, 837 n. 1, 12 USPQ2d 1824, 1826 n. 1 (Fed.Cir.1989):

> It is of no moment that the algorithm is not expressed in terms of a mathematical formula. Words used in a claim operating on data to solve a problem can serve thesame purpose as a formula. See, e.g., In re Freeman, 573 F.2d 1237, 1246, 197 USPQ 464, 471 (CCPA 1978). See also Johnson, 589 F.2d at 1079, 200 USPQ at 208 ("[T]he flow diagrams which form part of the specification disclose explicit mathematical equations which are to be used in conjunction with each of these [claimed] steps [of 'determining' or 'correlating'].").

In claim 15, clause (a), the "determining a vertical distance between the endpoints of each of the vectors in the data list" is described as a mathematical operation at page 11, line 21, through page 12, line 4, which is represented symbolically by the equation at page 12, line 1:

TABULAR OR GRAPHIC MATERIAL SET FORTH AT THIS POINT IS NOT DISPLAYABLE
where y sub@i and y sub@i + 1 represent the values of the endpoints. This indirectly recites a mathematical step. In clause (b), the "determining an elevation of a row of pixels that is spanned by the vector" is described as a mathematical operation at page 12, line 23, through page 13, line 2, and is represented symbolically by the equation:

TABULAR OR GRAPHIC MATERIAL SET FORTH AT THIS POINT IS NOT DISPLAYABLE
In clause (c), the "normalizing the vertical distance and elevation" is described at page 13, lines 3-20, as shifting the distance and elevation information to the left in barrel shifters 84 and 88, which is recognized as a mathematical step. See Gottschalk v. Benson, 409 U.S. 63, 73-74, 175 USPQ 673, 677 (1972) (Claim 8, steps (2), (5) and (7) which shift data left or right in a "reentrant shift register"). In clause (d), the "outputting illumination intensity data as a predetermined function of the normalized vertical distance and elevation" is described at page 13, line 27, through page 14, line 21, as a mathematical operation performed on the data from step (c).

***10** Claim 15 also fails the second part of the two-part test. Each step in claim 15 defines a mathematical operation which converts numbers from one form, vectors in a data list, into another form, illumination intensity data. As stated in In re Gelnovatch, 595 F.2d 32, 42, 201 USPQ 136, 145 (CCPA 1979):

> [W]here, as here, the claims solely recite a method whereby a set of numbers is computed from a different set of numbers by merely performing a series of mathematical computations, the claims do not set forth a statutory process.

What the means do in this case is perform mathematical operations on data, how they do it is also mathematical; this is not a case where what is done is devoid of mathematical significance. See In re Bradley, 600 F.2d 807, 811- 12, 202 USPQ 480, 485 (CCPA 1979), aff'd by an equally divided court, sub nom, Diamond v. Bradley, 450 U.S. 381, 209 USPQ 97 (1981). The algorithm is not "applied in any manner to physical elements or process steps" under Walter because when the claim is viewed without the steps of the mathematical algorithm, no other elements or steps are found. See Walter, 618 F.2d at 769, 205 USPQ at 409 ("Examination of each claim demonstrates that each has no substance apart from the calculations involved. The calculations are the beginning and end of the claims."). The Board correctly held that "[t]he outputting function is not necessarily a display function". That the preamble recites that the vector data "represent[s] sample magnitudes of an input waveform" and that the illumination intensity data "is to be displayed on a display means" does not, in our opinion, incorporate the measurement and display process into the claims. Nor do statements of where data came from or where it will be used mean the data is a "signal" or "physical thing" as stated by the dissent; claim 15 does not require physical quantities. It must be concluded that claim 15 is directed to the mathematical algorithm itself, rather than an application of the mathematical algorithm to an otherwise statutory process or apparatus.

The dissent does not resolve the conflict between Iwahashi and CCPA precedent, or deal with the form versus substance issue. The dissent's citation of Arrhythmia Research Technology, Inc. v. Corazonix Corp, --- F.2d ---, 22 USPQ2d 1033 (Fed.Cir.1992), decided after the panel

majority decision was written, does not change our decision. Both the process and apparatus claims in Arrhythmia operated on claimed electrocardiograph signals. Therefore, an otherwise statutory process of analyzing a signal related to a patient's heart activity was evident apart from the mathematical algorithm. The present case differs from Arrhythmia in that no statutory process remains when claim 15 is viewed without the mathematical algorithm. The dissent's reliance on Arrhythmia overlooks very real differences in claim language. We note that one must be careful in applying the statements regarding claim construction in Arrhythmia; Arrhythmia was an appeal from an infringement action involving a patent, and the rules of claim construction of patent claims are different than the rules for claim interpretation during ex parte prosecution.

Conclusion

***11** We hold that claims 15-19 are not directed to statutory subject matter under 35 U.S.C. § 101. Accordingly, the decision of the examiner rejecting claims 15-19 is affirmed, and the Board panel decision mailed June 26, 1991 (Paper No. 18) is modified as indicated above.

This is a new decision. The times for requesting reconsideration or seeking court review of this decision run from the mailing date of this decision. See 37 CFR § 1.197(b).

The request for reconsideration is granted. The Board's original decision is modified to the extent indicated.

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).

GRANTED

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. The examiner's request has been approved by the Office of the Assistant Commissioner for Patents. Manual of Patent Examining Procedure § 1214.04.

FN2. Inasmuch as claims 16-19 stand or fall with claim 15, the only claim argued by appellants and addressed by the original panel, we have no occasion to address the "arithmetic logic circuit" limitation of claims 16 or 17, the "barrel shifters" limitation of claim 18, or the "read only memory containing the illumination intensity data" limitation of claim 19. These limitations have not been argued by appellants, therefore were not addressed by the Examiner or the original panel, and are not before us for consideration. As noted, claims 16-19 were not argued, and therefore cannot now be given consideration by this Board.

FN3. ... 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.

FN4. 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).

DISSENTING OPINION

W.F. Lindquist, J.D. Thomas and E.A. Krass

Examiners-in-Chief (disagreeing with the majority of the new decision)

We disagree with the majority of the new decision for basically the reasons set forth in our original decision, which has not been vacated, and our following amplifying comments. We begin by reproducing the opinion portion of our original decision.

OPINION

We will not sustain the rejection.

The U.S. Supreme Court has determined that where a claimed invention is merely directed to an algorithm, such as a method for the conversion or encoding of binary coded decimal numbers to binary numbers, such claims do not define patentable subject matter under 35 U.S.C. 101. Note Gottschalk v. Benson, 409 U.S. 63, 175 USPQ 673 (1972). The Court additionally determined that an algorithm was a "procedure for solving a given type of mathematical problem." Note the discussion thereof in re Abele, 684 F.2d 902, 214 USPQ 682 (CCPA 1982). The holding of the Supreme Court became the basis for the first part of the two-part test of In re Freeman, 573 F.2d 1237, 197 USPQ 464 (CCPA 1978) and In re

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

***12** Under the first part of the Freeman-Walter test, claims are analyzed to determine whether a mathematical algorithm is either directly or indirectly recited. Under the second step, if the claims directly or indirectly recite a mathematical algorithm, it must be determined whether the claims as a whole, including all of the elements, merely recite the mathematical algorithm.

With this in mind, we disagree with appellants' assertion that the claims on appeal do not recite, either directly or indirectly, a mathematical algorithm. The four elements recited in the body of independent claim 15 on appeal each set forth a mathematical operation. Clause (a) determines a vertical distance; clause (b) determines an elevation value; and clause (c) normalizes the previously determined vertical distance and elevation values. Each of these are numeric values. Clause (d) outputs illumination intensity data as a predetermined function of the normalized vertical distance and elevation values determined in clause (c). The outputting function is not necessarily a display function and clearly numeric values are outputted since the disclosed invention clearly indicates that the illumination intensity data is a four bit binary number representing a pixel intensity gradation value which itself is clearly determined to be a function of numeric values. The analysis of the broadly defined outputting function in clause (d) is explained in the specification at pages 13 to 16 as being mathematically related operations. Since a numeric value is the end-product of the claimed invention, a reasonable position may be taken that the claim is nonstatutory within 35 U.S.C. 101 in accordance with In re Walter, supra. Each clause of the body of claim 15 recites a mathematical operation and they are recited to operate together to reach a numeric value or pure number as the end product of the claim.

The distinguishing feature of the claims on appeal over this analysis is that they set forth structure utilizing a "means for" performing a specified function claim approach permitted by 35 U.S.C. 112, paragraph six. Appellants assert that the claims on appeal are apparatus claims and correlate each of the clauses of claim 15 on appeal at page 3 of their brief to conventional structure in the art, as disclosed, for performing the recited functions. The means for determining in clause (a) is to be construed as the arithmetic logic unit (ALU) 74 in Figure 3 while the similar means for determining in clause (b) is said to correspond to the ALU 80 in Figure 3. The claimed normalizing means in clause (c) of claim 15 corresponds to the barrel shifters 84 and 88 in Figure 3. Finally, the means for outputting in clause (d) of claim 15 is to be construed as read only memories (ROMs) 92 and 100 in Figure 3. Our independent analysis agrees with this correlation. The actual structure recited in dependent claims 16 to 19 also comports with these interpretations in that they recite the specific apparatus per se for performing the functions recited in the "means for" clauses in independent claim 15. Thus, appellants' claims on appeal, as a whole, do in fact recite plural means for performing various specified functions which are clearly disclosed to be conventional structure in the art.

***13** Evaluating claims within 35 U.S.C. 101 during their examination in the PTO in this manner, that is, in view of the supporting

disclosure, has been recognized in In re Abele, supra, and in In re Meyer, 688 F.2d 789, 796, 215 USPQ 193, 199 (CCPA 1982), in cases involving the issue of statutory subject matter within 35 U.S.C. 101, and generally in In re Moore, 439 F.2d 1232, 169 USPQ 236 (CCPA 1971) with respect to interpreting claims in light of the requirements of 35 U.S.C. 112, second paragraph. The court in Abele indicated at 214 USPQ 687:

> 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.

More specifically, the court in Meyer also explained at 215 USPQ 199:

> 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 equivalents thereof." 6 We have done so here.

Each of the clauses in the body of apparatus claim 15 on appeal is recited in a "means for" preforming [sic] a specified function type of claim format. Guidance in determining whether such a claim approach may recite nonstatutory subject matter is found in In re Iwahashi, 888 F.2d 1370, 12 USPQ2d 1908 (Fed.Cir.1989). There the court specifically stated at 12 USPQ2d 1911:

> The claim as a whole certainly defines apparatus in the form of a combination of interrelated means and we cannot discern any logical reason why it should not be deemed statutory subject matter as either a machine or a manufacture as specified in § 101. The fact that the apparatus operates according to an algorithm does not make it nonstatutory. See In re Abele, 684 F.2d at 906, 214 USPQ at 686.

***14** In addition to Abele, the court also made reference to a companion case, In re Grams, 888 F.2d 835, 12 USPQ2d 1824 (Fed.Cir.1989), as authority supporting the last sentence quoted above. Not only is structure set forth in the instant claims on appeal, the apparatus recited therein does operate according to an algorithm. As Iwahashi makes clear, the fact that an apparatus operates according to an algorithm does not make it nonstatutory. Furthermore, dependent claims 16 to 19, in reciting specific structure, are like the ROM recited in the claim on appeal in Iwahashi.

The result that we reach here is also in accordance with the guidance provided in re Walter at 205 USPQ 407-408 regarding the interpretation of apparatus claims in the "means for" format. Appellants have certainly met their burden set forth in Walter and demonstrated "that the claims are truly drawn to specific apparatus distinct from other apparatus capable of performing the identical functions." 205 USPQ at 408. Appellants' analysis in their brief as well as our own analysis

verifies that conventional structure in the art is the basis for the "means for" language recitation in the body of claim 15 on appeal.

This analysis is critical to a proper analysis of whether apparatus claims in a "means for" claim format may comprise nonstatutory subject matter. Walter also gives guidance at 205 USPQ 408 that "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" (emphasis added). The facts presented in this appeal before us clearly indicate that we do not have functionally-defined disclosed means and their equivalents which are so broad that they encompass any and every means for performing the recited functions in claim 15 on appeal. 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 in the body of claim 15 of appeal, where such rectangular block diagrams may not be ascertained to be disclosed as conventional structure in the art. Additionally, the means for determining, for example, is not disclosed in a very broad, generic sense only as a means for determining. If that were the case, the apparatus claims would have been an attempt to encompass any and every means for performing the recited functions and, therefore, it would not be demonstrable that specific apparatus distinct from other apparatus was capable of performing the identical functions.

As we said before and as effectively acknowledged by the new decision majority, at least Bernhart, Walter, Abele, Meyer and Iwahashi support the proposition that claims drafted in "means for" format are to be construed in light of the disclosed means for performing the functions and the equivalents thereof in accordance with the sixth paragraph of 35 U.S.C. 112 in determining whether they are statutory or nonstatutory under 35 U.S.C. 101. (Of course, it is the appellants' burden to demonstrate that the claims are drawn to specific and distinct apparatus.) Accordingly, this is not a new concept that first appeared in Iwahashi as the new decision majority seems to think. Rather, Iwahashi simply stated what had been the law all along in this regard. And the new decision majority has pointed to no case that is inconsistent with Iwahashi. We add to this list Arrhythmia Research Technology, Inc. v. Corazonix Corp., --- F.2d ---, 22 USPQ2d 1033 (Fed.Cir.1992) [FN1].

***15** Yet the 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. [FN2] 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 U.S.C. 112 for 35 U.S.C. 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 U.S.C. 101, and the new decision majority has cited none.

The new decision majority refuses to accord Iwahashi its proper

weight because the sixth paragraph of 35 U.S.C. 112 interpretation of "means for" limitations for purposes of determining statutory subject matter under 35 U.S.C. 101 is said to be dicta. That issue ought to be laid to rest in view of Arrhythmia:

> The Simson apparatus for analyzing electrocardiographic signals is claimed in the style of 35 U.S.C. § 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 USPQ2d 1908, 1911-12 (Fed.Cir.1989). (22 USPQ2d at 1038).

In so construing the apparatus claims, the Court did not distinguish between the "high pass filter means" in apparatus claim 7 and the "means for" language recited therein.

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 U.S.C. 101.

Here, the claimed invention is for a rasterizer depicted as component 40 in Figure 2, which is part of component 18 in Figure 1. A rasterizer is an electrical device that converts waveform magnitude data into an array of intensity data for use in creating a smooth waveform display. The electrical components of this device are illustrated in detail in Figure 3 and described at pages 11-16 of the specification. The new decision majority had no trouble reading claim 15 on the Figure 3 rasterizer. Moreover, as we said in our original decision and in contrast to the assertion by the majority of the new decision panel, the appellants have clearly satisfied their burden of demonstrating that the "means for" features are drawn to specific and distinct apparatus at pages 3 and 4 of their appeal brief. That being the case, rasterizer claim 15 reads on the disclosed structure and the equivalents for purposes of determining whether statutory subject matter under 35 U.S.C. 101 is being claimed; it is not so broad as to encompass any and every means for performing the recited functions. Thus, we do not see any "form versus substance" issue. Manifestly, limitations have not been read into claim 15 in making this 35 U.S.C. 101 statutory subject matter determination in this manner, as the new decision majority seems to think.

***16** The new decision majority, we believe, also places too much emphasis on how the "means for" components perform their functions rather than focusing on what these components do. Arrhythmia Research Technology, Inc. v. Corazonix Corp., supra; Ex parte Logan, 20 USPQ2d 1465 (BPAI 1991). In doing so, limitations of claim 15 have been ignored. For example, the rasterizer converts vectors in a data list representing sample magnitudes of an input waveform into anti-aliased pixel illumination intensity data. And each of the "means for" features are clearly functionally interrelated, which the new decision majority fails to recognize, as they were in Arrhythmia.

The majority of the new decision states that we did not reach the second part of the Freeman-Walter test. On the contrary, the initial paragraphs of our original opinion indicate that we did so implicitly in reaching our conclusion that "[e]ach clause of the body of claim 15 recites a mathematical operation and they are recited to operate together to reach a numeric value or pure number as the end product of the claim." We also stated later in the opinion that "[n]ot only is structure set forth in the instant claims on appeal, the apparatus recited therein does operate according to an algorithm." Our analytical approach followed that of the Court in Iwahashi, 12 USPQ2d at 1911. Moreover, the two-part test is not the exclusive test for detecting nonstatutory subject matter. See Arrhythmia, supra, concurring opinion (22 USPQ2d at 1041-2).

At the end of our original opinion we stated the following:

> [With respect to claim 15 on appeal], 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 in the body of claim 15 on appeal, where such rectangular block diagrams may not be ascertained to be disclosed as conventional structure in the art. Additionally, the means for determining, for example, is not disclosed in a very broad, generic sense only as a means for determining.

The new decision majority mischaracterizes these remarks by asserting that they found "no legal basis for a test that the treatment of 'means for' claims as a method is limited only to the case where the disclosure is in terms of rectangular block diagrams and where such rectangular block diagrams may not be ascertained to be disclosed as conventional structure in the art." The above quoted material was not proffered as any type of legal test since the references are plainly stated as examples. The two examples were presented as analytical tools to aid examiners in sorting out statutory from nonstatutory subject matter during examination. Our original opinion did not characterize "means for" claims as method claims at all, so no attempt was made to limit such claims to cases when the disclosure was presented in terms of rectangular block diagrams which may not be ascertained to be disclosed as conventional structure in the art.

***17** Finally, the majority of the new decision, in conducting a mathematical algorithm analysis of claim 15, strips the "means for" language from the elements in the body of the claim, treats it as a method claim and concludes that claim 15 is directed to a mathematical algorithm itself. This contention, that a structure claim may be a mathematical algorithm per se, was implicitly rejected by the Court in Iwahashi since the original board opinion therein and the board opinion on reconsideration therein showed that Iwahashi's "means for" elements in his apparatus claim, as well as the ROM recited therein, essentially recited, as a whole, a mathematical algorithmic problem solving method.

The important aspect of this application is that the claimed means can be readily determined to be based on disclosed structure which is conventional in the art and not based on disclosed algorithms per se. Therefore, the means claimed are not a sham approach to disguise, as apparent structure, a true mathematical algorithm. Such a latter approach did not (and would not now) pass muster under In re Maucorps, supra. Moreover, as in In re Bradley, supra, there is no "subterfuge for masking the presence of an essentially nonstatutory invention" (202

USPQ at 486). The essence of the disclosure here is a machine, a rasterizer, and not merely a mathematical algorithm with or by which the rasterizer operates. There is no sham structure disclosed.

In the above quoted portion of our original decision, we quoted Meyer as stating that Bernhart directed that paragraph six of 35 U.S.C. 112 applies to 35 U.S.C. 101 considerations during examination in the PTO. As such, it is manifestly clear that the claimed rasterizer is a statutory machine within the meaning of 35 U.S.C. 101.

FN1. While this case was an infringement action, the issue before the Court was the validity of method and apparatus claims in defining statutory subject matter under 35 U.S.C. 101. In determining that the claims were statutory, the Court applied the tests and standards set forth in ex parte appeals from the PTO. Therefore, what was said in Arrhythmia with respect to statutory subject matter is equally applicable in ex parte cases.

FN2. The reason for the dichotomy is that there is no justification for granting patents with claims that literally read on the prior art or are obvious modifications of the prior art. To do so would generate mischief and confusion.

23 U.S.P.Q.2d 1340

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