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63 USLW 2088, 31 U.S.P.Q.2d 1545
United States Court of Appeals,
Federal Circuit

In re Kuriappan P. ALAPPAT, Edward E. Averill and James G. Larsen.

No. 92-1381.

July 29, 1994.

Applicants appealed from reconsideration decision of Board of Patent Appeals and Interferences of the United States Patent and Trademark Office which sustained rejection of claims of application as being unpatentable. After ordering matter to be heard en banc, 980 F.2d 1439, the Court of Appeals, Rich, Circuit Judge, held that: (1) Commissioner of Patents and Trademarks had authority under statute governing Board of Appeals and Interferences to designate members of panel to consider request for reconsideration of Board's decision; (2) Board had sole authority to grant rehearing; and (3) computer operating pursuant to software may represent patentable subject matter, as long as claimed subject matters meets all other statutory patentability claims.

Reversed.

Archer, Chief Judge, filed concurring and dissenting opinion with which Nies, Circuit Judge, joined.

Pauline Newman, Plager and Rader, Circuit Judges, filed concurring opinions.

Mayer, Circuit Judge, filed dissenting opinion with which Michel, Circuit Judge, joined.

Schall, Circuit Judge, filed dissenting opinion, with which Clevenger, Circuit Judge, joined.

West Headnotes

[1] Federal Courts k30
170Bk30

[1] Federal Courts k31
170Bk31

Jurisdiction cannot be conferred on Court of Appeals for Federal Circuit by waiver or acquiescence, and court thus has duty to raise issue of jurisdiction sua sponte.

[2] Statutes k188
361k188

[2] Statutes k190
361k190

When statutory interpretation is at issue, plain and unambiguous meaning of statute prevails in absence of clearly expressed legislative intent to contrary.

[3] Patents k111
291k111

Commissioner of Patents and Trademarks has authority under statute governing Board of Appeals and Interferences to designate members of panel to consider request for reconsideration of Board's decision, and Commissioner may designate expanded panel made up of members of original panel, other members of board, and himself, to consider request for reconsideration of decision rendered by that original panel. 35 U.S.C.A. ¤ 7.

[4] Patents k324.2
291k324.2

Reconsideration of decision of Board of Appeals and Interferences is valid decision over which court may exercise subject matter jurisdiction, in light of authority of Commissioner of Patents and Trademarks under statute governing Board of Appeals and Interferences to designate members of panel to consider request for reconsideration of Board's decision. 35 U.S.C.A. ¤ 7.

[5] Patents k111
291k111

Statute governing Board of Patent Appeals and Interferences plainly and unambiguously provides that Commissioner, Deputy Commissioner, and Assistant Commissioner of Patents and Trademarks are members of Board. 35 U.S.C.A. ¤ 7.

[6] Patents k111
291k111

Language in statute governing Board of Patent Appeals and Interferences providing that "at least three" Board members will hear each appeal was express grant by Congress of authority to Commissioner of Patents and Trademarks to designate expanded Board panels made up of more than three Board members. 35 U.S.C.A. ¤ 7(a, b).

[7] Patents k111
291k111

Commissioner of Patents and Trademarks has authority to convene expanded panel to hear appeal which panel includes, or is predominately made up of, senior executive officers of the Board of Patent and Trademark Office (PTO), such as Deputy Commissioner, Assistant Commissioner, Board's Chairman and Vice- Chairman, and himself.

[8] Patents k111
291k111

Commissioner of Patents and Trademarks reasonably interpreted statute providing that only Board of Patent Appeals and Interferences had authority to grant rehearings to apply to reconsideration action. 35 U.S.C.A. ¤ 7(b).

[9] Patents k111

291k111

Term "rehearings" in statute governing Board of Patents Appeals and Interferences included any reconsideration by Board of decision rendered by one of its panels, even though Patent Office regulation refers to "reconsideration"; differing terminology was nothing more than result of imprecise regulation drafting and did not indicate intent to create separate review process. 35 U.S.C.A. ¤ 7.

[10] Patents k111
291k111

Express statutory authority of Commissioner of Patents and Trademarks to designate members of panel hearing appeal extends to designation of panel to consider request for rehearing pursuant to state governing Board of Patent Appeals and Interferences; legislative history did not indicate clear congressional intent to limit authority to designate members of Board panel to designation of original panel. 35 U.S.C.A. ¤ 7.

[11] Patents k111
291k111

Statute governing Board of Patent Appeals and Interferences vests Board with sole authority to grant rehearing, and, thus, despite general authority of Commissioner of Patents and Trademarks over operation of Board of Patent and Trademark Office (PTO), Commissioner lacks authority to personally grant rehearing. 35 U.S.C.A. ¤ 7(b).

[12] Patents k97
291k97

Commissioner of Patents and Trademarks has broad supervisory authority regarding operation of Board of Patent and Trademark Office (PTO) and is not bound by Board decision that applicant is entitled to patent; only court, and not Board, can order Commissioner to act.

[13] Patents k97
291k97

Board of Patent Appeals and Interferences is highest level of Examining Corps, and, like all other members of Examining Corps, Board operates subject to overall ultimate authority and responsibility of Commissioner of Patents and Trademarks.

[14] Patents k111
291k111

Fact that Commissioner of Patents and Trademarks may determine composition of panels of Board of Patent Appeals and Interferences and may convene panel which he knows or hopes will render decision he desires does not reduce Board to alter ego or agent of Commissioner as Commissioner may not unilaterally overturn decision of Board panel or instruct other Board members how to vote.

[15] Amicus Curiae k3
27k3

Amicus curiae in patent case did not have standing to make due process argument on behalf of claimant.

[16] Constitutional Law k70.3(9.1)
92k70.3(9.1)

Whether it was sound policy to grant Commissioner of Patents and Trademarks limited ability to control Board decisions through his authority to designate Board panels was question for legislature and not courts.

[17] Patents k101(4)
291k101(4)

Board of Patent and Trademark Office (PTO) was not exempt from following statutory mandate to construe claim expressed as a "means" for performing specified function as covering corresponding structure, material, or acts described in specification and equivalents thereof.

[18] Patents k165(4)
291k165(4)

Means clauses in claim for invention relating to software for creating smooth waveform display in digital oscilloscope, which employed "anti-aliasing" technique and eliminated apparent discontinuity or oscillation in waveform, could not be read as mere process claim; claim unquestionably recited machine, or apparatus, made up of combination of known electronic circuitry elements.

[19] Patents k7.14
291k7.14
Invention.

Claim for "rasterizer," which was machine for converting vector list data representing sample magnitudes of input waveform into antialiased pixel illumination intensity data, was claim directed to "machine" which was patentable subject matter.

[20] Patents k6
291k6

Subject matter of invention relating to means for creating smooth waveform display in digital oscilloscope, which employed "anti-aliasing" technique eliminating apparent discontinuity or oscillation in waveform, did not fall within "mathematical algorithm" exception to subject matter jurisdiction over machines.

[21] Patents k11
291k11

[21] Patents k12
291k12

Plain and unambiguous meanings of patent law governing machines is that any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvements therefore may be patented if it meets patentability requirements.

[22] Patents k6
291k6

Fact that courts have tried to carve out exception to patentability for mathematical computations did not equal broad category of subject matter excluded from patentability; certain types of mathematical subject matter, standing alone, represent nothing more than abstract ideas until reduced to some type of practical application,and, thus, subject matter is not in and of itself entitled to patent protection.

[23] Patents k5
291k5

It is irrelevant to patentability that claim may contain, as part of the whole, subject matter that would not be patentable by itself; claim drawn to subject matter otherwise statutory does not become nonstatutory simply because it uses mathematical formula, computer program or digital computer.

[24] Patents k6
291k6

Proper inquiry in dealing with "mathematical subject matter" exception to patentability of machines is to see whether claimed subject matter, as a whole, is disembodied mathematical concept, whether categorized as mathematical formula, equation, algorithm, or the like, which in essence represents nothing more than law of nature, natural phenomenon or abstract idea.

[25] Patents k6
291k6

Invention relating to means for creating smooth waveform display in digital oscilloscope, which employed "anti-aliasing" technique eliminating apparent discontinuity or oscillation in waveform was not disembodied "mathematical concept" which would not be patentable, but rather invention was one to transform one set of data to another, although what may be viewed as series of mathematical calculations does not alone justify holding claim as one directed to nonstatutory subject matter.

[26] Patents k101(10)
291k101(10)

Claim which defined combination of elements constituting machine for producing antialiased waveform on computers defined combination of elements constituting machine for producing waveform.

[27] Patents k101(8)
291k101(8)

Fact that claimed invention would read on general purpose computer programmed to carry out claimed invention did not preclude finding that programming creates new machine, as general purpose computer became, in effect, special purpose computer once it was programmed to perform particular functions pursuant to instructions from program software.

[28] Patents k11
291k11

Computer operating pursuant to software may represent patentable subject matter, as long as claimed subject matters meet all other statutory patentability claims; computer is "apparatus" and not mathematics.

*1529 Alexander C. Johnson, Jr., Marger, Johnson, McCollom & Stolowitz, P.C., Portland, OR, argued for appellants. With him on the brief was Peter J. Meza. Also on the brief was Francis I. Gray, Tektronix, Inc., Wilsonville, OR. Allen M. Sokal, Finnegan, Henderson, Farabow, Garrett & Dunner, of Washington, DC, argued for amicus curiae, Federal Circuit Bar Association. With him on the brief were Gerald H. Bjorge, Herbert H. Mintz and George E. Hutchinson.

Fred E. McKelvey, Solicitor, Office of the Sol., Arlington, VA, argued for appellee. With him on the brief were Lee E. Barrett and Richard E. Schafer, Associate Sol. Of counsel were Albin F. Drost and John W. Dewhirst.

Herbert C. Wamsley and Richard C. Witte, Intellectual Property Owners, Inc., Washington, DC, were on the brief for amicus curiae, Intellectual Property Owners, Inc.

Richard H. Stern, Graham & James, Washington, DC, was on the brief for amicus curiae, Seagate Technology, Inc. Also on the *1530 brief was Edward P. Heller, III, Patent Counsel.

Fred I. Koenigsberg and Nancy J. Linck, Cushman, Darby & Cushman, Washington, DC, were on the brief for amicus curiae, American Intellectual Property Law Association. Also on the brief were Harold C. Wegner and H. Ross Workman, Wegner, Cantor, Mueller & Player, Washington, DC. Of counsel was William S. LaFuze.

Before ARCHER, Chief Judge, and RICH, NIES, NEWMAN, MAYER, MICHEL, PLAGER, LOURIE, CLEVENGER, RADER and SCHALL, Circuit Judges.

RICH, Circuit Judge, with whom:
as to Part I (Jurisdiction): PAULINE NEWMAN, LOURIE and RADER, Circuit Judges, join; ARCHER, Chief Judge, NIES and PLAGER, Circuit Judges, concur in conclusion; and MAYER, MICHEL, CLEVENGER and SCHALL, Circuit Judges, dissent; and
as to Part II (Merits): PAULINE NEWMAN, LOURIE, MICHEL, PLAGER and RADER, Circuit Judges, join; ARCHER, Chief Judge, and NIES, Circuit Judge, dissent; and MAYER, CLEVENGER and SCHALL, Circuit Judges, take no position.

Kuriappan P. Alapatt, Edward E. Averill, and James G. Larsen (collectively Alappat) appeal the April 22, 1992, reconsideration decision of the Board of Patent Appeals and Interferences (Board) of the United States Patent and Trademark Office (PTO), Ex Parte Alappat, 23 USPQ2d 1340 (BPAI, 1992), which sustained the Examiner's rejection of claims 15-19 of application Serial No. 07/149,792 ('792 application) as being unpatentable under 35 U.S.C. ¤ 101 (1988).

I. JURISDICTION

This court must determine whether the Board's reconsideration decision constitutes a valid decision over which this court may exercise subject matter jurisdiction pursuant to 28 U.S.C. ¤ 1295(a)(4)(A) (1988) and 35 U.S.C. ¤ 141 (1988). As discussed below, the legality of the Board panel which issued the reconsideration decision is in question, thus raising the issue of the validity of the decision itself and consequently our authority to review that decision. Therefore, before addressing the merits, it is appropriate that we first determine that the decision was rendered by a legally constituted panel to ensure that a jurisdictional cloud does not hang

over our holding on the merits. See In re Bose Corp., 772 F.2d 866, 869, 227 USPQ 1, 3-4 (Fed.Cir.1985). [FN1]

FN1. In Bose, this court examined the composition of a panel of the Trademark Trial and Appeal Board (TTAB), holding that this court has jurisdiction to decide whether a TTAB panel was properly constituted when a decision from that panel is appealed. This court stated in pertinent part:
[I]t is appropriate for this court to determine whether a valid decision is before us before addressing the merits of that decision. The matter of the board's composition is logically related to, indeed, inseparable from the merits and can be raised in the appeal from the board's decision.
Bose, 772 F.2d at 866, 227 USPQ at 3.

[1] Although Alappat does not contest the validity of the Board's reconsideration decision, jurisdiction cannot be conferred on this court by waiver or acquiescence. Coastal Corp. v. United States, 713 F.2d 728, 730 (Fed.Cir.1983). This court therefore has raised the issue of jurisdiction sua sponte, as is its duty. See Mansfield, Coldwater & Lake Mich. Ry. Co. v. Swan, 111 U.S. 379, 382, 4 S.Ct. 510, 511, 28 L.Ed. 462 (1884); Wyden v. Commissioner of Patents & Trademarks, 807 F.2d 934, 935, 231 USPQ 918, 919 (Fed.Cir.1986); see also 5 WRIGHT & MILLER, FEDERAL PRACTICE AND PROCEDURE ¤ 1393 (1990). To this end, this court, having decided to hear the case in banc, issued an Order on December 3, 1992, requesting briefing on the following three questions:
(1) When a three-member panel of the Board has rendered its decision, does the Commissioner have the authority to constitute a new panel for purposes of reconsideration?
(2) If the Commissioner lacks such authority, is the decision of such a new panel a decision of the Board for purposes of 28 U.S.C. ¤ 1295(a)(4)(A)? If not, does this *1531 court have jurisdiction to reach the merits of the appealed decision?
(3) What is the relationship, if any, between the "reconsideration" action taken in this case and "rehearings" by the Board provided for in 35 U.S.C. ¤ 7(b)?
Consistent with our discussion below, we hold that the answer to the first question is yes. Consequently, we need not address the second question. As to the third question, we hold, for the reasons explained later, that the "reconsideration" by the Board was a "rehearing" as provided for in 35 U.S.C. ¤ 7(b) (1988).
A. Background
In an Office Action mailed December 5, 1989, the Examiner finally rejected claims 15-19 under 35 U.S.C. ¤ 101 as being directed to non-statutory subject matter. Alappat appealed this rejection to the Board pursuant to 35 U.S.C. ¤ 134 (1988), and a three-member panel made up of Examiners-in- Chief Lindquist, Thomas, and Krass reversed the Examiner's non-statutory subject matter rejection in a decision mailed June 26, 1991. The Examiner then requested reconsideration of this decision, pursuant to section 1214.04 of the Manual of Patent Examining Procedure (MPEP), stating that the panel's decision conflicted with PTO policy. The Examiner further requested that such reconsideration be carried out by an expanded panel.
An expanded eight-member panel, acting as the Board, granted both of the Examiner's requests. The expanded panel was made up of PTO Commissioner Manbeck, PTO Deputy Commissioner Comer, PTO Assistant Commissioner Samuels, Board Chairman Serota, Board Vice-Chairman Calvert, and the three members of the original panel. On April 22, 1992, the five new members of the expanded panel issued the majority decision now on appeal, authored by Chairman Serota, in which they affirmed the Examiner's ¤ 101 rejection, thus ruling

contrary to the decision of the original three-member panel. The three members of the original panel dissented on the merits for the reasons set forth in their original opinion, which they augmented in a dissenting opinion.

The majority stated that its reconsideration decision was a "new decision" for purposes of requesting reconsideration or seeking court review of that decision. It did not, however, vacate the original three-member panel decision. Instead, the majority indicated that the original, three-member panel decision was only "modified to the extent indicated." Alappat, 23 USPQ2d at 1347. That "modification" was, however, a de facto reversal of the original panel's decision, affirming instead of reversing the examiner.

B. Discussion

(1) The Legality of the Board's Rehearing Panel

[2] When statutory interpretation is at issue, the plain and unambiguous meaning of a statute prevails in the absence of clearly expressed legislative intent to the contrary. See Mansell v. Mansell, 490 U.S. 581, 592, 109 S.Ct. 2023, 2030, 104 L.Ed.2d 675 (1989); Hoechst Aktiengesellschaft v. Quigg, 917 F.2d 522, 526, 16 USPQ2d 1549, 1552 (Fed.Cir.1990). In this case, the composition of the Board and its authority to reconsider its own decisions, and the Commissioner's authority over the Board, are governed by 35 U.S.C. ¤ 7, which reads:

(a) The examiners-in-chief shall be persons of competent legal knowledge and scientific ability, who shall be appointed to the competitive service. The Commissioner, the Deputy Commissioner, the Assistant Commissioners, and the examiners-in-chief shall constitute the Board of Patent Appeals and Interferences.

(b) The Board of Patent Appeals and Interferences shall, on written appeal of an applicant, review adverse decisions of examiners upon applications for patents and shall determine priority and patentability of invention in interferences declared under section 135(a) of this title. Each appeal and interference shall be heard by at least three members of the Board of Appeals and Interferences, who shall be designated by the Commissioner. Only the Board of Patent Appeals and Interferences has the authority to grant rehearings.

35 U.S.C. ¤ 7 (1988) (emphasis added).

[3][4] For the reasons set forth below, we hold that ¤ 7 grants the Commissioner the *1532 authority to designate the members of a panel to consider a request for reconsideration of a Board decision. This includes, as in this case, the Commissioner designating an expanded panel made up of the members of an original panel, other members of the Board, and himself as such, to consider a request for reconsideration of a decision rendered by that original panel. The Board's reconsideration decision therefore constituted a valid decision over which this court may exercise subject matter jurisdiction.

(a)

[5][6] At the outset, we note that ¤ 7(a) plainly and unambiguously provides that the Commissioner, the Deputy Commissioner, and the Assistant Commissioners are members of the Board. Section 7(b) plainly and unambiguously requires that the Commissioner designate "at least three" Board members to hear each appeal. By use of the language "at least three," Congress expressly granted the Commissioner the authority to designate expanded Board panels made up of more than three Board members. [FN2]

FN2. Both this court and the Court of Customs and Patent Appeals (CCPA), one of this court's predecessors, have reviewed Board decisions rendered by panels made up of more than three Board members without questioning the

validity of such panels. See e.g. Hahn v. Wong, 892 F.2d 1028, 1031, 13 USPQ2d 1313, 1316 (Fed.Cir.1989) (seven-member panel because of significance of issues raised); In re Lundak, 773 F.2d 1216, 1219, 227 USPQ 90, 92 (Fed.Cir.1985) (eighteen-member panel); In re Durden, 763 F.2d 1406, 1409 n. 3, 226 USPQ 359, 360 n. 3 (Fed.Cir.1985) (sixteen-member panel); In re Henriksen, 399 F.2d 253, 254 n. 1, 158 USPQ 224, 225 n. 1 (CCPA 1968) (nine-member panel because of "the nature of the legal issues raised"). Other instances wherein the Commissioner has convened an expanded panel include Ex parte Alpha Indus. Inc., 22 USPQ2d 1851, 1852 (Bd.Pt.App. & Inter.1992) (five-member panel); Ex parte Fujii, 13 USPQ2d 1073, 1074 (Bd.Pat.App. & Inter.1989) (five-member panel because of significance of issue raised); Ex parte Kristensen, 10 USPQ2d 1701, 1702 (Bd.Pat.App. & Inter.1989) (five-member panel); Ex parte Kitamura, 9 USPQ2d 1787, 1788 (Bd.Pat.App. & Inter.1988) (five-member panel because of possible conflict in case law); Lamont v. Berguer, 7 USPQ2d 1580, 1581 (Bd.Pat.App. & Inter.1988) (five-member panel because of novelty of issue raised); Kwon v. Perkins, 6 USPQ2d 1747, 1748 (Bd.Pat.App. & Inter.1988) (nine-member panel because of novelty of issues raised); Ex parte Horton, 226 USPQ 697, 698 (Bd.Pat.App. & Inter.1985) (five-member panel); Ex parte Tytgat, 225 USPQ 907, 908 (Bd.Pat.App. & Inter.1985) (five-member panel); and Ex parte Jackson, 217 USPQ 804, 806 (Bd.Pat.App. & Inter.1982) (nine-member panel because legal issue was one of first impression).

[7] There is no evidence in the legislative history of ¤ 7, or Title 35 as a whole, clearly indicating that Congress intended to impose any statutory limitations regarding which Board members the Commissioner may appoint to an expanded panel or when the Commissioner may convene such a panel. [FN3] The Commissioner thus has the authority to convene an expanded panel which includes, or as in this case is predominately made up of, senior executive officers of the PTO such as the Deputy Commissioner, the Assistant Commissioner, the Board's Chairman and Vice-Chairman, and himself. [FN4]

FN3. The Commissioner has interpreted his authority to convene an expanded panel as granting him the authority to expand a three-member panel to include additional Board members after oral hearing. See e.g. Ex parte Kuklo, 25 USPQ2d 1387, 1388 (Bd.Pat.App. & Inter.1992) (five-member panel); Larson v. Johenning, 17 USPQ2d 1610, 1610 (Bd.Pat.App. & Inter.1991) (five-member panel); Ex parte Lyell, 17 USPQ2d 1548, 1549 (Bd.Pat.App. & Inter.1990) (five-member panel); Ex parte Remark, 15 USPQ2d 1498, 1498 (Bd.Pat.App. & Inter.1990) (five-member panel); Ex parte Kumagai, 9 USPQ2d 1642, 1643 (Bd.Pat.App. & Inter.1988) (five-member panel).

FN4. This is not to say that the Commissioner's authority to designate the members of a Board panel may or may not be constrained by principles of due process or by Title 5, the Administrative Procedure Act (APA). However, as noted herein, Alappat has not raised any such arguments in this appeal, and therefore we need not address such issues.

(b)

[8] The focus of the jurisdictional inquiry in this case is the last sentence of ¤ 7(b) which provides: "Only the Board of Patent Appeals and Interferences has the authority to grant rehearings." The Commissioner contends that the reconsideration action taken in this case constituted a type of "rehearing" as mentioned in the last sentence of ¤ 7(b). For the reasons set forth below, we find the Commissioner's interpretation of ¤ 7 *1533 to be a reasonable one entitled to deference, given that neither the

statute itself nor the legislative history thereof indicates Congressional intent to the contrary.

[9] We interpret the term "rehearings" in ¤ 7 as encompassing any reconsideration by the Board of a decision rendered by one of its panels. The fact that ¤ 7 refers to "rehearings" whereas 37 C.F.R. 1.197 (PTO Rule 197) [FN5] refers to "reconsideration" is of no significance. The differing terminology appears to be nothing more than the result of imprecise regulation drafting. [FN6] We have been unable to find any evidence suggesting that, in promulgating Rule 197, the PTO intended to create a review process separate and distinct from that provided by statute. In addition, our interpretation finds support in In re Schmidt, 377 F.2d 639, 641, 153 USPQ 640, 642 (CCPA 1967), wherein the CCPA accepted, without criticism, the PTO's treatment of a Board reconsideration pursuant to Rule 197, on an examiner's request, as a "rehearing" provided for in ¤ 7(b). [FN7]

FN5. Rule 197(b) reads in pertinent part:
A single request for reconsideration or modification of the decision may be made if filed within one month from the date of the original decision,....

FN6. The terms "rehearing" and "reconsideration" are often used interchangeably. In some contexts, a distinction is made between the two. We see no basis, however, for imposing any such distinctions in the context of PTO Board proceedings, especially considering that the Commissioner argues that the PTO does not make such distinctions, citing McCrady, Patent Office Practice, ¤ 235 (3d ed. 1950). We note that McCrady's Patent Office Practice, 4th ed. (1959) states in ¤ 235: "These two terms 'reconsideration' and 'rehearing' seem to be treated by Rule 197 as interchangeable, and are so treated here." Although not legislative history per se, we also note that Karl Fenning, at the time a former Assistant Commissioner of Patents, stated during the 1926 House hearing on the bill to include the rehearing provision in the statute that "It says rehearing, and rehearing, used in the technical or legal sense, is reconsideration." Procedure in the Patent Office, Hearing on H.R. 7563 and H.R. 13487 Before the Committee on Patents, United States House of Representatives, 69th Cong., 2d Sess. 29 (1926) (1926 House Hearing). Finally, we additionally note that Black's Law Dictionary defines "rehearing" in part as a "[s]econd consideration of cause for purpose of calling to court's or administrative board's attention any error, omission, or oversight in first consideration." Black's Law Dictionary (6th ed. 1990). Black's defines "reconsideration" as follows: "[a]s normally used in the context of administrative adjudication 'reconsideration' implies reexamination, and possibly a different decision by the entity which initially decided it."

FN7. Apparently, the Board's reconsideration decision in the present case was based on the same record that was before the original three-member panel, and Alappat was not allowed an opportunity to add to that record. We do not intend to suggest herein that "rehearings" under ¤ 7(b) are limited to such situations. Indeed, it would not be unreasonable to construe "rehearings" under ¤ 7(b) broadly as also encompassing reconsideration by the Board wherein the Board allows an applicant to supplement the existing record or wherein the Board allows both the applicant and the examiner to brief the issues anew.

[10] We also interpret the Commissioner's express statutory authority to designate the members of a panel hearing an appeal as extending to designation of a panel to consider a request for a rehearing pursuant to ¤ 7(b). [FN8] There is no indication to the contrary in the statute, and we

have found no legislative history indicating a clear Congressional intent that the Commissioner's authority to designate the members of a Board panel be limited to the designation of an original panel or that the Board be limited to exercising its rehearing authority only through the panel which rendered an original decision. In those cases where a different *1534 panel of the Board is reconsidering an earlier panel decision, the Board is still the entity reexamining that earlier decision; it is simply doing so through a different panel.

FN8. The Commissioner has consistently interpreted his statutory authority to designate the constituency of a Board panel as allowing him to change or augment an originally designated panel in response to a request for reconsideration. See e.g. Ex parte Johnson, Appeal No. 91-0143 (Bd.Pat.App. & Inter.1991) (on request for reconsideration, augmented panel of seven examiners-in-chief granted the request and voted four to three to affirm the examiner, contrary to the original three-member panel); Ex parte Holt, 218 USPQ 747, 747 (Bd.App.1982) (on request for reconsideration by Group Director, rehearing granted by an augmented fifteen-member panel); Ex parte Scherer, 103 USPQ 107, 107-08 (Bd.App.1954) (rehearing by an augmented eleven-member panel granted because of probable importance of issues); Ex parte Ball, 99 USPQ 146, 146 (Bd.App.1953) (reconsideration granted to allow further consideration by an augmented eight-member panel including the Commissioner); Ex parte Wiegand, 61 USPQ 97, 99 (Bd.App.1944) (rehearing by a different three- member panel).

[11] The last sentence of ¤ 7(b) is nothing more than an exclusionary statement vesting the Board with the sole authority to grant a rehearing. Thus, for example, the Commissioner cannot personally grant a rehearing, notwithstanding the general authority that he has over the operation of the PTO. For a general history of the Board and of appeals within and from the PTO, see Michael W. Blommer, The Board of Patent Appeals and Interferences, AIPLA Bulletin 188 (1992), P.J. Federico, The Board of Appeals 1861-1961, 43 JPOS 691 (1961), and Evolution of Patent Office Appeals, 22 JPOS 838-64, 920-49 (1940).

The predecessor of ¤ 7 was section 482 of the Revised Statutes, as amended by the Act of March 2, 1927. The 1927 Act added to the Board the Commissioner, the First Assistant Commissioner, and the Assistant Commissioner. It also eliminated the right of an applicant to appeal to the Commissioner from an adverse Board decision, by adding to the statute the language "[t]he the Board of Appeals shall have sole power to grant rehearings," essentially the same provision as in today's ¤ 7(b). Act of March 2, 1927, ch. 273, ¤ 3, 44 Stat. 1335. Prior to this amendment, the Commissioner acted on petitions for rehearing of adverse Board decisions. Through this amendment, Congress effectively eliminated the onerous burden placed on the Commissioner regarding reviewing such appeals, instead steering applicants to the Board with such requests.

The events surrounding the enactment of the 1927 Act do not indicate any Congressional intent to lessen the great supervisory power that the Commissioner possessed over the PTO prior to that Act. [FN9] Indeed, at the end of the 1926 House and Senate hearings during which the last sentence of what is now ¤ 7(b) was discussed, the Senate Committee on Patents concluded:

FN9. The Commissioner's supervisory authority under Section 482 of the Revised Statutes prior to the 1927 Act was described aptly as follows: The law has provided certain official agencies to aid and advance the work of the Patent Office, such as the Primary Examiners, the Examiners of Interferences [now obsolete], and the Examiners-in-Chief; but they are all

subordinate, and subject to the official direction of the Commissioner of Patents, except in the free exercise of their judgments in the matters submitted for their examination and determination. The Commissioner is the head of the bureau, and he is responsible for the general issue of that bureau.
Moore v. United States, 40 App.D.C. 591, 596 (D.C.Cir.1913), quoting In re Drawbaugh, 9 App.D.C. 219, 240 (D.C.Cir.1896).

One lawyer [remarks of Fenning, chairman of the committee on laws and rules of the American Patent Law Association, Procedure in the Patent Office, Hearing on S. 4812 Before the Committee on Patents, United States Senate, 69th Con.2d Sess. 19, 21-22 (1926)] has expressed the fear that in providing in lines 16- 17, page 2 (sec. 482) [the precursor to section 7(b)], that the board of appeals shall have the sole power to grant "rehearings," the bill may lessen the present supervisory power of the commissioner, but it was agreed by the other lawyers at the hearing, and the Committee on Patents concurs in this view, that the supervisory power of the commissioner, as it has existed for a number of decades, remains unchanged by the bill.
S.Rep. No. 1313, 69th Cong., 2d Sess. 4 (1927) (emphasis added). Fenning expressed the same concerns to the House Committee on Patents. 1926 House Hearing at 22-23. The House Committee Report, H.R. No. 1889, 69th Cong., 2d Sess. (1927), is silent on the issue, thus suggesting that the House did not intend to give the last sentence of ¤ 7(b) a different meaning than was ascribed to it by the Senate. We believe the foregoing illustrates the lack of intent on the part of Congress in enacting the last sentence of ¤ 7(b) to place any limitations on the Commissioner's ability to designate Board panels, including Board panels for "rehearing" purposes.
(c)

[12][13] Our holding is consistent with the broad supervisory authority that Congress has granted the Commissioner under *1535 Title 35 regarding the operation of the PTO. Exemplary thereof is ¤ 6(a), which reads in pertinent part:
The Commissioner, under the direction of the Secretary of Commerce, shall superintend or perform all duties required by law respecting the granting and issuing of patents.
35 U.S.C. ¤ 6(a) (1988) (emphasis added). The Commissioner also may establish regulations not inconsistent with the law, with the approval of the Secretary of Commerce, 35 U.S.C. ¤ 6 (1988), cause an examination to be made of an application, 35 U.S.C. ¤ 131 (1988), declare an interference, 35 U.S.C. ¤ 135 (1988), and issue a patent when authorized by law, 35 U.S.C. ¤¤ 131, 145 (1988), 151 (1988), 153 (1988).
Moreover, the Commissioner is not bound by a Board decision that an applicant is entitled to a patent. Only a court can order the Commissioner to act, not the Board. Even though Board members serve an essential function, they are but examiner-employees of the PTO, and the ultimate authority regarding the granting of patents lies with the Commissioner. [FN10] For example, if the Board rejects an application, the Commissioner can control the PTO's position in any appeal through the Solicitor of the PTO; the Board cannot demand that the Solicitor attempt to sustain the Board's position. Conversely, if the Board approves an application, the Commissioner has the option of refusing to sign a patent; an action which would be subject to a mandamus action by the applicant. The Commissioner has an obligation to refuse to grant a patent if he believes that doing so would be contrary to law. The foregoing evidences that the Board is merely the highest level of the Examining Corps, and like all other members of the

Examining Corps, the Board operates subject to the Commissioner's overall ultimate authority and responsibility.

FN10. Examiners-in-chief are appointed by the Secretary of Commerce upon nomination by the Commissioner. Thus, principles respecting the independence of judges or other concepts associated with the judicial process are not necessarily applicable to Board members. The fact that we apply the clearly erroneous standard of review rather than the more restrictive substantial evidence standard usually applied to administrative boards illustrates the purely administrative nature of the Board.

One also should not overlook the asymmetry of ¤ 141, which grants applicants, but not the Commissioner, the right to appeal a decision of the Board to this court. Since Congress has reenacted ¤ 141 several times since the 1927 debates about the Board's independence, see 1926 House Hearing at 22-29, it is safe to infer that Congress believed the Commissioner did not need a right of appeal in view of his limited control over the Board pursuant to ¤ 7 and in view of his rulemaking authority pursuant to ¤ 6(a).
(d)

Contrary to suggestions by Amicus Curiae Federal Circuit Bar Association (FCBA), our holding does not conflict with this court's previous statements in Animal Legal Defense Fund v. Quigg, 932 F.2d 920, 928-29, 18 USPQ2d 1677, 1684 (Fed.Cir.1991), that the Board is not the alter ego or agent of the Commissioner. In that case, this court merely pointed out that the Board derives its adjudicatory authority from a statutory source independent of the Commissioner's rulemaking authority, and that, although the Commissioner may sit on the Board, "in that capacity he serves as any other member." Animal Legal Defense Fund, 932 F.2d at 929 n. 10, 18 USPQ2d at 1684 n. 10. In other words, the Commissioner has but one vote on any panel on which he sits, and he may not control the way any individual member of a Board panel votes on a particular matter. However, the present statutory scheme does allow the Commissioner to determine the composition of Board panels, and thus he may convene a Board panel which he knows or hopes will render the decision he desires, even upon rehearing, as he appears to have done in this case.
[14] Such a result does not reduce the Board to an alter ego or agent of the Commissioner. To the contrary, the fact remains that the Commissioner may not unilaterally overturn a decision of a Board panel or instruct other Board members how to vote. The Commissioner's limited control in this *1536 manner over the Board and the decisions it issues is not offensive to Title 35 as a whole, given that Congress clearly did not intend the Board to be independent of any and all oversight by the Commissioner. See e.g. Lindberg v. Brenner, 399 F.2d 990, 992-93, 158 USPQ 380, 381-82 (D.C.1968). The plain and unambiguous wording of ¤ 7 intertwining the powers of the Board and the Commissioner clearly indicates that Congress did not intend the Board to have such complete independence.
(e)

Amicus Curiae FCBA suggests that the Commissioner's redesignation practices in this case violated Alappat's due process rights, citing Utica Packing Co. v. Block, 781 F.2d 71 (6th Cir.1986). In addition, an issue was raised at oral argument as to whether the Commissioner's designation practices are governed by any provisions of the Administrative Procedure Act (APA), and if so, whether the Commissioner's actions in this case violated any of these provisions. We need not address either of these issues.
[15] The FCBA does not have standing to make a due process argument, see Broadrick v. Oklahoma, 413 U.S. 601, 610, 93 S.Ct. 2908, 2915, 37 L.Ed.2d 830

(1973) ("constitutional rights are personal and may not be asserted vicariously") and United Parcel Service, Inc. v. Mitchell, 451 U.S. 56, 60 n. 2, 101 S.Ct. 1559, 1562 n. 2, 67 L.Ed.2d 732 (1981) (amicus may not rely on new arguments not presented below), and Alappat has waived any due process argument by acquiescing to the Commissioner's actions in this case. Thus, there is no case or controversy before this court with respect to any alleged due process violation. There also is no case or controversy as to whether the Commissioner's actions in this case violated any provision of the APA, given that Alappat does not contest these actions, and this is not an issue which this court may raise sua sponte. Moreover, neither of these issues is germane to the jurisdictional issue this court raised sua sponte, i.e., whether the Board's reconsideration decision constituted a statutorily valid decision under 35 U.S.C. ¤ 141 over which this court may exercise subject matter jurisdiction pursuant to 28 U.S.C. ¤ 1294(a)(4)(A).
(f)

[16] Finally, we acknowledge the considerable debate and concern among the patent bar and certain Board members regarding the Commissioner's limited ability to control Board decisions through his authority to designate Board panels. [FN11] Our responsibility, however, is merely to adjudge whether the Commissioner's designation practices as they were applied in this particular case resulted in a valid decision over which this court may exercise subject matter jurisdiction, not to assess whether they were sound from a public policy standpoint. We leave to the legislature to determine whether any restrictions should be placed on the Commissioner's authority in this regard. Absent any congressional intent to impose such restrictions, we decline to do so sua sponte.

FN11. See e.g. En Banc Federal Circuit Will Consider Board of Appeals Issues in Alappat Case, 45 PTCJ 107 (1992); Changes Urged in Structure and Operation of PTO Appeals Board, 45 PTCJ 75 (1992); Independence of the Board of Patent Appeals and Interferences, Federal Circuit Bar Journal, Vol. 2, No 2, pg. 215 (1992); CLE Weekend Highlights, 33 NYPTC Bull. 6 (1992); Patent and Trademark Office Authorization Act, 138 Cong.Rec. S16, 614 (1992), reprinted in 44 PTCJ 618-19 (1992); Review of Patent and Trademark Office Appeal Procedure, 57 FR 34123 (1992), reprinted in 44 PTCJ 352 (1992); Comments Sought on Commissioner's Relationship with Appellate Boards, 44 PTCJ 325 (1992); PTO's Automation and Board Autonomy at Issue in House Hearing on PTO Budget, 44 PTCJ 102, 103 (1992); Correspondence Between Board Members and PTO Commissioner on Board Independence, 44 PTCJ 43 (1992); Members of Board of Appeals Complain about Interference with Independence, 44 PTCJ 33 (1992); Michael W. Blommer, The Board of Patent Appeals and Interferences, AIPLA Bulletin 188 (1992).

II. THE MERITS

Our conclusion is that the appealed decision should be reversed because the appealed claims are directed to a "machine" which is one of the categories named in 35 U.S.C. ¤ 101, as the first panel of the Board held.

*1537 A. Alappat's Invention

Alappat's invention relates generally to a means for creating a smooth waveform display in a digital oscilloscope. The screen of an oscilloscope is the front of a cathode-ray tube (CRT), which is like a TV picture tube, whose screen, when in operation, presents an array (or raster) of pixels arranged at intersections of vertical columns and horizontal rows, a pixel being a spot on the screen which may be illuminated by directing an electron beam to that spot, as in TV. Each column in the array represents a

different time period, and each row represents a different magnitude. An input signal to the oscilloscope is sampled and digitized to provide a waveform data sequence (vector list), wherein each successive element of the sequence represents the magnitude of the waveform at a successively later time. The waveform data sequence is then processed to provide a bit map, which is a stored data array indicating which pixels are to be illuminated. The waveform ultimately displayed is formed by a group of vectors, wherein each vector has a straight line trajectory between two points on the screen at elevations representing the magnitudes of two successive input signal samples and at horizontal positions representing the timing of the two samples.

Because a CRT screen contains a finite number of pixels, rapidly rising and falling portions of a waveform can appear discontinuous or jagged due to differences in the elevation of horizontally contiguous pixels included in the waveform. In addition, the presence of "noise" in an input signal can cause portions of the waveform to oscillate between contiguous pixel rows when the magnitude of the input signal lies between values represented by the elevations of the two rows. Moreover, the vertical resolution of the display may be limited by the number of rows of pixels on the screen. The noticeability and appearance of these effects is known as aliasing.

To overcome these effects, Alappat's invention employs an anti-aliasing system wherein each vector making up the waveform is represented by modulating the illumination intensity of pixels having center points bounding the trajectory of the vector. The intensity at which each of the pixels is illuminated depends upon the distance of the center point of each pixel from the trajectory of the vector. Pixels lying squarely on the waveform trace receive maximum illumination, whereas pixels lying along an edge of the trace receive illumination decreasing in intensity proportional to the increase in the distance of the center point of the pixel from the vector trajectory. Employing this anti-aliasing technique eliminates any apparent discontinuity, jaggedness, or oscillation in the waveform, thus giving the visual appearance of a smooth continuous waveform. In short, and in lay terms, the invention is an improvement in an oscilloscope comparable to a TV having a clearer picture.

Reference to Fig. 5A of the '792 application, reproduced below, better illustrates the manner in which a smooth appearing waveform is created.

*1538
RPT.CC.1994160591.00010 #0895;1;(2.75 X 1.25)

Each square in this figure represents a pixel, and the intensity level at which each pixel is illuminated is indicated in hexadecimal notation by the number or letter found in each square. Hexadecimal notation has sixteen characters, the numbers 0-9 and the letters A-F, wherein A represents 10, B represents 11, C represents 12, D represents 13, E represents 14, and F represents 15. The intensity at which each pixel is illuminated increases from 0 to F. Accordingly, a square with a 0 (zero) in it represents a pixel having no illumination, and a square with an F in it represents a pixel having maximum illumination. Although hexadecimal notation is used in the figure to represent intensity illumination, the intensity level is stored in the bit map of Alappat's system as a 4-bit binary number, with 0000 representing a pixel having no illumination and 1111 representing a pixel having maximum illumination.

Points 54 and 52 in Fig. 5A represent successive observation points on the screen of an oscilliscope. Without the benefit of Alappat's anti-aliasing system, points 54 and 52 would appear on the screen as separate, unconnected spots. In Alappat's system, the different intensity level at which each of

the pixels is illuminated produces the appearance of the line 48, a so-called vector.

The intensity at which each pixel is to be illuminated is determined as follows, using pixel 55 as an example. First, the vertical distance between the y coordinates of observation points 54 and 52(<<triangle>>y subi) is determined. In this example, this difference equals 7 units, with one unit representing the center-to-center distance of adjacent pixels. Then, the elevation of pixel 55 above pixel 54 (<<triangle>>y subi,j) is determined, which in this case is 2 units. The <<triangle>>y subi and <<triangle>>y subi, j j values are then "normalized," which Alappat describes as converting these values to larger values which are easier to use in mathematical calculations. In Alappat's example, a barrel shifter is used to shift the binary input to the left by the number of bits required to set the most significant (leftmost) bit of its output signal to "1." The <<triangle>>y subi and <<triangle>>y subi,j values are then plugged into a mathematical equation for determining the intensity at which the particular pixel is to be illuminated. In this particular example, the equation I'(i, j) = [1 - (<<triangle>>y subi,j /<< triangle>>>>>>>>>>>>>>>>>>>>>>y subi)]F, wherein F is 15 in hexadecimal notation, suffices. The intensity of pixel 55 in this example would thus be calculated as follows:
[1 - (2/7)]15 = (5/7)15 = 10.71 <<SYM>> 11 (or B).

Accordingly, pixel 55 is illuminated at 11/15 of the intensity of the pixels in which observation points 54 and 52 lie. Alappat discloses that the particular formula used will vary depending on the shape of the waveform.

B. The Rejected Claims

Claim 15, the only independent claim in issue, reads:

A rasterizer for converting vector list data representing sample magnitudes of an *1539 input waveform into anti-aliased pixel illumination intensity data to be displayed on a display means comprising:
(a) means for determining the vertical distance between the endpoints of each of the vectors in the data list;
(b) means for determining the elevation of a row of pixels that is spanned by the vector;
(c) means for normalizing the vertical distance and elevation; and
(d) means for outputting illumination intensity data as a predetermined function of the normalized vertical distance and elevation.

Each of claims 16-19 depends directly from claim 15 and more specifically defines an element of the rasterizer claimed therein. Claim 16 recites that means (a) for determining the vertical distance between the endpoints of each of the vectors in the data list, <<triangle>>y subi described above, comprises an arithmetic logic circuit configured to perform an absolute value function. Claim 17 recites that means (b) for determining the elevation of a row of pixels that is spanned by the vector, <<triangle>>y subi,j described above, comprises an arithmetic logic circuit configured to perform an absolute value function. Claim 18 recites that means (c) for normalizing the vertical distance and elevation comprises a pair of barrel shifters. Finally, claim 19 recites that means (d) for outputting comprises a read only memory (ROM) containing illumination intensity data. As the first Board panel found, each of (a)-(d) was a device known in the electronics arts before Alappat made his invention.

C. The Examiner's Rejection and Board Reviews

The Examiner's final rejection of claims 15-19 was under 35 U.S.C. ¤ 101 "because the claimed invention is non statutory subject matter," and the original three-member Board panel reversed this rejection. That Board panel held that, although claim 15 recites a mathematical algorithm, the claim as a whole is directed to a machine and thus to statutory subject matter named in

¤ 101. In reaching this decision, the original panel construed the means clauses in claim 15 pursuant to 35 U.S.C. ¤ 112, paragraph six (¤ 112 ¦ 6), as corresponding to the respective structures disclosed in the specification of Alappat's application, and equivalents thereof.

In its reconsideration decision, the five-member majority of the expanded, eight-member Board panel "modified" the decision of the original panel and affirmed the Examiner's ¤ 101 rejection. The majority held that the PTO need not apply ¤ 112 ¦ 6 in rendering patentability determinations, characterizing this court's statements to the contrary in In re Iwahashi, 888 F.2d 1370, 1375, 12 USPQ2d 1908, 1912 (Fed.Cir.1989), "as dicta," and dismissing this court's discussion of ¤ 112 ¦ 6 in Arrhythmia Research Technology, Inc. v. Corazonix Corp., 958 F.2d 1053, 1060, 22 USPQ2d 1033, 1038 (Fed.Cir.1992) on the basis that the rules of claim construction in infringement actions differ from the rules for claim interpretation during prosecution in the PTO. The majority stated that, during examination, the PTO gives means-plus-function clauses in claims their broadest interpretation and does not impute limitations from the specification into the claims. See Applicability of the Last Paragraph of 35 USC ¤ 112 to Patentability Determinations Before the Patent and Trademark Office, 1134 TMOG 633 (1992); Notice Interpreting In Re Iwahashi (Fed.Cir.1989), 1112 OG 16 (1990). Accordingly, the majority held that each of the means recited in claim 15 reads on any and every means for performing the particular function recited.

The majority further held that, because claim 15 is written completely in "means for" language and because these means clauses are read broadly in the PTO to encompass each and every means for performing the recited functions, claim 15 amounts to nothing more than a process claim wherein each means clause represents only a step in that process. The majority stated that each of the steps in this postulated process claim recites a mathematical operation, which steps combine to form a "mathematical algorithm for computing pixel information," Alappat, 23 USPQ2d at 1345, and that, "when the claim is viewed without the steps of this mathematical algorithm, no other elements or steps are *1540 found." Alappat, 23 USPQ2d at 1346. The majority thus concluded that the claim was directed to nonstatutory subject matter. [FN12]

FN12. See also Patent and Trademark Practice is Reviewed at PTO Day, 45 PTCJ 245, 246 (1993); IP Laws Attempt to Adapt to Changes of New Technologies, 45 PTCJ 49 (1993); Federal Circuit Will Hear In Re Alappat Case En Banc, 45 PTCJ 56 (1992); "Means For" Claim Recites Non- Statutory Algorithm When Treated as Method Claim, 44 PTCJ 69 (1992); MPEP ¤ 2110.

In its analysis, the majority further stated:

It is further significant that claim 15, as drafted, reads on a 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.

Alappat, 23 USPQ2d at 1345. [FN13] The Board majority also stated that dependent claims 16-19 were not before them for consideration because they had not been argued by Alappat and thus not addressed by the Examiner or the original three-member Board panel. Alappat, 23 USPQ2d at 1341 n. 1. [FN14]

FN13. See also PTO Report on Patentable Subject Matter: Mathematical Algorithms and Computer Programs, 1106 TMOG 5 (1989), reprinted in 38 PTCJ 551, 563 (1989).

FN14. Nevertheless, we note that the Examiner stated during prosecution: "the use of physical elements to provide the 'number crunching' is not considered patentable. The mere display of illumination intensity data is not considered significant post solution activity." 12/05/89 Office action, pg. 4. Thus, even if the specific structures recited in dependent claims 16-19 had been incorporated into claim 15, the Examiner presumably would have found claim 15 to be directed to nonstatutory subject matter.

D. Analysis

(1) Section 112, Paragraph Six

[17] As recently explained in In re Donaldson, 16 F.3d 1189, 1193, 29 USPQ2d 1845, 1050 (Fed.Cir.1994), the PTO is not exempt from following the statutory mandate of ¤ 112 ¦ 6, which reads:

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

35 U.S.C. ¤ 112, paragraph 6 (1988) (emphasis added). [FN15] The Board majority therefore erred as a matter of law in refusing to apply ¤ 112 ¦ 6 in rendering its ¤ 101 patentable subject matter determination.

FN15. Accord, In re Bond, 910 F.2d 831, 833, 15 USPQ2d 1566, 1568 (Fed.Cir.1990); In re Iwahashi, 888 F.2d 1370, 1375, 12 USPQ2d 1908, 1912 (Fed.Cir.1989); In re Meyer, 688 F.2d 789, 796, 215 USPQ 193, 199 (CCPA1982); In re Knowlton, 481 F.2d 1357, 1366, 178 USPQ 486, 492-93 (CCPA1973); In re Foster, 438 F.2d 1011, 1014, 169 USPQ 99, 102 (CCPA1971); In re Bernhart, 417 F.2d 1395, 1399, 163 USPQ 611, 615 (CCPA1969); In re Prater, 415 F.2d 1393, 1406, 162 USPQ 541, 551-52 (CCPA1969). See also generally R. Carl Moy, The Interpretation of Means Expressions During Prosecution, 68 JPOS 246 (1986).

[18] Given Alappat's disclosure, it was error for the Board majority to interpret each of the means clauses in claim 15 so broadly as to "read on any and every means for performing the functions" recited, as it said it was doing, and then to conclude that claim 15 is nothing more than a process claim wherein each means clause represents a step in that process. Contrary to suggestions by the Commissioner, this court's precedents do not support the Board's view that the particular apparatus claims at issue in this case may be viewed as nothing more than process claims. The cases relied upon by the Commissioner, namely, In re Abele, 684 F.2d 902, 214 USPQ 682 (CCPA 1982), In re Pardo, 684 F.2d 912, 214 USPQ 673 (CCPA 1982), In re Meyer, 688 F.2d 789, 215 USPQ 193 (CCPA 1982), In re Walter, 618 F.2d 758, 205 USPQ 397 (CCPA 1980), and In re Maucorps, *1541 609 F.2d 481, 203 USPQ 812 (CCPA 1979), differ from the instant case. In Abele, Pardo, and Walter, given the apparent lack of any supporting structure in the specification corresponding to the claimed "means" elements, the court reasonably concluded that the claims at issue were in effect nothing more than process claims in the guise of apparatus claims. This is clearly not the case now before us. As to Maucorps and Meyer, despite suggestions therein to the contrary, the claimed means-plus- function elements at issue in those cases were not construed as limited to those means disclosed in the specification and equivalents thereof. As reaffirmed in Donaldson, such claim construction is improper,

and therefore, those cases are of limited value in dealing with the issue presently before us. We further note that Maucorps dealt with a business methodology for deciding how salesmen should best handle respective customers and Meyer involved a "system" for aiding a neurologist in diagnosing patients. Clearly, neither of the alleged "inventions" in those cases falls within any ¤ 101 category.

When independent claim 15 is construed in accordance with ¤ 112 ¦ 6, claim 15 reads as follows, the subject matter in brackets representing the structure which Alappat discloses in his specification as corresponding to the respective means language recited in the claims:

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

(a) [an arithmetic logic circuit configured to perform an absolute value function, or an equivalent thereof] for determining the vertical distance between the endpoints of each of the vectors in the data list;

(b) [an arithmetic logic circuit configured to perform an absolute value function, or an equivalent thereof] for determining the elevation of a row of pixels that is spanned by the vector;

(c) [a pair of barrel shifters, or equivalents thereof] for normalizing the vertical distance and elevation; and

(d) [a read only memory (ROM) containing illumination intensity data, or an equivalent thereof] for outputting illumination intensity data as a predetermined function of the normalized vertical distance and elevation.

As is evident, claim 15 unquestionably recites a machine, or apparatus, made up of a combination of known electronic circuitry elements.

Despite suggestions by the Commissioner to the contrary, each of dependent claims 16-19 serves to further limit claim 15. Section 112 ¦ 6 requires that each of the means recited in independent claim 15 be construed to cover at least the structure disclosed in the specification corresponding to the "means." Each of dependent claims 16-19 is in fact limited to one of the structures disclosed in the specification.

(2) Section 101

[19] The reconsideration Board majority affirmed the Examiner's rejection of claims 15-19 on the basis that these claims are not directed to statutory subject matter as defined in ¤ 101, which reads:

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

As discussed in section II.D.(1), supra, claim 15, properly construed, claims a machine, namely, a rasterizer "for converting vector list data representing sample magnitudes of an input waveform into anti-aliased pixel illumination intensity data to be displayed on a display means," which machine is made up of, at the very least, the specific structures disclosed in Alappat's specification corresponding to the means-plus-function elements (a)-(d) recited in the claim. According to Alappat, the claimed rasterizer performs the same overall function as prior art rasterizers, [FN16] but does so in a different way, *1542 which is represented by the combination of four elements claimed in means-plus-function terminology. [FN17] Because claim 15 is directed to a "machine," which is one of the four categories of patentable subject matter enumerated in ¤ 101, claim 15 appears on its face to be directed to ¤ 101 subject matter.

FN16. Representative examples of prior art rasterizers are illustrated in U.S. Patent No. 4,215,414, U.S. Patent No. 4,540,938, U.S. Patent No. 4,586,037, and U.S. Patent No. 4,672,369.

FN17. Alappat further notes that the Examiner found the particularly claimed combination to be patentably distinct from prior art rasterizers.

[20] This does not quite end the analysis, however, because the Board majority argues that the claimed subject matter falls within a judicially created exception to ¤ 101 which the majority refers to as the "mathematical algorithm" exception. Although the PTO has failed to support the premise that the "mathematical algorithm" exception applies to true apparatus claims, we recognize that our own precedent suggests that this may be the case. See In re Johnson, 589 F.2d 1070, 1077, 200 USPQ 199, 206 (CCPA 1978) ("Benson [referring to Gottschalk v. Benson, 409 U.S. 63, 93 S.Ct. 253, 34 L.Ed.2d 273 (1972)] applies equally whether an invention is claimed as an apparatus or process, because the form of the claim is often an exercise in drafting."). Even if the mathematical subject matter exception to ¤ 101 does apply to true apparatus claims, the claimed subject matter in this case does not fall within that exception.
(a)

[21] The plain and unambiguous meaning of ¤ 101 is that any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may be patented if it meets the requirements for patentability set forth in Title 35, such as those found in ¤¤ 102, 103, and 112. The use of the expansive term "any" in ¤ 101 represents Congress's intent not to place any restrictions on the subject matter for which a patent may be obtained beyond those specifically recited in ¤ 101 and the other parts of Title 35. Indeed, the Supreme Court has acknowledged that Congress intended ¤ 101 to extend to "anything under the sun that is made by man." Diamond v. Chakrabarty, 447 U.S. 303, 309, 100 S.Ct. 2204, 2208, 65 L.Ed.2d 144 (1980), quoting S.Rep. No. 1979, 82nd Cong., 2nd Sess., 5 (1952); H.R.Rep. No. 1923, 82nd Cong., 2nd Sess., 6 (1952). Thus, it is improper to read into ¤ 101 limitations as to the subject matter that may be patented where the legislative history does not indicate that Congress clearly intended such limitations. See Chakrabarty, 447 U.S. at 308, 100 S.Ct. at 2207 ("We have also cautioned that courts 'should not read into the patent laws limitations and conditions which the legislature has not expressed.' "), quoting United States v. Dubilier Condenser Corp., 289 U.S. 178, 199, 53 S.Ct. 554, 561, 77 L.Ed. 1114 (1933).
[22][23] Despite the apparent sweep of ¤ 101, the Supreme Court has held that certain categories of subject matter are not entitled to patent protection. In Diamond v. Diehr, 450 U.S. 175, 101 S.Ct. 1048, 67 L.Ed.2d 155 (1981), its most recent case addressing ¤ 101, the Supreme Court explained that there are three categories of subject matter for which one may not obtain patent protection, namely "laws of nature, natural phenomena, and abstract ideas." Diehr, 450 U.S. at 185, 101 S.Ct. at 1056. [FN18] Of relevance *1543 to this case, the Supreme Court also has held that certain mathematical subject matter is not, standing alone, entitled to patent protection. See Diehr, 450 U.S. 175, 101 S.Ct. 1048; Parker v. Flook, 437 U.S. 584, 98 S.Ct. 2522, 57 L.Ed.2d 451; Gottschalk v. Benson, 409 U.S. 63, 93 S.Ct. 253, 34 L.Ed.2d 273. [FN19] A close analysis of Diehr, Flook, and Benson reveals that the Supreme Court never intended to create an overly broad, fourth category of subject matter excluded from ¤ 101. Rather, at the core of the Court's analysis in each of these cases lies an attempt by the Court to explain a rather straightforward concept, namely, that certain types of mathematical subject matter, standing alone, represent nothing more than abstract ideas until reduced to some type of practical application, and thus

that subject matter is not, in and of itself, entitled to patent protection. [FN20]

FN18. Laws of nature and natural phenomena are in essence "manifestations of ... nature [i.e., not "new"], free to all men and reserved exclusively to none," see Chakrabarty 447 U.S. at 309, 100 S.Ct. at 2208, quoting Funk Bros. Seed Co. v. Kalo Inoculant Co., 333 U.S. 127, 130, 68 S.Ct. 440, 441, 92 L.Ed. 588 (1948), whereas abstract ideas constitute disembodied concepts or truths which are not "useful" from a practical standpoint standing alone, i.e., they are not "useful" until reduced to some practical application. Of course, a process, machine, manufacture, or composition of matter employing a law of nature, natural phenomenon, or abstract idea may be patentable even though the law of nature, natural phenomenon, or abstract idea employed would not, by itself, be entitled to such protection. See e.g. Parker v. Flook, 437 U.S. 584, 590, 98 S.Ct. 2522, 2526, 57 L.Ed.2d 451 (1978) ("a process is not unpatentable simply because it contains a law of nature or a mathematical algorithm."); Funk Bros. Seed, 333 U.S. at 130, 68 S.Ct. at 441 ("He who discovers a hitherto unknown phenomenon of nature has no claim to a monopoly of it which the law recognizes. If there is to be invention from such a discovery, it must come from the application of the law to a new and useful end."); Mackay Radio & Telegraph Co. v. Radio Corp. of America, 306 U.S. 86, 94, 59 S.Ct. 427, 431, 83 L.Ed. 506 (1939) ("While a scientific truth, or the mathematical expression of it, is not a patentable invention, a novel and useful structure created with the aid of knowledge of scientific truth may be.").

FN19. The Supreme Court has not been clear, however, as to whether such subject matter is excluded from the scope of ¤ 101 because it represents laws of nature, natural phenomena, or abstract ideas. See Diehr, 450 U.S. at 186, 101 S.Ct. at 1056 (viewed mathematical algorithm as a law of nature); Benson, 409 U.S. at 71-72, 93 S.Ct. at 257 (treated mathematical algorithm as an "idea"). The Supreme Court also has not been clear as to exactly what kind of mathematical subject matter may not be patented. The Supreme Court has used, among others, the terms "mathematical algorithm," "mathematical formula," and "mathematical equation" to describe types of mathematical subject matter not entitled to patent protection standing alone. The Supreme Court has not set forth, however, any consistent or clear explanation of what it intended by such terms or how these terms are related, if at all.

FN20. The Supreme Court's use of such varying language as "algorithm," "formula," and "equation" merely illustrates the understandable struggle that the Court was having in articulating a rule for mathematical subject matter, given the esoteric nature of such subject matter and the various definitions that are attributed to such terms as "algorithm," "formula," and "equation," and not an attempt to create a broad fourth category of excluded subject matter.

[24] Diehr also demands that the focus in any statutory subject matter analysis be on the claim as a whole. Indeed, the Supreme Court stated in Diehr:

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

Diehr, 450 U.S. at 192, 101 S.Ct. at 1059-60 (emphasis added). In re Iwahashi, 888 F.2d at 1375, 12 USPQ2d at 1911; In re Taner, 681 F.2d 787, 789, 214 USPQ 678, 680 (CCPA 1982). It is thus not necessary to determine whether a claim contains, as merely a part of the whole, any mathematical subject matter which standing alone would not be entitled to patent protection. Indeed, because the dispositive inquiry is whether the claim as a whole is directed to statutory subject matter, it is irrelevant that a claim may contain, as part of the whole, subject matter which would not be patentable by itself. [FN21] "A claim *1544 drawn to subject matter otherwise statutory does not become nonstatutory simply because it uses a mathematical formula, [mathematical equation, mathematical algorithm,] computer program or digital computer." Diehr, 450 U.S. at 187, 101 S.Ct. at 1057.

FN21. We note, however, that an analysis wherein one attempts to identify whether any part of a claim recites mathematical subject matter which would not by itself be patentable is not an improper analysis. Such a dissection of a claim may be helpful under some circumstances to more fully understand the claimed subject matter. Nevertheless, even in those cases wherein courts have applied a variant of the two-part analysis of In re Freeman, 573 F.2d 1237, 197 USPQ 464 (CCPA1978), as amended by In re Walter, 618 F.2d 758, 205 USPQ 397, the ultimate issue always has been whether the claim as a whole is drawn to statutory subject matter. See e.g. In re Grams, 888 F.2d at 838, 12 USPQ2d at 1827; In re Meyer, 688 F.2d at 796, 215 USPQ at 198; In re Pardo, 684 F.2d at 915, 214 USPQ at 676; In re Abele, 684 F.2d at 907, 214 USPQ at 687; In re Walter, 618 F.2d at 767, 205 USPQ at 407. In In re Pardo, the CCPA described the Freeman-Walter two-part test as follows: "First, the claim is analyzed to determine whether a mathematical algorithm is directly or indirectly recited. Next, if a mathematical algorithm is found, the claim as a whole is further analyzed to determine whether the algorithm is 'applied in any manner to physical elements or process steps,' and, if it is, it 'passes muster under ¤ 101.' " In re Pardo, 684 F.2d at 915, 214 USPQ at 675-76 (emphasis added) (quoting In re Walter, 618 F.2d at 767, 205 USPQ at 407.).

(b)

[25] Given the foregoing, the proper inquiry in dealing with the so called mathematical subject matter exception to ¤ 101 alleged herein is to see whether the claimed subject matter as a whole is a disembodied mathematical concept, whether categorized as a mathematical formula, mathematical equation, mathematical algorithm, or the like, which in essence represents nothing more than a "law of nature," "natural phenomenon," or "abstract idea." If so, Diehr precludes the patenting of that subject matter. That is not the case here.

Although many, or arguably even all, [FN22] of the means elements recited in claim 15 represent circuitry elements that perform mathematical calculations, which is essentially true of all digital electrical circuits, the claimed invention as a whole is directed to a combination of interrelated elements which combine to form a machine for converting discrete waveform data samples into anti-aliased pixel illumination intensity data to be displayed on a display means. [FN23] This is not a disembodied mathematical concept which may be characterized as an "abstract idea," but rather a specific machine to produce a useful, concrete, and tangible result.

FN22. The Board majority stated that each of the means of claim 15 represents a mathematical operation. The majority failed, however, to point out any

particular mathematical equations corresponding to elements (c) and (d) of claim 15. In addition, we note the Board majority's irreconcilable position that it is free to impute mathematical equations from Alappat's specification into claim 15, yet it refuses to impute the electrical structure designed to carry out the arithmetic operations.

FN23. Although means (a) and (b) are independent of each other as claimed, each utilizes the same inputs and is connected to element (c), as means (c) normalizes the output of means (a) and (b). Means (c) is in turn connected to means element (d) which outputs illumination intensity data in response to an input from means (c).

[26] The fact that the four claimed means elements function to transform one set of data to another through what may be viewed as a series of mathematical calculations does not alone justify a holding that the claim as a whole is directed to nonstatutory subject matter. See In re Iwahashi, 888 F.2d at 1375, 12 USPQ2d at 1911. [FN24] Indeed, claim 15 as written is not "so abstract and sweeping" that it would "wholly pre-empt" the use of any apparatus employing the combination of mathematical calculations recited therein. See Benson, 409 U.S. at 68-72, 93 S.Ct. at 255-58 (1972). Rather, claim 15 is limited to the use of a particularly claimed combination of elements performing the particularly claimed combination of calculations to transform, i.e., rasterize, digitized waveforms (data) into anti-aliased, pixel illumination data to produce a smooth waveform.

FN24. The Board majority's attempts to distinguish Iwahashi on the basis that the claim at issue in that case recited a ROM are unavailing. The Iwahashi court clearly did not find patentable subject matter merely because a ROM was recited in the claim at issue; rather the court held that the claim as whole, directed to the combination of the claimed means elements, including the claimed ROM as one element, was directed to statutory subject matter. It was not the ROM alone that carried the day.

[27] Furthermore, the claim preamble's recitation that the subject matter for which Alappat seeks patent protection is a rasterizer for creating a smooth waveform is not a mere field-of-use label having no significance. Indeed, the preamble specifically recites that the claimed rasterizer converts waveform data into output illumination data for a display, and the means elements recited in the body of the claim make reference not only to the inputted waveform data recited in the preamble but also to the output illumination data also recited in the preamble. Claim 15 thus defines a combination of elements constituting a machine for producing an anti-aliased waveform.

[28] The reconsideration Board majority also erred in its reasoning that claim 15 is unpatentable merely because it "reads on a general purpose digital computer 'means' to perform the various steps under program *1545 control." [FN25] Alappat, 23 USPQ2d at 1345. The Board majority stated that it would "not presume that a stored program digital computer is not within the ¤ 112 ¦ 6 range of equivalents of the structure disclosed in the specification." [FN26] Alappat, 23 USPQ2d at 1345. Alappat admits that claim 15 would read on a general purpose computer programmed to carry out the claimed invention, but argues that this alone also does not justify holding claim 15 unpatentable as directed to nonstatutory subject matter. We agree. We have held that such programming creates a new machine, because a general purpose computer in effect becomes a special purpose computer once it is programmed to perform particular functions pursuant to instructions from program software. In re Freeman, 573 F.2d 1237, 1247 n. 11, 197 USPQ 464,

472 n. 11 (CCPA 1978); In re Noll, 545 F.2d 141, 148, 191 USPQ 721, 726 (CCPA 1976); In re Prater, 415 F.2d at 1403 n. 29, 162 USPQ at 549-50 n. 29.

FN25. The Board majority argued that the fact that claim 15 reads on a programmed digital computer further justifies treating claim 15 as a process claim. We disagree. Our discussion in section II.D.(1) sufficiently sets forth why claim 15 must be construed as an apparatus claim as it is illustrated in section II.D.(2).

FN26. The disclosed ALU, ROM and shift registers are all common elements of stored program digital computers.

Under the Board majority's reasoning, a programmed general purpose computer could never be viewed as patentable subject matter under ¤ 101. This reasoning is without basis in the law. The Supreme Court has never held that a programmed computer may never be entitled to patent protection. Indeed, the Benson court specifically stated that its decision therein did not preclude "a patent for any program servicing a computer." Benson, 409 U.S. at 71, 93 S.Ct. at 257. Consequently, a computer operating pursuant to software may represent patentable subject matter, provided, of course, that the claimed subject matter meets all of the other requirements of Title 35. In any case, a computer, like a rasterizer, is apparatus not mathematics.
CONCLUSION

For the foregoing reasons, the appealed decision of the Board affirming the examiner's rejection is
REVERSED.

ARCHER, Chief Judge, [FN1] with whom NIES, Circuit Judge, joins, concurring in part and dissenting in part.

FN1. Chief Judge Archer assumed the position of Chief Judge on March 18, 1994.

I. OUR JURISDICTION

None of the parties has challenged at any time the legality of the composition of the board, and, in fact, both parties to this appeal defend the procedure by which the board was composed. According to our precedent and that of the Supreme Court, a challenge to the validity of the board's composition is a procedural matter that can be waived by the parties. It is not a "jurisdictional" matter. But even if some sua sponte jurisdictional inquiry into the composition of the board were permissible, it must be strictly limited to the single question whether 35 U.S.C. ¤ 7 has been clearly contravened.
Because we should not be deciding the so-called issue of "jurisdiction" at all in this case, and alternatively because I am not persuaded that the statute clearly has been violated, I concur in the conclusion of the majority that Alappat's appeal is from a final decision of the board within the meaning of our jurisdictional statute, 28 U.S.C. ¤ 1295(a)(4)(A); see also 35 U.S.C. ¤ 141, and that therefore the merits of Alappat's [FN2] appeal are properly before us for disposition.

FN2. Throughout this opinion I shall refer to appellants Kuriappan P. Alappat, Edward E. Averill, and James G. Larsen collectively in the singular as "Alappat."

A.

Issues arising out of the combination of adjudicative and administrative functions within a single administrative agency, such *1546 as partiality of adjudicative officers and unfairness to parties, are by no means uncommonly litigated. See S. Breyer & R. Stewart, Administrative Law and Regulatory Policy 815-900 (3d ed. 1992); C. Koch, Administrative Practice and Procedure 324-75 (2d ed. 1991). Here, two questions have been raised arising out of such a combination of functions: (1) may an expanded panel of members of the Board of Patent Appeals and Interferences, designated by the Commissioner of Patents and Trademarks, grant an examiner's petition for reconsideration; and (2) may that expanded panel rehear an appeal and render a decision thereon?

What makes this case unusual, however, is that only the court has raised these questions. The Patent and Trademark Office rendered what it viewed to be final action on Alappat's appeal in his application for a patent--rejection of claims 15-19--and Alappat and the Commissioner both desire judicial resolution of whether this action was correct on the merits. Regardless of our view, the party appealing from the agency action does not feel at all that the agency gave him inadequate process. [FN3]

FN3. As the majority recognizes, Alappat does not challenge the action of the Commissioner or board under, for example, the Administrative Procedure Act, 5 U.S.C. ¤ 551 et seq, the Due Process Clause of the Fifth Amendment of the Constitution, or as part of its appeal on the merits of the board's decision, e.g., In re Bose Corp., 772 F.2d 866, 227 USPQ 1 (Fed.Cir.1985).

Administrative agencies' sole source of power to act is statutory; therefore any unlawful act of an administrative agency is in a sense performed without jurisdiction. But not every act of the Commissioner or the board that might possibly be contrary to a constitutional, statutory, or regulatory provision raises a jurisdictional matter that must be addressed in every case.

Beyond any constitutional restraints, there is good reason not to decide the procedural issues that are not disputed by the parties. Where the parties have not challenged the agency's action, and when asked, both parties argue to support it, the court lacks the benefit of advocacy that a controversy otherwise engenders and should proceed with caution in setting out any very-broad rules. In addition, the agency has not been given an opportunity to resolve or consider the challenge in the first instance, and this court might be condemning the agency for action which, had objection been raised, it might not have taken or done differently.

B.

Precedent precludes us from holding that the composition of the agency's board is illegal where none of the parties has raised the issue. Therefore, we need not and should not address whether the board was composed according to law.

In United States v. L.A. Tucker Truck Lines, Inc., 344 U.S. 33, 73 S.Ct. 67, 97 L.Ed. 54 (1952), the Supreme Court held that a decision of the Interstate Commerce Commission rendered by an invalidly appointed hearing examiner was not an error "which deprives the Commission of power or jurisdiction, so that even in the absence of timely objection its order should be set aside as a

nullity." 344 U.S. at 38. The Supreme Court cautioned: "[C]ourts should not topple over administrative decisions unless the administrative body not only has erred but has erred against objection made at the time appropriate under its practice." Id. at 37, 73 S.Ct. at 69. Tucker Truck Lines has recently been interpreted by Justice Scalia as holding "that, in the administrative context, the use of unauthorized personnel to conduct a hearing ... would not justify reversal of the agency decision where no objection was lodged before the agency itself." Freytag v. Commissioner of Internal Revenue, 501 U.S. 868, 898 n. 3, 111 S.Ct. 2631, 2649 n. 3, 115 L.Ed.2d 764 (1991) (Scalia, J., concurring).

Our predecessor court the Court of Customs and Patent Appeals expressly followed Tucker Truck Lines in a case involving a situation similar to Alappat's, In re Wiechert, 370 F.2d 927, 152 USPQ 247 (CCPA 1967). Wiechert involved an appeal from a Patent Office Board of Appeals decision. The court in Wiechert refused to consider the question whether a board composed of an examiner-in-chief, a primary examiner, and a supervisory examiner of higher grade than a primary examiner, was illegal under 35 U.S.C. *1547 ¤ 7. The stated reason was that the parties had not properly raised the issue in the appeal from the merits of that board's decision. Citing Tucker Truck Lines we held: "[A]n invalid appointment [of a board member by the Commissioner] would not so vitiate a board's decision that neither waiver nor abandonment of the defect would be possible." Id. at 936 n. 6, 152 USPQ at 253 n. 6. [FN4] Wiechert expressly holds that a defect in the composition of the board is a waivable matter.

FN4. We are not the only circuit to have so held. See NLRB v. Newton-New Haven Co., 506 F.2d 1035, 1038 (2d Cir.1974) (party can abandon challenge to illegality of composition of NLRB); We Shung v. Brownell, 207 F.2d 132, 133 (D.C.Cir.) (party can abandon challenge to composition of immigration Board of Special Inquiry), vacated on other grounds, 346 U.S. 906, 74 S.Ct. 237, 98 L.Ed. 405 (1953).

We followed Wiechert in later cases. In In re Marriott-Hot Shoppes, Inc., 411 F.2d 1025, 162 USPQ 106 (CCPA 1969), the Court of Customs and Patent Appeals refused to consider the question whether the Trademark Trial and Appeal Board was by statute or regulation required to be composed of all of its members in order to hear an appeal and render a decision, where the appellant had not appealed the merits of the allegedly improperly constituted board's decision. The court stated:

While we might be able to reach that question [whether three-member panels of the board had or have jurisdiction to hear ex parte appeals in the sense of being legally constituted boards], if properly raised, in an appeal from one or more board decisions on the merits of the applications, In re Wiechert, 370 F.2d 927, 54 CCPA 957 (1967), appellant has made it amply clear that this is not such an appeal....

411 F.2d at 1029, 162 USPQ at 110 (emphasis added, footnote and original emphasis omitted). [FN5] So too here Alappat has "made it amply clear" that he is not challenging the board composition.

FN5. The statutes relating to the composition of the Trademark Trial and Appeal Board and the Commissioner's powers vis-a-vis that board are, for purposes of the issues here involved, substantially the same as the statute relating to the Board of Patent Appeals and Interferences. Compare 35 U.S.C. ¤ 7 (patents) with 15 U.S.C. ¤¤ 1067, 1070 (trademarks).

And lastly, in In re Bose Corp., 772 F.2d 866, 227 USPQ 1 (Fed.Cir.1985), the appellant challenged the composition of the Trademark Trial and Appeal

Board as part of its appeal on the merits. In addition to appealing from the board decision on its merits, the appellant argued that that board was improperly constituted because the Commissioner substituted one of the three members for another member after oral argument but before the decision of the board. [FN6] We permitted the appellant to challenge the composition of the board, following Marriott and Wiechert, and stated: "The matter of the board's composition is ... inseparable from the merits and can be raised in the appeal from the board's decision." 772 F.2d at 869, 227 USPQ at 3. We characterized the alleged illegality of the board, not as a defect that could void the board decision, but merely as a "technical claim of procedural error" subject to the harmless error rule. Id. at 870, 227 USPQ at 4.

FN6. Compare MPEP ¤ 1201 (1993): If a board member becomes incapacitated after a hearing but before the decision, the Chairman of the Board, at his discretion, may without rehearing substitute a different board member for the incapacitated one, or offer the applicant an opportunity for rehearing; if a member becomes unavailable to reconsider a decision, normally the Chairman of the Board will designate another member as a substitute.

Under the Wiechert-Marriott-Bose decisions, a party can waive a challenge to the legality of the composition of the board. Since that has been done in this case, we are precluded from considering any composition question not raised in the appeal brought under 28 U.S.C. ¤ 1295(a)(4)(A). Wiechert is binding precedent unless we overrule it in banc. South Corp. v. United States, 690 F.2d 1368, 1369, 215 USPQ 657, 657 (Fed.Cir.1982) (in banc). Although the other judges address the board composition questions that have not been raised by the parties, in apparent contravention of Wiechert, they do not *1548 explain why they may do so. [FN7] I believe that stare decisis demands that this court either adhere to Wiechert in this case or expressly justify its overruling. Therefore, I would not address the board composition question at all.

FN7. Any reliance on In re Bose to reach the composition question in the present case is misplaced. The CCPA's decision in Wiechert precludes consideration of composition questions that are not properly raised by the parties, and the Federal Circuit's later panel decision in Bose could not have overruled that CCPA decision. In any event, Bose was consistent with Wiechert 's holding that board composition challenges are waivable because the party in Bose challenged the composition of the board as a procedural challenge raised as part of its appeal from the merits of the board's decision. In the present case, however, Alappat has purposefully waived the procedural challenge and therefore Wiechert applies, not Bose.

C.

Even if it were permissible and appropriate to treat the composition of this board as a jurisdictional matter, I am not persuaded that any statutory provision has clearly been violated. 35 U.S.C. ¤¤ 6 and 7 set out the administrative and adjudicative functions within the Patent and Trademark Office. They provide as follows: "The Commissioner [of Patents and Trademarks] ... shall superintend or perform all duties required by law respecting the granting and issuing of patents.... He may ... establish regulations, not inconsistent with law, for the conduct of proceedings in the Patent and Trademark Office." 35 U.S.C. ¤ 6(a). "The Commissioner, the Deputy Commissioner, the Assistant Commissioners, and the examiners-in-chief shall constitute the Board of Patent Appeals and Interferences." Id. ¤ 7(a). "The Board of Patent Appeals and Interferences shall, on written

appeal of an applicant, review adverse decisions of examiners upon applications for patents...." Id. ¤ 7(b). "Each appeal ... shall be heard by at least three members of the Board of Patent Appeals and Interferences, who shall be designated by the Commissioner." Id. "Only the Board of Patent Appeals and Interferences has the authority to grant rehearings." Id.

Two other statutes are relevant: "An applicant dissatisfied with the decision in an appeal to the Board of Patent Appeals and Interferences ... may appeal the decision to" this court. 35 U.S.C. ¤ 141. This court has "jurisdiction ... of an appeal from a decision of ... the Board of Patent Appeals and Interferences." 28 U.S.C. ¤ 1295(a)(4)(A).

There is no question but that the board had subject matter jurisdiction of Alappat's appeal, that the parties regard the expanded reconsideration board's decision to be the final "decision in [Alappat's] appeal to the Board," 35 U.S.C. ¤ 141, and that that "decision of ... the Board" was appealed to us. There is no question but that all the persons who sat as the expanded panel which rendered the appealed-from decision were statutory members of the board, 35 U.S.C. ¤ 7(a), [FN8] and that the number of members was greater than two, id. ¤ 7(b). There has been no showing that these particular members were designated to act for the board by a person other than the Commissioner of Patents and Trademarks, id. ¤ 7(b). Finally, there is no question but that a group designated by the Commissioner to act for the board consisting of more than two statutory members of the board granted a petition so as to rehear an initial appeal, and that that group rendered a decision thereon.

FN8. The members of the reconsideration board were the Commissioner of Patents and Trademarks, the Deputy Commissioner, an Assistant Commissioner, the Board Chairman and Vice-Chairman, and three examiners-in- chief.

The precise question then is whether the board that granted the rehearing and rendered a decision was designated by the Commissioner of Patents and Trademarks in a manner clearly prohibited by the enabling statute. In determining sua sponte whether there has been a "decision of ... the Board," we are not to be guided by general considerations of whether the board's or Commissioner's actions were fair or in compliance with due process, or the product of bias, prejudice, partiality, or the like. These are important procedural matters but only the parties may properly raise them; they are not matters for us to raise and impose on the parties.

*1549 35 U.S.C. ¤ 7(b) states expressly that for "each appeal" to the board, the persons that may hear that appeal and act as the board are to be designated by the Commissioner at his discretion (so long as he chooses at least three members from the set defined in ¤ 7(a)). The statute then says "[o]nly" the board has authority to grant a rehearing. Then, the statute stops.

Consequently ¤ 7 says nothing about the rehearing itself. Unlike for "each appeal," the statute does not expressly describe how "the board" is to grant rehearings and is totally silent on who may act as the board to rehear the appeal. The "board" must act through people, its members. Thus, the language of the last sentence of ¤ 7(b) could be interpreted to mean that only all the members of the board acting together have authority to grant rehearings (and perhaps must also vote unanimously in order to decide the merits of the rehearing), or the statute could be interpreted to mean that only the members of the board who first heard the appeal have authority to grant rehearing. [FN9] Or, if the "rehearing" is considered to be a form of "appeal," the statute must be interpreted to mean that the Commissioner may designate members of the board who, acting together, are the only ones to have authority to grant rehearings and decide appeals. Though reasonable

persons may disagree as to which of the above is the better or best interpretation, none is compelled or prohibited by the sparse language contained in the statute. In the backdrop of these possible interpretations are 35 U.S.C. ¤ 6, which gives the Commissioner broad administrative powers, and 35 U.S.C. ¤ 7, which contemplates that the Commissioner will play some but not a controlling role in the adjudicative aspect of the agency. See Lindberg v. Brenner, 399 F.2d 990, 158 USPQ 380 (D.C.Cir.1968).

FN9. Under either of these interpretations, ¤ 7 would still offer no guidance whatsoever on the actual rehearing itself.

Finally, the legislative history of ¤ 7 does not clearly advance the narrowest interpretation of the Commissioner's powers. Although the legislative history shows a transfer of some functions from the Commissioner to a Board of Patent Appeals, there is nothing indicating that the board was to be completely independent of the influence of the Commissioner. Originally, under the first patent act, a board composed of the Secretary of State, the Secretary of the Department of War, and the Attorney General, or any two of them, examined and issued patents. Act of April 10, 1790, ch. 7, ¤ 1, 1 Stat. 109, 109-10. The refusal of a petition for patent had no appeal. It was said that Thomas Jefferson, then Secretary of State, dominated the board with his high standards of patentability. W. Wyman, Thomas Jefferson and the Patent System, 1 J.Pat.Off.Soc'y 5 (1918), cited in R. Hantman, The Doctrine of Equivalents, 70 J.Pat.Off.Soc'y 511, 513 (1988); see Graham v. John Deere Co., 383 U.S. 1, 7-10, 86 S.Ct. 684, 688-90, 15 L.Ed.2d 545, 148 USPQ 459, 463-64 (1966). In 1793, Congress dispensed with examination altogether: if a petition to the Secretary of State met the formal technical requirements of the statute, a patent was granted, leaving the responsibility for striking down invalid patents to the courts. Patent Act of 1793, ch. 11, ¤ 3, 1 Stat. 318-23. Concerned with the need for examination, the Patent Act of 1836, ch. 357, 5 Stat. 117, established the Patent Office as a distinct bureau with a Commissioner of Patents as its head. Until 1861, the Commissioner heard all appeals from applicants for patents dissatisfied with an ex parte rejection by an examiner.

In 1861, Congress established a board of three examiners-in-chief to hear appeals from examiners' rejections in order to secure "greater uniformity of action in the grant and refusal of letters-patent" and to assist the Commissioner with appellate work. Act of March 12, 1861, ch. 88, ¤ 2, 12 Stat. 246. A further appeal could be taken from the board to "the Commissioner of Patents in person." Id. The Commissioner's power under this scheme was understood to be plenary:

The allowance of an application by the examiner, or by the examiners-in-chief upon appeal, does not oblige the Commissioner to grant the patent for which it *1550 prays. The law empowers him to withhold a patent whenever in his judgment the invention is not patentable, or the issue of the patent is forbidden by the statutes, or the patent if granted would probably be held invalid by the courts.

W. Robinson, The Law of Patents ¤ 583 (1890). [FN10]

FN10. Although we need not decide, Congress may intend that it still be plenary under the present statute. See infra, Senate Report No. 1313, at 4.

With the increasing number of patent applications being filed, the two levels of appeal within the Patent Office were thought to be an "antiquated procedure." H.R.Rep. No. 1889, 69th Cong., 2d Sess. 1-2 (1927); S.Rep. No. 1313, 69th Cong., 2d Sess. 3 (1927). By Act of 1927, the two levels of appeal--first to a board then to the Commissioner--were combined into one

appeal mixing the flavor of the earlier two: an appeal could be had to a Board of Appeals; the board was given the "sole power to grant rehearings." Act of March 2, 1927, ch. 273, ¤ 3, 44 Stat. 1335, 1335-36. But, under the Act of 1927, the Commissioner was one of the members of the board, and the Commissioner was given the power to designate at least three members of the board who together would act as the board and hear each appeal. The Act of 1927 corresponds in substance to 35 U.S.C. ¤ 7, the act applicable today.

The events surrounding the enactment of the 1927 Act do not indicate that Congress intended to eliminate entirely the great power understood to have been possessed by the Commissioner prior to the act. For example, during debate in the House of Representatives it was agreed that the statute did not require the entire membership of the board to act on and decide every rehearing, which of course would be unmanageable. Procedure in the Patent Office: Hearing Before the House Comm. on Patents, 69th Cong., 2d Sess. 19-29 (1926) (statement of Mr. Barnett, President, American Patent Law Association). On the other hand, discussions in the Senate focused on the ability under the statute to have in appropriate cases more than the original three-member panel rehear an appeal. Procedure in the Patent Office: Hearing Before the Senate Comm. on Patents, 69th Cong., 2d Sess. 22-23 (1926) ("Senate Hearing "). As previously discussed, the language of the statute is unclear on the manner of exercising the "power to grant rehearings," and is silent on the rehearing itself. This lack of clear expression is what could have enabled the House and Senate to view the prospective legislation as permitting either the full board or less than the full board to rehear a case, notwithstanding the inclusion of the word "sole." In other words, by requiring the "board" to be the formal body to act on rehearings, instead of the Commissioner, yet at the same time reposing in the Commissioner discretionary power to define that board within certain express confines, the statute created "something that is flexible," Senate Hearing, supra, at 23. In this way, the Senate was able to report that "the supervisory power of the Commissioner, as it has existed for a number of decades, remains unchanged." Senate Report No. 1313, at 4 (emphasis added).

Because the decision appealed in this case was not obtained in clear contravention of ¤ 7, and because the parties agree that it was a decision of the board that should be reviewed, I would decline to analyze further the board composition issue. By doing so, this court would not be announcing as does the majority that in all respects it approves the manner by which the rehearing was granted in this case or in another similar case. Nor would it be condemning as does the dissent the Commissioner or board for supposedly prejudicing or treating unfairly a party who has not complained of any prejudice or mistreatment. It may well be that a party could successfully challenge the procedures used in composing the board to hear an appeal in a case similar to this one, for example, by petition to the Commissioner, under the Administrative Procedure Act in a district court, as part of an appeal from the merits of the board's decision, etc. [FN11] That, *1551 however, should appropriately be left for another day.

FN11. For example, a case in which the Commissioner designated a panel to rehear a case in order to redo what the Commissioner believed to be incorrect historical fact-finding might well be deemed arbitrary and capricious.

II. THE SECTION 101 REJECTION

A.

I disagree with the majority's conclusion that Alappat's "rasterizer," which is all that is claimed in the claims at issue, constitutes an invention or discovery within 35 U.S.C. ¤ 101. I would affirm the board's decision

sustaining the examiner's rejection of claims 15-19 to the rasterizer under 35 U.S.C. ¤ 101 because Alappat has not shown that he invented or discovered a machine within ¤ 101.

In 1873, George Curtis made certain general observations about patent law, the scope of patentable subject matter being at its heart. He stated them with such force and eloquence, and in my view they have such relevance to the issue we face today, that I repeat them as follows:

It is necessary ... to have clear and correct notions of the true scope of a patent right ... which may be found to assist, in particular cases, the solution of the question, whether a particular invention or discovery is by law a patentable subject.

In this inquiry it is necessary to commence with the process of exclusion; for although, in their widest acceptation, the terms "invention" and "discovery" include the whole vast variety of objects on which the human intellect may be exercised, so that in poetry, in painting, in music, in astronomy, in metaphysics, and in every department of human thought, men constantly invent or discover, in the highest and the strictest sense, their inventions and discoveries in these departments are not the subjects of the patent law.... The patent law relates to a great and comprehensive class of discoveries and inventions of some new and useful effect or result in matter, not referable to the department of the fine arts. The matter of which our globe is composed is the material upon which the creative and inventive faculties of man are exercised, in the production of whatever ministers to his convenience or his wants. Over the existence of matter itself he has no control....

The direct control of man over matter consists, therefore, in placing its particles in new relations. This is all that is actually done, or that can be done, namely, to cause the particles of matter existing in the universe to change their former places, by moving them, by muscular power or some other force. But as soon as they are brought into new relations, it is at once perceived that there are vast latent forces in nature, which come to the aid of man, and enable him to produce effects and results of a wholly new character, far beyond the mere fact of placing the particles in new positions. He moves certain particles of matter into a new juxtaposition, and the chemical agencies and affinities called into action by this new contact produce a substance possessed of new properties and powers, to which has been given the name of gunpowder. He takes a stalk of flax from the ground, splits it into a great number of filaments, twists them together, and laying numbers of the threads thus formed across each other, forms a cloth, which is held together by the tenacity or force of cohesion in the particles, which nature brings to his aid. He moves into new positions and relations certain particles of wood and iron, in various forms, and produces a complicated machine, by which he is able to accomplish a certain purpose, only because the properties of cohesion and the force of gravitation cause it to adhere together and enable the different parts to operate upon each other and to transmit the forces applied to them, according to the laws of motion. It is evident, therefore, that the whole of the act of invention, in the department of useful arts, embraces more than the new arrangement of particles of matter in new relations. The purpose of such new arrangements is to produce some new effect or result, by calling into activity some latent law, or force, or property, by means of which, in a new application, the new effect or result may be accomplished. In every form in which matter is used, in every production of the ingenuity of man, he relies upon the laws of nature and the properties of matter, and seeks for new effects and results through their agency *1552 and aid. Merely inert matter alone is not the sole material with which he works. Nature supplies powers, and forces, and active properties, as well as the particles of matter, and these powers,

forces, and properties are constantly the subjects of study, inquiry, and experiment, with a view to the production of some new effect or result in matter. Any definition or description, therefore, of the act of invention, which excludes the application of the natural law, or power, or property of matter, on which the inventor has relied for the production of a new effect, and the object of such application, and confines it to the precise arrangement of the particles of matter which he may have brought together, must be erroneous.

G. Curtis, A Treatise on the Law of Patents for Useful Inventions at xxiii-xxv (4th ed. 1873) (emphasis added).

Alappat has arranged known circuit elements to accomplish nothing other than the solving of a particular mathematical equation represented in the mind of the reader of his patent application. Losing sight of the forest for the structure of the trees, the majority today holds that any claim reciting a precise arrangement of structure satisfies 35 U.S.C. ¤ 101. As I shall demonstrate, the rationale that leads to this conclusion and the majority's holding that Alappat's rasterizer represents the invention of a machine are illogical, inconsistent with precedent and with sound principles of patent law, and will have untold consequences.

B.

The Patent Clause of the Constitution empowers the Congress to "promote the Progress of ... useful Arts, by securing for limited Times to ... Inventors the exclusive right to their ... Discoveries." U.S. Const. art. I, ¤ 8, cl. 8.

Congress has implemented this limited grant of power in 35 U.S.C. ¤ 101 by enumerating certain subject matter, the invention or discovery of which may entitle one to a patent: "Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title." 35 U.S.C. ¤ 101 (1988). The terms used in ¤ 101 have been used for over two hundred years--since the beginnings of American patent law--to define the extent of the subject matter of patentable invention. See In re Chatfield, 545 F.2d 152, 159, 191 USPQ 730, 736-37 (CCPA 1976) (Rich, J., dissenting); 1 D. Chisum, Patents ¤ 1.01 (1993).

Coexistent with the usage of these terms has been the rule that a person cannot obtain a patent for the discovery of an abstract idea, principle or force, law of nature, or natural phenomenon, but rather must invent or discover a practical "application" to a useful end. Diamond v. Diehr, 450 U.S. 175, 185, 187-88, 101 S.Ct. 1048, 1056, 1057, 67 L.Ed.2d 155, 209 USPQ 1, 7-9 (1981) (citing, for example, Rubber-Tip Pencil Co. v. Howard, 87 U.S. (20 Wall.) 498, 507, 22 L.Ed. 410 (1874)); Parker v. Flook, 437 U.S. 584, 589, 591, 98 S.Ct. 2522, 2525, 2526, 57 L.Ed.2d 451, 198 USPQ 193, 197-98 (1978).

Thus patent law rewards persons for inventing technologically useful applications, instead of for philosophizing unapplied research and theory. Brenner v. Manson, 383 U.S. 519, 534-35, 86 S.Ct. 1033, 1041-42, 16 L.Ed.2d 69, 148 USPQ 689, 695 (1966) ("Unless and until a process is refined and developed to this point--where specific benefit exists in currently available form--there is insufficient justification for" the reward of a patent.); Graham v. John Deere Co., 383 U.S. 1, 5, 86 S.Ct. 684, 687, 15 L.Ed.2d 545, 148 USPQ 459, 462 (1966) ("the federal patent power ... is limited to the promotion of advances in the 'useful arts' "); In re Meyer, 688 F.2d 789, 795, 215 USPQ 193, 197 (CCPA 1982) (quoting O'Reilly v. Morse, 56 U.S. (15 How.) 62, 132-33, 14 L.Ed. 601 (1853) (Grier, J., concurring)); 1 D. Chisum, Patents ¤ 1.01, at 1-5 & n. 9 (1993) ("[I]n enacting patent legislation,

Congress is confined to the promotion of the 'useful arts,' not 'science' (i.e., knowledge) in general.... The general purpose of the statutory classes of subject matter is to limit patent protection to the field of applied technology, what the United States constitution calls 'the useful arts.' ").

*1553 Additionally, unapplied research, abstract ideas, and theory continue to be the "basic tools of scientific and technological work," which persons are free to trade in and to build upon in the pursuit of among other things useful inventions. Flook, 437 U.S. at 589, 98 S.Ct. at 2525, 198 USPQ at 197 (quotations omitted). [FN12] Even after a patent has been awarded for a new, useful, and nonobvious practical application of an idea, others may learn from the underlying ideas, theories, and principles to legitimately "design around" the patentee's useful application. See Slimfold Mfg. Co. v. Kinkead Indus., Inc., 932 F.2d 1453, 1457, 18 USPQ2d 1842, 1845-46 (Fed.Cir.1991).

FN12. Even Sir Isaac Newton, who is credited with among other things the formulation of differential calculus, conceded that he traded in prior ideas, stating, "If I have seen further it is by standing upon the shoulders of Giants."

The requirement of the patent law that an invention or discovery reside in the application of an abstract idea, law of nature, principle, or natural phenomenon is embodied in the language of 35 U.S.C. ¤ 101. A patent can be awarded to one who "invents or discovers" something within the enumerated classes of subject matter--"process," "machine," "manufacture," "composition of matter." These terms may not be read in a strict literal sense entirely divorced from the context of the patent law. Diehr, 450 U.S. at 185, 101 S.Ct. at 1056, 209 USPQ at 7 ("[E]very discovery is not embraced within the statutory terms." (emphasis added)); In re Schrader, 22 F.3d 290, 295-96 & n. 11, 30 USPQ2d 1455, 1459-60 & n. 11 (Fed.Cir.1994) (use of terms of art in ¤ 101 is presumed to be in accord with their well-established meaning); cf. Stafford v. Briggs, 444 U.S. 527, 535, 100 S.Ct. 774, 780, 63 L.Ed.2d 1 (1980) (statutory provisions should be considered in light of the entire statute and purpose). Rather they must be read as incorporating the longstanding and well-established limitation that the claimed invention or discovery must reside in a practical application. [FN13]

FN13. It is erroneous therefore to characterize, as the majority does, nonstatutory subject matter such as a mathematical algorithm as an "exception" to ¤ 101. Defining patentable subject matter is the raison d'etre of ¤ 101.

In addition to the basic principles embodied in the language of ¤ 101, the section has a pragmatic aspect. That subject matter must be new (¤ 102) and nonobvious (¤ 103) in order to be patentable is of course a separate requirement for patentability, and does not determine whether the applicant's purported invention or discovery is within ¤ 101. Diehr, 450 U.S. at 190, 101 S.Ct. at 1058, 209 USPQ at 10. Section 101 must be satisfied before any of the other provisions apply, and in this way ¤ 101 lays the predicate for the other provisions of the patent law. See Flook, 437 U.S. at 593, 98 S.Ct. at 2527, 198 USPQ at 199 (The determination of "what type of discovery is sought to be patented must precede the determination of whether that discovery is, in fact, new or obvious."); Diehr, 450 U.S. at 189, 101 S.Ct. at 1058, 209 USPQ at 9 ("[s]pecific conditions for patentability follow" ¤ 101). When considering that the patent law does not allow patents merely for the discovery of ideas, principles, and laws of nature, ask whether, were it not so, the other provisions of the patent law could be applied at all.

If Einstein could have obtained a patent for his discovery that the energy of an object at rest equals its mass times the speed of light squared, how would his discovery be meaningfully judged for nonobviousness, the sine qua non of patentable invention? [FN14] 35 U.S.C. ¤ 103. When is the abstract idea "reduced to practice" as opposed to being "conceived"? See id. ¤ 102(g). What conduct amounts to the "infringement" of another's idea? See id. ¤ 271.

FN14. See Graham, 383 U.S. at 9, 86 S.Ct. at 689, 148 USPQ at 464 (nonobviousness "draw[s] a line between the things which are worth to the public the embarrassment of an exclusive patent, and those which are not") (quoting Thomas Jefferson).

Consider for example the discovery or creation of music, a new song. Music of course is not patentable subject matter; a composer cannot obtain exclusive patent rights for the original creation of a musical composition. But now suppose the new melody is recorded on a compact disc. In such case, the particular *1554 musical composition will define an arrangement of minute pits in the surface of the compact disc material, and therefore will define its specific structure. See D. Macaulay, The Way Things Work 248-49 (Houghton Mifflin 1988). Alternatively suppose the music is recorded on the rolls of a player piano or a music box.

Through the expedient of putting his music on known structure, can a composer now claim as his invention the structure of a compact disc or player piano roll containing the melody he discovered and obtain a patent therefor? The answer must be no. The composer admittedly has invented or discovered nothing but music. The discovery of music does not become patentable subject matter simply because there is an arbitrary claim to some structure.

And if a claim to a compact disc or piano roll containing a newly discovered song were regarded as a "manufacture" and within ¤ 101 simply because of the specific physical structure of the compact disc, the "practical effect" would be the granting of a patent for a discovery in music. Where the music is new, the precise structure of the disc or roll would be novel under ¤ 102. Because the patent law cannot examine music for "nonobviousness," the Patent and Trademark Office could not make a showing of obviousness under ¤ 103. The result would well be the award of a patent for the discovery of music. The majority's simplistic approach of looking only to whether the claim reads on structure and ignoring the claimed invention or discovery for which a patent is sought will result in the awarding of patents for discoveries well beyond the scope of the patent law.

Patent cases involving the distinction between idea or principle may involve subtle distinctions. Flook, 437 U.S. at 589, 98 S.Ct. at 2525, 198 USPQ at 197. [FN15] Section 101 embodies the very soul of the intangible nature of invention. Without particular claimed subject matter in mind, it is impossible to generalize with bright line rules the dividing line between what is in substance the invention or discovery of a useful application within ¤ 101 versus merely the discovery of an abstract idea or law of nature or principle outside ¤ 101. Each case presenting a question under ¤ 101 must be decided individually based upon the particular subject matter at issue. See In re Grams, 888 F.2d 835, 839, 12 USPQ2d 1824, 1828 (Fed.Cir.1989) (Section 101 analysis "depends on the claims as a whole and the circumstances of each case."). There are however answers in every ¤ 101 case. But they are found by applying precedent and principles of patent law to the particular claimed subject matter at issue.

FN15. Similarly, the copyright law prohibits exclusive appropriation of "ideas," but provides for rights in the idea's "expression." 17 U.S.C. ¤

102(a), (b). Although our sister circuits find the task of distinguishing between idea and expression difficult and somewhat imprecise, see Peter Pan Fabrics, Inc. v. Martin Weiner Corp., 274 F.2d 487, 489, 124 USPQ 154, 155 (2d Cir.1960) (Learned Hand, J.); Nichols v. Universal Pictures Corp., 45 F.2d 119, 121, 7 USPQ 84, 86 (2d Cir.1930) (same), they nevertheless continue to make those important distinctions. E.g., Whelan Assocs., Inc. v. Jaslow Dental Lab., Inc., 797 F.2d 1222, 1233-42, 230 USPQ 481, 488-95 (3d Cir.1986); Gates Rubber Co. v. Bando Chem. Indus., Ltd., 9 F.3d 823, 834-46, 28 USPQ2d 1503, 1508-19 (10th Cir.1993); Kepner-Tregoe, Inc. v. Leadership Software, Inc., 12 F.3d 527, 533-34, 29 USPQ2d 1747, 1750 (5th Cir.1994).

C.

1. Discoveries and inventions in the field of digital electronics are analyzed according to the aforementioned principles as any other subject matter. In re Walter, 618 F.2d 758, 765, 205 USPQ 397, 405 (CCPA 1980). Digital electronics, including so-called general purpose digital computers, often call into play ¤ 101 because digital electronic devices "operate[ ] on data expressed in digits, solving a problem by doing arithmetic as a person would do it by head and hand." Gottschalk v. Benson, 409 U.S. 63, 65, 93 S.Ct. 253, 254, 34 L.Ed.2d 273, 175 USPQ 673, 674 (1972). Applicants sometimes attempt to claim digital-electronic related subject matter by reference to the mathematical function performed by the digital electronic structure. See Walter, 618 F.2d at 764, 205 USPQ at 404-05 (¤ 101 problems are a "natural consequence" of applicants' use of mathematics to define their alleged inventions). However, like the discovery of a law of nature, abstract *1555 idea, or principle, the discovery of mathematic functions, relationships, operations, or algorithms does not entitle a person to a patent therefor. Diehr, 450 U.S. at 191, 101 S.Ct. at 1059, 209 USPQ at 10 ("a mathematical formula as such is not accorded the protection of our patent laws"); see Walter, 618 F.2d at 770, 205 USPQ at 409 (pure mathematics is not an art or technology). [FN16] It does not matter how "original," "inventive," or "useful" the mathematics might be in the ordinary sense of those words.

FN16. It is unnecessary to discuss what is or is not a "mathematical algorithm," as opposed to being a mathematical "relationship," "formula," "operation," "function," "principle," "theory," or the like. The Supreme Court did not arrive at its holdings in Benson, Flook, and Diehr, discussed infra, by creating a new rule about "algorithms" and finding in two cases algorithms and in the other no algorithm. Rather, the holdings are expressly based upon the axioms that abstract ideas, principles, and laws of nature are not patentable subject matter, but that their useful applications may be. Mathematic operations, like ideas and laws of nature, are not useful applications and therefore not statutory subject matter. The hypertechnical distinction between calling something a mathematical "algorithm" versus another mathematic noun is without legal distinction.

The trilogy of Supreme Court cases in this area must be applied to determine whether an invention or discovery in the field of digital electronic related subject matter is within the scope of the patent law. These cases govern both product and process claims. Diehr, 450 U.S. at 188 n. 11, 101 S.Ct. at 1057 n. 11, 209 USPQ at 9 n. 11; accord In re Maucorps, 609 F.2d 481, 485, 203 USPQ 812, 815 (CCPA 1979).

In the first case, Gottschalk v. Benson, 409 U.S. 63, 93 S.Ct. 253, 34 L.Ed.2d 273, 175 USPQ 673 (1972), the Supreme Court held that claims to a method of converting binary-coded decimal numbers into pure decimal numbers

did not recite an invention or discovery within ¤ 101, and thus were ineligible for patent protection. In Benson, the claimed method was to be performed specifically in a general purpose digital computer, and one of the claims (claim 8) contained express digital electronic structure limitations by reciting "signals" and a "reentrant shift register." [FN17] 409 U.S. at 64, 73, 93 S.Ct. at 254, 258, 175 USPQ at 674, 677. The Court found that the "practical effect" of a patent for the method would be the impermissible award of a patent for a discovery in mathematics because the whole of the subject matter sought to be patented was a mathematical formula that had "no substantial practical application except in connection with a digital computer." Id. at 71-72, 93 S.Ct. at 257, 175 USPQ at 676; see Diehr, 450 U.S. at 185-86, 101 S.Ct. at 1056, 209 USPQ at 8 (so interpreting Benson). [FN18] In Benson the Court made clear that it was "deal [ing] with a program only for digital computers." 409 U.S. at 71, 93 S.Ct. at 257, 175 USPQ at 676.

FN17. Based on the specification, the claim term "signals" was construed to mean "signals of the kind upon which the disclosed electronic digital computer hardware operates" and the claim term "reentrant shift register" was construed to mean a "particular apparatus." See In re Benson, 441 F.2d 682, 687, 169 USPQ 548, 552 (CCPA1971) (emphasis in original), rev'd sub nom. Gottschalk v. Benson, 409 U.S. 63, 93 S.Ct. 253, 34 L.Ed.2d 273, 175 USPQ 673 (1972).

FN18. Consider in Benson the subject matter that would have been examined if it had passed muster under ¤ 101. When is a method for converting numbers to numbers nonobvious, and how is such a method reduced to practice as opposed to being conceived?

In the second case, Parker v. Flook, 437 U.S. 584, 98 S.Ct. 2522, 57 L.Ed.2d 451, 198 USPQ 193 (1978), the Court held that a claim to a method of updating "alarm limits" (numbers) did not recite an invention or discovery within ¤ 101, and thus was ineligible for patent protection. The claims in Flook did not "wholly preempt" the claimed mathematical formula because they did not cover every application of the formula. See 437 U.S. at 586, 589-90, 98 S.Ct. at 2523, 2525-26, 198 USPQ at 196, 197. The claimed method was expressly limited to operation "in a process comprising the catalytic chemical conversion of hydrocarbons," and thereby to application in a particular technological environment. Id. at 586, 98 S.Ct. at 2524, 198 USPQ at 196. The claimed formula also was "primarily useful for computerized calculations." Id. And the claim recited specific activity beyond the solution of the mathematical formula (so called "post-solution" activity), namely adjusting *1556 an "alarm limit" to the figure computed according to the formula. See id. at 589-90, 98 S.Ct. at 2525, 198 USPQ at 197. The Court reasoned that the updating of alarm limits in chemical processes was well known, and all that Flook purported to invent and claim was a new formula coupled to a computer for doing so (limited to certain post-solution activity in a technological environment). Id. at 594-95, 98 S.Ct. at 2527-28, 198 USPQ at 199; see Diehr, 450 U.S. at 186, 101 S.Ct. at 1056, 209 USPQ at 8 ("the Court concluded [in Flook] that the [patent] application sought to protect a formula for computing [a] number"); id. at 192 n. 14, 101 S.Ct. at 1060 n. 14, 209 USPQ at 10 n. 14. On these facts, the Court reasoned that the claimed invention or discovery was an alleged newly discovered mathematical formula, which was "not the kind of 'discover[y]' that the statute was enacted to protect." Flook, 437 U.S. at 593-95, 98 S.Ct. at 2527-28, 198 USPQ at 198-99.

In the third case, Diamond v. Diehr, 450 U.S. 175, 101 S.Ct. 1048, 67 L.Ed.2d 155, 209 USPQ 1 (1981), the Court held that a process for operating a rubber-molding press was within ¤ 101. An element of the claimed process was a digital computer programmed to perform a mathematical function. It was known that temperature inside a rubber-molding press determined in part the time the press was required to remain closed. 450 U.S. at 177-79, 101 S.Ct. at 1052-53, 209 USPQ at 4-5. The problem faced in the art was that when the press opened during operation, it cooled, thereby changing the amount of time needed for curing. Id. By including a thermocouple or other temperature- detecting device for measuring temperature inside the press, feeding signals to a computer which would repeatedly calculate the cure time and then cause the press to open at the right moment, the applicant claimed to have invented a new, useful, and nonobvious precision method of curing rubber. Id. The Court reasoned that the claimed subject matter was, as a whole, a process for precision rubber curing that included a computer performing a mathematical formula; the totality of claimed subject matter was not just the mathematical formula. Id. at 187, 191, 101 S.Ct. at 1057, 1059, 209 USPQ at 7, 8. Therefore, held the Court, the claimed subject matter was eligible for patent protection. [FN19]

FN19. Consider that in Diehr, the subject matter to be examined would be a precision rubber curing process. Examination would not merely be of the particular mathematical formula.

The Court in Diehr distinguished its decision in Flook. Both cases involved claims including mathematical formulae to be performed by digital electronics, with application in chemical processes. Flook's patent application, however, "did not purport to explain how the variables used in the formula were to be selected." Diehr, 450 U.S. at 192 n. 14, 101 S.Ct. at 1060 n. 14, 209 USPQ at 10 n. 14; see also id. at 186, 101 S.Ct. at 1056, 209 USPQ at 8. Flook's patent application did not "contain any disclosure relating to the chemical processes at work, the monitoring of process variables, or the means of setting off an alarm system." Diehr, 450 U.S. at 187, 101 S.Ct. at 1057, 209 USPQ at 8; see also id. at 192 n. 14, 101 S.Ct. at 1060 n. 14, 209 USPQ at 10 n. 14. In contrast, Diehr's claims were neither to the mathematical formula nor to the "the isolated step of 'programming a digital computer.' " Id. at 193 n. 15, 101 S.Ct. at 1060 n. 15, 209 USPQ at 11 n. 15. They were to a process "beginning with the loading of [a] mold and ending with the opening of [a] press and the production of synthetic rubber product that has been perfectly cured--a result [t]heretofore unknown in the art." Id. The chemical process in Flook was not the alleged invention or discovery but only was related tangentially to the mathematic formula; the applicant simply "limit[ed] the use of the formula to a particular technological environment" and claimed "insignificant postsolution activity." Diehr, 450 U.S. at 192 n. 14, 101 S.Ct. at 1060 n. 14, 209 USPQ at 10 n. 14. All this demonstrated that in Diehr the applicant was, in substance, asserting and claiming to have invented a new and useful chemical process, thereby qualifying the subject matter for examination under the remaining provisions of the patent law, while in Flook as in Benson the applicant was, in substance, asserting and claiming as his invention or discovery a mathematical function (to be performed by a *1557 computer), thereby placing the subject matter outside the patent law.

Under Benson, Flook, and Diehr the posing and solution of a mathematic function is nonstatutory subject matter. It is nonstatutory even if the particular mathematics is limited to performance in digital electronic circuitry or a general purpose digital computer, even if the mathematic operations are alleged generally to have some application in one or various

technologies, and even if the solution of the function is said generally to "represent" something of physical or technologic relevance. On the other hand, an invention or discovery of a process or product in which a mathematic operation is practically applied may be statutory subject matter. The fact that one element of the claimed process or product is a programmed digital computer or digital electronics performing a mathematic function does not necessarily preclude patent protection for the process or product. In this way, the door remains open to the advancement of technologies by the incorporation of digital electronics. But the mere association of digital electronics or a general purpose digital computer with a newly discovered mathematic operation does not per se bring that mathematic operation within the patent law.

2. Every case involving a ¤ 101 issue must begin with this question: What, if anything, is it that the applicant for a patent "invented or discovered"? In re Abele, 684 F.2d 902, 907, 214 USPQ 682, 687 (CCPA 1982), quoted in In re Grams, 888 F.2d 835, 839, 12 USPQ2d 1824, 1827 (Fed.Cir.1989); see Kneass v. Schuylkill Bank, 14 F.Cas. 746, 748 (C.C.Pa.1820) (No. 7875) (Washington, J.). To resolve this inquiry, the patent or patent application must be reviewed and the subject matter claimed as the invention or discovery "must be considered as a whole." Diehr, 450 U.S. at 188, 101 S.Ct. at 1057, 209 USPQ at 9; Flook, 437 U.S. at 594, 98 S.Ct. at 2527, 198 USPQ at 199; Walter, 618 F.2d at 758, 205 USPQ at 405 (Inquiry under section 101 depends on "the relationship which the truth or principle bears to the substance of the invention as claimed.").

In considering claimed subject matter for eligibility under ¤ 101, "it must be determined whether a scientific principle, law of nature, idea, or mental process, which may be represented by a mathematical algorithm, is included in the subject matter" claimed as the invention or discovery. In re Meyer, 688 F.2d 789, 795, 215 USPQ 193, 198 (CCPA 1982). When the claimed invention or discovery includes "a mathematical formula (or scientific principle or phenomenon of nature), an inquiry must be made into whether the claim is seeking patent protection for that formula in the abstract," Diehr, 450 U.S. at 191, 101 S.Ct. at 1059, 209 USPQ at 10, or whether the "claim containing a mathematical formula implements or applies that formula in a structure or process which, when considered as a whole, is performing a function which the patent laws were designed to protect," id. at 192, 101 S.Ct. at 1059, 209 USPQ at 10.

Thus the dispositive issue is not whether the claim recites on its face something more physical than just abstract mathematics. If it were, Benson and Flook would have come out the other way and Diehr would have been a very short opinion. The dispositive issue is whether the invention or discovery for which an award of patent is sought is more than just a discovery in abstract mathematics. Where the invention or discovery is only of mathematics, the invention or discovery is not the "kind" of discovery the patent law was designed to protect and even the most narrowly drawn claim must fail. Diehr, 450 U.S. at 192 n. 14, 101 S.Ct. at 1060 n. 14, 209 USPQ at 10 n. 14. To come within the purview of ¤ 101 and the patent law, a mathematical formula or operation must be "applied in an invention of a type set forth in 35 U.S.C. ¤ 101." Meyer, 688 F.2d at 795, 215 USPQ at 198.

D.

1. The Claimed Invention or Discovery. Alappat's specification discloses a digital oscilloscope. See Alappat specification at 1-3. The majority is quite taken in by the structure and functioning of the oscilloscope. But as the majority recognizes, the oscilloscope is not claimed as Alappat's invention. Rather the claimed invention is, as the majority says, "a means

for creating a smooth waveform *1558 display in a digital oscilloscope," or an "anti-aliasing system" for an oscilloscope.

Thus, Alappat discloses a component of a digital oscilloscope to be a "display system," see Fig. 1, and a component of the "display system" to be a "rasterizer," see Fig. 2. Only the "rasterizer" and the immediate handling of its input and output are described in any structural detail.

In claim 15, Alappat claims his invention to be:

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

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

(b) means for determining the elevation of a row of pixels that is spanned by the vector;

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

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

The specification depicts the "rasterizer" 40 in Figure 3 with the following circuit diagram: [FN20]

FN20. As can be seen from the circuit diagram, it is not clear what circuitry in particular "40" refers to. Alappat's specification locates the beginning of the rasterizer at ALU 74 and the end at ROM 92.

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The claimed rasterizer is described to function as follows. It starts with "vector list" data which the specification states may be obtained by "sampling" and "digitizing" an analog input "signal." See spec. at 2, ll. 16-18. Sequential pairs of "vector list" data are stored in registers 70 and 72. Id. at 11, ll. 30-33. Vector list data are thus simply a sequence of numbers (y coordinates on an x-y coordinate system).

With respect to each pair of data, a first arithmetic logic unit (ALU) 74 calculates their difference; the result is stored in another register 76. Id. at 11, l. 34, to 12, l. 6. This difference is called the "vertical distance." The difference is calculated by the following formula: << triangle>>>>>>>>>>>>>>>>>>y subi =y subi -y subi + sub1 , where i and i+1 are the sequential y coordinates.

A second ALU 80 calculates the "elevation." The elevation is the distance between the starting y value and a particular y value *1559 under consideration. It is calculated by the following formula: <<triangle>>y subi,j =y subi -s subj , where s subj is distance of the point under consideration and y subi is the "vertical distance" described above. The "elevation" is stored in a fourth register 82. Id. at 12, ll. 27-31.

The vertical distance and elevation are each then "normalized" in barrel shifters 84 and 88, respectively, to make the values larger, and the results are stored in a fifth register 90. Id. at 13, ll. 3-16. Normalization means in this context multiplying in base two.

A read-only-memory (ROM) 92 operates on the stored "vertical distance" and "elevation." The ROM contains a table of values, namely "intensity" data as a function of the elevation and vertical distance data. Id. at 13, ll. 27-32. The mathematical function for calculating the intensity data is described generally as follows:

When the vector trajectory [i.e., the line that would have been had the starting coordinates been connected] passes through or very near the center of a pixel [the point under consideration], the pixel is given maximum intensity.... When the ... distance between the center point of a pixel and

any vector trajectory is greater than or equal to the ... distance between center points of contiguous pixels, the pixel intensity is set to 0. For pixels having center points intermediate in distance from the vector trajectory, pixel intensity is selected to be roughly in inverse proportion to such distance. [Spec. at 9, ll. 23-33.]

The most basic formula for selecting the pixel intensity is given as follows: I'(i,j) = [1 - (<<triangle>>y subi,j /<<triangle>>y subi)]x F, where F = 15. Id. at 14, l. 18.

Figure 5 provides an example of what the "rasterizer" does. The input to the rasterizer is given as two consecutive y coordinates, i = 0 and i + 1 = 7. [FN21] (The "vertical distance" therefore is 7 - 0 = 7.) The rasterizer outputs the following array of "I" data (vector endpoints are emphasized):

FN21. The numbers in the digital circuit are of course in binary (base two) format. The figure in the specification uses hexadecimal (base 16). For my discussion, I shall refer to the decimal equivalent.

i	j	I	i + l	j	I
0	7	0	1	7	15
0	6	2	1	6	13
0	5	5	1	5	10
0	4	7	1	4	8
0	3	9	1	3	6
0	2	11	1	2	4
0	1	13	1	1	2
0	0	15	1	0	0

According to the preamble of the claim the data is to be displayed on a display means. The specification gives as an example a cathode-ray-tube. The "I" data produced above by "rasterizing" is "anti-aliased" when a cathode- ray-tube is illuminated according to the data. This means that there would be no discontinuity, jaggedness, or oscillation that might otherwise appear had merely a line been attempted to be graphed. There is no discussion in the specification of the structure of the means for actually displaying the data or of the oscilloscope.

2. The Original Panel Decision

The examiner rejected claims 15-19 as not being directed to an invention or discovery within ¤ 101. As the majority notes, the examiner rejected the claims even though he recognized that claim 15 recited "physical elements" to perform number crunching and an output of the data for eventual display.

On appeal to the board, the original panel found 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." The original panel also found that the claim does not include display of the output data on a cathode-ray-tube but simply a transmission of the result of the mathematical operations. That panel decided, however, that the "critical analysis" for whether claimed subject matter including a mathematical algorithm is within ¤ 101 is whether the claims on their face recite "specific apparatus distinct from other apparatus capable of performing the identical [mathematic] function." (Emphasis added.)

*1560 From this general rule about claiming structure, the panel reasoned that where a claim recites "means for performing functions," the claimed invention is within ¤ 101, unless the functionally-defined means are so broad that they encompass "every means for performing the recited [mathematical] functions." Since the means must be construed to correspond to the

structures disclosed in the specification and their equivalents per 35 U.S.C. ¤ 112, the original board's test for whether an invention or discovery was of the type enumerated in ¤ 101 depended on the quantity of disclosure in the specification.

Applying this rule, the original panel found that the structures disclosed in the specification as corresponding to the means were two ALUs, two barrel shifters, and a ROM. It concluded that these were "specific apparatus" because they were "clearly disclosed to be conventional structure in the art" and were not simply "rectangular block diagrams" that "may not be ascertained to be disclosed as conventional structure in the art," nor were they means described in a "very broad, generic sense." The original panel therefore concluded that the claimed invention or discovery was within ¤ 101 and reversed the examiner's contrary rejection of claims 15-19.

3. The Decision of the Reconsideration Panel

The reconsideration panel of the board also felt that the dispositive issue under ¤ 101 was whether the claims recited "specific apparatus." Ex Parte Alappat, 23 USPQ2d 1340, 1341 (BPAI 1992). The reconsideration panel, however, applied this test to an opposite conclusion. First it reasoned that the means-for-function clauses must be interpreted as covering every structure for performing the recited function, and the burden was on the applicant to prove otherwise. Id. at 1343; see In re Donaldson Co., 16 F.3d 1189, 1192, 1193-94, 29 USPQ2d 1845, 1847-48, 1849 (Fed.Cir.1994) (in banc) (discussing PTO practice of not applying ¤ 112, ¦ 6, during prosecution). The panel refused to interpret the means-for-function clauses as limited to the corresponding circuit structure disclosed in the specification and equivalents thereof. Thus, this panel concluded that the claim was to every structure for performing the recited mathematic functions, and that the claim was to be analyzed as though it actually was directed to a "method" comprising the functions performed by the claimed means. 23 USPQ2d at 1344-45.

Alternatively, the reconsideration panel found that a "general purpose digital computer" was within the range of equivalents contemplated by ¤ 112, ¦ 6. It reasoned that in such cases the claimed structure should be treated as a method. Id. at 1345.

In passing, the reconsideration panel rejected the original panel's holding that claims containing means-for-function clauses are nonstatutory only when the corresponding structure in the specification is so generic as to be illusory, although it recognized that where the structure is illusory, the claim would be to the mathematic function and would fail under ¤ 101.

Applying the "method" analysis, the reconsideration panel agreed with the original panel that each element of the claim recited a mathematical operation and that the displaying of the waveform on a cathode-ray-tube was not claimed. It found that the specification did not disclose, nor was it claimed, where the input data--the vector list--was to come from or how it was to be generated. The reconsideration panel concluded that the claimed invention was simply a method of computing a set of numbers from another set of numbers, and therefore was a nonstatutory claim to a mathematical algorithm. Id. at 1346-47.

4. The Majority's Decision in this Case

The majority of this court first recognizes that the reconsideration panel erred by refusing to interpret the means-for-function clauses as not being directed to the specific structures disclosed in the specification--two ALUs, two barrel shifters, and a ROM--and their equivalents, and that the original panel was correct in its construction of claim 15. Thus, pursuant to ¤ 112, ¦ 6, and in view of the specification, the claims do recite specific digital circuitry structures.

*1561 The majority concludes that because the claim recites connected structures, the claim "unquestionably recites a machine." Page 1541. Although stating that it is unquestionable, the court asks whether the claimed apparatus is not a machine within ¤ 101 because of one of the "judicially- created" exceptions called the "mathematical algorithm" exception. Page 1542. The majority explains in answering this question that the "claim as a whole" must be analyzed, and that a portion thereof is not dispositive. The court first concludes that the claimed subject matter is not a "disembodied mathematical concept" because the claim recites a "combination of interrelated [circuitry] elements" for converting data into data. Page 1544. Second, the majority reasons that because the claim is limited to specific structural elements, it would not "wholly preempt" the mathematical algorithm contained therein. Page 1544. Third, the majority holds that the word "rasterizer" in the preamble is not a mere "field-of-use" limitation, but limits the claimed subject matter to the production of "output illumination data." Id.

Finally, the court concludes that if the claimed "rasterizer" were equivalent to a "general purpose digital computer" programmed to perform the calculations performed by the rasterizer, such programmed computer would be the invention of a "new machine" within ¤ 101. Page 1545.

E.

1. Of course, I agree that the means-for-function elements in claim 15 must be construed to cover the corresponding structure described in Alappat's specification and equivalents thereof. 35 U.S.C. ¤ 112, ¦ 6; see In re Donaldson Co., 16 F.3d 1189, 1195, 29 USPQ2d 1845, 1850 (Fed.Cir.1994) (in banc). Accordingly, Alappat correctly argues and the majority properly holds that when the "means" elements of the claim are construed under 35 U.S.C. ¤ 112, ¦ 6, paragraphs (a) to (d) of the claim read as follows (the preamble has been shortened for brevity):

A rasterizer for converting vector list data ... into ... pixel illumination intensity data to be displayed ... comprising:

(a) a first ALU;

(b) a second ALU;

(c) two barrel shifters; and

(d) a ROM.

Further, pursuant to 35 U.S.C. ¤ 112, ¦ 6, elements (a)-(d) also cover equivalents of the two ALUs, the two barrel shifters, and the ROM.

Because the "means" clauses of claim 15 correspond to structure described in the specification, under Donaldson the reconsideration panel of the board erred in failing to construe the claims to recite that structure and equivalents.

2. The ¤ 112, ¦ 6, issue, however, is a red herring in this case. Although the reconsideration panel erred by ignoring specific structure recited in the claims, Alappat's claimed invention still is not the invention or discovery of a machine. The presence of structure on the face of the claims does not ipso facto make the claimed invention or discovery one of statutory subject matter.

To hold that a claim reciting structure necessarily defines an invention within ¤ 101, the majority implicitly resurrects long-dead precedent of the Court of Customs and Patent Appeals in direct conflict with Supreme Court precedent and subsequent precedent of that court. Early precedent of the Court of Customs and Patent Appeals held that a claimed invention or discovery is outside ¤ 101 only if the claim on its face recites in its entirety mathematics, because claims like that would wholly preempt the mathematical operation at issue. That was the extent of the boundaries of the patent law under ¤ 101. E.g., In re Bernhart, 417 F.2d 1395, 1399, 163

USPQ 611, 616 (CCPA 1969); In re Chatfield, 545 F.2d 152, 156, 191 USPQ 730, 733 (CCPA 1976); In re Freeman, 573 F.2d 1237, 1245, 197 USPQ 464, 471 (CCPA 1978). As a corollary, the court reasoned that if the claim does recite structure, the claim necessarily does not "wholly preempt" an abstract idea. E.g., In re Noll, 545 F.2d 141, 148, 191 USPQ 721, 726 (CCPA 1976) ("The instant claims, however, are drawn to physical structure and not to an abstract" mathematical formula.); In re Johnston, 502 F.2d 765, 771, 183 USPQ 172, 177 (CCPA 1974) ("the instant *1562 claims, in apparatus form, do not claim or encompass a law of nature, a mathematical formula, or an algorithm" (emphasis in original)), rev'd on other grounds sub nom. Dann v. Johnston, 425 U.S. 219, 96 S.Ct. 1393, 47 L.Ed.2d 692, 189 USPQ 257 (1976).

However, the Supreme Court expressly reversed the court's wholesale preemption test in Parker v. Flook, 437 U.S. 584, 98 S.Ct. 2522, 57 L.Ed.2d 451, 198 USPQ 193 (1978). There the Supreme Court concluded that the claimed discovery was nonstatutory even though the applicant's claim did not wholly preempt the mathematic function involved. 437 U.S. at 589-90, 98 S.Ct. at 2525-26, 198 USPQ at 197; accord Diehr, 450 U.S. at 192 n. 14, 101 S.Ct. at 1060 n. 14, 209 USPQ at 10 n. 14; Walter, 618 F.2d at 767, 205 USPQ at 407 (under Flook subject matter can be outside ¤ 101 without "literal preemption"). Flook should have made clear that satisfaction of ¤ 101, and eligibility for the patent reward in general, requires a judgment that the applicant for the patent has actually invented or discovered something in the useful arts and for that reason is deserving of exclusive patent rights. To determine whether the applicant has invented or discovered something within the patent law, it makes no sense for the sole question to be, "Does the applicant happen to recite structure in the claims or not?" See Diehr, Flook, and Benson, supra part II.C.1. (no patent for discovery of mathematical function); Funk Bros. Seed Co. v. Kalo Inoculant Co., 333 U.S. 127, 68 S.Ct. 440, 92 L.Ed. 588, 76 USPQ 280 (1948) (no patent for discovery of naturally occurring phenomenon); Brenner v. Manson, 383 U.S. 519, 86 S.Ct. 1033, 16 L.Ed.2d 69, 148 USPQ 689 (1966) (no patent for creation of a product without discovering a specific practical utility for it) (discussed supra part II.A.); Kewanee Oil Co. v. Bicron Corp., 416 U.S. 470, 480-81, 94 S.Ct. 1879, 1885-86, 40 L.Ed.2d 315, 181 USPQ 673, 679 (1974) (discussing generally the practical policy of the patent law). Because the wholesale preemption test cares nothing about the nature of the alleged invention or discovery, [FN22] the Supreme Court not surprisingly rejected it.

FN22. See, e.g., Bernhart, 417 F.2d at 1399, 163 USPQ at 616 ("To allow the claims in issue here would not prohibit all uses of [the] equations [disclosed by appellants in their patent application].").

Although the wholesale preemption test became outmoded, the inquiry into specific structure has survived, and indeed has been elevated to the inquiry under ¤ 101, as this case evidences. See also In re Iwahashi, 888 F.2d 1370, 1375, 12 USPQ2d 1908, 1911 (Fed.Cir.1989) (The claimed subject matter is a statutory "machine" or "manufacture" because the claim is to "apparatus with specific structural limitations" and the claim "defines apparatus in the form of a combination of interrelated means."). However, the majority's test under ¤ 101 that looks simply to whether specific structure is claimed is as inconsistent with Supreme Court precedent as is the wholesale preemption test.

The Supreme Court has held that a claimed invention may represent merely the discovery of a law of nature and be outside the patent law, even though the claim entirely recites a specific and complete structure. See Funk Bros. Seed Co., 333 U.S. at 130, 68 S.Ct. at 441, 76 USPQ at 281 (claim to species of bacteria represented discovery of law of nature and was outside ¤ 101).

The Supreme Court has also held that a claimed process may be non-statutory even if it implements a principle in a "specific fashion." Flook, 437 U.S. at 593, 98 S.Ct. at 2527, 198 USPQ at 198. And the Supreme Court has held that a claimed invention may represent the discovery of mathematics alone and be outside ¤ 101 even though the claim recites specific structural limitations. E.g., Benson, 409 U.S. at 64, 73, 93 S.Ct. at 254, 258, 175 USPQ at 674, 677.

In addition, this court's predecessor court has expressly stated that a "claimed computing system" does not necessarily reflect the invention or discovery of a "machine" within ¤ 101. In re Maucorps, 609 F.2d 481, 485, 203 USPQ 812, 816 (CCPA 1979) (claimed apparatus was nonstatutory even though it referred to a disclosed dedicated hard-wired circuit); see also Meyer, 688 F.2d at 796, 215 USPQ at 199 (claimed apparatus nonstatutory even though it was limited to a computer *1563 performing the claimed mathematical operations and displaying the result).

Furthermore, the statute does not support a simple "structure" test. 35 U.S.C. ¤ 101 plainly refers to several classes of subject matter having longstanding usage in the patent law and requires that the applicant have "invent[ed] or discover[ed]" a new and useful one of them. "Structure" is not one of these classes. Nor does ¤ 101 simply require a claim that recites structure. Finally, there is no reason to suppose that ¤ 101 should depend only on the adequacy of disclosure when specificity of disclosed and claimed structure is expressly required in 35 U.S.C. ¤ 112.

As the Supreme Court and this court have said, and as the majority says now, the claimed subject matter must be considered as a whole to determine whether the invention or discovery is within ¤ 101. A claim may thus include a limitation directed to a "mathematical formula, computer program or digital computer," and yet the invention or discovery will be within ¤ 101 so long as the claimed invention in total represents an application of such formula, program, or computer. See Diehr, 450 U.S. at 187, 101 S.Ct. at 1057, 209 USPQ at 8. Likewise, a claim may include the recitation of something physical (i.e., structure), and yet the invention or discovery is essentially only mathematical. See In re Grams, 888 F.2d 835, 838-40, 12 USPQ2d 1824, 1827 (Fed.Cir.1989) ("[I]f there are physical steps included in the claim in addition to the [mathematical] algorithm, the claim might be eligible for patent protection." (emphasis added)). Where the claimed invention is nothing more than a newly discovered mathematical formula or solution, the claimed subject matter will not be statutory simply because included in the claim are one or more references to structure. [FN23]

FN23. See Arrhythmia Research Technology, Inc. v. Corazonix Corp., 958 F.2d 1053, 1063, 22 USPQ2d 1033, 1041 (Fed.Cir.1992) (Rader, J., concurring) (accurately pointing out that precedent fails to "suggest how many physical steps a claim must take to escape the fatal 'mathematical algorithm' category").

3. So what did Alappat invent or discover? Alappat's specification clearly distinguishes between an "oscilloscope" and a "rasterizer," and Alappat claims his invention in claims 15-19 to be only the "rasterizer."

The "rasterizer" as claimed is an arrangement of circuitry elements for converting data into other data according to a particular mathematical operation. The rasterizer begins with vector "data"--two numbers. "[I]t does not matter how they are ascertained." Brief for Alappat at 39. The two numbers, as they might to any algebra student, "represent" endpoints of a line.

The claimed "rasterizer" ends with other specific "data"--an array of numbers, as the original and reconsideration panels of the board both

expressly agreed. See Diehr, 450 U.S. at 186, 101 S.Ct. at 1056, 209 USPQ at 8 ("The claims [in Flook] were drawn to a method for computing an 'alarm limit.' An 'alarm limit' is simply a number...."); Abele, 684 F.2d at 909, 214 USPQ at 688 (the "claim presents no more than the calculation of a number and display of the result"); Walter, 618 F.2d at 768, 205 USPQ at 407 ("if the end- product of a claimed invention is a pure number, as in Benson and Flook, the invention is nonstatutory"). The end-data of the "rasterizer" are a predetermined and claimed mathematic function of the two input numbers. [FN24]

FN24. The preamble calls the data "anti-aliased pixel illumination intensity data." Of course, no matter how many adjectives the claim uses to describe data, data are still data--i.e., pure numbers.

Alappat admits that each of the circuitry elements of the claimed "rasterizer" is old. He says they are merely "form." Thus, they are only a convenient and basic way of electrically representing the mathematical operations to be performed, that is, converting vector data into matrix or raster data. In Alappat's view, it is the new mathematic operation that is the "substance" of the claimed invention or discovery. Claim 15 as a whole thus claims old circuitry elements in an arrangement defined by a mathematical operation, which only performs the very mathematical operation that defines it. Rather than claiming the mathematics itself, *1564 which of course Alappat cannot do, Alappat claims the mathematically defined structure. But as a whole, there is no "application" apart from the mathematical operation that is asserted to be the invention or discovery. [FN25] What is going on here is a charade. Alappat asks the following:

FN25. This is very different from the example given in Flook of a directional antenna system in which the wire arrangement is defined by the logical application of a mathematical formula, but the effect of the arrangement is an improved antenna that achieves "the greatest directional radio activity." See Mackay Radio & Tel. Co. v. Radio Corp. of Am., 306 U.S. 86, 94, 59 S.Ct. 427, 431, 83 L.Ed. 506, 40 USPQ 199, 202 (1939) (expressly assuming without deciding that such arrangement could be patentable subject matter).

An input to ... a circuit or processing function is converted into a different thing at the output (otherwise why have the circuit or function in the first place?). If the process is new, useful, and nonobvious, does it really matter whether the implementation is in the form of analog components, digital components, programs for a computer, or a combination thereof? Isn't such a differentiation exalting form over substance? ... [Br. for Alappat at 48.]

The questions are properly answered thusly: "No," in Alappat's claimed "rasterizer" it really does not matter how the mathematics is implemented, and "Yes," assigning ¤ 101 significance to the disclosed structure would be exalting form over substance. So where the claimed structure does not matter and the invention or discovery is only of a "new, useful, and nonobvious" process for solving a mathematical formula, Benson, Flook, Diehr, and years of precedent command that the patent law shall not exalt form over substance, but rather recognize that the substance is outside ¤ 101.

The subject matter of claim 15, as in Flook, "has no substance apart from the calculations involved. The calculations are the beginning and end of the claim[ ]." Walter, 618 F.2d at 769, 205 USPQ at 409. Also as in Flook, the oscilloscope disclosed in Alappat's specification presents a general technological environment for the claimed "rasterizer," insignificant in relation to it. Claim 15 is not even limited to the environment of an

oscilloscope. See Abele, 684 F.2d at 909, 214 USPQ at 688. The claimed rasterizer mathematical function presumably has application in conjunction with any current or future device that prints in an x-y coordinate grid, such as oscilloscopes, computer monitors, televisions, laser printers, mechanical printing devices, etc.

This is not to say that digital circuitry cannot be an element in an otherwise statutory machine. Under Diehr, it can. [FN26] But Alappat expressly recognizes the distinction between a "machine," even giving some examples, and the "digital processing" one of its components might perform:

FN26. Likewise, but not present in this case, improved digital circuitry itself, such as faster digital processors, would be statutory subject matter. Unlike the "rasterizer" in this case, they are not simply a claimed arrangement of circuit elements defined by a mathematical operation which does nothing more than solve the operation that defines it. See Maucorps, 609 F.2d at 486 n. 3, 203 USPQ at 816 n. 3; Freeman, 573 F.2d at 1247 n. 10, 197 USPQ at 472 n. 10; cf. infra note 29 and accompanying text (player piano analogy).

In today's technological environment virtually every machine, from cars to washing machines to instruments [e.g., oscilloscopes], uses digital processing, either with specific digital circuitry and/or a microprocessor executing a program. [Brief for Alappat at 47.]

Thus unlike the rubber curing process in Diehr, the claimed rasterizer here is not an application of mathematics in an otherwise statutory process or product. The rasterizer is simply the mathematical conversion of data. In Diehr, the input data were derived by a claimed component of the overall rubber curing process--the press and thermocouple--which fed data to the claimed computer. Here, however, as the specification and claims indicate, the waveform data converted by the claimed rasterizer are not required to come from a particular machine connected up to the rasterizer, and, as Alappat admits, it does not matter how the data are selected. The sets of waveform numbers converted by the claimed rasterizer could come simply from the mind and hand of a person. The end product of the claimed rasterizer is not *1565 precisely cured rubber as it was in Diehr but rather different data as a mathematical function of the original data. Sure the data have some use. Most data have uses, and that is why people spend time calculating data. But just having some use for data does not make the creation of particular data patentable. Like the subject matter in Flook and Benson, and unlike the subject matter in Diehr, Alappat's claimed rasterizer is newly discovered mathematics and not the invention or discovery of a process or product applying it. Cf. Alappat, 23 USPQ2d at 1345 ("The claimed invention must be evaluated for what it is. The claimed invention is a mathematical algorithm for computing pixel information." (citation omitted)). Even though it recites structure, claim 15 should be rejected under ¤ 101.

Rejection under ¤ 101 is especially important for the following reason. The examination of Alappat's "rasterizer" must focus on, as Alappat says, the "process" of the circuit elements--the mathematic function performed by them. Because the patent law does not examine abstract mathematics, if the "rasterizer" is held to be within ¤ 101, there can be no meaningful examination for compliance with ¤ 103, and other sections of the patent statute become inapplicable. The practical result is that there is patentability so long as the mathematics is "new." This is reflected in Alappat's statement that the rasterizer is a "novel combination of conventional electronic circuits which, as functionally defined in the claims, is patentably distinct from prior art rasterizers." Brief for Alappat at 7 (emphasis added). But standing alone, "the novelty of the

mathematical algorithm is not a determining factor at all." Flook, 437 U.S. at 591, 98 S.Ct. at 2526, 198 USPQ at 198.

4. Finally, a "general purpose computer" issue has been raised as an aside in this case. The parties agree that each of the "means" elements in claim 15 would find an "equivalent" within the meaning of 35 U.S.C. ¤ 112, ¦ 6, in a "general purpose digital computer." Alappat goes so far as to plead emphatically for recognition of equivalency, saying, "Any employable circuit designer could readily design around claims ... limited" to two ALUs, two barrel shifters, and one ROM. Brief for Alappat at 21.

Yet Alappat also concedes that a claim drawn to "a method which amounted to a mathematical algorithm [without] any disclosed hardware or structure, other than a programmed general purpose computer," is nonstatutory. Br. for Alappat at 22; see Majority Opinion at Page 1540 (agreeing with this premise). Alappat's argument is that "bona fide hardware supporting the 'means plus function' recitals" in claim 15 renders the claimed subject matter statutory, but then the claim may cover general purpose digital computers as equivalents through ¤ 112, ¦ 6, even though that subject matter could not be claimed outright. Br. for Alappat at 22.

Alappat cannot have it both ways. If a programmed general purpose digital computer is not statutory subject matter, then a claim cannot be drawn to that subject matter whether outright or by application of equivalents under 35 U.S.C. ¤ 112, ¦ 6. Paragraph 6 of ¤ 112 is not a magical way to expand patent protection into nonstatutory subject matter.

As to equivalency, finding equivalency in a programmed general purpose computer proves the nonstatutory nature of Alappat's purported invention or discovery. Alappat argues that the electrical circuitry of the "rasterizer" is equivalent to a programmed general purpose computer because "powerful, inexpensive microprocessors" are equivalent to "discrete digital components, such as AND, OR, NAND, etc., gates, registers, latches, and the like" are equivalent to "analog components, such as transistors, operational amplifiers, and resistors." They are all equivalents, in Alappat's view, because they all may achieve the same effect: performing the particular mathematics that is the claimed rasterizer.

A patent is awarded only "for the discovery or invention of some practical method or means of producing a beneficial result or effect, ... and not for the result or effect itself." Diehr, 450 U.S. at 183 n. 7, 101 S.Ct. at 1055 n. 7, 209 USPQ at 7 n. 7 (quoting Corning v. Burden, (15 How.) 252, 268, 14 L.Ed. 683 (1854)) (emphasis added). The *1566 patent's "substance is a new mode of operation, by means of which a new result is obtained. It is this new mode of operation which gives it the character of an invention, and entitles the inventor to a patent...." Winans v. Denmead, 56 U.S. (15 How.), 330, 341, 14 L.Ed. 717 (1854) (emphasis added).

If Alappat's claimed rasterizer represents statutory subject matter, which I do not believe it does, then Alappat's claims must be strictly construed. Mackay Radio & Tel. Co. v. Radio Corp. of Am., 306 U.S. 86, 94, 59 S.Ct. 427, 431, 83 L.Ed. 506, 40 USPQ 199, 202 (1939) (assuming the invention is within the patent law, the invention would be "a narrow one, consisting of a structure conforming to [a] formula, ... and is to be strictly construed with regard ... to ... devices" alleged to be covered by the claims.). Thus, assuming for the moment that Alappat's "rasterizer" is statutory subject matter, then determining what circuit elements are equivalent to the various means claimed in the rasterizer must be performed by reference to the claimed apparatus and means and the means of the alleged equivalent. The majority, however, reasons that any "general purpose computer" is "in effect" the claimed invention or discovery because they do the same mathematics, without knowing anything particular about the general purpose computer. To find equivalence based solely on the identity of mathematical function, with

absolute disregard for the particular claimed circuitry, therefore, is to concede that Alappat's claimed circuitry is irrelevant and nonstatutory.

Getting back to the music analogy, Alappat is like a composer who claims his song on a compact disc, and then argues that the compact disc is equivalent to a player piano or a music box with the song on a roll or even sheet music because they all represent the same song. The composer is thus clearly asking for (and getting from the majority) a patent for the discovery of a song and a patent covering every physical manifestation of the song.

In any event, even if a programmed general purpose computer is "equivalent" to the rasterizer, it cannot be deemed to be within ¤ 101 by simply reasoning as does the majority that it is a "new machine." See Page 1545. Alappat posits that a "programmed digital computer becomes a special purpose digital computer to perform the function specified by the software. [FN27] The special purpose computer can be implemented likewise by digital components, or even by analog components." The majority casually agrees that a "general purpose computer in effect becomes a special purpose computer once it is programmed to perform particular functions from program software." Id. (emphasis added). [FN28] One cannot, however, just call a programmed computer a "new machine" without going through the ¤ 101 analysis required by the trilogy of Supreme Court decisions. Whether or not subject matter is a "new machine" within ¤ 101 is precisely the same question as whether or not the subject matter satisfies the ¤ 101 analysis I have described. See Johnston, 502 F.2d at 773, 183 USPQ at 178-79 (Rich, J., dissenting) (accepting the validity of the "new and different machine" principle, but then analyzing that issue according to Supreme Court ¤ 101 precedent).

FN27. Because the term "general purpose digital computer" is a definition of apparatus broadly by its effect--i.e., a particular mathematical computation--it is a truism that a "general purpose computer" becomes a "special purpose computer" when instructed with a special purpose.

FN28. The Freeman case cited by the majority did not hold that a general purpose computer when programmed becomes a special purpose computer and a "new machine" within ¤ 101. 573 F.2d 1237, 197 USPQ 464. Although the Noll and Prater cases did so state, they predated Parker v. Flook and their vitality on this point is as questionable as the proposition for which the majority cites them. See 1 D. Chisum, Patents ¤ 1.03[6], at 102 (1993); P. Samuelson, Benson Revisited: The Case Against Patent Protection for Algorithms and Other Computer Program- Related Inventions, 39 Emory L.J. 1025, 1045 n. 62, 1048 n. 70 (1990) (arguing that much of the reasoning supporting patentability in the early cases has been impliedly overruled).

Thus, a known circuit containing a light bulb, battery, and switch is not a new machine when the switch is opened and closed to recite a new story in Morse code, because the "invent[ion] or discover[y]" is merely a new story, which is nonstatutory subject matter. *1567 An old stereo playing a new song on a compact disc is not a new machine because the invention or discovery is merely a new song, which is nonstatutory subject matter. The "perforated rolls [of a player piano] are parts of a machine which, when duly applied and properly operated in connection with the mechanism to which they are adapted, produce musical tones in harmonious combination." White-Smith Music Publishing Co. v. Apollo Co., 209 U.S. 1, 18, 28 S.Ct. 319, 323, 52 L.Ed. 655 (1908). Yet a player piano playing Chopin's scales does not become a "new machine" when it spins a roll to play Brahms' lullaby. The distinction between the piano before and after different rolls are inserted resides not in the piano's changing quality as a "machine" but only in the changing melodies being played by the one machine. The only invention by

the creator of a roll that is new because of its music is the new music. Because the patent law does not examine musical compositions to determine their relation to those that have gone before, the distinction between new and old music can never qualify for patent protection. [FN29]

FN29. Of course, a player piano itself could be a new machine, for example in relation to a music box, and, likewise, a player piano capable because of design of improved piano-playing might also be a new machine. E.g., Aeolian Co. v. Schubert Piano Co., 261 F. 178 (2d Cir.1919). In such cases, the invention or discovery is the quality of the structure of the piano--its mode of operation--and not the particular piece of music being played. Cf. supra note 26 and accompanying text (digital electronic devices).

It is not the computer--the machine qua computer--that performs the [mathematic] function, but, rather, the [mathematic function] is attained only through "use" of the general-purpose computer. The general-purpose digital computer is itself a total and self-complete machine entity. Versatility in electronic data processing is its endowment, its reason for being, its stock in trade.

Digitronics Corp. v. New York Racing Ass'n, Inc., 187 USPQ 602, 640, 1975 WL 21112 (E.D.N.Y.1975), aff'd on other grounds, 553 F.2d 740, 193 USPQ 577 (2d Cir.1977). A programmed general purpose digital computer alleged to be patentable subject matter because of the program presents an independent ¤ 101 inquiry that is not resolved simply by calling the structure a "new machine."

Finally, a claim formally to a general purpose computer running a certain program cannot be deemed to satisfy ¤ 101 simply because the computer is a physical, tangible device. As the invalidated claims in Flook and Benson demonstrate, and consistent with my earlier discussion, a computer program for use in a physical electronic thing called a computer may nevertheless be held to be nonstatutory subject matter. It is illogical to say that although a claim to a newly discovered mathematical operation to be performed by a computer is merely a nonstatutory discovery of mathematics, a claim to any computer performing that same mathematics is a statutory invention or discovery. Our precedent has rejected reasoning that way. See Abele, 684 F.2d at 909, 214 USPQ at 688; Walter, 618 F.2d at 768, 205 USPQ at 408; Maucorps, 609 F.2d at 485, 203 USPQ at 815-16; Freeman, 573 F.2d at 1247, 197 USPQ at 472; accord Noll, 545 F.2d at 152, 191 USPQ at 730 (Lane, J., joined by Rich, J., dissenting). Furthermore, the broad statement that a computer using any program is patentable subject matter trivializes the principles and distinctions wrestled with in Benson, Flook, and Diehr, and the case law thereunder.

In summary, it cannot be said that Alappat's circuit means each find equivalents in a programmed general purpose digital computer. If it can be said that Alappat's claimed circuit elements are each equivalent to a programmed general purpose computer just because they will perform the same claimed mathematics, then this demonstrates that Alappat's claimed circuitry does not represent the invention or discovery of statutory subject matter. As to the programmed general purpose computer itself, there is no justification for saying that it must constitute statutory subject matter. When a particular claim directed to an isolated general purpose digital computer instructed to store, compute, or retrieve information comes before us, the claimed invention or discovery must be analyzed as a whole by reference to the Supreme Court cases, cases of this court, and *1568 principles of ¤ 101, as has been done in this opinion with regard to Alappat's claimed rasterizer. Neither the recitation in the claim of structure nor the expedient label of "new machine" is sufficient for ¤ 101.

CONCLUSION

This opinion discusses several contexts involving inventions or discoveries in the field of digital electronics: One might invent or discover a new and useful product or process that includes as an element therein digital electronics performing mathematics, such as the rubber curing process in Diamond v. Diehr, or the improved washing machine mentioned by Alappat. One might invent or discover a mode of operation of a digital electronic device, capable ultimately of being used to perform mathematics, such as an improved transistor, chip, or computer. Or, one might discover a particular mathematic operation and claim the use of digital electronics to perform the mathematic operation, such as the methods of calculating numbers in Gottschalk v. Benson and Parker v. Flook, and the rasterizer for converting numbers claimed by Alappat. This last category, however, is at best newly discovered mathematics which is not being "implement[ed] or applie [d] ... in a structure or process which, when considered as a whole," Diehr, 450 U.S. at 192, 101 S.Ct. at 1059, 209 USPQ at 10 (emphasis added), represents an invention or discovery of a machine or process (as in the case of Diehr) for which one may obtain a patent pursuant to ¤ 101.

The majority's holding is dangerous in the following way. First, it reasons that one can obtain a patent for a discovery in mathematics as long as some structure is formally recited on the face of the claim. Under this aspect of the holding, many of the requirements for patentability other than "newness," such as nonobviousness, make no sense and cannot be meaningfully applied. Thus, mathematical patents will be easier to obtain than other patents. Moreover, the patent law will now engage in the charade wherein claims directed to a particular method of calculating numbers (for use in a computer) are unpatentable, but claims directed to a computer (performing a particular method of calculating numbers) are patentable. [FN30]

FN30. Mercifully, the majority leaves open the possibility that a claim reciting structure on its face can still be rejected under ¤ 101. The majority says that this will happen where the claim reciting structure on its face is merely a "guise" for a claim to a mathematical process. Pages 1540-41. Although the majority finds that Alappat's claim to a rasterizer is clearly not a "guise" for a discovery of a mathematical process, the majority does not describe in detail how one distinguishes in general a "true" apparatus claim from an apparatus claim in "guise." Presumably, the way this is done is to determine what is the invention or discovery for which the patent applicant seeks an award of patent, and then to determine whether that discovery is the kind the statute was enacted to protect, as this dissenting opinion does.

Second, the majority accepts the argument that all digital electronic circuitry is statutory subject matter when it performs a mathematical operation, and it is all equivalent when the particular mathematical operation is the same. Under this aspect, the mathematical patents will create an enormous scope of technological exclusivity. The lack of meaningful examination and the breadth of exclusive rights conferred by patents for discoveries of bare mathematical operations are repugnant to Congress's careful statutory scheme for the promotion of the useful arts.

As the player piano playing new music is not the stuff of patent law, neither is the mathematics that is Alappat's "rasterizer." And the Supreme Court has in its decisions required it so. Alappat's claimed discovery is outside 35 U.S.C. ¤ 101, and for this reason I would affirm the board's rejection. I dissent from the majority's decision on the merits to the contrary.

PAULINE NEWMAN, Circuit Judge, concurring.

I

I join the opinion authored for the court by Judge Rich. I write separately to state additional views on the basic question of this case: that of statutory subject matter. This question has been dominant in the PTO's administration of its responsibilities with respect to computer-related inventions. I explore this subject in the context of the statutory*1569 purposes of Title 35, and specifically the issues of 35 U.S.C. ¤ 101 that are raised in this appeal. The Board's historical practice of giving ¤ 101 the narrowest possible reading--even were that ever a valid administrative policy--is out of place in a world that has become totally dependent on technology, and in which the laws governing technological innovation have direct consequences for industrial growth. Governmental timidity in the face of scientific and technologic change is not only unnecessary: it is unsupportable.

The boundary between patentable and unpatentable subject matter is not always a bright line. A good example is the function of mathematics in modern technology. Mathematics is not only a set of abstract principles, but a powerful vehicle of applied technology--just as chemistry is both a set of scientific principles and a vehicle of applied technology. The Board's underlying error in its Alappat decision arose from failure to distinguish between abstract mathematical principles and their practical applications.

II

Phenomena of nature and abstract scientific and mathematical principles have always been excluded from the patent system. Some have justified this exclusion simply on the ground of lack of "utility"; some on the ground of lack of "novelty"; and some on the ground that laws of nature, albeit newly discovered, are the heritage of humankind. On whatever theory, the unpatentability of the principle does not defeat patentability of its practical applications. See, e.g., O'Reilly v. Morse, 56 U.S. (15 How.) 62, 14 L.Ed. 601 (1854).

Most technologic inventions involve the application of scientific principles and phenomena of nature to specific purposes. It is these purposes that are the subject matter of 35 U.S.C. ¤ 101, and we need not decide such interesting epistemological questions as whether mathematical formulae exist in nature, or are created by mathematicians in the way that chemical compounds are created by chemists. However, the distinction between principle and practice was not observed in the Board's decision on Mr. Alappat's invention.

The theme underlying the Board's rejection of the Alappat claims was that since mathematical steps were involved, and were performable by computer, Alappat was claiming a mathematical algorithm such as was held unpatentable in Gottschalk v. Benson, 409 U.S. 63, 93 S.Ct. 253, 34 L.Ed.2d 273, 175 USPQ 673 (1972). [FN1] However, as is explained by Judge Rich, Alappat is claiming a rasterizer of an oscilloscope and similar devices of applied technology. The flaw contained in the Board's premise as applied to Alappat was recognized in Diamond v. Diehr, 450 U.S. 175, 101 S.Ct. 1048, 67 L.Ed.2d 155, 209 USPQ 1 (1981), the Court explaining that "A claim drawn to subject matter otherwise statutory does not become nonstatutory simply because it uses a mathematical formula, computer program or digital computer." Id. at 187, 101 S.Ct. at 1057, 209 USPQ at 8. [FN2] It is conspicuous that the Board in its opinion cited only Benson, suggesting a failure of appreciation of the evolution in Supreme Court and this court's jurisprudence.

FN1. In Benson the invention sought to be patented was a process whereby a number expressed in binary coded decimal form was converted to the same number expressed in binary form, for use in a digital computer. The Court held that such a patent would preempt all uses of the Benson mathematical formula in digital computers, viewing the formula as a form of scientific principle.

FN2. In Diehr the Court approved the patenting of a process for curing rubber wherein a well known mathematical equation (the Arrhenius equation) was used in a computer to calculate optimum cure time. The Court held that the presence of the mathematical algorithm did not defeat patentability of the overall process. In this context the CCPA and this court developed, case by case, the jurisprudence that the court now applies to Alappat's invention. See Arrhythmia Research Technology, Inc. v. Corazonix Corp., 958 F.2d 1053, 22 USPQ2d 1033 (Fed.Cir.1992) (discussing the evolution of Supreme Court, CCPA, and Federal Circuit decisions after Benson).

Alappat's rasterizer is an electronic device for displaying a smooth waveform by selective illumination of pixels. The Alappat rasterizer operates by performing a sequence of steps in accordance with instructions that are generated electronically. This operation requires several mathematical calculations that *1570 are performed with the aid of microelectronic circuitry, and can be performed by a digital computer. The structure resides in the configuration by which the device operates, as Judge Rich has explained, and is independent of how that configuration is provided. The structure may reside in semiconductor chips and hardwired connections, or be permanently embedded in the electronic form designated read-only memory, or removably embedded in the electronic form designated random-access memory. It is not relevant to section 101 whether the structure is hardwired or programmed, machine-readable or manually performed, and indeed the means-plus-function style of claim accommodates these alternatives.

Devices that work by way of digital electronics are not excluded from the patent system simply because their mechanism of operation can be represented by mathematical formulae. The output of an electronic device or circuit may be approximated to any required degree as a mathematical function of its current state and its inputs; some devices, such as the transistor, embody remarkably elementary mathematical functions. Principles of mathematics, like principles of chemistry, are "basic tools of scientific and technological work". Benson, 409 U.S. at 67, 93 S.Ct. at 255. Such principles are indeed the subject matter of pure science. But they are also the subject matter of applied technology.

Digital electronic devices implement mathematical manipulations of electronic signals, as chemical structures and reactions implement principles of molecular behavior. An apparatus that is configured to perform specific electronic procedures in accordance with instructions that require numerical measurements and mathematical calculations is no less statutory than any other combination of steps and components. A combination of mechanical or chemical components, structured to operate in accordance with the principles of mechanics or chemistry, does not become nonstatutory because those interactions and reactions follow basic scientific principles. Mathematics is not a monster to be struck down or out of the patent system, but simply another resource whereby technological advance is achieved. Alappat's claim to a rasterizer that is characterized by specified electronic functions and the means of performing them no more preempts the mathematical formulae that are used to direct these functions than did Chakrabarty's bacterium preempt genetic theory.

III

An inquiring and receptive attitude by the PTO to new technologies finds a mandate in the statute. The text of section 101 [FN3] has not changed since 1793, other than to change the word "art" to "process". This simple text served the industrial revolution and the atomic age; surely it can serve modern electronics. Indeed, the First Congress anticipated that new fields of human ingenuity would be developed, for the Patent Act of 1790 stated that the written description should enable one "skilled in the art of manufacture, whereof it is a branch, or wherewith it may be nearest connected " to make and use the invention. The Act contemplated that there would be inventions for which there was no established art, by referring to the art "nearest connected". An Act to promote the progress of the useful Arts, ch. VII, 1 Stat. 109, 110 (1789).

FN3. 35 U.S.C. ¤ 101 Inventions patentable
Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

Old law is often adapted to new needs: "If Congress has made a choice of language which fairly brings a given situation within a statute, it is unimportant that the particular application may not have been contemplated by the legislators." Barr v. United States, 324 U.S. 83, 90, 65 S.Ct. 522, 525, 89 L.Ed. 765 (1945). In Diamond v. Chakrabarty, 447 U.S. 303, 100 S.Ct. 2204, 65 L.Ed.2d 144, 206 USPQ 193 (1980) the Court emphasized that the patent system is available to serve all fruits of human ingenuity.
Law and public policy intertwine in embracing new fields in the scope of section 101. Patent law has nicely fostered technological *1571 advance in the United States, for its principles are particularly suited to a free market system: it requires neither governmental intrusion nor federal funds to provide the incentive for industrial innovation; the innovation incentive is the direct consequence of the patent grant. I know of no major technological advance, no new industry or evolving technology, that has not participated in the patent system. It is estimated that 85-90% of the world's technology is disclosed only in patent documents. Justice Story's words at the threshold of our nation's industrialization have been reinforced by experience:
Patents for inventions are now treated as a just reward to ingenious men, and as highly beneficial to the public, not only by holding out suitable encouragements to genius and talents and enterprise; but as ultimately securing to the whole community great advantages from the free communication of secrets, and processes, and machinery, which may be most important to all the great interests of society, to agriculture, to commerce and to manufactures, as well as to the cause of science and art.
Blanchard v. Sprague, 3 F.Cas. 648, 650 (C.C.D.Mass.1839). The nation was forcefully reminded of this truth when our economic leadership faltered in the 1970s. In an address before the Economic Club of Detroit, Irving S. Shapiro, Chairman, E.I. duPont de Nemours & Co., discussing "Technology's Decline", stated:
What seems to be missing in our country is an understanding that, no matter how much money we spend on research and development, the findings are not going to benefit the public unless there are suitable incentives to invest in commercialization. That means a chance of reasonable profits from risk taking and a chance to hold onto one's original ideas once they are created.
XLV Vital Speeches of the Day, 360, 364 (1979). To bar such inventions as Alappat's rasterizer from access to the patent system is to eliminate the

incentive provided by this law, disserving not only technological industry, but the public benefit of improved technology. One must have a powerful reason to exclude technology from the scope of Title 35. Indeed, the importance of the patent incentive in industrial innovation was the principal factor in the formation of the Federal Circuit. It is thus appropriate constructively to apply statute, precedent, and policy to the variety of inventions that the information age has generated, and to remove the cloud on whether these inventions may participate in the benefits and obligations of the patent system.

MAYER, Circuit Judge, with whom MICHEL, Circuit Judge, joins, dissenting.

I do not agree that we have jurisdiction over this appeal. The Commissioner exceeded his statutory authority in convening a new, expanded panel to reconsider the board's original decision in Alappat's appeal from the examiner. Because the Commissioner's acts were not in accordance with law, the reconsideration decision cannot be a "decision of the Board of Patent Appeals and Interferences" within the meaning of 28 U.S.C. ¤ 1295(4)(A) (1988), and this court has no jurisdiction to address the merits of the appeal. See In re Bose Corp., 772 F.2d 866, 869, 227 USPQ 1, 3 (Fed.Cir.1985) (an improperly constituted board may not render a valid decision over which this court may exercise its review jurisdiction). As the Supreme Court has said, "A court-martial [for which we may substitute "board"] is the creature of statute, and, as a body or tribunal, it must be convened and constituted in entire conformity with the provisions of the statute, or else it is without jurisdiction." McClaughry v. Deming, 186 U.S. 49, 62, 22 S.Ct. 786, 791, 46 L.Ed. 1049 (1902).

The Patent Act provides that "[o]nly the Board of Patent Appeals and Interferences has the authority to grant rehearings." 35 U.S.C. ¤ 7(b) (1988). The Solicitor argues that the statute is ambiguous, that it is unclear what the composition of the "Board" must be for the "Board" to "grant rehearings" or to actually rehear an appeal. Therefore, this court should defer to the Commissioner's interpretation of the meaning of this clause of section 7.

However, the Solicitor presents conflicting impressions of the board and its role. On one hand, he argues that the board is not an independent body, but is simply an extension of the former power of the Commissioner to *1572 directly hear appeals from decisions of primary examiners. [FN1] The board is an alternative avenue through which the Commissioner may make "policy" decisions, of which as head of the Patent Office, he is the final arbiter. This being the case, the Commissioner has broad discretionary authority to designate, or redesignate, panels to keep the board from rendering decisions contrary to his policy. Therefore, the "Board" that either grants rehearings or rehears appeals is whatever collection of members the Commissioner chooses to designate at any stage of the proceeding before a final decision is entered.

FN1. The Commissioner has publicly set forth this view in an April 29, 1992, letter to the members of the board, reprinted in 44 PTCJ (BNA) 43 (May 14, 1992).

On the other hand, the Solicitor analogizes the board to a court. He says it regularly sits in panels of three, but is capable, as is this court, of sitting in expanded panels if certain criteria are met. He also compares the board to the Court of Appeals for the Ninth Circuit and its ability to sit en banc with less than the entire court. See 28 U.S.C. ¤ 46(c) (1988); 9th Cir. Rule 35-3. The board also has this option, argues the Solicitor, and the use of limited "en banc" is discretionary with the Commissioner.

The Commissioner cannot have it both ways. Either the board is a quasi-judicial body, deciding each case by applying existing law to the facts before it, or the board is simply an extension of the Commissioner's office, making decisions on the basis of policy.

I think the statute is unambiguous and that it unarguably vests the power to grant rehearings in the board itself, free from undue interference by the Commissioner. The patent board is not the "alter ego" of the Commissioner; it is an adjudicative body which functions independently and has its own separate and distinct authority. See Animal Legal Defense Fund v. Quigg, 932 F.2d 920, 928, 18 USPQ2d 1677, 1684 (Fed.Cir.1991). The Commissioner may only influence a decision when he sits as a voting member of the board and in this role he serves as any other member. Id. at 929 n. 10, 18 USPQ2d at 1684 n. 10. It is on this assumption that this court has routinely reviewed patentability decisions of the board on the same basis as it does those of a court. See, e.g., In re King, 801 F.2d 1324, 1326, 231 USPQ 136, 138 (Fed.Cir.1986) ("Our review of a finding of anticipation [a fact question] is the same whether it was made by the board or by a district court."); compare In re Bond, 910 F.2d 831, 833, 15 USPQ2d 1566, 1567 (Fed.Cir.1990) (anticipation is a question of fact for the board reviewed under the clearly erroneous standard), with Lindemann Maschinenfabrik Gmbh v. American Hoist & Derrick Co., 730 F.2d 1452, 1458, 221 USPQ 481, 485 (Fed.Cir.1984) (applying same clearly erroneous standard to district court's finding of anticipation); and In re McCarthy, 763 F.2d 411, 412, 226 USPQ 99, 100 (Fed.Cir.1985) (obviousness is reviewed for legal correctness without deference to the board's determinations), with Gardner v. TEC Systems, Inc., 725 F.2d 1338, 1344, 220 USPQ 777, 782 (Fed.Cir.1984) (district court's conclusion on obviousness "is one of law and subject to full and independent review in this court.").

The role of the board is also readily apparent from the history of the Patent Office. The Office's primary task is to answer questions on the patentability of inventions. The Commissioner has the authority to promulgate regulations consistent with the patent laws to aid the efficient operation of the Office. 35 U.S.C. ¤ 6(a) (1988); see Ethicon, Inc. v. Quigg, 849 F.2d 1422, 1425, 7 USPQ2d 1152, 1154 (Fed.Cir.1988). The Patent Office also has the responsibility to make individual determinations on patentability by examining particular applications. 35 U.S.C. ¤ 131 (1988). Originally, these functions were colocated in the Office of the Commissioner, who had the authority to "administer" the Office as well as to act as the final stage of decision on individual applications by hearing appeals directly from the examiners. See M. Blommer, The Board of Patent Appeals and Interferences, 1992 AIPLA Bulletin 188 (October, 1992); P.J. Federico, The Board of Appeals 1861-1961, 43 J.Pat.Off.Soc'y 691 (1961) (summarizing the history of the board from its inception). Growth in the number of applications *1573 and correspondingly of appeals, made it necessary to give the Commissioner help in hearing appeals. In 1861 the Board of Appeals was created, and the Commissioner was given the task of hearing appeals from this board's decisions. 1992 AIPLA Bulletin at 190.

The Act of March 2, 1927, set up the division of authority in the Patent Office essentially as it exists today by abolishing the appeal to the Commissioner and delegating the task of hearing appeals solely to the newly expanded board. The Commissioner was made a member of the board along with the First Assistant Commissioner, the Assistant Commissioner and the examiners- in-chief. See Pub.L. No. 69-690, 44 Stat. 1335 (1927). The act separated the administrative function of running the Patent Office assigned to the Commissioner, from the adjudicatory function of deciding individual cases of patentability, delegated to the board. This division was retained in the 1952 Patent Act. See 35 U.S.C. ¤¤ 6 and 7. The additional

requirement that "examiners-in-chief shall be persons of competent legal knowledge and scientific ability" suggests the board is to render its decisions on legal and scientific bases independent of administrative and policy concerns. See id. ¤ 7(a).

The independent character of the board comports with the arrangement of other adjudicatory bodies in the executive branch. For example, Congress has created agency boards of contract appeals and given them the authority to rule on disputes arising out of contracts between the government and private parties. 41 U.S.C. ¤ 607 (1988). These boards preside over cases in which contract rights of private individuals and entities are directly pitted against the interests of the government. Likewise the patent appeals board resolves conflicts between individuals seeking exclusive rights to inventions and the government's interest in promoting free exchange of technology. Both the board of patent appeals [FN2] and the contract appeals boards [FN3] function under similar grants of authority that, at least facially, are not limited by the authority of the head of the agency. Both bodies are in some sense, "designated" by their agency head, but this does not mean their decisions may be limited or controlled by that official. Historical and statutory notes explaining the authority of the boards of contract appeals state that the boards act independently, "not as a representative of the agency, since the agency is contesting the contractor's entitlement to relief." 41 U.S.C.A. ¤ 607 notes; see also United States v. General Dynamics Corp., 828 F.2d 1356, 1364 (9th Cir.1987) (the "ASBCA is intended to be independent of the Department of Defense," and its function is "strictly quasi-judicial"). By virtue of its similar function and statutory authority, the patent appeals board cannot be viewed as a "representative of the agency" because the Patent Office, through the examiner, also contests the entitlement of the applicant by arguing for rejection of the patent application.

FN2. "The Board of Patent Appeals and Interferences shall, on written appeal of an applicant, review adverse decisions of examiners upon applications for patents and shall determine priority and patentability of invention in interferences declared under section 135(a) of this title. Each appeal and interference shall be heard by at least three members of the Board of Patent Appeals and Interferences, who shall be designated by the Commissioner." 35 U.S.C. ¤ 7(b).

FN3. "Each agency board shall have jurisdiction to decide any appeal from a decision of a contracting officer (1) relative to a contract made by the agency, and (2) relative to a contract made by any other agency when such agency or the Administrator has designated the agency board to decide the appeal." 41 U.S.C. ¤ 607(d).

If Congress intended to create a board that is not independent, but subject to the policy-making authority of the agency head, it would have specifically done so as it has in other contexts. For example, it specified that the secretaries of the military departments may correct the military records of an individual by acting "through" a civilian board. See 10 U.S.C. ¤ 1552 (1988 & Supp. IV 1993). [FN4] By the statute, the board acts as *1574 the secretary would, it acts on his behalf. This contrasts sharply with the situation of the board of patent appeals on which the Commissioner acts simply as one member of the board. The Patent Act does give the Commissioner authority to designate the members who will sit on panels of the board, 35 U.S.C. ¤ 7(b), but this is a far cry from a proviso that the board acts for the Commissioner, or the Commissioner acts "through" the board.

FN4. In pertinent part, ¤ 1552 reads as follows:
(a)(1) The Secretary of a military department may correct any military record of the Secretary's department when the Secretary considers it necessary to correct an error or remove an injustice ... such corrections shall be made by the Secretary acting through boards of civilians of the executive part of that military department.

By way of another example, Congress specifically limited the independence of the Board of Veterans Appeals. See 38 U.S.C. ¤ 7104 (1988). In addition to regulations of the department and precedent of the department's chief legal officer, instructions of the secretary are specifically made binding upon the board in making its decisions. Id. ¤ 7104(c). [FN5] The statute also gives the chairman, who is directly responsible to the secretary, the authority to order reconsideration of board appeals to be heard by an expanded section of the board. Id. ¤¤ 7101(a), 7103(a) & (b).

FN5. Section 7104(c) reads as follows: "The Board shall be bound in its decisions by the regulations of the Department, instructions of the Secretary, and the precedent opinions of the chief legal officer of the Department."

While the boards for the correction of military records and the Board of Veterans Appeals also serve a purpose similar to the boards of contract appeals and the patent board in that they preside over disputes with the government, their authority is significantly constrained by their subservience to the heads of those departments. Conversely, there is no similar limitation on the statutory authority of the patent appeals board in its adjudicatory role.
As a quasi-judicial adjudicatory body, the board is, or ought to be, imbued with certain court-like qualities. It accepts the submission of legal briefs, holds hearings, admits declarations, exhibits and affidavits upon a showing of good cause, issues written opinions, and has the power to remand cases to the examiner for action consistent with those opinions. See 37 C.F.R. ¤ 1.191 et. seq. (1993). Inherent in this adjudicative posture are certain standards of conduct. Of primary importance are both the decisional independence of the individual members of the adjudicatory body, and assurance that the decisions of the body as a whole are free from undue influence. Once an agency head decides to delegate some of his discretionary decision-making power to a board, even in the absence of specific congressional command, much less the situation here, he must then respect the independent decisional authority of the board and refrain from attempting to influence its decisions. United States ex rel. Accardi v. Shaughnessy, 347 U.S. 260, 266, 74 S.Ct. 499, 503, 98 L.Ed. 681 (1954) (once the Attorney General has delegated authority to rule on deportation orders to the Board of Immigration Appeals, he must not attempt to influence the board's decisions).
That courts and judges are to be free from outside influence in rendering decisions is unquestionably a basic concept of jurisprudence. See Chandler v. Judicial Council of Tenth Circuit, 398 U.S. 74, 84, 90 S.Ct. 1648, 1653, 26 L.Ed.2d 100 (1970) ("There can, of course, be no disagreement among us as to the imperative need for total and absolute independence of judges in deciding cases or in any phase of the decisional function."). Executive agencies, even acting in their adjudicatory capacity, are not courts, but the Supreme Court has emphasized that they must conform to the same standards: The maintenance of proper standards on the part of administrative agencies in the performance of their quasi-judicial functions is of the highest importance and in no way cripples or embarrasses the exercise of their

appropriate authority. On the contrary, it is in their manifest interest. For, as we said at the outset, if these multiplying agencies deemed to be necessary in our complex society are to serve the purposes for which they are created and endowed with vast powers, they must accredit themselves by acting in accordance with the cherished judicial tradition embodying the basic concepts of fair play.

Morgan v. United States, 304 U.S. 1, 22, 58 S.Ct. 773, 778, 82 L.Ed. 1129 (1938). To allow the Commissioner to gerrymander the *1575 composition of the board to insure a preordained result directly conflicts with the concept "that in administrative proceedings of a quasi- judicial character the liberty and property of the citizen shall be protected by the rudimentary requirements of fair play." Id. at 14-15, 58 S.Ct. at 775. See also Utica Packing Co. v. Block, 781 F.2d 71, 78 (6th Cir.1986) (decision of the Department of Agriculture reversed because the secretary's removal of the adjudicating officer who rendered the original decision and assigning a new one to rule on a petition for reconsideration violated due process.) "There is no guarantee of fairness when the one who appoints a judge has the power to remove the judge before the end of proceedings for rendering a decision which displeases the appointer." 781 F.2d at 78.

Because the board is a quasi-judicial body, and its proceedings must conform to judicial standards and be free from undue influence by the Commissioner, there is no mistaking the meaning of 35 U.S.C. ¤ 7(b). By its terms, the power to grant rehearings resides solely in the board and that power is separate and distinct from the powers of the Commissioner. Thus the decision to grant a rehearing must be made by the "Board" without interference by the Commissioner; he is limited to his membership on the board with a single vote. Although the Commissioner does have additional authority to designate panels, it is limited by the need to protect the board's decisional independence. See Ethicon, 849 F.2d at 1428, 7 USPQ2d at 1156 (Commissioner may conduct activities in the Patent Office "so long as he does not violate the statute."). In this respect the Commissioner holds a position on the board similar to a chief judge of a court, who has only one vote on a case, but has additional administrative authority.

In his dual role, as "rule-maker" for the Patent Office, and as "judge" when sitting on a panel of the board, the Commissioner is in a position similar to a federal judge on the United States Sentencing Commission. The Supreme Court has said it is not inherently impermissible for a judge to play such a dual role: "[T]he Constitution, ... does not forbid judges to wear two hats; it merely forbids them to wear both hats at the same time." Mistretta v. United States, 488 U.S. 361, 404, 109 S.Ct. 647, 671, 102 L.Ed.2d 714 (1989). So too the Commissioner; when dealing with the board, he is as limited in his authority as any other member, and may not wear his policy-making "hat" or seek to force pre-ordained, policy-driven decisions.

The procedure to grant rehearing, although not the subject of formal rule, [FN6] must be consistent with the quasi-judicial character of the board itself, and must conform to the same standards as other judicial bodies. When a court grants a "rehearing," it means one of two things: that the case is heard again by the original panel, or is heard by the entire court sitting en banc. See, e.g., Fed.R.App.P. 35, 28 U.S.C.App. (1988); Fed.Cir.R. 40 (1993) and Practice Note (petitions for rehearing); D.C.Cir. Rule 15, 28 U.S.C.A. (1993). In keeping with this practice, once a case is heard by a properly designated panel of the Board of Patent Appeals and Interferences, and a decision rendered, rehearing may be granted and the case reheard only by the "Board," i.e. the original panel or the board as a whole. There is no room for any intermediate procedure. Just as it would be impermissible for the chief judge of a court *1576 to personally decide that a case should be reheard by an "expanded" panel and then pack the panel with judges known

for conforming views, such action by the Commissioner is likewise unacceptable.

FN6. The lack of formal, published regulations covering the procedure to grant rehearings may itself make the Commissioner's practice of designating a new, or expanded panel unlawful. Redesignation in this case was outcome-determinative. As such, the redesignation practice affected substantive rights of the applicant. Under the Administrative Procedure Act, "substantive rules of general applicability," as well as "the general course and method by which [the agency's] functions are channeled and determined," are required to be published in the Federal Register. 5 U.S.C. ¤ 552(a)(1)(D) & (a)(1)(B). There are no published rules or notices or even general explanations of how redesignation (or designation) of panels is to be accomplished by the Commissioner. "The Administrative Procedure Act was adopted to provide, inter alia, that administrative policies affecting individual rights and obligations be promulgated pursuant to certain stated procedures so as to avoid the inherently arbitrary nature of unpublished ad hoc determinations. See generally S.Rep. No. 752, 79th Cong., 1st Sess., 12-13 (1945); H.R.Rep. No. 1980, 79th Cong., 2d Sess., 21-23 (1946)." Morton v. Ruiz, 415 U.S. 199, 232, 94 S.Ct. 1055, 1073, 39 L.Ed.2d 270 (1974).

That the Commissioner "stacked" the board is abundantly clear. After the original panel rendered a decision favorable to Alappat, the Commissioner designated an expanded panel to rehear the case consisting of himself, the Deputy Commissioner, an Assistant Commissioner, the Chairman and Vice-Chairman of the board, and the original three panel members. With himself and the four other "command group" members making up a majority of the board rehearing the appeal, the outcome was assured. These five members voted together, and the original panel filed an emphatic dissent.

The Solicitor argues that the large size of the board, over forty members, would make it unwieldy to sit as a whole. According to the Solicitor, like the Ninth Circuit, the board has the power to sit in "limited en banc" panels, at the discretion of the Commissioner. The circuit courts, however, have express statutory authority to divide themselves into smaller "administrative units" to hear cases en banc if the circuit has more than fifteen active judges. [FN7] The board has no similar statutory authority and any attempt by the Commissioner to provide for limited en banc, by rule or otherwise, would be inconsistent with the exclusive authority of the board to grant rehearings. If the large size of the board impedes its operation by making it difficult to rehear cases en banc, congressional consent for an alternative procedure like the circuit courts' should be sought. Because no such statutory authority now exists, however, the power of the board to grant rehearings is limited to the two choices available to other adjudicatory bodies, rehearing by the panel or by the entire board. The "rehearing" in this case was not accomplished by either of the two permissible options, so the decision of the expanded panel was not a decision of the "Board" within the meaning of the jurisdictional statute of this court and we have no authority to reach the merits, no matter how great their perceived importance.

FN7. 28 U.S.C. ¤ 46(c) (1988); Pub.L. No. 95-486 ¤ 6, 92 Stat. 1633 (Oct. 20, 1978). Currently only the Ninth Circuit qualifies under this statute.

However, we always have jurisdiction to the extent necessary to determine the jurisdiction of our subordinate tribunals, as well as our own. Bender v. Williamsport Area School District, 475 U.S. 534, 541, 106 S.Ct. 1326, 1331,

89 L.Ed.2d 501 (1986) ("every federal appellate court has a special obligation to 'satisfy itself not only of its own jurisdiction, but also that of the lower courts in a cause under review' ... '[When the lower federal court] lack[s] jurisdiction, we have jurisdiction on appeal, not of the merits but merely for the purpose of correcting the error of the lower court in entertaining the suit.' ") (citations omitted, bracketed material in original); accord C.R. Bard, Inc. v. Schwartz, 716 F.2d 874, 877, 219 USPQ 197, 200 (Fed.Cir.1983). For the same reason we lack jurisdiction to hear this appeal, so too did this board in its reconsideration. Accordingly, I would "correct[ ] the error" of the board by vacating its decision.

The decision of the court to take jurisdiction nevertheless, raises another troubling issue. If the Commissioner is correct, as the court apparently thinks, the board must be seen as simply an extension of the Commissioner's policy-making authority and thus not independent. If this is so, the standard by which this court reviews decisions of the board is questionable. It is now the practice, dubious from the start, to review the board under the same standard as we review a district court. In re King, 801 F.2d at 1326, 231 USPQ at 138. Questions of law are reviewed de novo, while findings of fact are examined to determine whether they are clearly erroneous. E.g., In re McCarthy, 763 F.2d at 412, 226 USPQ at 100 (obviousness is reviewed for legal correctness without deference to the board's determinations); In re Bond, 910 F.2d at 833, 15 USPQ2d at 1567 (anticipation is a question of fact for the board reviewed under the clearly erroneous standard). But if the board is simply implementing policy set out by the Commissioner, its decisions cannot be considered "legal" but must be subject to review as statements of agency policy. How such agency policy decisions *1577 are to be reviewed is not uniformly agreed upon by the courts; some review them for abuse of discretion, some for whether they are arbitrary and capricious, and some virtually refuse to review them at all. [FN8] Regardless of which of these standards would be most appropriate, it at least may be said that the standard of review applied by this court to the board should include a good deal more deference than has been applied heretofore. [FN9] Our practice is inconsistent with our review of agency boards of contract appeals. Those boards are "independent" of their agencies, and yet the Contract Disputes Act directs that their fact finding be reviewed under the deferential "substantial evidence" standard. See 41 U.S.C. ¤ 609(b) (1988); Triax-Pacific v. Stone, 958 F.2d 351, 353 (Fed.Cir.1992). If the court is correct that the patent appeals board is less "independent" and makes policy-based decisions, then arguably it should be reviewed more deferentially than contract appeals boards, not less so, as now.

FN8. See, e.g., Mada-Luna v. Fitzpatrick, 813 F.2d 1006, 1015 (9th Cir.1987) ("[A]gency decisions made pursuant to general statements of policy may be judicially reviewable at least for abuse of discretion." [citations omitted]); Mercury Motor Express, Inc. v. United States, 648 F.2d 315, 319 (5th Cir.1981) (policy statements reviewed under arbitrary, capricious standard); American Trucking Association, Inc. v. United States, 755 F.2d 1292, 1298 (7th Cir.1985) ("[T]he scope of our review [of a statement of general policy] would be exceedingly narrow, and our approval of the Commissioner's action would therefore be virtually assured.").

FN9. This court has taken a step in that direction in its review of the Trademark Trial and Appeal Board. See Eastman Kodak Co. v. Bell & Howell, 994 F.2d 1569, 26 USPQ2d 1912 (Fed.Cir.1993) (applying Chevron U.S.A. Inc. v. Natural Resources Defense Council, Inc., 467 U.S. 837, 104 S.Ct. 2778, 81 L.Ed.2d 694 (1984), to a decision of the TTAB, which is treated as if it were the "agency," and holding the TTAB's interpretation of an ambiguous provision

of the trademark statute reasonable, rather than undertaking a de novo interpretation of law).

The court seems inclined to let this matter slide, but I believe the decision today upholding jurisdiction puts the issue squarely before us, and the ramifications of that decision should not go quietly unnoticed. We should not pretend we are reviewing judicial decisions if they are really nothing more than policy actions. Even on a more deferential standard of review, however, I would still hold the Commissioner's manipulation of the board illegal.

PLAGER, Circuit Judge, concurring.

This case raises two significant issues. The first is whether, as a predicate for our review, there was a proper decision of the Board of Patent Appeals and Interferences. The second, which we can reach only if the answer to the first is yes, is how to dispose of the case on its merits. The first issue, the question of our jurisdiction over this appeal, is particularly troubling since it implicates the Commissioner's overall power and status within the agency, and particularly vis-a-vis the examining corps., and because the statutory provision, 35 U.S.C. ¤ 7, is so remarkably vague and incomplete. I join the majority's conclusion that we have jurisdiction in these particular circumstances; I write to sharpen the focus on specific administrative law issues which I believe to be important to an understanding of the case, and to explain my disagreement with the reasoning found in the opinions which dissent on the question of our jurisdiction.

On the merits of the appeal, there is no doubt that the Board erred as a matter of law in refusing to apply ¤ 112 ¦ 6 as we have instructed. I would have sent the matter back to the Board with instructions to do it right, but I recognize the validity in Lord Salisbury's famous dictum--if he had had more time, he might have delegated the work, but as he was pressed, he had to do it himself. [FN1] Accordingly, I join the majority's disposition of the merits, and in particular Judge Rich's skillful chasing out of some of the less useful judicial accretions regarding patentability under ¤ 101.

FN1. Robert Cecil, the Third Marquess of Salisbury, was one of the great Prime Ministers of nineteenth-century England. See R.K. Massie, Dreadnought--Britain, Germany, and the Coming of the Great War (1991).

On first--or even second--reading, the action of the Commissioner in reconstituting *1578 the Board in order to produce a result more to his liking seems beyond the pale. There is no express statutory warrant for it, nor has the Commissioner exercised his rulemaking power to purport to grant himself explicit authority to do such a thing. Furthermore, 'court-packing' has never caught on in this country as a prerogative of the Executive.

Closer study of the applicable law, however, leads to a different conclusion. The statute defines the overall membership of the Board: "The Commissioner, the Deputy Commissioner, the Assistant Commissioners, and the examiners-in- chief shall constitute the Board of Patent Appeals and Interferences." 35 U.S.C. ¤ 7(a) (1988). It gives the Commissioner authority to designate those particular members who shall constitute the Board in any given case: "Each appeal and interference shall be heard by at least three members of the Board of Patent Appeals and Interferences, who shall be designated by the Commissioner." 35 U.S.C. ¤ 7(b). And it gives "the Board" exclusive authority to grant rehearings: "Only the Board of Patent Appeals and Interferences has the authority to grant rehearings." Id.

The regulations add nothing of help. After decision by the Board, "A single request for reconsideration or modification of the decision may be

made if filed within one month...." 37 C.F.R. ¤ 1.197(b) (1993). [FN2] Neither the regulations or the statute explain which "Board" is being referred to: is it the full Board with membership now over forty people? the original Board designated by the Commissioner to hear the initial appeal? or the Board designated to consider the rehearing? The regulations do not even track the statute; they refer to "reconsideration," whereas the statute talks about "rehearings."

FN2. The regulations also provide that an applicant is entitled to have his case reconsidered by "the Board" under 37 C.F.R. ¤ 1.197(b) when "the Board" makes a new rejection of an appealed claim. See 37 C.F.R. ¤ 1.196(b)(2) (1993).

The question before us, however, is not whether the statute could have been better drafted, or whether the Commissioner could or should have written more explicit regulations. The question is much narrower, and more basic--does this court have subject matter jurisdiction over the cause here on appeal. Our statute (28 U.S.C. ¤ 1295(a) (1988)) directs that we shall have exclusive jurisdiction

(4) of an appeal from a decision of--

(A) the Board of Patent Appeals and Interferences of the Patent and Trademark Office....

Again the reference to "the Board," nowhere defined. The question, then, is, do we have a "decision of the Board" before us.

Judge Mayer, in his dissent, says no. He analogizes the Board to a court, and vests it with virtually complete independence from guidance, including policy guidance, from the Commissioner. The Board is imbued with "court-like qualities." Among these is freedom from outside influence in rendering decisions, including undue influence by the Commissioner. It follows then that Congress could not have intended the Commissioner to have the kind of power he claims to reconstitute the Board on a reconsideration. If the premise is correct, the conclusion indeed follows. I suggest, however, that the premise is not correct because it does not take into account the fundamental differences between administrative and judicial decision-making.

Courts, especially courts created under Article III of the Constitution, have a unique role--they stand as equal partners with the Executive and Legislative Branches, and, subject only to those restraints imposed by the Constitution, are wholly independent in their judicial function from the other two branches. Their mission is to ensure that the law is carried out in a just and proper way, consistent with the Constitution and statutes of the land.

Administrative judges and boards are quite a different thing. They stand as part of the agency which they serve, and represent the decisional authority of the official who is the administrative head of the agency. Their mission is, within the law, to promote and further the mission of the agency. The particular function they serve may be characterized as 'quasi-judicial,' but this must be understood within the context in which they function.

*1579 Congress has delegated to various Executive Branch agencies--or more accurately, to the officials who head the agencies--a wide range of functions, aimed at enabling the agencies to perform their missions. In addition to purely administrative functions (the internal management of the agency), agency heads typically are given rulemaking authority--the power to promulgate legislative-type rules to fill in gaps left by the Legislature, and adjudicative authority--the power to decide, as an administrative matter, the application of the agency's rules to individual cases.

An agency head could not today perform effectively all these functions without being able to delegate responsibility to various officials within the agency. In the case of the adjudicative function, a complex of individual- and board-adjudicators, like Topsy, has 'growed up.' [FN3] They come with various titles: some agencies have 'administrative judges,' some have 'administrative law judges,' some use other titles. ('Hearing examiner' was a popular title before the Civil Service Commission in 1972 bestowed the appellation of 'judge' on many of these positions.) Adjudicative boards of various kinds, with various memberships and various duties, have been established, generally by legislation. Some board members are referred to as 'judge,' some are not.

FN3. There are currently almost 1,200 Administrative Law Judges (ALJs) employed by 30 federal agencies. In addition, there are other administrative officials who do work similar to that of ALJs; these "non-ALJs" conduct almost 350,000 cases annually, involving over 2,600 presiding officers, either on a full-time or part-time basis. See Paul Verkuil et al., The Federal Administrative Judiciary 5-7 (1992), an exhaustive study of the federal administrative judiciary commissioned by the Administrative Conference of the United States at the request of the Office of Personnel Management.

Whoever they are, and however many of them there are in any given agency, they all have a common role--they stand in the shoes of the agency head and carry out specified duties which Congress has assigned to that agency. This does not mean that these agency adjudicators simply do what the agency head tells them. As a practical matter, no agency head has time or opportunity to monitor the daily work of these employees. Furthermore, the institutional distance between them has an important value--it serves to remove the adjudicative function from any improper political or personal bias that might otherwise infect the process if left exclusively in the hands of one individual. Another important value is to avoid having the agency activities of investigation, prosecution, and adjudication combined in the same person or office. [FN4]

FN4. See Paul Verkuil et al., supra note 3, at 14-15.

This separation is particularly important in fact-finding: the adjudicator is entitled to independence, i.e., freedom from interference, in determining the facts of the case. But 'independence' in the administrative adjudicative function is not independence from the policies and program of the agency, the policies and programs of which are uniquely the responsibility of the agency head.

The dissent's parallel between agency adjudicators and courts demonstrates the inaptness of this analogy. For example, he states that "the Commissioner holds a position on the board similar to a chief judge of a court, who has only one vote on a case, but has additional administrative authority." Slip op. at 11. But a chief judge of an Article III court is not selected for that position by virtue of any particular talent for the job, or because of any particular policy-making skills; indeed, a chief judge is not 'selected,' but inherits the job by virtue of a mathematical combination of seniority and longevity. [FN5]

FN5. There is one exception among the chief judges: the chief judge of the Court of International Trade, an Article III trial court, is appointed to that office by the President. And of course the Chief Justice of the United

States, who functions for the Supreme Court in a role not unlike that of a chief judge, is also appointed to that office.

By contrast, the appointment of the head of a major administrative agency is a matter of considerable political and professional concern, and requires both Presidential selection and nomination and Senate confirmation for that particular post. The person selected is expected to have important skills in the role *1580 to be played, and equally importantly is expected to support the President's program and must be acceptable to the concerned policy interests reflected in the Senate.

The relative roles of a chief judge and an agency head reflect these differences. A chief judge has a purely administrative function by virtue of the office; policy making and adjudication lie elsewhere. The agency head, in this case the Secretary of Commerce, assisted by the Commissioner of Patents and Trademarks who holds office as an Assistant Secretary of Commerce, has, subject to direction from the President, all three of the functions and powers described. In this light, the majority's view of the statute governing the Board's organization and powers is more consistent with the proper role and authority of the Commissioner, who acts for the Secretary, than is the dissent's.

There no doubt are limits to the Commissioner's power over Board adjudications. The Commissioner is not free to unduly interfere with individual adjudications--that is, the application of established rules to independently found facts of a case. But this is not such a case. In this case the Board decision at bottom turned on an important issue of statutory interpretation--what is patentable subject matter under ¤ 101 of the 1952 Patent Act. The Commissioner had a quite different view of how ¤ 101 should be interpreted than did the Board that initially heard the case. While the Commissioner has various vehicles at his command for announcing official interpretations of the agency's organic legislation and for enunciating agency policy, there is nothing unusual about using the adjudicative process for that purpose. [FN6]

FN6. In the early years, adjudication was the principal method agencies used to promulgate policies. See Daniel J. Gifford, Adjudication in Independent Tribunals: The Role of an Alternative Agency Structure, 66 Notre Dame L.Rev. 965 (1991). The Administrative Procedure Act provided for the role of adjudications made on the record. See ch. 324, ¤¤ 5, 7(d), Pub.L. No. 404, 60 Stat. 239, 241-42 (1946).

The Commissioner has an obligation to ensure that all parts of the agency, including agency boards and adjudicative officials, conform to official policy of the agency, including official interpretations of the agency's organic legislation. Otherwise the citizenry would be subject to the whims of individual agency officials of whatever rank or level, and the Rule of Law would lose all meaning in the administrative law context. If Congress intended to transfer policy choice to the subordinate officials who constitute the normal membership of a Board, and remove from the agency head the fundamental responsibility for agency policy direction, it would have to make explicit such an extraordinary procedure before a court should countenance it. [FN7]

FN7. It is worth noting that, in recent years, the examiners-in-chief are included with "all other officers and employees" who are appointed by the Secretary of Commerce upon the nomination of the Commissioner. Pub.L. No. 93-601, 88 Stat.1956 (1975). Prior to that they, along with the Commissioner and assistant commissioners, were appointed by the President with Senate

confirmation. See, e.g., ch. 950, Pub.L. No. 593, 66 Stat. 792 (1952): "A Commissioner of Patents, one first assistant commissioner, two assistant commissioners, and nine examiners-in- chief shall be appointed by the President, by and with the advice and consent of the Senate." Article III judges are neither appointed by or subject to removal by a chief judge.

Judge Schall in his dissent also says no to the question of whether we have before us a decision of "the Board." He bases his conclusion on an analysis different from that of Judge Mayer. Applying classic literal or 'plain meaning' statutory analysis, Judge Schall concludes that the Board's reconsideration decision was invalid because the PTO panel was not the Board intended by the statute: "the Board" is all forty-plus members described, and nothing less. The technique of legal analysis employed by the dissent is certainly legitimate, and based on sound precedent. If it applies here, Judge Schall's treatment is hard to fault. However, I do not find the statute 'plain', and am hard pressed to discern its 'meaning' in this context.

One could ask how a literal reading of the statute is called for when the statute, literally read, is literally incomplete. The statute states that "only the Board ... has the authority to grant rehearings." And then it stops. It does not tell us, or even hint at an *1581 answer to: when a rehearing is granted, who appoints the rehearing Board? Must the rehearing Board be the full Board (which, per Judge Schall, must grant the rehearing), or can it be less than the full Board? Does the Commissioner have a supervisory role to play? A wide range of possible permutations comes readily to mind.

Equally troubling is the impact this 'plain meaning' interpretation will have on our prior cases (as well as future ones). A preliminary canvas of ex parte appeals to the Board in the FY 1990--FY 1993 period (Oct. 1, 1990--Sept. 30, 1993) indicates that the Board decided 17,132 appeals. Of these, 1,551 involved a "reconsideration" decision by the Board. The available data do not reveal whether these reconsideration decisions were always by the same board that rendered the initial decision, but presumably that would be true in most if not all of these cases. It is presumably also true that these rehearings were granted pursuant to the existing PTO regulations, which do not involve the Board as the authorizing entity.

If we were to adopt the plain meaning analysis offered by this dissent, what are we to think about all such prior rehearing decisions? A government act that is ultra vires is void, which means the defect in the appeal is not waived simply because the parties failed to raise it. Since there is no compelling reason to adopt such a radical result--as I say, I find the statute's plain meaning not so easily discerned--I conclude that the outcome called for by Judge Schall is not warranted. I would also note that under this analysis, the Commissioner by subsequent regulation could not clarify the circumstances and manner in which he intended to exercise this reconstitution power, since he would be without authority to exercise it.

I conclude that Chief Judge Archer in his opinion comes closer to the answer to today's jurisdictional puzzle. Although there remains opportunity for attack should the Commissioner again reconstitute a board the way he did here-- does he violate his own regulations, is there a due process question, what is the exact scope of the legislative grant of authority--that attack has not here been launched. A court must attend to its own jurisdiction, and the parties cannot grant jurisdiction by their consent. Nevertheless, the absence of challenge removes peripheral and secondary issues, and leaves only the basic jurisdictional question. I am unpersuaded by the arguments my colleagues make against jurisdiction. And while I do not necessarily agree with all that is said about it by those in support of jurisdiction, I

do agree that there is sufficient basis in law for this court to conclude that we have before us on this record a decision of "the Board;" I concur in the court's decision to proceed to address the merits.

RADER, Circuit Judge, concurring.

I join Judge Rich's opinion holding that this court has subject matter jurisdiction over this appeal and reversing the reconstituted Board of Patent Appeals and Interferences' decision on the merits. While I fully agree with Judge Rich that Alappat's claimed invention falls squarely within the scope of 35 U.S.C. ¤ 101 (1988), I write to clarify that this conclusion does not hinge on whether Alappat's invention is classified as machine or process under section 101.

The reconstituted Board determined that applicants' (Alappat's) invention is a process excluded from the subject matter of 35 U.S.C. ¤ 101. The Board concluded that the invention is a "mathematical algorithm" rather than a patentable machine. The Board reached this conclusion by impermissibly expanding the scope of the claimed subject matter, thereby running afoul of 35 U.S.C. ¤ 112, ¦ 6 (1988). See In re Donaldson Co., 16 F.3d 1189, 1193, 29 USPQ2d 1845, 1848 (Fed.Cir.1994) (in banc). Not surprisingly, the initial Board found no problem with 35 U.S.C. ¤ 101 when the claims were properly interpreted in light of the specification.

Judge Rich, with whom I fully concur, reads Alappat's application as claiming a machine. In fact, whether the invention is a process or a machine is irrelevant. The language of the Patent Act itself, as well as Supreme Court rulings, clarifies that Alappat's invention fits comfortably within 35 U.S.C. ¤ 101 whether viewed as a process or a machine.

Section 101 of the Patent Act states:

*1582 Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

Any new and useful process, machine, article of manufacture, or composition of matter, including improvements, may thus receive patent protection. Section 101 explicitly covers both processes and machines. Furthermore, according to the Supreme Court, "any" is an expansive term encompassing " 'anything under the sun that is made by man.' " Diamond v. Chakrabarty, 447 U.S. 303, 309, 100 S.Ct. 2204, 2208, 65 L.Ed.2d 144 (1980) (quoting S.Rep. No. 1979, 82d Cong., 2d Sess. 5 (1952); H.R.Rep. No. 1923, 82d Cong., 2d Sess. 6 (1952)). Section 101 does not suggest that patent protection extends to some subcategories of processes or machines and not to others. The Act simply does not extend coverage to some new and useful inventions and deny it to others.

Indeed, the Supreme Court has clarified that section 101 means what it says: any new and useful invention is entitled to patent protection, subject to the remaining statutory conditions for patentability. See Diamond v. Diehr, 450 U.S. 175, 182, 101 S.Ct. 1048, 1054, 67 L.Ed.2d 155 (1981). In determining what qualifies as patentable subject matter, the Supreme Court has drawn the distinction between inventions and mere discoveries. On the unpatentable discovery side fall "laws of nature, natural phenomena, and abstract ideas." Diehr, 450 U.S. at 185, 101 S.Ct. at 1056. On the patentable invention side fall anything that is "not nature's handiwork, but [the inventor's] own." Chakrabarty, 447 U.S. at 310, 100 S.Ct. at 2208. While Judge Rich correctly applies these principles to machines, they apply with equal force to processes.

The dividing line between patentable invention and mere discovery applies equally well to algorithmic inventions. In Diehr, the Court indicated that in special cases, an algorithm is tantamount to a "law of nature" and

therefore non-statutory. Diehr, 450 U.S. at 186, 101 S.Ct. at 1056. However, the Court noted that "[t]he term 'algorithm' is subject to a variety of definitions." Id. at 186 n. 9, 101 S.Ct. at 1056 n. 9. The Court refused to expand the term "algorithm" beyond the narrow definition employed in Gottschalk v. Benson, 409 U.S. 63, 65, 93 S.Ct. 253, 254, 34 L.Ed.2d 273 (1972) and Parker v. Flook, 437 U.S. 584, 589, 98 S.Ct. 2522, 2525, 57 L.Ed.2d 451 (1978), two cases in which the Court ruled the inventions non-statutory:

[The petitioner's] definition is significantly broader than the definition this Court employed in Benson and Flook. Our previous decisions regarding the patentability of "algorithms" are necessarily limited to the more narrow definition employed by the Court, and we do not pass judgment on whether processes falling outside the definition previously used by this Court, but within the definition offered by the petitioner, would be patentable subject matter.

Diehr, 450 U.S. at 186 n. 9, 101 S.Ct. at 1056 n. 9.

Thus, in Diehr, the Court specifically confined the holdings of Benson and Flook to the facts of those cases. Significantly, the Court thereby refused to classify all algorithms as non-statutory subject matter. Only algorithms which merely represent discovered principles are excluded from section 101. The inventions in Benson and Flook involved such algorithms. In Benson, the invention was simply a way to solve a general mathematics problem; in Flook the invention was a way to obtain a number. Diehr, 450 U.S. at 185-86, 101 S.Ct. at 1056. In pronouncing the severe confinement of the earlier decisions, the Supreme Court restored the Patent Act's clear meaning that processes and machines are patentable subject matter even if they include an algorithm. In the wake of Diehr and Chakrabarty, the Supreme Court only denies patentable subject matter status to algorithms which are, in fact, simply laws of nature.

Moreover, "a claim drawn to subject matter otherwise statutory does not become nonstatutory simply because it uses a mathematical formula, computer program or digital computer." Diehr, 450 U.S. at 187, 101 S.Ct. at 1057. Viewing the claim as a whole, if a digital circuit or its use would define an invention under section 101, then the same *1583 invention described in terms of "a mathematical formula, computer program or digital computer" should be statutory subject matter as well. Neither Alappat's digital circuit, nor a mathematical algorithm that replaces it in a computer, is a "fundamental law of nature" excluded from the scope of section 101. In sum, section 101 is no bar to Alappat whether his invention is a machine--which it is--or a process--which it employs.

The limits on patentable subject matter within section 101 do not depend on whether an invention can be expressed as a mathematical relationship or algorithm. Mathematics is simply a form of expression--a language. As this court's predecessor pointed out:

[S]ome mathematical algorithms and formulae do not represent scientific principles or laws of nature; they represent ideas or mental processes and are simply logical vehicles for communicating possible solutions to complex problems.

In re Meyer, 688 F.2d 789, 794-95, 215 USPQ 193, 197 (CCPA 1982).

The Supreme Court's Diehr doctrine in effect recognizes that inventors are their own lexicographers. Therefore, inventors may express their inventions in any manner they see fit, including mathematical symbols and algorithms. Whether an inventor calls the invention a machine or a process is not nearly as important as the invention itself. Thus, the inventor can describe the invention in terms of a dedicated circuit or a process that emulates that circuit. Indeed, the line of demarcation between a dedicated circuit and a computer algorithm accomplishing the identical task is frequently blurred and

is becoming increasingly so as the technology develops. In this field, a software process is often interchangeable with a hardware circuit. Thus, the Board's insistence on reconstruing Alappat's machine claims as processes is misguided when the technology recognizes no difference and the Patent Act treats both as patentable subject matter.

The Supreme Court has frequently cautioned that "courts 'should not read into the patent laws limitations and conditions which the legislature has not expressed.' " Chakrabarty, 447 U.S. at 308, 100 S.Ct. at 2207 (quoting United States v. Dubilier Condenser Corp., 289 U.S. 178, 199, 53 S.Ct. 554, 561, 77 L.Ed. 1114 (1933)). This same counsel applies to the Board. The Board has no justification within the Patent Act to ignore algorithmic processes or machines as "useful Arts" within the scope of section 101. U.S. Const. art. I, ¤ 8. This court should not permit the Patent and Trademark Office to administratively emasculate research and development in this area by precluding statutory protection for algorithmic inventions.

The applicants of the instant invention do not seek to patent a mathematical formula. They seek protection for an invention that displays a smooth line on an oscilloscope. Although Alappat's machine or process might employ an equation, it does not pre-empt that equation. Consequently, whether the invention is called a machine or a process is inconsequential. For these reasons, I agree with this court's reversal of the reconstituted Board's decision.

SCHALL, Circuit Judge, dissenting, with whom CLEVENGER, Circuit Judge, joins.

I respectfully dissent. I believe that the decision on reconsideration is invalid because the grant of reconsideration was not by the full membership of the Patent and Trademark Office Board of Patent Appeals and Interferences ("Board"), as required by statute. Accordingly, we are without jurisdiction to hear Alappat's appeal because it is not from a decision of the Board within the meaning of 28 U.S.C. ¤ 1295(a)(4)(A) (1988).

The pertinent statutory provisions are found at 35 U.S.C. ¤¤ 7(a) and 7(b) (1988):

(a) .... The Commissioner, the Deputy Commissioner, the Assistant Commissioners, and the examiners-in-chief shall constitute the Board of Patent Appeals and Interferences.

(b) The Board of Patent Appeals and Interferences shall, on written appeal of an applicant, review adverse decisions of examiners upon applications for patents.... Each appeal ... shall be heard by at least three members of the Board of Patent Appeals and Interferences, who shall be designated by the Commissioner. Only *1584 the Board of Patent Appeals and Interferences has the authority to grant rehearings.

The statutory scheme is straightforward. An adverse decision of an examiner is appealed to the Board. Thereafter, the Board hears the appeal through a panel of at least three members, who are designated by the Commissioner. Following the panel's decision, "[o]nly the Board of Patent Appeals and Interferences has the authority to grant rehearings." [FN1] Finally, the statute provides that the "Board of Patent Appeals and Interferences" consists of "[t]he Commissioner, the Deputy Commissioner, the Assistant Commissioners, and the examiners-in-chief."

FN1. I agree with the majority that the reconsideration action in this case constituted a "rehearing" as provided for in ¤ 7(b).

When statutory interpretation is at issue, if "the language of the statute is clear and fits the case, the plain meaning of the statute will be regarded as conclusive." VE Holding Corp. v. Johnson Gas Appliance Co., 917 F.2d

1574, 1579, 16 USPQ2d 1614, 1618 (Fed.Cir.1990). Here, the plain language of the statute compels the conclusion that only the full Board--which currently has roughly 43 members (the Commissioner, the Deputy Commissioner, about two Assistant Commissioners, and about 39 Examiners-in-Chief [FN2])--has authority to grant rehearings. For present purposes, the critical word is "Only," appearing at the beginning of the third sentence of ¤ 7(b). The use of this word and its location in the statute say to me that Congress intended to draw a distinction between the initial hearing of an appeal--which is to be heard by "at least three members of the Board ..., who shall be designated by the Commissioner"--and a rehearing--which "[o]nly" the full Board may grant. [FN3] I simply can see no other way to read the statute.

FN2. The members of the Board who are examiners-in-chief are now called "Administrative Patent Judges." See 1158 Official Gazette Pat.Off. 347.

FN3. The statute does not define the word "Only." It is a basic principle of statutory interpretation, however, that undefined terms in a statute are deemed to have their ordinarily understood meaning. See, e.g., United States v. James, 478 U.S. 597, 604, 106 S.Ct. 3116, 3120, 92 L.Ed.2d 483 (1986) ("[W]e assume that the legislative purpose is expressed by the ordinary meaning of the words used.") (alteration in original) (quoting American Tobacco Co. v. Patterson, 456 U.S. 63, 68, 102 S.Ct. 1534, 1537, 71 L.Ed.2d 748 (1982)). For that "ordinary meaning," we look to the dictionary. See, e.g., Board of Educ. v. Mergens, 496 U.S. 226, 237, 110 S.Ct. 2356, 2365, 110 L.Ed.2d 191 (1990); Best Power Technology Sales Corp. v. Austin, 984 F.2d 1172, 1177 (Fed.Cir.1993). The dictionary gives the following primary definition for the word "only" when it is used as an adverb: "1a: as a single solitary fact or instance or occurrence: as just the one simple thing and nothing more or different: SIMPLY, MERELY, JUST ... b: EXCLUSIVELY, SOLELY." Webster's Third New International Dictionary 1577 (1986).

It is undisputed that, in this case, rehearing was granted by less than the full membership of the Board. For this reason, the decision on rehearing, from which Alappat has appealed, is invalid and thus is not a decision of the Board whose merits we may review. See In re Bose, 772 F.2d 866, 869, 227 USPQ 1, 3 (Fed.Cir.1985). A predicate to this court's jurisdiction under 28 U.S.C. ¤ 1295 is that there be "an appeal from a decision of ... the Board of Patent Appeals and Interferences...." 28 U.S.C. ¤ 1295(a)(4)(A) (1988). Because, for the reasons stated above, Alappat's appeal is not from a valid decision of the Board, we are without jurisdiction. I thus join that portion of Judge Mayer's dissent which concludes that the decision of the Board on appeal is invalid because rehearing was not statutorily authorized.

The final two sentences of 35 U.S.C. ¤ 7(b) are descended directly from section 482 of the Revised Statutes, as amended by the Act of March 2, 1927. In that statute, the final two sentences stated:

Each appeal shall be heard by at least three members of the board of appeals, the members hearing such appeal to be designated by the commissioner. The board of appeals shall have sole power to grant rehearings. Act of March 2, 1927, ch. 273, ¤ 3, 44 Stat. 1335, 1336.

In the 1927 statute, the board of appeals having "sole power to grant rehearings" consisted of "[t]he Commissioner of Patents, the first assistant commissioner, the assistant *1585 commissioner, and the examiners in chief...." Id. At that time, there were only five examiners-in-chief; thus, the board of patent appeals had a total of eight members. Since 1927, the size of the Board has increased. As noted above, there are now about 39 examiners-in-chief, and the full Board has roughly 43 members. Time and

events have overtaken the language of the statute. While I recognize that it is unwieldy to have it be that only the full membership of the Board can grant rehearings, that is the result which the language of the statute compels. This is a state of affairs that Congress, not the court, should remedy. [FN4]

FN4. In his dissent, Judge Mayer concludes that the Board is "a quasi-judicial body." I express no views on that question. However, regardless of the nature of the Board, the manner in which it may grant "rehearings" is governed by a statute whose language is clear. For that reason, I do not believe that the issue of the validity of the reconsideration decision turns upon how one views the Board.

For the foregoing reasons, I would hold that the Board's reconsideration decision is invalid, and therefore a legal nullity. Because I think this court lacks jurisdiction to pass on the merits of this appeal, I express no views on the merits.

33 F.3d 1526, 63 USLW 2088, 31 U.S.P.Q.2d 1545

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