SOLVING THE ALGORITHM CONUNDRUM:
AFTER 1994 IN THE FEDERAL CIRCUIT
PATENT LAW NEEDS A RADICAL
ALGORITHMECTOMY

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I. INTRODUCTION

The Federal Circuit decided five mathematical algorithm cases in 1994 (the Year of the Algorithm): *In re Schrader,* In re Alappat, *In re Warmderam,* *In re Lowry,* and *In re Trovato.* In addition, in 1994 the Board of Patent Appeals and Interferences (Board) decided *Ex Parte Beauregard,* which was appealed to the Federal Circuit in early 1995 as *In re Beauregard.* The recent evolution of mathematical algorithm case law in the Federal Circuit may be characterized as illustrative of chaos theory, or at least some kind of devolution in which the predictability of outcome progressively decreases with time. At this point, as Federal Circuit Judge Newman has aptly remarked of the doctrine of equivalents, "interpretation . . . will continue to depend on the selection of the panel." That *Alappat,* the second of 1994's opinions, was decided *en banc* did not improve predictability. It is only fair to say that rulings became less predictable after *Alappat* than before, except when one knows the panel composition, whereupon predictability increases dramatically.

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1. 22 F.3d 290, 30 U.S.P.Q.2d (BNA) 1455 (Fed. Cir. 1994).
5. 42 F.3d 1376, 33 U.S.P.Q.2d (BNA) 1194 (Fed. Cir. 1994).
7. Appeal No. 95-1054 (Fed. Cir.)
8. Chaos theory analyzes complex systems in which the value of a function varies widely in accordance with small differences in boundary conditions or initial values of one or more parameters. See generally *James Gleick,* *Chaos: Making a New Science* (1987).
Something is wrong with the law of patenting algorithms. The rich diversity in correlation of cases' outcomes to cases' operative parameters cannot be attributed entirely to individual diversity of opinion in the Federal Circuit. The problem is a fundamental difficulty in fit between highly abstract late 20th and early 21st century technology and the structure of patent law, a difficulty that mathematical algorithms paradigmatically illustrate. Patent law was fashioned to address, and it works well with, tangible machines (hardware). It also works well with industrial processes for converting one substance to another. It works acceptably with machines and processes for converting electronic signals of one kind into another. It works very poorly or not at all, however, when it addresses systems for processing one kind of data into another kind of data, where it does not matter to anybody what kind of machine does the processing, or what meaning the user associates with the data, because the technological advance is in the idea of how to transform the data into other data.

At that point, legal fictions take over and ingenious lawyers pretend to courts that abstractions and ideas are really tangible machines or articles of manufacture. There are good reasons why courts should condone the fictions and pretend that the emperor of algorithms is wearing clothes, and there are also good reasons why courts should not do so. The policy arguments on each side are so good that the courts are unable to choose sensibly between them, and enter the realm of chaos theory. That is what happened in the Year of the Algorithm.

Consideration of these opposing policy arguments compels the conclusions that algorithms need and deserve intellectual property law protection and that protecting algorithms under traditional utility patent law would be a mistake. Accordingly, this article concludes with a proposal for a petty patent statute on algorithms and related subject matter. Some statutory language is proposed, and several of the problems in devising such a statute are discussed.
II. FROM THEN TO NOW

A. The Case Law Before 1994

1. Morse

It all began some time around 1850, when the Supreme Court decided *O'Reilly v. Morse.* Morse invented the telegraph, solving a long existing problem of how to keep a signal from dissolving into noise by devising a particular apparatus that boosted the signal level at regular distances before noise overwhelmed the signal. Morse claimed the invention in terms of this apparatus and also, in his notorious claim 8, he claimed the use of "electro magnetism, however developed, for marking and printing intelligible characters . . . at any distances."

The Supreme Court sustained the other claims, but disallowed claim 8, because it blocked other inventors from developing and patenting other methods of using electromagnetism to transmit written information, with other apparatus, even though Morse had not discovered the other methods or means and taught them to the public. For

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11 Others before Morse had devised the electric battery and had developed equipment in which a flow of current through a coil caused deflection of a piece of iron. Others had combined these things to provide an apparatus in which closure of a switch caused current to flow through a remotely located coil and thus deflect a remotely located iron strip. This apparatus permitted one to send a signal to another location, but noise overcame the signal and made it useless beyond about ten miles. Morse used such a circuit to actuate the coil of another similar circuit located within ten miles' distance, which in turn operated still another similar circuit located within another ten miles. A cascade of such circuits (so-called repeaters) in series, spaced about ten miles apart, permitted a signal to be sent any desired distance. The last repeater in the series operated a clicker, which marked dots and dashes in Morse code on a moving strip of paper and/or sounded the dits and dahs. See *id.* at 72. This system apparently provided the first effective telegraph.

12 *Id.* at 112.

example, Morse did not teach the public how to make and use a facsimile (fax) machine. Yet, Morse's claim 8 would cover the fax machine. A fax machine marks and prints intelligible characters at a distance through the use of electromagnetism. By no stretch of the imagination, however, did Morse teach or enable the fax machine, and therefore he was not entitled to a patent broad enough to cover it. The Court therefore held that Morse was entitled to patent protection on the particular form of apparatus that he disclosed for telecommunications use, but not on different forms of telecommunications apparatus that only future inventors would give to the public. Too broad a grant to Morse would take away, or at least diminish, their potential rewards as incentive to invent and would thus discourage their creative efforts.¹⁴

That is one way of explaining the Morse decision. Another explanation might be that no one can have a patent on the use of electromagnetism, for that would be a patent on a principle of nature. The first explanation is now subsumed within the first paragraph of section 112 of the patent code. The second explanation, that principles of nature are nonstatutory subject matter, is now subsumed within section 101 of the patent code. Are they really different theories of unpatentability? Or are they just different ways of expressing a policy of the patent system that a patent on too abstract a legal formulation of an invention necessarily preempts more than an inventor is entitled to as the quid pro quo for public disclosure? Such patents would thwart the enterprise of other potential inventors, and their net effect would be

¹⁴ For example, if Morse's claim 8 had been sustained, a notional contemporary inventor considering whether to undertake research and development leading to the fax machine would have to consider the fact that any patent on the fax machine would be "subservient" to Morse's claim 8. That means that a licensee under the fax patent would need a license from Morse under claim 8 in order to use the license under the fax patent. Morse might withhold the license entirely, price it at a high royalty, or otherwise subject it to conditions that he dictated. See id. at 113. If the fax inventor could obtain a royalty \( R_1 \) for the use of the fax invention, in the sense that \( R_1 \) was all that the traffic would bear, at the very least existence of claim 8 would require the fax inventor to net a lower royalty \( R_2 \), where \( R_2 = R_1 - R_3 \), and \( R_3 \) is the toll Morse required for use of claim 8. This would suggest to the notional fax inventor that inventive efforts could more profitably be directed to another invention and getting a patent on it that would not be subservient to someone else's patent. This point is addressed in Brenner v. Manson, 383 U.S. 519, 534–35, 148 U.S.P.Q. (BNA) 689, 695 (1966).
to discourage rather than promote the progress of science and useful arts.\textsuperscript{15}

2. Benson

Skipping over another 120 years of variations on this theme brings us to the Supreme Court's first algorithm decision, \textit{Gottschalk v. Benson}.\textsuperscript{16} In \textit{Benson}, the Court held a process claim to an algorithm for converting one form of number (binary-coded decimals) to another form (binary) unpatentable as nonstatutory subject matter. The only limitation on the scope of the claim which Benson sought was that the process used a shift register, a form of general-purpose digital computer apparatus.\textsuperscript{17} Because the algorithm had no utility except for use with a computer, the limitation was meaningless and the claim for all practical purposes totally preempted any possible use of the algorithm.\textsuperscript{18} As in the \textit{Morse} case, Benson's claim was "so abstract and sweeping as to cover both known and unknown uses" of the claimed subject matter.\textsuperscript{19} The Court therefore held that this kind of process—numerical manipulation in a general-purpose digital computer—was not the kind of "process" that Congress intended section 101 to cover.

The \textit{Benson} opinion also introduced some of the recurrent themes in computer algorithm case law. One theme was that abstract intellectual concepts, such as mathematical algorithms, should not be patented because "they are the basic tools of scientific and technological

\textsuperscript{15} See U.S. CONST., art. I, § 8, cl. 8.

\textsuperscript{16} 409 U.S. 63, 175 U.S.P.Q. (BNA) 673 (1972). \textit{Benson} summarizes the case developments over the intervening 120 years.

\textsuperscript{17} Only one of the two claims before the Court had this limitation. Compare claims 8 and 13. \textit{Id.} at 73–74, 175 U.S.P.Q. (BNA) at 677.

\textsuperscript{18} \textit{Id.} at 71–72, 175 U.S.P.Q. (BNA) at 676 (The algorithm "has no practical application except in connection with a digital computer, which means that if the judgment below is affirmed, the patent would wholly preempt ... and in practical effect would be a patent on the algorithm itself.").

\textsuperscript{19} \textit{Id.} at 68, 175 U.S.P.Q. (BNA) at 675.
work. That is, a monopoly over such tools will hinder technological progress of other artisans in the field, because they will be deprived of access to their tools; the implied analogy is that of taking the hammer and saw from a carpenter. Another theme was whether a process patent for an operation in which the specific nature of the apparatus did not matter—such as a process to be performed in any general-purpose digital computer—must involve "[t]ransformation and reduction of an article 'to a different state or thing'." The Court called this the "clue" to patentability, but indicated that even though earlier precedents required such transformations, perhaps some other kind of process patent could nonetheless "qualify." A theme pervading the opinion was that a patent on an algorithm would be a patent on an idea, that is, something at a very high level of abstraction, and patenting ideas is antithetical to our patent system. Finally, the Court raised the theme of "tell it to Congress, not the courts" that algorithms are worthy creations and therefore deserve patents.

3. Flook

The next decision of the Supreme Court, Parker v. Flook, involved another attempt to obtain a patent on a numerical manipulation algorithm. In this case, numerical data representative of an operational parameter (for example, temperature) associated with a petrochemical production plant was processed in a general-purpose digital computer to provide a number whose value indicated whether

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20 Id. at 67, 175 U.S.P.Q. (BNA) at 675.

21 Id. at 70, 175 U.S.P.Q. (BNA) at 676.

22 Id. at 70-71, 175 U.S.P.Q. (BNA) at 676.

23 See, e.g., id. at 67, 71, 175 U.S.P.Q. (BNA) at 675, 676.

24 Id. at 72–73, 175 U.S.P.Q. (BNA) at 677.


the plant was approaching what amounted to a meltdown. This time, the applicant expressly limited the claimed use of the algorithm to a petrochemical process, allegedly avoiding total preemption of the algorithm for all uses as in Benson.

This made no difference in result, however. The Court said that a field-of-use limitation could not save this claim because it was still directed to an algorithm as such. Here, there were no limitations on the apparatus used for numerical manipulation; clearly, a general-purpose digital computer was contemplated, and the claim recited nothing but determination of a number. The applicant did not purport to disclose anything new except the algorithm; otherwise, all elements of the claimed subject matter were conventional. In such circumstances, the Court held, one must dissect out from the claim the nonstatutory subject matter of the algorithm and treat it as if part of the prior art. Since what was then left did not even purport to be novel, the invention considered as a whole must be regarded as entirely old and thus unpatentable. Finally, the Court said that as a matter of policy it might be in the public interest to give patent protection to algorithms (the Court called them computer programs), but Congress would have to be the judge of that.

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27 Id. at 594, 198 U.S.P.Q. (BNA) at 199. This patent law analysis is remarkably like a very common form of copyright analysis, which courts particularly apply to computer program copyrights. The inherently unprotectible material—such as elements in the public domain, elements dictated by function or trade custom, and scènes à faire—is dissected out and only the residuum is analyzed for actionable similarity. See, e.g., Apple Computer, Inc. v. Microsoft Corp., 35 F.3d 1435, 1443, 1445, 32 U.S.P.Q.2d (BNA) 1086, 1091, 1093 (9th Cir. 1994), cert. denied, 115 S. Ct. 1176 (1995); Engineering Dynamics, Inc. v. Structural Software, Inc., 26 F.3d 1335, 1342–45, 31 U.S.P.Q.2d (BNA) 1641, 1645–49 (5th Cir. 1994); Gates Rubber Co. v. Bando Chem. Indus., 9 F.3d 823, 28 U.S.P.Q.2d (BNA) 1503 (10th Cir. 1993); Computer Assoc. Int’l, Inc. v. Altai, Inc., 982 F.2d 693 (2d Cir. 1992); Data East USA, Inc. v. Epyx, Inc., 862 F.2d 204, 9 U.S.P.Q.2d (BNA) 1322 (9th Cir. 1988).

4. **Diehr**

The last algorithm case that the Supreme Court has thus far considered, *Diamond v. Diehr*,\(^2\) marked a change in direction. This time, an applicant sought a patent on an algorithmic process that implemented a known thermodynamic equation (the Arrhenius equation) for use in a rubber molding apparatus. This process presented the Court, for the first time, with a claim that both had apparatus limitations and had physical activity occurring after completion of the numerical calculations.\(^3\) The majority of the Court (5-4) considered the claim not to be one on an algorithm, as such, but rather on a machine process that merely used an algorithm or formula.

Further, the Court rejected the analytic dissection approach of *Flook*. It refused to dissect out the algorithm, find an old residuum, and declare the latter unpatentable. Instead, the Court said, one must view the claimed subject matter as a whole, in which old algorithm and possibly old (or possibly novel) apparatus combined to form a novel and unobvious entirety.

The Court reaffirmed *Benson* and *Flook* as authority for the proposition that a mathematical formula, as such, is not patentable subject matter.\(^3\) On the other hand, the Court said, the statutory subject matter requirements of section 101 are met when a claim describes a structure or process for implementing or applying a formula and the structure or process performs a patentable function, such as "transforming or reducing an article to a different state or thing."\(^4\)

Since *Diehr* claimed a process for transforming uncured rubber into a

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\(^3\) The method was limited to operation of a rubber molding press. One element to which the steps referred was an interval timer; another was a mold with a mold cavity. One claim called for use of a rheometer. Some claims called for automatically opening the press when a comparison of temperature and a calculated value were equivalent; one claim called for opening the press and removing the molded article from the mold. *Id.* at 179 n.5, 209 U.S.P.Q. (BNA) at 5 n.5.

\(^4\) *Id.* at 191, 209 U.S.P.Q. (BNA) at 10.

\(^4\) *Id.* at 192, 209 U.S.P.Q. (BNA) at 10.
cured, molded rubber article, that legal test was met. In addition, the process was carried out in a specific kind of special apparatus.

After Diehr, the Supreme Court left the field of algorithm patents to the Federal Circuit and its predecessor court. After struggling with various approaches over several decades, by early 1994 the decisions of the Federal Circuit seemed to be converging toward a predictable rule, generally based on Diehr. The rule, broadly stated, was that one might obtain a claim on a machine that merely uses an algorithm, but not a claim on an algorithm itself. More narrowly stated, the rule was that use of an algorithm could be patented when the use was limited to specific, special-purpose implementing apparatus (that is, something more specific than just a programmed general-purpose digital computer or programmed microprocessor). Also, an algorithm-related claim might omit recitation of such particular apparatus if the claim described a series of steps, or means, for manipulating specific electronic signals. Such signals might be ones coming from a specific,

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34 In re Grams, 888 F.2d 835, 12 U.S.P.Q.2d (BNA) 1824 (Fed. Cir. 1989) (Archer, J.) and In re Iwahashi, 888 F.2d 1370, 12 U.S.P.Q.2d (BNA) 1908 (Fed. Cir. 1989) (Rich, J.), illustrate the principle. In Grams there was no special apparatus limitation and the court considered the claim to be one directed to an algorithm or method of doing business. In Iwahashi, however, the court held that the claim did not preempt the use of the algorithm involved because the claimed use was limited to systems containing a ROM (read-only memory); others were free to use the algorithm, so long as they did not use a ROM or its equivalent. See also Arrhythmia Research Technology, Inc. v. Corazonix Corp., 958 F.2d 1053, 22 U.S.P.Q.2d (BNA) 1033 (Fed. Cir. 1992) (use of analog-to-digital converter to convert analog EKG signal to digital format for computerized signal processing) (Newman, J.).

35 A limitation of the use of a computer algorithm to use with a programmed general-purpose digital computer has been considered not to be a meaningful limitation because one would ordinarily expect to use a computer algorithm with a computer. See Gottschalk v. Benson, 409 U.S. 63, 71–72, 175 U.S.P.Q. (BNA) 673, 676–77 (1972) (The algorithm "has no substantial practical application except in connection with a digital computer, which means that if the judgment below is affirmed, the patent would wholly preempt . . . and in practical effect would be a patent on the algorithm itself.").
special-purpose apparatus, such as a CAT scanner\textsuperscript{36} or an electrocardiograph machine.\textsuperscript{37} Probably, signals would qualify, also, if they were representative of physical parameters, such as the temperatures\textsuperscript{38} or weights of objects. But signals representative of pure data, not tied to any specific physical parameter of an object, probably would not qualify for this purpose.\textsuperscript{39}

\section*{B. The Federal Circuit's 1994 Decisions}

\subsection*{1. Schrader}

The first of the Federal Circuit's 1994 decisions, \textit{In re Schrader},\textsuperscript{40} illustrated the seeming convergence toward a predictable rule, described above. The applicant devised a new system for carrying on real-time auctions of related, multiple items. For example, a tract of land might be divided into several plots—A, B, C, D, and E. Bidders might offer a bid on a single plot, such as A, or on any combination of plots, such as A+B+C. Because the value of A+B+C might be worth more to a given bidder than the sum of the values of A, B, and C sold separately to three different bidders, the seller of the tract may be able to realize more money by auctioning the property off in this manner.\textsuperscript{41}

\begin{footnotes}


\item[41] For example, combining the particular plots into one unit might permit use of more efficient agricultural equipment or other economies of scale, warranting a higher bid. The same principle applies to suppliers' bids in procurement of systems including a number of components, where a minimum sum of bids is sought.
\end{footnotes}
The problem is that determining what is the prevailing, or maximizing, combination of bids at any given time involves making calculations too difficult for a person to carry out quickly, and the difficulty increases exponentially with the number of items (for example, plots) involved.\textsuperscript{42} The procedure must be computerized to make it practicable.

As Schrader contemplated carrying out a multiple-item auction according to his invention, he would group bidders in different locations, possibly in different cities. Bidders would view a large TV display unit on which bids would be displayed. Telecommunications links would relay bids to a central processing unit, which would determine the prevailing bid combinations and send the information back to the display units. The display units would show the bidders what combinations of bids for plots and sets of plots were prevailing at a given time. That would give different bidders the opportunity to submit higher bids for particular plots and sets of plots, so as to become prevailing bidders instead of those previously prevailing.

The Federal Circuit panel denied the patent, ultimately, on the ground that it was directed to an algorithm rather than to a machine using an algorithm or to an algorithm–using process involving physical activity. Schrader argued that the claimed invention was patentable subject matter because it involved considerable physical activity and apparatus. Thus, bidders sent bids to the central processing unit of a computer via a telecommunications link (apparatus). The processor sent bid information back to the displays (apparatus) via a telecommunications link (apparatus). The bidders then input new bids into the system, in response to what they saw on the displays. The court rejected Schrader's argument, however. The court pointed to the wording of the claim and considered it determinative that "[t]he word 'display' is nowhere mentioned in the claim."\textsuperscript{43} The claim therefore con-

\textsuperscript{42} The number of calculations per round of bidding is approximately $2^n$ where $n$ is the number of items involved.

\textsuperscript{43} 22 F.3d at 293, 30 U.S.P.Q.2d (BNA) at 1458. The court also said that there was no closed–circuit TV system (telecommunications link) mentioned in the claim. \textit{Id.} at 294, 30 U.S.P.Q.2d (BNA) at 1458.
tained no "structural" limitations on the claimed use of an algorithm.\footnote{Arrhythmia Research Technology, Inc. v. Corazonix Corp., 958 F.2d 1053, 22 U.S.P.Q.2d (BNA) 1033 (Fed. Cir. 1992).} It simply described a transformation of one set of nonphysical data to another data set in accordance with a particular scheme. That was fatal to patentability.

The court compared the case to others allowing patents even though algorithms were involved. In one case,\footnote{In re Abele, 684 F.2d 902, 214 U.S.P.Q. (BNA) 682 (C.C.P.A. 1982). In re Taner, 681 F.2d 787, 214 U.S.P.Q. (BNA) 678 (C.C.P.A. 1982).} the claims "involved the manipulation of electrical signals [electrocardiograph signals] and data representative of human cardiac activity." In another case,\footnote{For example, an 1877 Supreme Court decision, Cochrane v. Deener, 94 U.S. 780 (1876), held a method for grinding up flour more finely to be patentable because acts were "performed upon the subject matter to be transformed and reduced to a different state or thing." The court pointed out that the same notion is reflected in the Supreme Court's decision in Gottschalk v. Benson, 409 U.S. 63, 175 U.S.P.Q. (BNA) 673 (1972). According to the Benson opinion, a process claim is patentable when it results in the "transformation and reduction of an article 'to a different state or thing.'" Id. at 70, 175 U.S.P.Q. (BNA) at 676. See supra note 22 and accompanying text.} the claims involved manipulation of data coming from a CAT scanning X-ray machine. In still another case,\footnote{In re Taner, 681 F.2d 787, 214 U.S.P.Q. (BNA) 678 (C.C.P.A. 1982).} the claims involved "the manipulation of electrical signals representative of reflected seismic energy" from discontinuities in the earth. In every one of these cases, the court said, the claims involved use of special apparatus or "involved the transformation or conversion of subject matter representative of or constituting physical activity or objects." For a method or process to be patentable, the court added, the case law for over a century has required either limitations in the claim to particular apparatus or else "that there be a transformation or reduction of subject matter" from one state to another.\footnote{The algorithm in this case was the method for determining an optimal combination of bids, that is, a combination whose sum was a maximum possible sum.} This does not mean, the Federal Circuit said, that the transformation in a method patent must occur in a physical substance; a
method patent may also cover a state transformation of intangibles, such as electrical signals, if the subject matter thus transformed is "representative of or constitutes physical activity or objects." 

In summary, then, in early 1994 the legal standard for claiming algorithms or algorithm-related inventions was that one should put into the claim some apparatus of some kind before the claimed use of the algorithm (for example, a CAT scanner apparatus$^{50}$ to gather and provide data for the algorithm to process), alongside of it (for example, a ROM$^{51}$ to aid in performing calculations using the algorithm), or after it (for example, a device to open a heated rubber mold$^{52}$ after it has cooked a molded article long enough according to the algorithm). One wanting a belt along with these patent-drafting suspenders could also mention signals on which the algorithm operates, where the signals are representative of a physical activity or object (such as reflected energy from an underground explosion$^{53}$). If one did none of these things, or simply claimed a general-purpose digital computer or microprocessor programmed to carry out the algorithm, with data going in and data going out, the claim would be rejected as lacking proper structural limitations.$^{54}$

$^{49}$ Judge Newman dissented, on the grounds that methods of doing business should not be considered nonstatutory subject matter and that data-in, data-out transformations were as patentable as those of signals representative of physical parameters.


$^{53}$ See Taner, 681 F.2d at 787, 241 U.S.P.Q. (BNA) at 678.

$^{54}$ In re Grams, 888 F.2d 835, 12 U.S.P.Q.2d (BNA) 1824 (Fed. Cir. 1989).
The rule was not simple, but it was clear. If not a bright-line rule, it was a bright zig-zag rule. Counsel could predict case outcomes, based on the Schrader opinion’s restatement, even if the rule may have seemed artificial.55 For those of us who highly value predictability and security of expectation, among whom the author ranks himself, that was as good as it got.

2. Alappat

In re Alappat56 was largely a by-product of a running skirmish between the Federal Circuit and Patent and Trademark Office over how paragraph 6 of section 112 should be applied in patent prosecution matters. This section permits an applicant to claim an element of an invention in functional language, such as "means for doing so—and so." This is a useful expedient when it does not matter to the inventor how a function is accomplished—for example, a given invention may work equally well when A is nailed to B, or screwed, glued, welded, or soldered to it. The problem arises when one tries to determine the scope of the "means for fastening" claim. Does it include making A relaxably stick to B by a switch-controlled electromagnet? Section 112 says that the scope of a claim written in this form extends to all structures expressly described in the specification of the patent application and to equivalents of what is expressly described.

Determining equivalency in patent infringement litigation is a major project, however, and the Federal Circuit has been unable to form an internal consensus on the appropriate legal standard.57 The Office had tried to avoid the equivalency quagmire by adopting a rule that in patent prosecution it would interpret a means—for claim to cover any

55 There was a policy problem that the rule did not address. The rule made problematical the protection of computerized methods of doing business, despite their economic value, as Judge Newman persuasively argued in her dissenting opinion in Schrader, 22 F.3d 290, 30 U.S.P.Q.2d (BNA) 1455 (Fed. Cir. 1994). See also Stern, supra note 40 (supporting Newman's policy position).


reasonable means whatsoever for accomplishing the function, rather than try to puzzle out what is and what is not equivalent to that which the specification describes, unless the applicant persuaded the Office that particular means were not equivalents. After a running battle for years, the Federal Circuit set *Alappat* and another case, *In re Donaldson*, for argument together *en banc* to resolve the issue. The upshot was that the Federal Circuit *en banc* unanimously directed the Office to read the specifications of patent applications and determine in each case what equivalent means are, just as courts must do in patent infringement litigation.

The by-product was that the *Alappat* opinion revealed the Federal Circuit's inability to provide a clear articulation of a rule on patenting algorithms to which an *en banc* court would subscribe. Moreover, the resolution of *Alappat* was complicated by the disagreement of four members of the court with the Office's internal appeal procedures, specifically, the extent to which the Commissioner was entitled to prescribe substantive law interpretations that must be followed within the Office.

a. *Alappat's invention.*

*Alappat* invented a system for improving the appearance of digital oscilloscopes' screen displays. A digital oscilloscope ordinarily represents data points as isolated points on the screen; each point occupies a small area on the screen termed a "pixel." It is convenient to connect successive data points on the screen by a line, so that the data appears on the screen as a line graph. There were two problems. First, there would be "jaggies" or a "staircase effect." Second, random noise superimposed on the signal makes the lines appear to flicker and move up and down ("aliasing").

Expedients to overcome these problems are known, and the record in this case contains other patents addressing them. The basic technique ("anti-aliasing") generally used is to lessen the illumination intensity of those pixels more remote from the desired trajectory between data points, in accordance with some formula or scheme (for example, least squares averaging). Conventional means are well known for varying the amount of energy delivered to the location of a pixel.

and accordingly for varying the intensity of its illumination. In a television or cathode-ray tube (CRT), a beam of electrons is accelerated by an electromagnet coil around the neck of the tube. The electrons' speed (and therefore energy, and therefore illuminating effect) is proportional to the current in the coil at the time the electrons pass through it. Hence, to implement an anti-aliasing scheme one controls pixel intensity by varying CRT neck coil current in accordance with the scheme. The result is to provide variable illumination intensity for each pixel, so that the pixels closest to the trajectory of the data points are made brighter, and those farther away, dimmer. The procedure improves the appearance of the display by providing a continuous-appearing and non-jumping waveform.

Alappat devised what appears to be a novel and convenient anti-aliasing scheme—an anti-aliasing algorithm. The specification discloses how to provide a smooth-appearing waveform (something appearing to be a straight diagonal line without jaggies) by determining illumination intensity of each of the pixels in accordance with the new formula \( I' = c \left(1 - \frac{\Delta y_{1j}}{\Delta y_{ij}}\right) \). In this formula, \( c \) is an arbitrary constant, and the \( \Delta \) values represent vertical pixel-to-pixel distances on the screen. Presumably, one then makes the CRT's neck coil current proportional to \( I' \), as calculated according to the foregoing formula.

There was no serious question whether Alappat invented the kind of thing with which the patent laws are concerned. Alappat invented and described a device within an oscilloscope, that helps to control the oscilloscope's screen illumination in a certain way. The issue was whether the patent claimed merely that thing or claimed something else, as well—something that goes beyond the kinds of thing on which the patent laws grant exclusive rights.

b. The majority opinion.

According to Judge Rich's opinion for six members\(^59\) of the eleven-judge \textit{en banc} court, the proper interpretation of the claim on appeal was that it was a directed to a machine that used an algorithm

\(^{59}\) Three members of the court refused to express a view on the merits because they considered the court to lack jurisdiction of the appeal. Two members dissented on the merits.
or formula, not to an algorithm or formula as such. The claim does not preempt all use of the algorithm:

Rather, claim 15 is limited to the use of a particularly claimed combination of elements performing the particularly claimed combination of calculations to transform . . . digitized waveforms (data) into anti-aliased, pixel illumination data to produce a smooth waveform. . . . Claim 15 thus defines a combination of elements constituting a machine for producing an anti-aliased waveform.60

That would have been enough to resolve the case. One may disagree with how the majority construed claim 15.61 It is clear, however, that once one reads the claim, as the majority did, the case is over. The claim is then limited to an oscilloscope containing a subcombination or subsystem that interacts with the rest of the oscilloscope system; the subsystem passes signals back and forth to the rest of the oscilloscope system and it controls the screen illumination of the oscilloscope. Claim 15, so read, covers the same kind of algorithm–using apparatus as the prior decisions62 say a claim must, rather than covering an algorithm as such. So read, the majority opinion is hardly different from Schrader and other earlier decisions.

60 33 F.3d at 1544, 31 U.S.P.Q.2d (BNA) at 1558.

61 One may question the majority’s interpretation of claim 15 because it implies into the claim in order to sustain its patentability, structural limitations connecting the body of the claim (the part following “comprising:”) to the environment of an oscilloscope even though these limitations are not made explicit in the claim itself. These structural limitations include receiving input signals representative of vertical elevation of pixels and sending output signals representative of illumination intensity to a device in the oscilloscope that controls illumination intensity of pixels on the screen. The problem of interpreting claim 15 stems from its drafter’s reluctance to place into the body of the claim any language reciting relations and interactions with the oscilloscope or other environment in which the claimed subject matter operates.

But Judge Rich's opinion for the court did not stop after the quoted passage. Perhaps, the court could not stop there, because the board had also found claim 15 unpatentable because it "reads on a general purpose digital computer 'means' to perform the various steps under program control." (This finding appears to be directly contrary to the interpretation of claim 15 described above, limiting claim 15 to a subsystem embedded in and connected to an oscilloscope system.) The parties had agreed that claim 15 covered, among other things, a general-purpose digital computer programmed to operate in accordance with "the claimed invention." Indeed, counsel for Alappat urged the court not to limit the scope of claim 15 to the hardware system disclosed in the specification, because then it would be far too easy for a would-be infringer to evade the claim to the invention by using a programmed microprocessor or general-purpose digital computer instead of hardware. A pirate might even make and sell floppy diskettes encoded with a computer program for performing Alappat's anti-aliasing procedure, and end users might then load this software into their oscilloscope systems.

Therefore, after holding claim 15 to be patentably directed to the use of an algorithm in a limited hardware setting, rather than unpatentably directed to an algorithm itself, the majority opinion made an

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63 The Office's legal theory apparently was based on the Court's statement in Benson, 409 U.S. at 71-72, 175 U.S.P.Q. (BNA) at 676-77, that a patent on an algorithm, if limited only by the requirement that the algorithm must be used with computer equipment, is in practical effect a patent on the algorithm itself.

64 This is not entirely fanciful. Similar procedures occur in which software is "uploaded" to a hard disk or modem to upgrade its capabilities.

65 This interpretation would not preclude the anti-aliasing algorithm from being implemented in a programmed microprocessor (or general-purpose digital computer) connected to and intertwined with an oscilloscope. Such a system would still be a machine (oscilloscope) with software elements embedded inside it. The problem arises when the anti-aliasing algorithm is implemented in a free-standing microprocessor (or general-purpose digital computer) that is not connected to and intertwined with an oscilloscope. That erases the machine system limitation on the claim.
about face. Sweeping past all objections with a broad brush, the majority said:

Alappat admitted 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. . . [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. 66

This is where cognitive dissonance sets in. Two interpretations are possible for the phrase "the claimed invention" in the first sentence of the quoted passage. One interpretation is that the phrase refers to some type of programmed computer equipment subsystem intertwined with an oscilloscope, in which case the scope of claim 15 is limited to an oscilloscope environment. Alternatively, "the claimed invention" also includes a free-standing microprocessor or general-purpose digital computer programmed to carry out the algorithm, in which event claim 15 is not limited to the oscilloscope environment and effectively covers the algorithm itself. 67 The only way that this passage can make sense is if some of the terms have a secret or private, question-begging meaning that is different from their apparent meaning. For example, a programmed computer might "represent" patentable subject matter but not

66 33 F.3d at 1545, 31 U.S.P.Q.2d (BNA) at 1558.

67 Conceivably, there is another possibility, but it is not significant. In theory one might devise a different hardware implementation of the invention, which claim 15 would not cover if the implementation were considered nonequivalent to the hardware and software implementations of the patent application. It is questionable, however, that any such nonequivalent implementation could be devised; any possible implementation would seem to be equivalent to those that Alappat disclosed.
"be" patentable subject matter, whatever that might mean. Or maybe meeting "all of the other requirements of Title 35" means complying with section 101 as interpreted in Benson, Flook, Diehr, Abele, Schrader and so on. To say the least, this passage of the opinion is more poetic than lucid.

Is the statement about a newly programmed computer being a new machine just so much irrelevant *obiter dictum* without substantive significance? Or does it state a manifesto for a new doctrine that past rules (the clear zig-zag of Schrader) may be disregarded; that now, a novel, unobvious computer program X is patentable if claimed as "a computer programmed with program X"? Under this doctrine, there is no longer any need for more specific apparatus at the front end, such as a CAT scanner or EKG machine; for specific apparatus in the middle, such as a ROM; for specific apparatus at the back end performing significant post-solution activity, such as a press opener; or for signals that are representative of physical quantities, such as temperature. "Data in, data out" will now suffice. As will appear, different post-Alappat Federal Circuit panels have embraced diverse interpretations of the decision.

c. *The dissenting opinion.*

The manifesto is what bothered the two dissenting judges, Chief Judge Archer and former Chief Judge Nies. Their first concern was that claim 15 was broad enough to cover the use of the described anti-aliasing procedure "in conjunction with any current or future device that prints in an x-y coordinate grid, such as oscilloscopes, computer monitors, televisions, laser printers, [or] mechanical printing devices . . . ." More important, that claim 15 also covered a general-purpose digital computer or microprocessor programmed to carry out Alappat's algorithmic procedure\(^68\) was critical. Because a programmed computer is just a collection of the functions for which it is programmed, claim 15 effectively claimed the mathematical functions of the algorithmic procedure—which is to say, claimed the algorithm itself. Moreover, because the same mathematical operations can be performed in many ways—with gate arrays, operational amplifiers, and other devices—the range of equivalents for claim 15 will be so broad that the patent would cover and thus preempt all practical ways to use the algorithm.

\(^68\) *See supra* text accompanying notes 65-67.
As for the argument that a programmed general-purpose digital computer is statutory subject matter because putting a new program into an old computer converts the latter into a new machine, Judge Archer argued that a Chopin-playing player piano does not magically become a "new" player piano simply because one inserts into it a piano roll for Brahms' Lullaby. He denied that a claim to a general-purpose digital computer running a new program could be directed to statutory 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."69

The public policy implications of the majority opinion also troubled Judge Archer. He considered "[t]he majority's holding . . . dangerous"70 because it will create mathematical patents with an enormous scope of technological exclusivity. These patents will issue without "meaningful examination," because the patent office cannot effectively examine such claims in terms of obviousness and other statutory requirements.

3. Warmerdam and Lowry

That the immediate aftermath of Alappat is a great deal of uncertainty is illustrated in two Federal Circuit panel decisions, respectively decided two and four weeks after the en banc Alappat decision—In re Warmerdam71 and In re Lowry.72 That these opinions were written for the court by two different members of the Alappat majority, Judges

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69 33 F.3d at 1567, 31 U.S.P.Q.2d (BNA) at 1577.

70 33 F.3d at 1568, 31 U.S.P.Q.2d (BNA) at 1578.


Plager and Rader, illustrates also the difficulty even for members of the court that decided it to determine what Alappat holds or stands for.

In Warmerdam, the court held a claim to a "data structure" generated by a given computer procedure, and claims to methods of generating such a data structure, to be directed to nothing but "a way of describing the manipulation of ideas" and thus nonstatutory subject

73 Judge Plager spoke for the court in Schrader, see supra notes 40–49 an accompanying text. The unanimous Warmerdam panel also included Judge Lourie, who was part of the Alappat majority, and Judge Clevenger, who joined no opinion on the substantive merits in Alappat because he did not consider that the court had appellate jurisdiction.


The unanimous Lowry panel included Judge Rich, who wrote for the court in Alappat and Senior Judge Skelton, who did not participate in Alappat.

75 A data structure is a scheme or plan of organization of information, such as that of information stored in a computer's memory. A possible non–computer analogy for a data structure is a scheme or plan of organization of data written on a piece of paper. Cf. Baker v. Selden, 101 U.S. 99 (1879) (system of double entry bookkeeping described in book held not within scope of copyright in book; accounting sheets used to practice system thus not within scope of copyright in book; decision codified in 17 U.S.C. § 102(b) (1994)). Baker may be regarded as denying copyright protection to a type of data structure because it is an "idea."
matter. The data structure was not "a physical arrangement of the contents of a memory" device (an article of manufacture?), and it certainly was not "a physical, interconnected arrangement of hardware and thus embraced by the term 'machine'."77 The court declined to resolve the case in terms of whether the "essentially mathematical" steps of the claimed method were a mathematical algorithm because of the difficulty in resolving cases in terms of that legal category.78 Irrespective of whether the Warmerdam claims belonged to the algorithm species, they clearly belonged to the genus comprising algorithms—manipulation of abstract ideas.79 The claimed steps described nothing more than manipulation of mathematical constructs, which the court considered "paradigmatic" of abstract ideas.80 In effect, the court said, "Never mind Benson, Flook, Diehr, whatever," and strategically retreated to the precedential underpinning of that line of authority: "An abstract idea of itself is not patentable."81

In Lowry, the court held that a claim to a memory82 comprising a data structure was patentable subject matter, because the applicant's "data structures impose a physical organization on the data" that they contain, and the elements of the data structures have not been shown to

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76 Warmerdam, 33 F.3d at 1362, 31 U.S.P.Q.2d (BNA) at 1760. The invention in Warmerdam was a method of controlling operation of a robot to avoid collisions with obstacles. The claims, however, did not have any apparatus limitations referring to that environment.

77 Id.

78 33 F.3d at 1360, 31 U.S.P.Q.2d (BNA) at 1758.

79 Id. at 1360, 31 U.S.P.Q.2d (BNA) at 1759.

80 Id.


82 A memory is typically a device such as the random-access memory of a PC, which is typically implemented by DRAM chips. More abstractly, a memory is the information storage function in a computer that such a device performs. A floppy diskette or hard disk is perhaps equivalent to a DRAM memory for purposes of this invention.
"lack a new and nonobvious functional relationship with the memory." The Lowry court rejected the Office's argument that an arrangement of data in a memory was a form of "printed matter" and therefore unpatentable. The court said that whatever vitality the printed matter doctrine still had, if any, it did not apply to the facts before the court. The court very tersely indicated that the printed matter doctrine applies only to human-readable information, such as books and trolley transfers, which almost all previous printed matter cases had involved, and does not apply to the machine-readable information to which Lowry's invention was directed.

Perhaps, there is in some way a meaningful difference between a data structure (Warmerdam) and a memory device or medium containing a data structure (Lowry). But the difference in membership

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83 Lowry, 32 F.3d at 1583, 1584, 32 U.S.P.Q.2d (BNA) at 1035. Judge Rader criticized the Office's determination that the subject matter was obvious because it was so-called printed matter. Judge Rader said that the printed matter cases have no factual relevance where the invention requires the information to be processed by a machine rather than a human being. Id. at 1583, 32 U.S.P.Q.2d (BNA) at 1035. (Query: Does this theory apply to piano rolls and CD ROMs?) He also said that data structures are not even analogous to printed matter, because the claimed data structures impose a physical organization on the data. But see Baker v. Selden, 101 U.S. 99 (1879) (format of ledger sheet for carrying out book keeping procedure unprotectible under copyright law).

84 Lowry, 32 F.3d at 1583, 32 U.S.P.Q.2d (BNA) at 1035.

85 See In re Russell, 48 F.2d 668 (C.C.P.A. 1931) (directory book in which surnames are arranged phonetically rather than as spelled held unpatentable).

86 See Cincinnati Traction Co. v. Pope, 210 F. 443 (6th Cir. 1913) (trolley transfer with detachable "P.M." stub, to be torn off when the transfer was issued in the morning, so that customers could not use it in the afternoon, held patentable).

87 The printed matter issue comes up again in connection with the Beauregard appeal and is discussed then in more detail. See infra text accompanying notes 101-120.

88 There appears to be no way to exploit a data structure other than putting data into a memory in accordance with the data structure. A patent on a memory having a given data structure therefore effectively
of the panels may more readily pave the road to predicting the outcome than will any exercise in doctrinal harmonization. Some Federal Circuit panels will now find patentability-conferring "structure" in the fact that an algorithm or other idea is to be used in a computer or portion of a computer. Other panels will find structure only when a computer-using algorithm or idea is embedded in a more specialized environment that is regarded as an integral part of the claim. Each approach can find support in Alappat.

4. Trovato

In re Trovato was the last Federal Circuit panel decision in 1994 on algorithms. The invention was a method of determining the least distance between two points, where "least distance" is defined in terms of some material parameter such as cost, time, or even physical distance. Trovato described a mathematical procedure for manipulating a data structure to determine a least cost path, without describing any apparatus more specific than "means" for accomplishing the various steps. It was clear that the various means were different software instructions to be used in a program for a general-purpose digital computer. There was no X-ray machine front end or mold press opener back end. This led the court to conclude that "Trovato claims nothing preempts the use of the data structure and is therefore equivalent to a patent on the data structure itself. Presumably, the Warmerdam panel would have held Lowry's memory device containing a given data structure to be unpatentable as nonstatutory subject matter, while the Lowry panel would have held Warmerdam's data structure to be statutory subject matter and patentable.

89 The Office petitioned for rehearing en banc because of the seeming conflict between Lowry and Warmerdam, but the court denied the petition. The Solicitor General did not seek certiorari in Lowry.

90 42 F.3d 1376, 33 U.S.P.Q.2d (BNA) 1194 (Fed. Cir. 1994).

91 See id. at 1377-78, 33 U.S.P.Q.2d (BNA) at 1196.

92 Id. at 1382, 33 U.S.P.Q.2d (BNA) at 1199 ("all the disclosed means are simply software instructions; no 'structure' appears in the specification").
more than the process of performing a numerical calculation." Trovato failed even to explain what to do with the calculated numbers.

The court said the case was indistinguishable from Warmerdam and operated entirely in the realm of abstract ideas. Although the apparatus claims were like those of Alappat in that they consisted of a series of means-for elements, unlike the claims of Alappat (the court said) these claims did not recite a combination of hardware elements, and the specification of the patent application did not disclose any such combination. Any apparatus was "illusive." There was too little "application or connection to a technical art" for the claims to pass muster under any Federal Circuit formulation of the legal test for statutory subject matter.

Finally, the court addressed Trovato's argument that computer software advances are no less worthy than those in more traditional mechanical fields, and that therefore it would be unjust to deny patents on them. The court responded that "[i]ngenuity and utility . . . have never been sufficient in themselves to garner patent protection." The statute provides its own measure, and it does not embrace mathematical calculation procedures; if that gives you a problem, tell Congress about it.

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93 Id. at 1380, 33 U.S.P.Q.2d (BNA) at 1197; see also id. at 1383, 33 U.S.P.Q.2d (BNA) at 1200.
94 Id. at 1381, 33 U.S.P.Q.2d (BNA) at 1198.
95 Trovato, 42 F.3d 1376, 1381, 33 U.S.P.Q.2d (BNA) 1194, 1198 (Fed. Cir. 1994).
96 Id. at 1383, 33 U.S.P.Q.2d (BNA) at 1200.
97 Id. at 1383, 33 U.S.P.Q.2d (BNA) at 1199.
98 Id. at 1381, 33 U.S.P.Q.2d (BNA) at 1198.
99 Id. at 1383, 33 U.S.P.Q.2d (BNA) at 1200.
100 The applicant has sought rehearing en banc. The Office responded with a statement that it did not agree with the applicant's arguments, but agreed that matters were so unsettled that rehearing the case en banc might be useful, for "[l]arification by this Court in this complex and
5. Beauregard

Finally, the Board's mid-1994 decision in *Ex Parte Beauregard*,\(^{101}\) appealed to the Federal Circuit in early 1995, addresses another variation on these themes. *Beauregard* is IBM's test case on still another way of imparting alleged "structure" to an algorithm claim, so that the claim can be said to be something more than a claim to a mathematical algorithm as such. The *Beauregard* claims are essentially in the following format: An article of manufacture that is a storage medium (such as a floppy diskette\(^ {102}\)) encoded with machine-readable computer program code for carrying out a mathematical algorithm. The claims then describe the algorithm as a sequence of "means" for performing various mathematical functions. The specific algorithm involved in *Beauregard* is one for filling in a polygon on a screen display of a computer, but the principle of the case would appear to apply equally well to any algorithm.

a. *Beauregard’s invention.*

A polygon fill according to the *Beauregard* algorithm operates, essentially, as follows: Beginning at the highest vertex of the polygon, a series of horizontal stripes ("scan lines") are established across the polygon. Then, a complete circuit of the polygon is made in which the leftmost and rightmost values of the x-coordinates of the polygon are calculated at each horizontal stripe, and these \(x_{\text{min}}\) and \(x_{\text{max}}\) values are recorded in memory. Finally, a series of traverses of each horizontal

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\(^{101}\) The Board's original opinion of September 29, 1993, preceded the Alappat decision by approximately ten months. The August 4, 1994, Board opinion denying reconsideration followed Alappat by a week and preceded Lowry by three weeks.

\(^{102}\) The Board said that IBM admitted that the instructions are computer readable code placed on "a magnetic diskette, an optical disk, a read-only memory (ROM), a random-access memory (RAM) . . . etc." For whatever it is worth, the examiner and Board found that the list of computer media should also include similar instructions in English or a programming language on a sheet of paper, if one equips the computer with an optical scanner.
stripe from the left side of the polygon to the right side are made and every pixel between the two sides (i.e., wherever $x_{\text{min}} \leq x \leq x_{\text{max}}$) is illuminated, starting at the top vertex and proceeding down to the bottom vertex.

The article of manufacture claims of the patent application are not limited in terms of any particular apparatus, and it is clear that the computer and the screen of the associated monitor are not elements of the claims. The claims cover the encoded floppy diskette, *per se*, standing apart from the computer and screen.103

b. *The Board's opinion.*

The Board said that the claimed article of manufacture was non-statutory subject matter and obvious, for essentially the same reasons in both instances. A floppy diskette encoded with a computer program is like a piece of paper or other substrate on which information is printed or otherwise placed (so-called printed matter). Unless the information in the printed matter interacts functionally with the medium or substrate, in a novel and unobvious way, the printed matter product is unpatentable and obvious. In *Beauregard* the algorithm was conventionally encoded into C programming language, the computer

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103 IBM has already obtained a presumably valid patent on computer graphics methods and systems operating in accordance with the algorithm, U.S. Pat. No. 4,962,468, and acquiesced in an obviousness double patenting rejection of the claims of the continuation application. The question thus is whether IBM is *additionally* entitled to a patent on a floppy diskette into which is encoded computer program code for carrying out the algorithm. The claims of the issued patent and the continuation application on appeal are essentially alike, except that the patent claims' preambles refer to a system or method, while the appeal claims' preambles refer to an article of manufacture; after the preambles, all of the claims have the same kind of "means for" elements or their equivalents.

It is said that the purpose of writing the present claims this way is to make it possible to sue a supplier of an infringing diskette for direct infringement under 35 U.S.C. § 271(a) (1994) instead of being obliged to sue for inducement of infringement or contributory infringement under 35 U.S.C. § 271(b) or (c) (1994). This avoids the need to prove the seller's culpable knowledge, an element of the plaintiff's case under sections 271(b) or (c), but not an element under section 271(a). See *Aro Mfg. Co. v. Convertible Top Replacement Co.*, 377 U.S. 476, 141 U.S.P.Q. (BNA) 681 (1964) (innocent infringement not actionable under section 271(c)).
Program code was conventionally encoded onto the floppy disk, and the computer apparently read the code from the diskette in a normal, conventional manner. Everything was old and conventional except for the particular algorithm embodied in the code. The message was new, but the medium was old, and the cooperation between message and medium was old. To the Board, that made the combination of that message on that medium unpatentable under the printed matter rule.

IBM's position was that the instructions of the code (the alleged printed matter) interact in patentable, functional ways with the floppy diskette, with the computer into which the floppy diskette is placed, and with one another. The Board responded that under the printed matter case law it is immaterial whether a new functional relationship exists among the elements of the printed matter or whether one exists between the printed matter and the device reading or using it. The only material question is whether there is a new and unobvious functional relationship between the printed information and the substrate. Here the substrate acts only as a support for the printed matter. That is an old and obvious relationship.

IBM made two other points. It criticized the Office for placing focus on the various old, conventional elements of the claim instead of on "the subject matter considered as a whole." This may be regarded as the battle of Diehr versus Flook. The Board apparently felt that, no matter how many times the mantra "subject matter as a whole" is chanted, when the claimed subject matter is a conventional storage medium conventionally encoded with new information that conventionally cooperates with the old medium, the subject matter as a whole still remains old and conventional.

IBM also argued that an algorithm-encoded floppy diskette, when inserted into drive A of a computer, operates in a manner analogous to a machine part such as a new cam or gear. Therefore the diskette should be patented because it causes the machine to operate in a new, unobvious way. (This echoes the argument in Alappat that a

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104 The leading case is In re Gulack, 703 F.2d 1381, 217 U.S.P.Q.2d (BNA) 401 (Fed. Cir. 1983).

105 See supra text accompanying notes 27, 30–31.
new computer program turns an old computer into a new machine.\textsuperscript{106} The Board simply brushed aside the metaphor of the cam and the argument based on it.\textsuperscript{107} Perhaps, the Board should have said that the patentability of a machine system as a whole does not necessarily confer patentability on every individual conventional element or subcombination in the machine. Cams as such are old. A new cam shape, when the cam cooperates with the adjacent part of the machine just as any other cam does, is obvious and not separately patentable. By the same token, even if one regards the encoded diskette of Beauregard as a quasi-cam, it is still an \textit{obvious} quasi-cam.\textsuperscript{108} However, the Board said none of that; perhaps it simply could not take the cam metaphor seriously.

The Board opinion is most remarkable for what it fails to say. It does not state that a patent on a floppy diskette containing code for a mathematical algorithm is tantamount to a patent on the algorithm itself. As a practical matter, however, there is no way to exploit a mathematical algorithm without encoding it in machine readable form into a floppy diskette or other storage medium and placing the latter

\textsuperscript{106} \textit{See supra} text accompanying notes 65–67.

\textsuperscript{107} The Board said a floppy diskette is unlike a cam, because a cam is dynamic and active, but a floppy diskette is static and passive. (A cam \textit{pushes} [v.t.] a cam follower as it rotates, while a diskette or similar medium \textit{is read} by [passive mode] a computer’s disk drive’s read head.) The dissenting Board opinion said that a cam lying on a shelf is not active but in use becomes a dynamic element.

The Board also said that a phonograph record is like a cam, the undulations on the record acting as the cam shape and the phonograph needle acting as the cam follower. It then noted that IBM conceded at oral argument that putting new music on an otherwise old phonograph record does not make the phonograph record patentable.

The Board opinions are richer in metaphor than in depth of legal analysis of floppy diskettes and cams as active/dynamic–static/passive statutory/nonstatutory subject matter.

\textsuperscript{108} Similarly, one can patent a new circuit comprising conventional resistors, capacitors, and other elements. One resistor in the circuit may have the resistance value 314,159 ohms, and no published reference may exist that discloses a resistor of that value. But nonetheless one cannot get a patent on otherwise conventional resistors that have the value 314,159 ohms.
into a computer.\textsuperscript{109} That means that a patent on all floppy diskettes encoded with the algorithm is effectively a patent on the algorithm \textit{per se}. Unless the policy against patents on algorithms as such no longer has any vitality or precedential support, therefore, one might well conclude that a claims drafting expedient that completely undermines that policy would be explicitly challenged on that basis. Yet, the Board said nothing about patents on algorithms; the Board's discussion of the legal issues is confined entirely to doctrinal analysis of the printed matter rule. It contains no explanation of whether or why the printed matter rule is sound or sensible, let alone whether the case is really one about algorithms and whether allowing claims on algorithms in the form of claims to printed matter describing algorithms would subvert the rule against patenting algorithms as such (or, for that matter, whether that rule ought to be preserved or deserves to be subverted).

c. \textit{The printed matter rule.}

Previous printed matter cases did not in the main involve somebody's attempt to get a patent on a table of sines and cosines, thus preempting others from doing trigonometry. Rather, the printed matter sought to be patented was usually an arrangement of information in a way that facilitated doing something useful with it. For example, a trolley transfer ticket might be issued with a detachable "P.M." stub, to be torn off when the transfer was issued in the morning, so that

\textsuperscript{109} That is, unless a nonequivalent hardware implementation were practicable, which is not suggested in the Board's opinion or the specification.

In any event, a wrinkle in this case places IBM in a position to preempt all exploitation of the algorithm, even if a nonequivalent hardware implementation is feasible. The application on appeal is a continuation of an earlier application that has already resulted in issuance of a patent on methods and systems using the same algorithm or algorithms. The "means" claims of the issued patent would apparently cover any hardware implementation. However, this case's wrinkle would probably become the rule in subsequent cases if article of manufacture claims of this type are upheld. A well advised applicant would then separately claim any algorithm in apparatus (means), method, and article of manufacture formats. (That would cover any conceivable implementation and exhaust all possibilities except for compositions of matter.).
customers could not use it in the afternoon;\textsuperscript{110} a directory might be printed in which surnames are arranged phonetically rather than as spelled;\textsuperscript{111} conventional dice might be imprinted with new symbols for playing a game;\textsuperscript{112} a measuring cup for making half as much of a food item as shown in a recipe book might have a line reading "1 cup" where the actual volume was 0.5 cup, a line reading "0.75 cup" where the actual volume was 0.375 cup, and so on, so that the user would not need to perform arithmetic calculations to get half as much of everything.\textsuperscript{113} The usual problem in printed matter cases was whether the subject matter was obvious, not that society would necessarily be injured, even apart from any obviousness considerations, if subject matter of this kind were patented.\textsuperscript{114}

\textsuperscript{110} Cincinnati Traction Co. v. Pope, 210 F. 443 (6th Cir. 1913) (held patentable).

\textsuperscript{111} In re Russell, 48 F.2d 668 (C.C.P.A. 1931) (held unpatentable).

\textsuperscript{112} Ex parte Gwinn, 112 U.S.P.Q. (BNA) 439 (Bd. App. 1955) (unpatentable).

\textsuperscript{113} In re Miller, 418 F.2d 1392, 164 U.S.P.Q. (BNA) 46 (C.C.P.A. 1969) (patentable).

\textsuperscript{114} A patent on printed matter is a patent on information, at least in the ordinary case where everything in the claim, including the functional interrelationships of the claim elements, is old and conventional except for the identity of the information. The printed matter rule thus emits faint emanations or overtones of the idea that our intellectual property system allocates protection of information to copyrights rather than patents, see Baker v. Selden, 101 U.S. 99 (1879), which in turn suggests a number of important differences between patent and copyright law. For example, independent creation is a defense under copyright law, Sheldon v. Metro-Goldwyn Pictures Corp., 81 F.2d 49 (2d Cir.), cert. denied, 298 U.S. 669 (1936), but not under patent law, Schnadig Corp. v. Gaines Mfg. Co., 620 F.2d 1166, 1173 n.3, 206 U.S.P.Q. (BNA) 202, 206 n.3 (6th Cir. 1980); see Granite Music Corp. v. United Artists Corp., 532 F.2d 718, 189 U.S.P.Q. (BNA) 406 (9th Cir. 1976); Alfred Bell & Co. v. Catalda Fine Arts, 191 F.2d 99, 103, 90 U.S.P.Q. (BNA) 153, 157 (2d Cir. 1951), so that assigning information to copyright gives information necessary breathing room. Moreover, patent law examines its subject matter for technical merit, see 35 U.S.C. §§ 103, 131 (1994), but copyright does not. Baker, supra. Information is usually not readily susceptible to examination for intrinsic merit or technical advance. And so on.

However, the printed matter rule cannot be justified simply on
Courts have on rare occasions perceived printed matter cases as involving a question of giving a patent on an abstract idea.\textsuperscript{115} \textit{Beauregard} is one of the rare examples of such an attempt to get a patent on an abstract idea (algorithm) in a printed matter case—if indeed \textit{Beauregard} should be regarded as a printed matter case. The phrase "printed matter" is really more a metaphor for what is wrong with claims of the kind involved in the \textit{Beauregard} case than a reasoned legal analysis or perhaps even a useful analytic tool. The kind of information encoded on the floppy diskettes in \textit{Beauregard} is not information in the form of data but in the form of code for a computer program. Is that fact situation conceptually akin to configuring trolley transfer stubs, arranging surnames phonetically instead of orthographically, or putting a new set of symbols on dice? Perhaps it is, but it seems more likely that the wrong analytic mechanism, or at least a suboptimal one, is being used here to determine whether algorithms or computer pro-

\begin{itemize}
\item the basis of the relative roles of patents and copyrights in our intellectual property laws. Actually, neither patents nor copyrights protect information as such. The reason is that doing so would run counter to their respective purposes of promoting the progress of useful arts and human knowledge. Thus, copyright protects only the expression of information, not the substantive or idea content. \textit{Baker, supra; see also} Feist Pubs., Inc. v. Rural Tel. Serv. Co., 499 U.S. 340, 18 U.S.P.Q.2d (BNA) 1275 (1991) (data cannot be protected in itself by a copyright on a compilation of such data; selection and arrangement features of data are protectible under copyright law, but not the underlying data itself). In contrast, the European Community has promulgated a directive that requires its member states to protect the data in compilations of data under \textit{sui generis} data protection laws. For a general discussion of the EC approach to data protection, see Simon Chalton, \textit{Amended Database Directive Proposal: A Commentary and Synopsis}, 16 EUR. INTELL. PROP. REV. 94 (1994).

Therefore, neither patents nor copyrights are appropriate for protection of information as such, if one believes that protecting information as such under intellectual property law is inconsistent with its constitutional purpose. On the other hand, things such as information may perhaps be protected under some system other than patents or copyrights, as trademarks and trade secrets are. But in any event, patent law's printed matter rule is not supportable simply on the basis that our intellectual property system allocates different respective roles to copyright and patents.

\begin{itemize}
\item \textit{Boggs v. Robertson}, 13 U.S.P.Q. (BNA) 214 (D.C. Sup. Ct. 1931), suggested that patents on printed matter would amount to patents on ideas, adding that "where an idea is simply an abstraction the mere reduction of it to writing does not amount to invention."
grams on a floppy disk ought to be patented. The substance of the claimed invention, not its form, should guide the analysis. The substance here is algorithm, not trolley ticket.

d. Lowry.

The Office apparently became troubled with defending the Board's decision in Beauregard on a printed matter theory because of the Federal Circuit's panel decision in Lowry stating that the printed matter rule does not apply to machine-readable information.\(^{116}\) That statement was clearly too broad, however, and missed the point. It was too broad, particularly for obviousness purposes, because it welcomed machine-readable piano rolls, music CDs, and videotaped sales presentations into the patent system as articles of manufacture, something against which Judge Archer warned in his dissenting opinion in Alappat.\(^{117}\)

It missed the point, also, because the printed matter rule effectively is a rule against patents on information as such—whether the information is machine-readable is not the point. If every claim element is old and conventional, if all elements cooperate in an old, conventional manner, and if the only thing novel in the whole claim is the identity of the information, then a patent on that combination of elements amounts to a patent on the new information, regardless of

\(^{116}\) In re Lowry, 32 F.3d 1579, 32 U.S.P.Q.2d (BNA) 1031 (Fed. Cir. 1994); see supra text accompanying notes 82-87.

\(^{117}\) In re Alappat, 33 F.3d 1526, 1553-54, 31 U.S.P.Q.2d (BNA) 1545, 1565-66 (Fed. Cir. 1994). The Board also noted in its initial opinion that IBM had admitted on oral argument that claims to phonograph records are nonstatutory subject matter because one phonograph record differs from another only in the informational content. The Board's opinion and IBM's concession preceded Alappat and Lowry.

In addition, at least one of the printed matter cases did involve machine-readable information. In re Jones, 373 F.2d 1007 (C.C.P.A. 1967). In that case, the inventor encoded markings on a disk—successive opaque and transparent regions—so that light would or would not pass through the disk, depending on the angle of rotation. That permitted the disk's analog rotary motions to be converted to digital signals. The court held that the information on the disk functionally cooperated with the disk, and that therefore the combination was patentable.
whether it is machine-readable. Where the information is an algorithm or another abstract idea, the patent amounts to one on the algorithm or other abstract idea. That is why *Lowry* is not a sound basis for reversing the Board's rejection of the claims in *Beauregard* as printed matter. The Board's verbalization of the unpatentability of information as such (for example, calling it "printed matter" rather than an "abstract idea") may be suboptimal, but *Lowry* does not provide a clue for improving it.

e. **The motion to remand.**

On the other hand, the rejection of these claims makes more sense on algorithm or abstract idea grounds than it does on printed matter grounds; or, to reverse the judgmental spin, it makes less sense on printed matter grounds than on algorithm or abstract idea grounds. This created a dilemma, for the Office understandably did not want to risk having the Federal Circuit roast, or at least chide, it for trying to substitute its appellate counsel's post hoc algorithm rationalizations for the printed matter opinion of the Board. The Office was caught between two millstones—difficulty in defending a rejection of machine-readable information as printed matter right after *Lowry*, on the one

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118 The leading case on printed matter, *In re Gulack*, 703 F.2d 1381, 217 U.S.P.Q. (BNA) 401 (Fed. Cir. 1983), holds that the key to patentability in a printed matter case is whether the information cooperates or interacts functionally with the substrate on which it is imprinted or encoded in a novel and unobvious way. *Id.* at 1386 ("whether there exists any new and unobvious functional relationship between the printed matter and the substrate").

119 Further, *Beauregard* and *Lowry* are different in the subject matter sought to be patented. Lowry sought a patent on a method of arranging information (or corresponding memory structure) without regard to the identity of the particular information to be arranged. But the *Beauregard* appeal involves an attempt to get a patent on particular information (the algorithm), as such, not just a method of arranging it or doing something with it.

side, and the absence of discussion of algorithms or abstract ideas in the Board's opinion, on the other.

The Office therefore filed a motion to remand the case to the Board for further proceedings and a new opinion that would take Lowry into account. IBM opposed the motion on the ground, among others, that the Office was hypocritical in asking for a remand to give the matter further consideration in the light of Lowry. IBM said that everyone knows that the Office pays no attention to a Federal Circuit panel decision unless it is "a decision that the Commissioner happens to agree with." One might have thought that the appeal was moot, or that important elements of a live, justiciable controversy between the appellant and appellee were lacking, once the Office said that it "appears" that the agency's rejections were inconsistent with a subsequent decision of the reviewing court and therefore a remand would be appropriate. At least, one might think it an uneconomical

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121 The Office said: "It appears to the Commissioner that the rejections in the present appeal are inconsistent with this Court's holding in Lowry. The Commissioner requests a remand ... for further consideration by the Office not inconsistent with Lowry." The Office said that if Beauregard were remanded the Office would also reconsider its decision in the light of Alappat and Trovato, and it noted two recent unpublished decisions in which the Federal Circuit remanded cases to permit the Office to apply Alappat. In re Fraenkel, Fed. Cir. App. No. 94-1217 (remanded Mar. 8, 1995); In re Sommen, Fed. Cir. App. No. 94-1023 (remanded Jan. 19, 1995).

122 IBM cited several directives from the Commissioner to the examining staff stating that certain Board decisions had been correctly decided, that Federal Circuit panel decisions reversing them were wrongly decided, and that the staff should continue to follow the Board decisions or authorities on which they had been based. See, e.g., 1161 Off. Gaz. Pat. Office 314 (Apr. 19, 1994) (In re Baird "was wrongly decided); 1134 Off. Gaz. Pat. Office 633, 636 (Jan. 7, 1992) (Federal Circuit panel decisions "do not overcome" In re Lundberg); 1112 Off. Gaz. Pat. Office 16 (Mar. 13, 1990) (limiting In re Iwahashi to its facts).

123 IBM argued that "appears" and similar words of qualification belied the Office's sincerity in requesting the remand. Without a more abject confession of error, IBM maintained, one could expect the Office simply to try to limit Lowry to its facts, for example, merely "computer data structures in memory or the like," and thus deem Lowry inapplicable to the Beauregard case, which involves storing an algorithm or computer
expenditure of judicial resources to have the Federal Circuit hear an appeal and write an opinion in a case in which the agency asks for such a remand. Nevertheless, in a terse and uninformative order, the Federal Circuit denied the motion.\textsuperscript{124} The \textit{Beauregard} appeal will therefore be argued shortly, and presumably will be decided on some basis later this year.

Clearly, no useful decision from the Federal Circuit can now be expected in \textit{Beauregard}. If the case had been remanded, perhaps the Office could have issued another decision presenting a more coherent view of the matter, stating what it considers to be the general principles applicable to cases involving computer-related abstractions, and whether the claims, invention, or patent application on appeal was congruent with those principles. The Federal Circuit might then have agreed or disagreed, stating its own views, preferably in a coherent and general way that would provide much-needed guidance to industry and the Office in this field. On the other hand, considering what happened in the Year of the Algorithm, one might properly and seasonably ask: Why is this opinion going to be different from other opinions? Is it not quixotic to expect coherent, much-needed guidance in an area of law that thus far has so resolutely defied such efforts? In any event, given the Office's frank statement to the court that it appears to the Office that the Board's \textit{Beauregard} decision, as written, is unsupportable after \textit{Lowry},\textsuperscript{125} there does not appear to be much room for reconsideration.

\textsuperscript{124} \textit{In re Beauregard, Fed. Cir. App. No. 95-1054 (Order of Apr. 6, 1995).}

\textsuperscript{125} Given the facts that the Federal Circuit denied rehearing \textit{en banc} in \textit{Lowry} and that the Solicitor General would not seek Supreme Court review, the Office is not in a position to argue to the Federal Circuit that \textit{Lowry} was wrongly decided. To be sure, \textit{Lowry} involved a patent sought on the article of manufacture resulting from use of a method or organizing data in general, without reference to what the specific information content of the data was, while \textit{Beauregard} involves a patent sought on an article of manufacture embodying specific information; a computer program carrying out the particular polygon-fill algorithm involved. (In both cases, the article of manufacture is generic—any memory means; hence that is not a distinguishing factor.) Thus, \textit{Beauregard} is more specifically a case on patenting information as such. Nonetheless, the Board's opinion in \textit{Beauregard} is clearly based on a
left to turn *In re Beauregard* into a silk purse\textsuperscript{126} but the court vacated and remanded. Probably, *Beauregard* will return to the Federal Circuit later in 1995 in a somewhat altered state and with a new spin vector.

6. **1994 Summary**

The sharp division among Federal Circuit panels in the 1994 algorithm decisions is illustrated in the following table:

\textsuperscript{126} *But see In re Schrader*, 22 F.3d 290 (Fed. Cir. 1994), discussed *supra* at notes 40-55. In Schrader, most observers and a dissenting member of the Federal Circuit panel thought that the Board had rejected the patent on the grounds that it claimed a nonstatutory method of doing business. Nevertheless, the majority of the Federal Circuit panel sustained the rejection below on the grounds that the patent claimed an algorithm. Such lightning might strike again in *Beauregard*. For example, the court could consider the abstract idea rationale implicit in the printed matter doctrine, indeed, its "true meaning." That would not be very difficult from how the court addressed a similar issue in *Warmerdam*. *See* 33 F.3d at 1360, 31 U.S.P.Q.2d (BNA) at 1758-59 (abstract idea rationale rather than algorithm rationale). The *Trovato* opinion operates similarly. *See* 42 F.3d at 1381.
1994 Algorithm Decisions of Federal Circuit
Table Showing Voting Patterns of Members of Court
(U=unpatentable, P=patentable, *=author, majority opinion)

<table>
<thead>
<tr>
<th>Cases</th>
<th>JJ.</th>
<th>Schrader</th>
<th>Alappat</th>
<th>Lowry</th>
<th>Warmerdam</th>
<th>Trovato</th>
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<td>Nies</td>
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<td>U*</td>
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</table>

It may be seen\textsuperscript{127} that three members of the court have consistently voted in favor of algorithm patents on every occasion, at least three are swing voters who have come down on one or the other side depending on the particular fact pattern (for example, content of specification) or claim wording, two are strongly committed to requiring nonfrivolous apparatus limitations in algorithm claims, and several have voted too few times (and have not authored opinions for

the court) to permit one to place them in Algorithm Alley or the opposite camp. Given this pattern, an observer might well be tempted to predict the outcome of subsequent decisions, such as the prospective decision of *In re Beauregard*, largely on the basis of panel composition.\(^{128}\)

III. WHERE WE ARE AND WHY

The *Alappat* decision and the rest of the Year of the Algorithm in the Federal Circuit have left algorithm-related and computer-related patent law in such disarray that, without legislative intervention, it may be years before any equilibrium is reached. The outcome of cases will now significantly depend on the happenstance of panel composition. By the same token, infringement and validity opinions of counsel will not be definite and reliable. Security of expectation and investment, for software innovators with software patents and for their competitors with potentially infringing products, will suffer. That is not acceptable. It is unfair to the software industry and unfair to the electronic industry upon which patents impact. It is not in the interest of the public that predictability of commercial affairs, business expectations, and security of investment should be impaired by this much legal uncertainty.

Many will regard this as an unmitigated evil. On the other hand, some in industry will applaud. They are hopeful that they can reshape the law from what *Schrader* and the precedents on which it relied said it is to something more hospitable to patents on software abstractions. They consider that hoped-for result far more important than any costs of uncertainty during the interim. Perhaps, there is something to be said for that view. Perhaps, the Year of the Algorithm has given us all an opportunity.

A reprise of the pros and cons of algorithm patents is in order. The sharp division of opinion about algorithm patents among different Federal Circuit panels is not a mere epiphenomenon of judicial temperament. Both camps can find considerable policy support for their respective positions. In a sense, and in some respects, public policy supports both positions; yet a fundamental problem with algorithm patents prevents satisfactory resolution of the controversy at this time. Intellectual property protection for algorithms is desirable and

\(^{128}\) It should be noted that a new twelfth member has recently joined the court, without any prior algorithm-related history.
appropriate—indeed, there may be a crying need for it. But the U.S. patent system is not equipped, in its present form, to provide appropriate legal protection for algorithms while appropriately satisfying the public interest.

Since the effort to obtain algorithm patents began, some time before Benson, proponents of algorithm patents have argued that the computer software industry is a major factor in the United States economy, and that it needs and deserves intellectual property incentives to innovation, which other United States industries enjoy. Although not empirically supportable, their arguments are forceful.

Furthermore, the difference between software and hardware implementations of a computer-related advance is usually casual and unrelated to the substance of the particular technological advance. Hardware and software implementations are largely interchangeable, and which of them one uses at any given time depends or should

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129 U.S. CONG., OFFICE OF TECHNOLOGY ASSESSMENT, FINDING A BALANCE: COMPUTER SOFTWARE, INTELLECTUAL PROPERTY AND THE CHALLENGE OF TECHNOLOGICAL CHANGE ch. 3 (1992) [hereinafter FINDING A BALANCE] collects a body of economic statistics on the United States software industry. In 1990, U.S. software development was a $35 billion industry. Id. at 93. U.S. software and services domestic industry revenue for 1990 was $93 billion, of which software products accounted for $42.5 billion. Id. at 96. There does not appear to be any data on what portion of this value should be attributed to algorithms and other abstract forms of software.

130 Arguments of this type can be found in the 11 amicus curiae briefs filed in the Federal Circuit in the Beauregard case. The difficulties in marshalling reliable empirical evidence to support the proposition that the social gain from establishing intellectual property protection for a form of technology exceeds the social cost are formidable. See Robert W. Kastenmeier and Michael Remington, The Semiconductor Chip Protection Act of 1984: A Swamp or Firm Ground?, 70 U. MINN. L. REV. 417, 422-23, 441-22 (1985). Not only is the data elusive but the methodology for evaluating it may not exist. See FINDING A BALANCE, supra, at 186–90; FRITZ MACHLUP, AN ECONOMIC REVIEW OF THE PATENT SYSTEM, Study of Subcomm. on Patents, Trademarks, and Copyrights of Comm. on the Judic., U.S. Sen., Study No. 15, 85th Cong., 2d Sess. (1958) at 62 (analysis "can only be highly speculative"), 76 ("perhaps a hopeless task"). Typically, legislative bodies make a leap of faith, for example, as in extending copyright scope and term. But see Kastenmeier and Remington, supra (calling for utilitarian calculus).
depend on engineering and economic considerations, not legal ones. Thus, a well known electrical engineering textbook states:

A central theme of this book that will occur over and over again is: hardware and software are logically equivalent.

Any operation performed by software can also be built directly into the hardware, and any instruction executed by the hardware can also be simulated in software. The decision to put certain functions in the hardware and others in the software is made on the basis of such factors as cost, speed, amount of memory required, reliability, and frequency of expected changes. There are no hard and fast rules to the effect that X must go into the hardware and Y must be programmed explicitly.\textsuperscript{131}

It is, therefore, unsound in principle to allow intellectual property protection on hardware implementations of a computer system advance and to deny such protection to software implementations. To do so distorts the making of choices between hardware and software, and decreases allocative efficiency.

The arguments against algorithm patents are in the main based on general principle or other abstract reasoning. The metaphor of depriving the artisan of his tools,\textsuperscript{132} for example, may be excessive and unrealistic. A new algorithm is not the same thing as an old screwdriver, and when new screws and screwdrivers were invented (consider the Phillips-head screw), patents were allowed without ensuing industrial disruption. Closely akin to the tool metaphor is the concept of entirely preempting the algorithm and thus hindering the scientific and technological advances of others in the field. That is really a remedy problem, however, rather than one of fundamental conflict.


A patent on an algorithm preempts others' use of the algorithm only if, and to the extent that, the law allows preemptive remedies, such as penal sanctions, injunctions, or confiscatory monetary relief. By the same token, if remedies can be appropriately adjusted, the preemption problem may vanish.

A problem with algorithm patents that is harder to address is that which the Supreme Court sensed in *O'Reilly v. Morse.* An algorithm patentee teaches and enables the public to enjoy only one implementation of the claimed algorithm but gains a patent (a monopoly if you will) on implementations that only subsequent workers in the field will teach and enable. Thus, Morse with claim 8 in hand discourages anyone else from developing the fax machine, because his patent will dominate their patents and any exploitation of their inventions. This problem, which greatly troubled Judge Archer and was a main focus of his dissenting opinion in *Alappat,* has been discussed at length elsewhere and need not be rehearsed here. In summary, the problem of enablement for broad, algorithm patents is extremely difficult to solve and may not be solvable at all:

If we are to have algorithm patents in the future, [after *Alappat,*] . . . a rational test must be devised to determine when an algorithm patentee has sufficiently enabled the defendant's infringing use to deserve to recover from the defendant, and how much is a fair recovery. That may be a formidable task, and the test may prove very expensive to administer and uncertain in application. There may be a considerable deficit in predictability and security of expectations. Indeed, the present patent system simply cannot satisfactorily deal with algorithm patents. For example, what is a fair test as to monetary recovery, if any, in this context may be inconsistent with the rest of patent law doctrine. Thus . . . a sliding scale proportioning . . . amount of recovery to . . . degree of enablement would be alien to United States patent law. One could not modify our patent law to deal


with this without changing it into something that was no longer our patent law, which would be unacceptable to the users and beneficiaries—the clients—of traditional patent law.\textsuperscript{135}

Without legislative resolution of some kind, we are probably in for a great deal of uncertainty in the law for a long time and the software and electronics industries will be condemned to a long and expensive educational experience. An appropriate legislative resolution would be a compromise that provided to those who disclose new and useful algorithms and other computer-related nonstatutory subject matter an industrial property right that did not preempt and discourage the creative work of others. Moreover, the scope of the new right and its relation to the patent system would have to be delineated with sufficient clarity to lessen significantly the high transaction costs illustrated by the litigation of the Year of the Algorithm. Above all, the new system of industrial property rights would have to increase certainty and predictability, and thus lead to greater security of business expectations.

A possible resolution of the algorithm patent problem in accordance with the foregoing prescription would be to provide a different kind of patent, a petty patent, for algorithms and such other computer-related nonstatutory subject matter as computer-related printed matter and methods of doing business. Petty patents are not complete strangers to United States intellectual property law. While not so denominated, plant patents\textsuperscript{136} and design patents\textsuperscript{137} are kinds of petty patent, in comparison with ordinary patents. They have shorter terms and are narrower. The Semiconductor Chip Protection Act of 1984,\textsuperscript{138} which protects chip layouts, also provides a type of petty patent right.\textsuperscript{139}

\textsuperscript{135} Id.


\textsuperscript{139} The EC data protection directive, see supra note 114, contemplates a kind of petty patent system.
The remainder of this article is directed to a proposal for a petty patent system for algorithms and related subject matter, with special attention to a few selected problems that crafting such a system raises. The most important of these special problems is how to deal with the issues raised in the five Federal Circuit cases decided during the Year of the Algorithm—notably, How does one properly distinguish between an algorithm per se and an algorithm—using machine?

IV. PETTY PATENTS FOR ALGORITHMS

The centerpiece of this proposal is a radical algorithmectomy—getting algorithms out of the regular patent system and into a new Part V at the end of Title 35 of United States Code. Legal protection under the new, petty-patent system would effectively supersede patent protection for all computer-related questionable statutory subject matter, whether called an algorithm, method of doing business, printed matter, or an abstract idea. Assuming that the new petty patent is sufficiently attractive to applicants to make them willing to elect it, a drastic reduction will occur in algorithm appeals to the Federal Circuit or even to the Board; there would not be another Year of the Algorithm in the Federal Circuit.

A. Overall Scheme Of Statute

A new Part V would be added to Title 35, at its end. The new part would direct the Commissioner to issue petty patents with only negligible prior examination, which would be limited to facial compliance with statutory requirements and implementing regulations. That would permit the Office to issue petty patents inexpensively, as in the case of copyright registrations. That, in turn, implies a very slight

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140 The proposed statutory provisions seek to implement two policy options described in FINDING A BALANCE, supra, note 129, at 33 (options 2.1 and 2.2—refining the statutory definition of patentable subject matter in regard to algorithms, excluding algorithms from the ordinary patent law and creating a new form of protection for them within a patent type of framework, utilizing shorter term, lower criteria for inventiveness, and/or special exemptions from infringement).
presumption of validity.\textsuperscript{141} Courts would need to scrutinize a registered computer-idea innovation in depth for its validity, in terms of the prior art and its technical merit, but this would occur only in the remote eventuality of litigation.\textsuperscript{142} Post-registration administrative opposition


\textsuperscript{142} The same scheme now applies in the United States to copyrights and rights under the Semiconductor Chip Protection Act of 1984. See generally RICHARD H. STERN, SEMICONDUCTOR CHIP PROTECTION §§ 3.9, 5.3[A] (1986). Invalidity of a copyright because of prior art or obviousness is not a meaningful concept in copyright law, however, so that copyright may not comprehensively provide a useful analogy. Rights under the chip act can be invalid, however, because of prior art and complete obviousness. Richard H. Stern, Determining Liability for Infringement of Mask Work Rights under the Semiconductor Chip Protection Act, 70 U. MINN. L. REV. 271, 317–21 (1985). Compare 17 U.S.C. § 902(b)(2) (work is unprotectable if commonplace designs are "combined in a way that, considered as a whole, is not original") with 35 U.S.C. § 103 (subject matter, considered as a whole, is obvious). The determination of originality under 17 U.S.C. § 902(b)(2) is made in the first instance, if at all, by a court in an infringement case; the determination of obviousness under 35 U.S.C. § 103 is made administratively, in the first instance, by a patent examiner.

A similar scheme exists in Germany for its Gebrauchsmuster or petty patent or utility model. Application is made to the German Patent Office's Utility Model Section, which performs a cursory examination to determine whether the claimed subject matter is the kind of subject matter that a Gebrauchsmuster protects, and if so the Office registers it. No examination for novelty or technical merit occurs unless infringement or cancellation proceedings occur. CHRISTINE FELLNER, THE FUTURE OF LEGAL PROTECTION FOR INDUSTRIAL DESIGN 138 (1985). For descriptions of the Gebrauchsmuster, see R. Liesegang, German Utility Models After the
(revocation)\textsuperscript{143} should also be available to permit those in the software industry to bring to the Office's attention prior commercial software

\textsuperscript{143} This would be like reexamination, see 35 U.S.C. §§ 302-07, but actually it would be the first real examination of the algorithmic subject matter for novelty. The procedure should be post-issuance, rather than pre-issuance, in order not to delay prompt registration of the subject matter and attachment of rights to the owner, and opposers should be allowed to submit art to the Office, explain its relevance, and controvert the owner's arguments as to the significance of the art. Generally, European patent practice permits \textit{inter partes}, post-grant opposition, but Japanese patent practice has thus far provided pre-grant opposition. For a general discussion of administrative revocation of patents, see Harold C. Wegner, \textit{Patent Harmonization by Treaty or Domestic Reform} § 2160 (1993).
products that anticipate a registered algorithm,\textsuperscript{144} rather than engage in infringement litigation.

The focus in determining entitlement to a petty patent (that is, validity) would be more on novelty than on level of technical merit, with a standard of required technical merit set below that of section 103.

\textsuperscript{144} One might expect those in the software industry to have knowledge of the content of previously commercialized software superior to that of the Office. This procedure would therefore help overcome the past difficulty experienced in the Office in finding relevant prior art in software cases. See Gottschalk v. Benson, 409 U.S. 63, 72, 175 U.S.P.Q. (BNA) 673, 677 (1972) (quoting report of presidential commission describing Patent Office's difficulty in making proper search for computer program art and stating that effect is to make "patenting of programs . . . tantamount to mere registration"). The reexamination of the Compton-Encyclopedia Britannica multimedia patent confirmed the value of post-issuance examination of prior art concerning software patents, as facilitated by software industry participation. See Ex Parte Reed, Reex. No. 90-3270 (final rejection of multimedia patent, order of Sept. 16, 1994), \textit{reprinted in COMPUTER L. REP.,} Dec. 1994, at 776.

In one respect, the post-issuance opposition contemplated here may be broader than that for reexamination of United States patents. Such reexamination is limited to patents and printed publications as prior art. 35 U.S.C. §§ 301-02. Public use and sale will not be considered unless the patentee admits it. Quad Environmental Technologies Corp. v. Union Sanitary Dist., 946 F.2d 870, 875 n.7, 20 U.S.P.Q.2d (BNA) 1392, 1395 n.7 (Fed. Cir. 1991). It is not clear whether a commercial floppy diskette containing a computer program embodying an algorithm is a printed publication disclosing the algorithm (although it does evidence public use and sale); the algorithm could be discerned from the diskette by disassembling ("reverse compiling") the object code. This obviously represents a different kind of disclosure or public knowledge than has been involved until now in precedents regarding printed publication for purposes of 35 U.S.C. § 102. Hence, it is uncertain whether the Office will consider such things as an old copy of a Visicalc diskette as prior art in a reexamination proceeding. However, this is precisely the best kind of prior art that should be particularly relevant to a post-issuance opposition against a software registration under the proposed legislation. It also illustrates the kind of art that those in the software industry will know about, although the Office does not.
of the patent law. (That in turn would imply reliance on the commerce clause, rather than the patent clause, as constitutional authority.\textsuperscript{145})

Remedies would be less preemptive, except in exceptional cases, and they would appropriately be gauged to the relative contributions of the parties to commercialization (e.g., relative enablement). The ordinary remedy would be reasonable and entire compensation for the use made.\textsuperscript{146}

**B. Subject Matter And Conditions Of Protection**

1. **Entry Into The System**

The basic scheme of the proposed statute is to offer patent applicants a right of election whenever they face a rejection of a claim on the ground that the claimed subject matter is computer-related non-statutory subject matter, for example, an algorithm, method of doing business, or printed matter. Such rejections triggered the appeals in every one of the algorithm cases that ever went to the Supreme Court as well as all of those before the Federal Circuit in 1994. The election would have two immediate results—the application for protection of the rejected subject matter would be transferred to the petty patent system, and the applicant then would probably immediately receive a petty patent on the subject matter.

In addition, such a petty patent system might well permit any person to apply for a petty patent without first filing a regular patent application or receiving a rejection on grounds of nonstatutory subject

\textsuperscript{145} In Graham v. John Deere Co., 383 U.S. 1, 148 U.S.P.Q. (BNA) 459 (1966), the Court asserted that the Constitution establishes a minimum level of invention for patentability and that present 35 U.S.C. § 103 provides a test equivalent to that of the Constitution. See also The Trademark Cases, 100 U.S. 82 (1879) (first trademark act held unconstitutional because not restricted to commerce). A provision of the type contemplated here exists in the enforcement section of the Semiconductor Chip Protection Act of 1984. 17 U.S.C. § 910(a).

\textsuperscript{146} See 28 U.S.C. § 1498, which provides for an award of reasonable and entire compensation, and permits no other remedy, when the United States infringes intellectual property rights.
matter. But that aspect of the system is beyond the scope of this Article. 147

The right of election, triggering a patent applicant's transfer into the petty patent system, may be statutorily described as follows:

§ ___. **Right of election of software protection**

Whenever any claim of any patent application is rejected under section 101 of this title on the ground that the claim is directed to an algorithm, printed matter, a method of doing business, or any other computer-related nonstatutory subject matter, the applicant may elect to obtain rights to the claimed subject matter under this part of this title instead of under Part II. Any applicant making such an election shall be entitled, for purposes of determining priority, to the benefit of the effective filing date of the applicant's patent application insofar as it discloses the claimed subject matter. This provision is intended only for use when a regular patent application can be transferred to petty patent application status and receive substantially automatic issuance without further processing. The Commissioner would prescribe regulations governing how the election and transfer would occur.

2. **Originality, Novelty, And Technical Advance**

The basic qualifying conditions for petty patent protection would be originality, novelty, and technical advance. These conditions may be described as follows:

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147 Permitting direct application for a petty patent on an algorithm or similar nonstatutory subject matter would raise a number of issues not necessary to address in a statute only contemplating transfer of a case from the regular patent system to a petty patent system. For example, how detailed an application should be required? Must there be claims? See 35 U.S.C. § 112.
§ ___. Requirements of originality, novelty, technical advance

(a) Registration and protection under this part of this title are available only to computer software innovations that are original, are novel, and embody a technical advance in computer software art, as further particularized in the following subsections of this section.

(b) The originality requirement of this section is met if and only if the person claiming to be the creator of the innovation created it without having copied it from computer software previously created by another person.

(c) The novelty requirement of this section is met if and only if, on the effective date of registration of the innovation, the identical, or substantially identical, subject matter has not previously been any of the following:

1. disclosed in a printed publication circulated anywhere in the world;

2. publicly known in the United States;

3. used anywhere in the world in a nonsecret manner that would permit a person skilled in computer software art to learn the subject matter; or

4. disclosed in an earlier filed application under this title.

(d) The requirement of this section that a protected innovation must embody a technical advance in computer software art is met if and only if, on the effective date of registration of the innovation, creation thereof involved more than mere average or routine technical skill, relative to software described in paragraphs (1)–(3) of subsection (c). The technical advance
need not, however, be unobvious within the meaning of section 103 of this title.

The originality requirement of subsection (b) is essentially the same as that for copyright law. The novelty requirement of subsection (c) is generally similar to that of patent law, adapted to a system in which rights depend on filing. The technical merit requirement of subsection (d) is not as high as that of patent law, and simply filters out routine or commonplace contributions. The term "innovation" under the French copyright law applicable to software. French copyright law uses the term "original" as the standard for legal protectability. In the Pachot judgment (Plen. sess., March 7, 1986, RIDA July 1986 at 136), the court defined an original computer program as one that bears "the mark of an intellectual contribution."

German law also uses the term "original" to describe works deserving legal protection. The German Supreme Court, in the Inkassoprogram decision (May 9, 1985, GRUR no. 12, at 1041), held that computer software is original only if "more than average programming skills" are required to develop the computer program for which protection is sought.

It has been said that the French standard of originality is lower than the German standard, and that the Dutch standard of originality is also lower than the German standard. J.H. Spoor, Protecting Expert Systems, In Particular Expert System Knowledge, 14 EUR. INTELL. PROP. REV. 9, 11 (1992). Probably, the German Supreme Court's standard of originality for computer program copyright, described above, comes closest to that of the present proposed statutory provision, whose language ("more than mere average or routine technical skill") is similar to that of the German court's Inkassoprogram decision. This level of technical advance is also approximately comparable to that required for

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149 See 35 U.S.C. § 103. According to Dann v. Johnston, 425 U.S. 219, 189 U.S.P.Q. (BNA) 257 (1976), "the gap between the prior art and respondent's system [must be] . . . so great as to render the system nonobvious to one reasonably skilled in the art" for a software innovation to be patented. Id. at 230, 189 U.S.P.Q. (BNA) at 261. Subsection (d) does not require a gap like that described in Johnston; put differently, the gap can be quite small, so long as it exceeds zero magnitude.

150 See 17 U.S.C. § 902(b)(2). There are considerable difficulties in specifying with precision the requisite level of technical advance for software protection to be warranted.

The French Court of Cassation has sought to define this level under the French copyright law applicable to software. French copyright law uses the term "original" as the standard for legal protectability. In the Pachot judgment (Plen. sess., March 7, 1986, RIDA July 1986 at 136), the court defined an original computer program as one that bears "the mark of an intellectual contribution."

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used throughout the section simply means the subject matter on which legal protection is sought and does not imply actual novelty and technical merit; the term is analogous to "alleged invention."^{151}

C. Relation To Regular Patent System

A bright-line distinction between the subject matter of petty patents (new Part V of Title 35) and that of regular patents (existing Part II of Title 35) is essential to bring an end to the present state of confusion and uncertainty. The following provision is intended to describe a sharp, bright-line divide between the respective domains of petty and regular patents:

a European or Japanese petty patent, utility model, or Gebrauchsmuster.

^{151} There has been a running controversy in United States patent law over whether the word "invention," as used in 35 U.S.C. § 101 and elsewhere, is a mere token or placeholder, or instead has substantive meaning. Graham v. John Deere Co., 383 U.S. 1, 5–6, 17, 148 U.S.P.Q. (BNA) 459, 462-463 (1966) (obviousness standard under § 103 same as constitutional standard of technical merit for discoveries of inventors), indicates that the word has substantive significance related to the use of the same-stemmed term "inventor" in U.S. CONST. art. I, § 8, cl. 8. On the other hand, In re Bergy, 596 F.2d 952, 201 U.S.P.Q. (BNA) 352 (CCPA 1979), vehemently denies that "invention" has any substantive meaning in patent law (and instead is, in effect, synonymous with "subject matter claimed in patent application"), so that "alleged invention," as used, for example, in 35 U.S.C. 131 ("alleged new invention") and Hotchkiss v. Greenwood, 52 U.S. (11 How.) 248, 252–53, 267 (1950) ("alleged invention"); decision states legal standard for obviousness on which 35 U.S.C. § 103 is based, see Graham, 383 U.S. at 11–17, 148 U.S.P.Q. (BNA) at 464-467, would be an utterly vacuous term.

It is unnecessary to resolve the merits of this controversy to know that one should avoid laying the groundwork for a new, like controversy. A definitional section of the statute or passage of legislative history would therefore advisedly state something to this effect: "'Innovation' means an aspect of software that a person seeks to register, or has registered, under this part of this title. The use of the term does not imply that the person necessarily has a valid right to legal protection under this part of this title." That would assure that the term "innovation" would be a mere token, as Bergy argues that "invention" in section 101 should be.
§ 1. Relation of software protection to patent laws

(a) ALGORITHMS UNPATENTABLE.—When the main point or points in which an alleged invention departs from the prior art is an algorithm, a category of printed matter, a method of doing business, or other subject matter protectable under this chapter, the sole available form of intellectual property protection, if any, for the alleged invention shall be that which this part of this title provides.

(b) ALGORITHM-USING MACHINE SYSTEMS PATENTABLE.—

(1) Notwithstanding subsection (a), even though an invention utilizes or carries out an algorithm, category of printed matter, method of doing business, or other subject matter protectable under this chapter:

(A) if the invention is implemented in novel and unobvious apparatus, the apparatus may be patented as provided under Part II of this title;

(B) if the invention is implemented by a novel and unobvious use of new or old apparatus, the use may be patented as provided under Part II of this title.

(2) Novelty for purposes of Part II of this title or paragraph (1) of this subsection shall not be predicated on newly causing an otherwise conventional apparatus to operate in accordance with an al-
algorithm, in combination with a category of printed matter, or to carry out a method of doing business.

3) Lack of obviousness for purposes of Part II of this title or paragraph (1) of this subsection shall not be predicated upon alleged recognition of the desirability of computerizing a procedure or method of doing business, nor upon motivation (or absence thereof) to use an algorithm or printed matter to computerize a procedure or method of doing business.

4) When an alleged invention otherwise falling within subsection (a) of this section is claimed with limitations requiring that it be carried out with a general-purpose digital computer or a portion thereof, including, without limitation, a read-only memory or an arithmetic logic unit, such limitations shall not bring the alleged invention within paragraph (1) of this subsection and outside subsection (a). Programming a conventional microprocessor or general-purpose digital computer with new software shall not be deemed to make the microprocessor or computer a new machine for purposes of this title.

(c) RELATION OF PART V TO PARTS I–III.—

1) Parts I–III and this part of this title are intended to be mutually exclusive in respect of the same, or substantially the same, subject matter. Nonetheless, any applicant owning subject matter described in section ____ [describing petty patent subject matter] shall have the right to elect to proceed exclusively under this part rather than under Parts I–III.
(2) The Commissioner is authorized to effectuate this section and particularize it as to technical details by promulgating regulations exclusively allocating specified subject matter to protection under this part of this title; and specifying the form, interpretation, and manner of examination of claims directed to such subject matter. Such regulations shall have the force of law. Such regulations shall be subject to judicial review only in the course of direct judicial review of a final rejection of an application under this title; and they shall be upheld unless arbitrary and capricious. Nothing contained in this paragraph, however, takes away the right of a person alleged to have infringed a patent to defend on the ground that the patent is invalid under section 101 because it claims nonstatutory subject matter.

1. **Point-Of-Departure Approach**

Subsection (a) of this section adopts the so-called point-of-novelty or point-of-departure approach in distinguishing petty patent subject matter from regular patent subject matter. Under this approach, analysis focuses on how the claimed innovation is different from the prior art. If everything described in the claim is old and conventional, except for a new algorithm (or other nonstatutory subject matter), the claimed innovation is really a new algorithm.\(^{152}\)

Whether to use the point-of-novelty approach, under regular patent law, as a conceptual tool to distinguish algorithmic, nonstatutory subject matter from algorithm-using, statutory subject matter was a major point of difference and contention between the Supreme Court's *Diehr* majority opinion, on the one hand, and the *Flook* majority opinion

and Diehr dissenting opinion, on the other hand. The point-of-novelty approach has always been the most workable one, however; it is by far the easiest to administer.

Since this exercise posits legislation, it is clear that Congress would be free to implement this scheme in whatever way seems best. It is believed that by far the best way to tell an intellectual property right directed to an algorithm as such from an intellectual property right to a machine or other thing that merely utilizes an algorithm is to ascertain whether the claimed subject matter is different from the prior art in any way but the algorithm. Subsection (a) therefore provides that, where the main point or points of departure from the prior art are algorithmic, a petty patent under Part V is the appropriate form of intellectual property right rather than a regular patent under Part II.

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154 As indicated earlier, supra note 27, this approach, which copyright decisions term "analytic dissection" or "filtration," is now almost uniformly employed in determining whether an aspect of a computer program is part of the copyrightable expression of a work or instead an unprotectable idea.

155 See Graham v. John Deere Co., 383 U.S. 1, 6, 148 U.S.P.Q. (BNA) 459, 462 (1966) (so long as Congress does not exceed the limitations of the patent clause, it may select patent policy and frame implementing legislation "which in its judgment best effectuates the constitutional aim"). Within limits, basing this statute on the power to regulate commerce provides Congress with further scope of discretion. (The limit would be subversion of the patent clause. By way of analogy, Congress could not re-establish slavery under the commerce power, in defiance of the 13th amendment.)

156 This section does not address preemption or supersession of other laws. A separate section or sections should address these matters. See generally Bonito Boats, Inc. v. Thunder Craft Boats, Inc., 489 U.S. 141, 9 U.S.P.Q.2d (BNA) 1847 (1989) (preemption of state law against misappropriation of molded shapes of articles); Sears, Roebuck & Co. v. Stiffel Co., 376 U.S. 225, 140 U.S.P.Q. (BNA) 524 (1964) (preemption of state unfair competition law as applied to unpatented articles).

Subsection (b) attempts to describe the patent/petty patent boundary in more detail. Paragraph (1)(A) confirms the patentability of novel and unobvious apparatus used to implement an algorithm, and paragraph (1)(B) confirms the patentability of novel and unobvious uses of old and new apparatus (i.e. methods) to implement an algorithm. No comparable language for articles of manufacture or compositions of matter is provided, because none is considered appropriate.

Paragraph (1) leaves open the possibility of a regular patent on an algorithm-using machine and a petty patent on the algorithm itself. For example, IBM and then other disk drive manufacturers implemented the Viterbi algorithm for reading and writing data in a disk drive system, developing necessary hardware to make that implementation possible, while AT&T implemented the same algorithm for telecommunications, developing different hardware necessary to make that implementation possible. If Professor Viterbi, who first published the algorithm, were an IBM employee, the proposed legislation might permit a situation in which IBM obtained a petty patent on the algorithm itself and a regular patent on its system enabling the use of the algorithm in a disk drive application, while AT&T obtained a regular patent on its system enabling the use of the algorithm in a telecommunications application. If one agrees that the subject matter of the three intellectual property rights is different, presumably one would find no duplication of rights and no impropriety or undesirability in that result.

Paragraph (2) states that the novelty requirement for regular patents cannot be met by operating conventional apparatus in accordance with a new algorithm. Such advances are to be protected

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157 See 35 U.S.C. § 100(b).

158 These are the other categories of patentable subject matter, in addition to machines and processes, listed in 35 U.S.C. § 101.

159 But see supra text accompanying notes 101-108.

160 For a discussion of this algorithm and enablement problems with it, see Stern and Heller, supra note 134.
under the petty patent law. This is a further particularization of the point-of-departure approach of subsection (a).

Paragraph (3) addresses a potential problem in administering the bright-line patent/petty patent distinction. An applicant might argue that mere recognition\textsuperscript{161} of the desirability of computerizing a procedure should be regarded as a basis for finding unobviousness of a machine system,\textsuperscript{162} so that the subject matter may thereby be shifted


\textsuperscript{162} Current Federal Circuit law holds that before the PTO may combine the disclosures of two or more prior art references in order to establish \textit{prima facie} obviousness, there must be some suggestion for doing so, found either in the references themselves or in the knowledge generally available to one of ordinary skill in the art. Heidelberger Druckmaschinen AG v. Hantscho Commercial Prods., Inc., 21 F.3d 1068, 1072, 30 U.S.P.Q.2d (BNA) 1377, 1379 (Fed. Cir. 1994) ("When the patented invention is made by combining known components to achieve a new system, the prior art must provide a suggestion or motivation to make such a combination."); \textit{In re} Jones, 958 F.2d 347, 351, 21 U.S.P.Q.2d (BNA) 1941, 1943–44 (Fed. Cir. 1992); \textit{In re} Fine, 837 F.2d 1071, 1074, 5 U.S.P.Q.2d (BNA) 1586, 1589–90 (Fed. Cir. 1988); \textit{In re} Geiger, 815 F.2d 686, 688, 2 U.S.P.Q.2d (BNA) 1276, 1278 (Fed. Cir. 1987); ACS Hosp. Sys., Inc. v. Montefiore Hosp., 732 F.2d 1572, 1577, 221 U.S.P.Q.2d (BNA) 929, 933 (Fed. Cir. 1984). Absent a showing of motivation to combine the claimed elements, even though they are all old, their combination cannot be termed obvious.

Thus, one might argue that the combination of an old machine consisting of elements B+C+D combined in a given way and a new algorithm A was not only novel, see supra text accompanying note 59; see also \textit{In re} Lowry, 32 F.3d 1579, 1583, 32 U.S.P.Q.2d (BNA) 1031, 1034 (Fed. Cir. 1994), but unobvious as well, unless motivation for use of algorithm A with the old machine can be shown in the prior art. Generally speaking, "obvious to try" is not a proper test for the ordinary subject matter of patent law. \textit{In re} Geiger, 815 F.2d 686, 688, 2 U.S.P.Q.2d (BNA) 1276, 1278 (Fed. Cir. 1987). In software arts, however, several considerations militate a different rule. First, those in the computer field are temperamentally motivated to try to computerize any existing procedure they encounter. Second, the cost of trial and error in this field is more often like that of a "thought experiment" than like that of testing insecticides or machine structures for efficacy, so that a rule of "obvious to try" does not necessarily act as a significant disincentive to investment in R&D. Finally, the choice here is not one between a patent or nothing at all; the fall-back reward is a petty patent.
from petty patent coverage under Part V to patent coverage under Part II. If that argument prevailed, it would completely undermine the compromise proposed here.

Paragraph (4) addresses possible frivolous apparatus limitations (for example, a ROM in which information is stored) and contentions that a general-purpose digital computer or portions of it provide "structural limitations" making an algorithm claim non-preemptive. It also addresses the contention that a new program placed into an old microprocessor or general-purpose digital computer makes the latter a new, patentable machine.\textsuperscript{163} Arguments of this kind, if accepted, would also undermine the proposed compromise. (If algorithms creep back into the regular patent system, the proposed radical algorithmectomy will not have been performed successfully.)

Conventional hardware implementations of algorithms raise an issue that this paragraph may not have covered, which therefore may warrant further specific language. Any algorithm can be implemented either in software as a programmed microprocessor or general-purpose digital computer or else in hardware as a series of interconnected chips, in a gate array, or by similar devices.\textsuperscript{164} Consider the case of an algorithm or equation implemented in such conventional hardware, for example, the method of computing a hypotenuse by using the Pythagorean Theorem—\(a^2 + b^2 = c^2\)—implemented as a summing circuit, which receives the outputs of two squaring circuits, and feeds the sum to a circuit for taking the square root.\textsuperscript{165} Should a conventional hardware implementation of a new, unobvious algorithm or formula, where there is no x-ray machine input, no mold press opener device output, and no physical signal transformation,\textsuperscript{166} be patented under the regular patent system? Since the hardware and software implementations are equivalent, why should the conventional hardware implementation be given preferred treatment? Such a bare hardware

\textsuperscript{163} See supra text accompanying notes 65-67.

\textsuperscript{164} See supra text accompanying note 134.

\textsuperscript{165} For a more detailed discussion of such circuitry, see Richard H. Stern, Tales from the Algorithm War: Benson to Iwahashi, It's Deja Vu All Over Again, 18 AIPLA Q.J. 371, 379–80 (1991).

\textsuperscript{166} See supra text accompanying notes 29-39, 45-55.
device, claimed as standing alone without interconnection to a larger machine system, arguably should be unpatentable either as nonstatutory subject matter or as per se obvious.\textsuperscript{167} Furthermore, as the dissenting opinion in Alappat suggests,\textsuperscript{168} if a hardware stand-alone implementation is patented, and the software implementation is then considered equivalent to the hardware implementation (as is ordinarily true), then a patent on the hardware implementation becomes a patent preempts all practicable use of the algorithm. That would undo the proposed algorithmectomy. One might therefore conclude that a further provision of this kind should be added to this paragraph.\textsuperscript{169}

3. Administration

Subsection (c) contains provisions relating the petty patent system to the regular patent system from an administrative standpoint. Paragraph (1) states that the patent and petty patent systems are intended to be mutually exclusive, but any applicant is entitled to elect a petty patent without risking a later challenge to the correctness of the election. Therefore, a petty patent cannot be invalid on the theory that the applicant should have taken a regular patent. However, an alleged infringer can still defend against a claim of infringement of a regular patent on the ground that the patent is invalid because it claims nonstatutory subject matter.

Paragraph (2) authorizes the Commissioner to promulgate regulations that will be definitive in the administration of the statute. For example, the Commissioner may promulgate a regulation stating that any claim in the form presented in the Beauregard case shall automatically be relegated to Part V. That regulation would have the


\textsuperscript{168} See supra text accompanying note 67-70.

\textsuperscript{169} So far as the writer is aware, no reported decision directly addresses this issue, although \textit{Flook} and the \textit{Alappat} dissent imply it. Therefore, the problem may be more academic than practical and consequently unnecessary to cure.
force of law unless proved to be arbitrary and capricious. This para-
graph would effectively bring to an end controversies such as that over
whether a data structure claim is statutory subject matter under Part

II.  \(^\text{170}\)

The last sentence of paragraph (2) is a savings clause that says,
in effect, that the Commissioner classifies something as patentable sub-
ject matter under Part II rather than petty patent subject matter under
Part V does not keep an alleged infringer from challenging patent
validity on the ground of nonstatutory subject matter, despite the
limited availability of judicial review of the Commissioner's regulations.
However, the alleged infringer would have to contend against the
 presumption that an agency interprets its organic statute correctly.  \(^\text{171}\)

This legislative proposal is not complete. It does not address
remedies in any detail, and yet proper definition of remedies is perhaps
at the crux of resolving the problem. Remedies must not be too
preemptive,  \(^\text{172}\) but they must be sufficient to make the election of a
petty patent attractive. The remedy mechanism should consider factors
that are material in the present context, even though regular patent law

\(^\text{170}\) See supra text accompanying notes 152-166.

if "permissible," particularly as to matters delegated to agency).

\(^\text{172}\) An injunction against use of an algorithm is a preemptive remedy.
Probably, a remedies system generally akin to that which 28 U.S.C. §
1498 applies to infringement by the United States of intellectual property
rights is not preemptive.
does not address them. The subject of remedies is so huge, however, that the scope of this Article cannot reasonably include them.

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173 Some of these factors are indicated in the following provision:

§ ____. Factors in determining compensation, reasonableness

(a) The following circumstances, among others, do not provide a complete defense to an action for infringement, but each may be considered in determining reasonable and entire compensation and the reasonableness of a party’s behavior:

(1) that the infringing computer program [that is, the defendant's computer program using the plaintiff's protected algorithm] or subject matter is a substantial enhancement over the infringed subject matter;

(2) that the infringer engaged in substantial independent work to implement or commercialize the infringed subject matter;

(3) that the infringer independently created the infringing subject matter or did not copy from the registrant;

(4) that the infringer reasonably, albeit incorrectly, believed that its conduct was not infringing;

(5) that the infringer did not act for purposes of commercial gain or financial benefit;

(6) whether the amount of technical advance in the art or technical merit of the infringed innovative subject matter was modest or substantial;

(7) that compatibility requirements made it commercially impracticable not to use the infringed subject matter;

(8) that the registrant made excessive demands for compensation or excessive claims as to the scope of its rights;

(9) that the registrant did not give reasonable notice of protection pursuant to this part of this title; and

(10) that the infringer in good faith, prior to the registrant's effective date of registration, and without derivation from the registrant, exploited the infringed subject matter.

(b) A court may, in its sound discretion, decrease a registrant's compensation award because of its unreasonable behavior and the infringer's reasonable behavior, or increase a registrant's compensation award because of the infringer's unreasonable behavior and the registrant's reasonable behavior.
Another difficult issue, not discussed here, is whether a system that is not limited to elections out of the regular patent system as a result of a rejection of a claim as nonstatutory subject matter should require claims, or should have peripheral rather than central claims. Without peripheral claims, the definition of infringement becomes very difficult. Yet, "the highly developed art of drafting" peripheral claims is expensive and raises the front-end costs of applicants.

V. Conclusion

The Year of the Algorithm in the Federal Circuit showed that present patent law probably cannot deal with algorithms in any satisfactory manner. At the beginning of the year, a long line of case law seemed to be converging toward some clear, albeit complex, rules for distinguishing patentable algorithm--using machines and algorithm--using processes from unpatentable algorithms. The en banc Alappat decision shattered any seeming consensus in Federal Circuit law, and three subsequent panel decisions showed irreconcilable differences among the members of the court, with "data structures" for computer software, for example, being either patentable or else unpatentable, depending on panel composition. In 1995 the court will address the

174 Copyrights have no claims, nor do registrations under the Semiconductor Chip Protection Act of 1984. Courts determine the scope of such intellectual property rights in the first instance in litigation.

Peripheral claims are the ordinary claims of regular patents. Typically, they define the scope of a patent in terms analogized to the metes and bounds of a realty deed. A typical peripheral claim is of this format: a machine comprising a combination of elements A, B, and C, connected to one another in such and such a way. A machine having only elements A and B, and lacking C, will not infringe. See generally Aro Mfg. Co. v. Convertible Top Replacement Co., 365 U.S. 336, 128 U.S.P.Q. (BNA) 354 (1961) (describing claims as definitive measure of patent grant).

A central claim is one that refers to the patent's specification describing the invention and states that the inventor claims the invention substantially as described. A claim in a design patent or plant patent is a central claim. See 35 U.S.C. § 162; 37 C.F.R. §§ 153, 164.

The respective arguments for and against algorithm patents are too powerful for the matter to be resolved under present law. A compromise in which an applicant could elect to take a petty patent on an algorithm or similar subject matter, instead of trying to snare the brass ring of a regular patent, has been proposed as a way out of the algorithm patent conundrum. The law would not only permit such an election, but it would spell out a sharp, definite boundary between the respective domains of petty patents (algorithms as such) and regular patents (algorithm-using machines that are not merely programmed general-purpose digital computers). Such a law, clearly setting boundaries between regular patents and algorithm petty patents, could bring an end to the uncertainty and confusion now plaguing the computer and electronic industries.