

4-15-1982

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Recommended Citation

Alan C. Rose *Protection of Intellectual Property Rights in Computers and Computer Programs: Recent Developments*, 9 Pepp. L. Rev. Iss. 3 (1982)

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Protection of Intellectual Property Rights in Computers and Computer Programs: Recent Developments

ALAN C. ROSE*

The following article examines the protection offered to computers and computer programs, under the various applicable patent, copyright, and trade secret laws. Concerning patent protection, the author discusses the history and current status of the patent laws, and analyzes in detail the landmark case of Diamond v. Diehr. Discussed also is an analysis of copyright protection for computer programs, offered by the 1980 amendments to section 117 of the 1976 Copyright Act; which paved the way for the increased protection.

I. INTRODUCTION

The extent of protection given to intellectual property rights encompassed by computers and computer programs has recently been redefined by both the Congress of the United States and the Supreme Court. Two events of major significance in the protection of computer software and firmware have occurred during the last eighteen months. The first, which occurred in December of 1980, was a major statutory change in the federal copyright laws

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relating to computer programs.¹ The second was the first modern decision of the United States Supreme Court to uphold claims involving computers or computer programs. In this case, *Diamond v. Diehr*,² the Court held that patent claims to an industrial process were not unpatentable merely because they included computer program steps.³

With the proliferation of computers and computer programs in the last twenty years, it was inevitable that many computer-related patent applications would be filed in the United States Patent and Trademark Office. However, computer cases are not easily accommodated by the Patent and Trademark Office. Computers are very complex, and as such, patent applications for them often have many sheets of drawings and written descriptions or specifications which are also lengthy. These patent applications require many hours of a patent examiner's time. It has also been felt by many that computer programs are better subject to copyright than patent protection. However, the copyright law concerning computer programs was in a similar state of uncertainty, consequently, neither patent nor copyright law satisfactorily protected the intellectual property encompassed in computers and computer programs.

This article will analyze the recent changes in the patent and copyright laws, giving first an introduction to the nature and structure of computers and computer programs for which protection is being sought, followed by a brief overview of the history of patent protection and copyright protection leading to the present state of the law in both areas. Included in this discussion will be a brief review of the protection offered under the umbrella of trade secrecy, and a discussion of possible federal preemption problems in this area.

II. HISTORICAL AND DEFINITIONAL OVERVIEW—COMPUTERS AND COMPUTER PROGRAMS

Intellectual property for which applicants seek protection by patents and copyrights can be embodied both in computer programs, known as software,⁴ and electrical circuits of the computers themselves, known as "hardware" or "firmware,"⁵ and also

1. 17 U.S.C. § 117 (1980).

2. 450 U.S. 175 (1981).

3. *Id.* For further discussion, see notes 46-51 *infra* and accompanying text.

4. Software is normally employed in the operation of a general purpose computer which performs calculations or other functions in accordance with instructions included in the program. "A program is a set of instructions for carrying out prearranged operations on data by use of processing equipment." *In re Ghiron*, 442 F.2d 985, 986 (C.C.P.A. 1971).

5. Computer hardware consists of all of the machinery which is part of the

in the microprocessing chips used in many modern day computers.⁶ These microprocessors have expanded the computer field tremendously. They have revolutionized the small, special purpose computer business by making computers available at a low cost, with the only change in circuitry being a different, inexpensively programmable "Read Only Memory Chip."⁷

A. Historical and Definitional Overview of Patent Protection

Software, firmware, and microprocessors must be either patented or copyrighted in order to give applicants statutory protection for their original contributions in these fields. There are three avenues of protection available to the applicant wishing to protect intellectual property embodied in software, firmware, and microprocessors: trade secret protection, copyright protection, and patent protection.

The Constitution grants Congress broad power to legislate to "promote the Progress of Science and the Useful Arts, by securing for limited times to authors and inventors the exclusive rights to their respective writings and discoveries."⁸ The patent laws⁹ provide protection by offering inventors exclusive rights for a limited period as an incentive for their inventiveness and research efforts.¹⁰ Section 101 of the Patent Act of 1952 provides that "whoever invents or discovers any new or useful process, machine, manufacture of composition of matter, or any new and useful improvement thereof, may obtain a patent therefor"¹¹ The rel-

computer system. This includes the central processing, input-output control systems, input-output devices, and various types of memory systems. Comment, *Protection of Computer Software—A Hard Problem*, 26 DRAKE L. REV. 180, 180 n.1 (1976-77).

6. These microprocessor chips can perform the functions of many special purpose computers, with the only change being the substitution of a new program included in a small memory chip forming part of the small electronic package. Accordingly, the cost of these new special purpose computers can be greatly reduced as compared with the prior hard-wired special computers.

7. It is these Read Only Memory or ROM chips which may be substituted into a microprocessor to perform the various special purposes.

8. U.S. Const. art. I, § 8, cl. 8.

9. 35 U.S.C. § 101 *et. seq.* (1976).

10. *Diamond v. Chakrabarty*, 447 U.S. 303, 307 (1980). Congress legislates in a patent area so that "the productive effort thereby fostered will have a positive effect on society through the introduction of new products and processes of manufacture into the economy, and the emanations by way of increased employment and better lives for our citizens." *Kewanee Oil Co. v. Bicron Corp.*, 416 U.S. 470, 480-81 (1974).

11. 35 U.S.C. § 101 (1976).

evant legislative history of section 101 also supports the broad protection offered by the wording of the statute. The original patent act of 1793, authored by Thomas Jefferson,¹² defined statutory subject matter as "any new or useful art, machine manufacture, or composition of subject matter, or any new or useful improvement thereof."¹³ In 1952, when the patent laws were codified by Congress, the word "art" was changed to "process," but otherwise the original language was left intact.¹⁴ The Committee Report accompanying the 1952 Act notes that Congress intended patentable subject matter to "include anything under the sun that is made by man."¹⁵

However, limits upon patentability appear in the 1952 statute. These limits are also reflected in the case law of the past twenty years interpreting the statute. More specifically, section 103 of the 1952 Act provides that a patent may not be obtained, despite the provision of sections 101¹⁶ and 102,¹⁷ if the subject matter of the

12. Act of Feb. 21, 1793, ch. 11, § 1, 1 Stat. 318, *amended by* 35 U.S.C. § 101 (1976).

13. *Id.*

14. 35 U.S.C. § 101 (1976). Very briefly, the patent statute presupposes three standards for patentability of inventions: novelty, utility and nonobviousness to the skilled artisan. For further information concerning patentability, see Pope & Pope, *Protection of Proprietary Interests in Computer Software*, 30 ALA. L. REV. 527, 539 (1979).

15. 447 U.S. at 309. (quoting from S. REP. No. 1979, 82d Cong., 2d Sess. 5 (1952)). One of the earliest reported decisions in which the question of software patentability was at issue was *Ex parte King*, 146 U.S.P.Q. 590 (Pat. Off. Bd. App. 1964). In *King* the combination of a computer program and the computer in which it was stored during operation was held unpatentable because the claims on appeal "merely set forth the result or function accomplished by any computer operating on data" in a certain known type of mathematical notation. *Id.* at 591. However, the decision indicated that the combination of a computer and a novel stored program could be patentable subject matter if defined to distinguish from the known prior operation of a general purpose computer.

16. For the text of § 101 see note 14 *supra* and accompanying text.

17. 35 U.S.C. § 102 (1976) provides in full:

A person shall be entitled to a patent unless

a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for a patent, or

b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of the application for a patent in the United States, or

c) he has abandoned the invention, or

d) the invention was first patented or caused to be patented, or was the subject of an inventor's certificate by the applicant or his legal representatives or assigns in a foreign country prior to the date of the application for patent in this country on an application for patent or inventor's certificate filed more than twelve months before the filing of the application in the United States, or

e) the invention was described in a patent granted on an application for patent by another filed in the United States before the invention thereof by the applicant for patent, or on an international application by another

patent as a whole would have been "obvious at the time the invention was made to a person having ordinary skill"¹⁸ in the art to which the subject matter pertains.

Supreme Court cases interpreting the 1952 patent statute appeared to ignore its nonobviousness standard. Instead, it seemed that mere unobviousness was not enough for patentability, but that an invention had to have "synergism"¹⁹ or "invention"²⁰ above and beyond the unobviousness test which Congress had articulated in the statute. The Supreme Court justices were knowledgeable in the antitrust field, and their antimonopoly approach appeared to carry over into the area of patents, regardless of the negative effects of such decisions on inventions and research and development. In part, because of the anti-patent negativism of the Supreme Court during the 1960's and 1970's, and the precedent-following decisions by lower courts, inventive effort and research and development activities in the United States were reduced.²¹ Also, larger numbers of U.S. patents were being

who has fulfilled the requirements of paragraphs (1), (2), and (4) of section 371(c) of this title before the invention thereof by the applicant for patent, or

f) he did not himself invent the subject matter sought to be patented, or
g) before the applicant's invention thereof, the invention was made in this country by another who had not abandoned, suppressed, or concealed it. In determining priority of invention there shall be considered not only the respective dates of conception and reduction to practice of the invention, but also the reasonable diligence of one who was first to conceive and last to reduce to practice, from a time prior to conception by writing.

18. 35 U.S.C. § 103 (1976). This statutory standard of unobviousness has generated much confusion and discussion by scholars in the field. For a very thorough discussion of this area, *see generally* J. WITHERSPOON, *NONOBVIOUSNESS—THE ULTIMATE CONDITION OF PATENTABILITY* (J. Witherspoon ed. 1980).

19. *Sakraida v. Ag Pro, Inc.*, 425 U.S. 273, 279 (1976). The Court describes synergism in the following passage:

We cannot agree that the combination of these old elements to produce an abrupt release of water directly on the barn floor from storage tanks or pools can properly be described as synergistic, that is "resulting in an effect greater than the sum of the several effects taken separately" quoting from *Anderson's-Black Rock v. Pavement Salvage Co., Inc.*, 396 U.S. 57, 61 (1969) . . . Such combinations are not patentable under standards appropriate for a combination patent.

425 U.S. at 282.

20. *Anderson's-Black Rock v. Pavement Salvage Co., Inc.*, 396 U.S. 57, 62-63 (1969). The *Anderson* Court articulated the invention standard for patentability holding that to "those skilled in the art, the use of the old elements in a new combination was not an invention by the obvious-nonobviousness standard . . . more than (a successful commercial venture) is needed for invention," *Id.*

21. The President's Commission on the Patent System rejected the proposal that computer programs be patentable in a 1966 report entitled "To Promote the Progress of . . . Useful Arts." In this report the Commission noted that "the crea-

granted to foreign inventors than in previous years (thirty-seven percent in 1980 as compared with twenty percent in 1960),²² and the United States lag in technological leadership became a common topic in Washington and elsewhere across the nation.

Several Supreme Court patent decisions in recent years involving computers and computer programs have denied the patentability of computer programs.²³ The first recent case of note was *Gottschalk v. Benson*.²⁴ In that case, the Supreme Court was dealing with a method or process for converting binary coded decimal numbers into pure binary numbers, wholly within the computer.²⁵ The Court held that this algorithm, or mathematical formula, was akin to the discovery of a law of nature, such as the

tion of programs has undergone substantial and satisfactory growth in the absence of patent protection and that copyright protection is currently available." PRESIDENT'S COMMISSION ON THE PATENT SYSTEM, TO PROMOTE THE PROGRESS OF . . . USEFUL ARTS 13 (1966).

22. L.A. Times, June 19, 1981, § 4, at 2, col. 1.

23. Not unexpectedly, many patent applications were rejected in the Patent Office as not being directed to statutory subject matter. On the other hand, the CCPA took a more positive view of the patentability. Judge Giles S. Rich, of the CCPA, had been a member of the drafting committee of the 1952 patent statute. Accordingly, it was not surprising that the CCPA reversed many of the decisions of the Patent Office Board of Appeals and found patentable subject matter in computers and computer programming areas. As will be discussed in the article, the Supreme Court decisions, which had been markedly negative on patentability, have undergone some change in the last eighteen months.

24. 409 U.S. 63 (1972).

25. The decimal system uses as digits the 10 symbols 0, 1, 2, 3, 4, 5, 6, 7, 8, and 9. The value represented by any digit depends, as it does in any positional system of notation, both on its individual value and on its relative position in the numeral. Decimal numerals are written by placing digits in the appropriate positions or columns of the numerical sequence, i.e., "unit" (10^0), "tens" (10^1), "hundreds" (10^2), "thousands" (10^3), etc. Accordingly, the numeral 1492 signifies $(1 \times 10^3) + (4 \times 10^2) + (9 \times 10^1) + (2 \times 10^0)$.

The pure binary system of positional notation uses two symbols as digits, 0 and 1, placed in a numerical sequence with values based on consecutively ascending powers of two. In pure binary notation, what would be the tens position is the twos position; what would be hundreds position is the fours position; what would be the thousands position is the eights. Any decimal number from 0 to 10 can be represented in the binary system with four digits or positions as indicated in the following table.

Decimal	Shown as the sum of powers of 2								Pure Binary
	2^3		2^2		2^1		2^0		
0 =	0	+	0	+	0	+	0	=	0000
1 =	0	+	0	+	0	+	2^0	=	0001
2 =	0	+	0	+	2^1	+	0	=	0010
3 =	0	+	0	+	2^1	+	2^0	=	0011
4 =	0	+	2^2	+	0	+	0	=	0100
5 =	0	+	2^2	+	0	+	2^0	=	0101
6 =	0	+	2^2	+	2^1	+	0	=	0110
7 =	0	+	2^2	+	2^1	+	2^0	=	0111
8 =	2^3	+	0	+	0	+	0	=	1000
9 =	2^3	+	0	+	0	+	2^0	=	1001
10 =	2^3	+	0	+	2^1	+	0	=	1010

law of gravity,²⁶ and therefore was not patentable subject matter.²⁷

The next Supreme Court computer case, *Dann v. Johnston*,²⁸ involved a process of using a computer in bookkeeping operations. The Court sidestepped the question of statutory subject matter, and quite summarily held the claims to be unpatentable due to the existence of prior bookkeeping systems.²⁹

The third case was *Parker v. Flook*,³⁰ where the process in question related to a catalytic chemical conversion with an algorithm or formula, so that the final step of the process adjusted an "alarm limit"³¹ to a calculated new value. The Court, applying

The Binary Coded Decimal (BCD) system using decimal numerals replaces the character for each component decimal digit in the decimal numeral with the corresponding four-digit binary numeral, shown in the right-hand column of the table. Thus, decimal 53 is represented as 0101 0011 in BCD, because decimal 5 is equal to binary 0101 and decimal 3 is equivalent to binary 0011. In pure binary notation, however, decimal 53 equals binary 110101. The conversion of BCD numerals to pure binary numerals can be done mentally through use of the foregoing table. The method sought to be patented varies the ordinary arithmetic steps a human would use by changing the order of the steps, changing the symbolism for writing the multiplier used in some steps, and by taking subtotals after each successive operation. The mathematical procedures can be carried out in existing computers long in use, no new machinery being necessary. Furthermore, as noted, the procedures can also be performed without a computer. *Id.* at 66-67.

26. *Id.* at 67. The Court was relying on the Supreme Court decision in *Funk Bros. Seed Co. v. Kalo Co.*, 333 U.S. 127 (1947), wherein the Court stated "patents cannot issue for the discovery of the phenomena of nature. . . ." *Id.* at 130. Such discoveries are "manifestations of laws of nature, free to all men and reserved exclusively to none." *Id.*

27. However, the Court in *Benson* was careful to point out that the decision did not prevent all patenting of computer programs:

It is said that the decision precludes a patent for any program servicing a computer. We do not so hold. It is said that we have before us a program for a digital computer but extend our holding . . . to analog computers. We have, however, made clear from the start that we deal with a program only for digital computers. It is said we freeze process patents to old technologies, leaving no room for the revelations of the new, onrushing technology. Such is not our purpose.

409 U.S. at 71.

28. 425 U.S. 219 (1976).

29. *Id.* at 230. The *Johnston* Court denied the patentability of this computer program on the unobviousness standard holding that one skilled in the art of bookkeeping systems would have been aware of the nature of the extensive use of data processing in the banking industry, thus revealing the Court's unwillingness to extend patent protection to one who had arguably created an innovation in data processing and bank bookkeeping.

30. 437 U.S. 584 (1978).

31. As the *Flook* Court explained, an alarm limit signals the presence of an abnormal condition during the catalytic conversion process, signaling either inefficiency or perhaps danger in the system. As the process fluctuates, it is necessary

its holding in *Benson*, denied the patent application.³² With three justices dissenting,³³ the Court held that the presence of post-solution activity³⁴ updating the alarm limit would not take the case out of the *Benson* precedent so that such claim involved non-statutory subject matter.³⁵ The Court strongly suggested that the computer program area required congressional legislation.³⁶

B. The CCPA decision in the Bergy Case

It was against the foregoing backdrop that the Court of Custom and Patent Appeals (CCPA) prepared its second opinion in the companion cases of *In re Bergy*³⁷ and *In re Chakrabarty*.³⁸ This

to update the alarm limits periodically, and the applicants claim utilized an algorithm in a computer program to do the updating. *Id.* at 585.

32. *Id.* at 590. The Court noted that:

Respondent correctly points out that this language of *Benson* does not apply to his claims. He does not seek to "wholly preempt the mathematical formula" since there are uses of his formula outside the petrochemical and oil refining industries that remain in the public domain. And he argues that the presence of specific "post solution" activity—the adjustment of the alarm limit to the figure completed according to the formula—distinguishes this case from *Benson* and makes his process patentable. We cannot agree.

Id.

33. Justices Stewart and Rehnquist and Chief Justice Burger dissented.

34. See note 32 *supra*.

35. 437 U.S. at 590. The Court felt that the notion that post-solution activity transformed an unpatentable principle into a patentable process exalted form over substance. The Court was reluctant to grant a patent, thereby setting a precedent for anyone to simply attach a form of post-solution activity to any mathematical formula to earn a patent, noting that even the Pythagorean theorem, solved and applied to surveying techniques, would thereby become patentable.

36. *Id.* at 584. The Court was reluctant to grant a patent in the relatively youthful computer industry but noted that their decision should not be interpreted to mean that patent protection of certain novel and useful computer programs would not promote the progress of science and the useful arts, or that such protection is socially undesirable. "Difficult questions of policy concerning the kinds of programs that may be appropriate for patent protection and the form and duration of such protection can be answered by Congress on the basis of current empirical data not equally available to this tribunal." *Id.* See also *Deep South Packing Co. v. Laitram Corp.*, 406 U.S. 518, 531 (1971), in which the Supreme Court noted that patent rights should not be expanded by modifying or overruling prior cases unless such expansion is based on more than inference from ambiguous statutory language.

37. 596 F.2d 952 (C.C.P.A. 1979). The Supreme Court had previously granted certiorari from the CCPA in *In re Bergy*, a patent case involving man-made living microorganisms, pending before the Supreme Court at the time *Flook* was decided on June 22, 1978. On June 29, 1978, in an unusual move, the Supreme Court vacated the *Bergy* CCPA judgment and remanded it to the CCPA in light of the anti-patent decision in *Flook*. *Parker v. Bergy*, 438 U.S. 902 (1978). It appeared probable at the time that the Court was referring to the issue of nonpatentable types of subject matter, such as laws of nature. It seemed as if the Court was suggesting that man-made microorganisms and computer related laws were nonpatentable subject matter under 35 U.S.C. § 101 and the following sections, and that an act of Congress might be needed for patentability.

38. 596 F.2d 952 (C.C.P.A. 1979).

second CCPA decision, which ultimately upheld the patents of both *Bergy* and *Chakrabarty*, is over fifty pages long, and was written with the clear expectation that the case would return to the Supreme Court for a thorough review. The decision is exhaustive, and delves into the legislative history and structure of the 1952 Patent Act, plant patent legislation, and many related factors and legal precedents. It seemed to be in the nature of an appellate brief, covering nearly all of the legal aspects of the case, with many points being directed to the undesirability of requiring that Congress enact new legislation to cover new developments such as man-made living organisms or methods using computer programs.³⁹

C. *Three Pro-Patent Decisions of the United States Supreme Court*

In *Diamond v. Chakrabarty*,⁴⁰ the Supreme Court upheld the CCPA decision on the patentability of living microorganisms. Less than two weeks later, the Supreme Court rendered a second pro-patent decision in *Dawson Chemical Co. v. Rohm and Haas*.⁴¹ The Court held that there was no patent misuse in the refusal by a patent owner to license competitors under a patent involving a use of an *unpatentable* chemical as a herbicide.⁴² Both decisions were rendered by a strongly divided court; a narrow five-to-four majority prevailed in each. In both cases, the majority opinions set aside the monopoly view of patents and recognized the patent system as a beneficial and worthwhile social institution.⁴³ In the dissenting opinions of both of these cases, the nation's deep-seated antipathy to monopolies was mentioned prominently.⁴⁴

39. It must be remembered that Judge Rich, who rendered the decision in this case, was also on the drafting committee of the 1952 Patent Act.

40. 447 U.S. 303 (1980).

41. 448 U.S. 176 (1980).

42. *Id.* at 182. The herbicide in question, propanil, was itself unpatentable, but respondents Rohm and Haas had obtained a patent on the method or process for applying propanil to inhibit the growth of undesirable plants. *Id.*

43. *Id.* at 176. "In our view the provisions of the Patent Act effectively confer upon the patentee, as a lawful adjunct of his patent rights, a limited power to exclude others from competition. . . ." *Id.* at 201. See also note 10 *supra*.

44. 448 U.S. at 230 (White, J., dissenting). "Respondent's conduct in this case clearly constitutes patent misuse . . . because respondent refuses to license others to use its patented process unless they purchase from it unpatented propanil." *Id.* The dissent also stated: "The Court offers reasons of policy for its obvious extension of patent monopoly, but whether to stimulate research and development in the chemical field it is necessary to give patentees monopoly control

In a third pro-patent decision, *Diamond v. Diehr*,⁴⁵ decided less than nine months after the *Chakrabarty* and *Rohm and Haas* decisions, the Supreme Court upheld a patent on an industrial process which included a computer program. This decision was also rendered by a narrow five-to-four majority.⁴⁶ The principal significance of the *Diehr* case is that the United States Supreme Court has finally determined that at least some subject matter involving computer programs may be patented.⁴⁷

Within a week after the *Diehr* decision, an evenly divided Supreme Court⁴⁸ upheld another computer decision of the CCPA in *Diamond v. Bradley*.⁴⁹ The CCPA had held⁵⁰ that the claimed invention involved a combination of hardware elements and did not preempt the use of an unpatentable mathematical algorithm, as had been forbidden in the earlier *Benson* decision.

D. Summary of Case Review

In recent years, up to the time of *Chakrabarty* and *Diehr* decisions, the United States Supreme Court had rarely affirmed the CCPA in patent cases, and had seldom found patentable subject matter in any invention. However, the Supreme Court has now begun to affirm CCPA decisions upholding patents, emphasizing the positive aspects of encouraging invention and research and development which result from the patent system.

E. The Two Step Test for Patentability of Computer-Related Inventions

The CCPA had enunciated a two-step test for patentability in the companion decisions of *In Re Freeman*⁵¹ and *In Re Walter*.⁵²

over articles not covered by their patents is a question for Congress to decide. . . ." *Id.* at 240 (Stevens, J., dissenting).

45. 450 U.S. 175 (1981).

46. It is interesting to note that in each of the three cases different groups of Justices formed the majority.

47. *Id.* at 187. In perhaps the strongest pro-patent statement to that date, the Court held: "a claim drawn to subject matter otherwise statutory does not become nonstatutory simply because it uses a mathematical formula, computer program or digital computer." *Id.*

48. Chief Justice Burger abstained.

49. 450 U.S. 381 (1981).

50. *In re Bradley*, 600 F.2d 807 (C.C.P.A. 1979).

51. 573 F.2d 1237 (C.C.P.A. 1978). The exact two-step test was articulated as follows:

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

Id. at 1245.

The test first involves a determination of whether the claims are actually directed to a formula, equation, or mathematical algorithm. If the answer to this first question is in the negative, the claims involve statutory subject matter and there is no need to proceed to the second test for patentability. However, if the answer to the first question is in the affirmative, one must deal with the second step of the test, which asks whether the claims, taken in their entirety, wholly preempt the mathematical algorithm from use in all fields.

In addition to clarifying the second step of the test announced in the *Freeman* decision, the *Walter* decision clarified the guidelines for determining patentability of existing patent claims. The guidelines are also useful in considering how to draft patent claims. Specifically, assuming that the claims do define a mathematical algorithm, if the implementation of the algorithm is couched in terms which either define the structural relationship between physical elements in a claimed apparatus or refine or limit steps in the process for which the patent is being sought, the claim will probably be patentable.⁵³ If the end product of the process is merely a number, however, as in *Benson* and *Flook*, the claims will normally be found invalid as involving nonstatutory subject matter.⁵⁴ On the other hand, if a claimed invention produces a physical thing, such as a noiseless seismic trace as in the *Walter* case, the fact that it is expressed in numerical form will not make the claim nonstatutory.⁵⁵

52. 618 F.2d 758 (C.C.P.A. 1980). In this case, the court expanded on the *Freeman* holding, and analyzed the crucial second step of the test.

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

Id. at 767 (emphasis in original).

53. *Id.*

54. *Id.*

55. *In re Johnson*, 589 F.2d 1070, 1078 (C.C.P.A. 1978). The *Johnson* court distinguished the mathematical formula in *Flook* by noting that the products produced by Johnson's claimed processes were new, noiseless seismic traces recorded on a record medium and "not mere mathematical values." *Id.*

To summarize, the more closely a claim is to being a pure mathematical algorithm, the more likely it will be held as unpatentable. However, the presence of novel structural limitations or novel process steps where there is a physical change of state or quality tends to make a claim patentable.

III. STATUTORY CHANGES TO THE 1976 COPYRIGHT ACT

In order to fully understand the meaning of the December 12, 1980 statutory changes to the 1976 Copyright Act, a brief detour into the history of computer software copyright is necessary. Protection for computer programs under the earlier 1909 Copyright Act was uncertain. The uncertainty stemmed in part from a landmark copyright decision of the United States Supreme Court, *White-Smith Music Publishing Co. v. Apollo Co.*⁵⁶ This decision involved a player piano roll having a pattern of openings⁵⁷ which caused a piano to play a certain musical composition. The decision held that the player piano roll did not infringe a copyright on the original sheet music for the composition on the basis that the music on the piano roller could not be "read" or was not "eye readable."⁵⁸ Apparently, *White-Smith* was adopted into the 1909 Copyright Act implicitly.⁵⁹ The repercussions from *White-Smith* were felt even as late as 1973 when the Supreme Court stated in *Goldstein v. California*⁶⁰ that copyrighting sheet music would not prohibit unauthorized recording of the original compositions under the applicable 1909 Federal Statute. Taken together, these two cases imply that since computer programs represent tangible expressions of intellectual labor, they are copyrightable, but copyrights on source programs will not prevent the unauthorized duplication of the programs on punched cards or magnetic tapes because such machine copies would not be deemed as "infringing copies" upon the source programs.⁶¹

Even though there was confusion under the 1909 Act as to what protection a copyrighted program would be given, the Register of

56. 209 U.S. 1 (1908).

57. The paper roll in a player piano is analogous to programs which have often been implemented by punched cards.

58. Justice Day held in *White-Smith* that a musical composition "is not susceptible of being copied until it has been put in a form which others can see and read since a copy is "a reproduction or duplication of a thing which comes so near to the original as to give every person seeing it the idea created by the original.'" 209 U.S. at 17. In a reluctant concurring opinion Justice Holmes stated: "On principle anything that mechanically reproduces that collocation of sounds ought to be made a copy, or, if the statute is too narrow, ought to be made so by a further act. . . ." *Id.* at 20.

59. See 1 NIMMER, NIMMER ON COPYRIGHT § 2.03[B][1] (1981).

60. 412 U.S. 546 (1973).

61. See Pope and Pope, *supra* note 14, at 546.

Copyrights declared that software would be accepted for deposit and registration.⁶² The Copyright Office allowed registration of software even though copyrightability was doubtful because of the Office's policy of resolving doubtful issues in favor of registration whenever possible.⁶³

The situation that existed under the 1909 Act as to whether programs were copyrightable subject matter and the scope of protection afforded by such copyrights became an issue because of the impending enactment of the 1976 Copyright Act. It had been hoped that the 1976 Copyright Act would resolve the difficulties surrounding the copyrighting of computer programs and the scope of protection thus afforded. However, due to a disagreement between the House and the Senate,⁶⁴ section 117 was included in the Act. Section 117 of the 1976 Copyright Act, effective January 1, 1978, codified prior law with respect to computer programs.⁶⁵ In effect, Congress declared a moratorium on further legislative action regarding copyright status of computer programs and maintained the status quo of protection that had been available under the 1909 Act until further notice.

During this time, a special commission, the National Commission on New Technological Uses of Copyright Works (CONTU), was created in 1974 under the auspices of the Library of Congress to study the problem of protecting computer programs.⁶⁶ The CONTU Report recommended that section 117 be replaced with two provisions. These provisions were ultimately adopted on December 12, 1980.⁶⁷ In order to see how the CONTU recommendations changed the previous section 117, and thus the protection of

62. See Cary, *Copyright Registration for Computer Programs*, 11 COPYRIGHT SOC'Y U.S.A. BULL. 361 (1964).

63. *Id.*

64. The House clearly indicated an intent to protect computer programs through copyright. H.R. REP. NO. 1476, 94th Cong., 2d Sess. 54, *reprinted in* [1976] U.S. CODE CONG. & AD. NEWS 5659, 5667. The intent of the Senate at the time of the passage of the 1976 Copyright Act was unclear. S. REP. NO. 473, 94th Cong., 1st Sess. 54 (1975).

65. Section 117 was first introduced in the Copyright Revision Bill of 1969. S. 543, 91st Cong., 1st Sess., 115 CONG. REC. 1382 (1969). Section 117 was agreed upon by interested parties as a means of permitting passage of the revision bill without committing Congress to a position on the computer issue until more study could be undertaken. H.R. REP. NO. 1476, 94th Cong., 2d Sess. 116, *reprinted in* [1976] U.S. CODE CONG. & AD. NEWS 5659, 5661.

66. Act of Dec. 31, 1974, Pub. L. No. 93-573, § 201, 88 Stat. 1873 (1974).

67. It is important to note that a lengthy and forceful dissent was filed by Commissioner Hersey. CONTU, FINAL REPORT OF THE NATIONAL COMMISSION ON NEW TECHNOLOGICAL USES OF COPYRIGHTED WORKS 10 (1979). For a good synopsis

computer programs, the exact wording of each section is of considerable interest and will be set forth here, with the original wording appearing first: 117. *Scope of exclusive rights: Use in Conjunction with Computers and Similar Information Systems*

Notwithstanding the provisions of section 106 through 116 and 118, this title does not afford to the owner of copyright in a work any *greater* or *lesser* rights with respect to the use of the work in conjunction with automatic systems capable of storing, processing, retrieving, or transferring information, or in conjunction with any similar device, machine, or process, than those afforded to works under the law, whether Title 17 or the common law or statutes of the State, in effect on December 31, 1977, as held applicable and construed by a court in an action brought under this title.⁶⁸

Now, the new statute, identified as H.R. 6933, and effective in December, 1980, included the following relative to Title 17:

SEC. 12 (a) Section 101 of Title 17 of the United States Code is amended to add at the end thereof the following new language:

A "computer program" is a set of statements or instructions to be used directly or indirectly in a computer in order to bring about a certain result.

(b) Section 117 of Title 17 of the United States Code is amended to read as follows:

117. *Limitations on exclusive rights: Computer programs*

Notwithstanding the provisions of section 106, it is not an infringement for the owner of a copy of a computer program to make or authorize the making of another copy or adaptation of that computer program provided:

(1) that such a new copy or adaptation is created as an essential step in the utilization of the computer program in conjunction with a machine and that it is used in no other manner, or

(2) that such new copy or adaptation is for archival purposes only and that all archival copies are destroyed in the event that continued possession of the computer program should cease to be rightful.

Any exact copies prepared in accordance with the provisions of this section may be leased, sold, or otherwise transferred, along with the copy from which such copies were prepared, only as part of the lease, sale, or other transfer of all rights in the program. Adaptations so prepared may be transferred only with the authorization of the copyright owner.⁶⁹

It can be seen that the original section 117 has been rewritten. It no longer merely preserves the status quo for computer program rights as available under the pre-1978 law. The new section 117 deals with an entirely different subject: the right of an owner of a computer program to make a copy of a computer program, with certain restrictions, apparently to permit normal use and archival protection to the program.

Apart from the specific provisions of the new section 117, the effect of the substitution is to make one important change in the law, and raise questions about a second. First, computer pro-

of Commissioner Hersey's views see Comment, *Copyright Protection for Computer Programs*, 47 TENN. L. REV. 809 (1980).

68. 17 U.S.C. § 117 (1976) (amended by 17 U.S.C. § 117 (1980)) (emphasis added).

69. *Id.*

grams are now clearly recognized as copyrightable subject matter by Congress and are specifically included in the 1976 Copyright Act. Second, cancellation of the original Section 117 might, in view of section 301 of the 1976 Act, the preemption statute, be construed as abrogating trade secret and unfair competition causes of action.

Returning to the first point, it may be noted that even though the House felt that some programs could be copyrighted,⁷⁰ nowhere in the original 1976 Copyright Act were programs mentioned. The Copyright Office did not, however, find any difficulty in determining that the 1976 Act included programs as copyrightable subject matter.⁷¹ But now, with the new changes in section 117, programs are specifically mentioned.⁷²

One effect of the amendment was to unequivocally overrule the out-dated *White-Smith Publishing Co. v. Apollo Co.*⁷³ decision as to computer programs. As noted above, this is the famous case in which the U.S. Supreme Court held that a piano roll did not infringe a sheet music copyright, although both would produce the same "collocation of sounds."⁷⁴ The *White-Smith* decision was based on the out-dated notion that there should be a significant difference in the treatment of eye-readable and non eye-readable material; thus it is a significant step that this archaic concept in the computer program infringement area has finally been eliminated.⁷⁵

70. H. REP. NO. 1476, 94th Cong., 2nd Sess. 54 (1976) specifically states that computer programs are appropriate matter for copyright "to the extent that they incorporate authorship in the programmer's expression of original ideas as distinguished from the ideas themselves." *Id.*

71. Marybeth Peters, Senior Attorney Advisor in the Copyright Office, has written in her General Guide to the Copyright Act of 1976:

Computer programs. Although they are not mentioned as copyrightable subject matter in section 102(a) and they are not referred to explicitly in the definition of "literary works" in Section 101, a careful reading of the new law with the legislative report makes it clear that computer programs are "software" is within the subject matter of copyright. The definition of "literary works" refers to work expressed in "words, number, or other verbal or numerical symbols or indicia." Cited in Bigelow, Copyrighting Programs-1978, 3 COMPUTER L. SERVICE REP. 4-3, art. 4, at 3.

72. 17 U.S.C. §§ 101, 117 (1976).

73. 209 U.S. 1 (1908).

74. *Id.* at 20.

75. It may be noted that the language of 17 U.S.C. § 102(a) states: "Copyright protection subsists, in accordance with this title, in original works of authorship fixed in any tangible medium or expression, now known or later developed, from which they can be perceived reproduced, or otherwise communicated, either directly or with the aid of a machine or device. . . ." This language would seem to

With respect to the second question regarding the effect of the cancellation of the original section 117, it may be noted that trade secret and unfair competition causes of action had clearly been preserved under the original section. There has been some concern that these possible causes of action for computer program subject matter might no longer be available in view of section 301 of the 1976 Act, the preemption section of the new copyright law.⁷⁶ This preemption section reads as follows:

17 USC Section 301 Preemption with Respect to Other Laws

(a) On and after January 1, 1978, all legal or equitable rights that are equivalent to any of the exclusive rights within the general scope of copyright as specified by section 105 in works of authorship that are fixed in a tangible medium of expression and come within the subject matter of copyright as specified by section 102 and 103, whether created before or after that date and whether published or unpublished, are governed exclusively by this title. Thereafter, no person is entitled to any such right or equivalent right in any such work under the common law or statutes of the State.

The scope of the preemption section set forth above is somewhat indefinite,⁷⁷ and a number of persons expressed concern that repeal of the prior section 117 might mean that unfair competition and trade secret rights might now be lost. However, the legislative history involving the repeal of the original section 117 is explicitly contra, with counsel for the cognizant legislative committee and counsel for the Copyright Office both stating that state remedies, such as those involving trade secrets or unfair competition, were not being limited or preempted by the change.

The *Goldstein* case⁷⁸ included a lengthy discussion of federal preemption under the pre-1978 copyright law, and its holding is of interest because the federal copyright law had *not* preempted a California criminal statute relating to record piracy. The moderately narrow view relative to federal preemption in the copyright field, as enunciated in *Goldstein*, supports the position that trade

overrule *White-Smith* in general but, as mentioned, there is now no doubt *White-Smith* has no validity regarding noneye-readable computer programs. H.R. REP. NO. 94-1476, 94th Cong., 2d Sess. 52 (1976) states: "it makes no difference what form, manner, or medium of fixation may be whether it is words, numbers, notes, sounds, pictures, or any other graphic or symbolic indicia, whether embodied in a physical object written, printed, photographed, sculptural, punched, magnetic, or any other stable form, and whether it is capable of perception directly or by means of any machine or device "now known or later developed." See 1 NIMMER, NIMMER ON COPYRIGHT § 2.03[B] (1981).

76. For a detailed discussion of the application and the history of the federal preemption doctrine see *Goldstein v. California*, 412 U.S. 546, 552-60 (1972).

77. The intent of Congress in enacting section 301 is set forth in HOUSE COMM. ON THE JUDICIARY, COPYRIGHT LAW REVISION H.R. REP. NO., 94th Cong., 2d Sess. 129-33 (1976). See also *Allied Artists Picture Corp. v. Rhode*, 496 F. Supp. 408 (1980), for a good discussion of section 301.

78. 412 U.S. 546 (1973).

secret and unfair competition relief has not been preempted as a result of the new changes.

IV. TRADE SECRET PROTECTION

Trade secret protection will only be mentioned to the extent necessary to point out that as an alternative method of protection for computer programs, it has retained its strength and viability. First, it is noted that the continued validity of trade Secret protection was confirmed in the recent past by a rare unanimous decision of the U.S. Supreme Court in *Aronson v. Quick Point Pencil Co.*⁷⁹ It is further noted that the 1976 Copyright Act states that copyrights arise or subsist upon creation and reduction to tangible form.⁸⁰ Therefore, publication, which might destroy the trade secret, with notice, is not necessary to establish copyright protection.

It is noted in passing that the definition of "publication" under section 101 of the 1976 Act includes "distribution of copies . . . by rental, lease or lending."⁸¹ It would appear possible, therefore, that the leasing of computer programs, even with suitable confidentiality provisions included in the lease, could be considered to constitute a "publication," which might destroy trade secret rights.

V. REGISTRATION OF COPYRIGHTS

Copyright protection is invoked by notice, but certain statutory benefits, including the right to bring suit, accrue from the filing or the registration of a copyright in the U.S. Copyright Office. In computer program situations, the Copyright Office has indicated that it prefers to register the underlying "source code" and the "object code" rather than only the latter.⁸² In this connection, it is

79. 440 U.S. 257 (1978).

80. 17 U.S.C. § 102 (1976).

81. 17 U.S.C. § 101 (1976).

82. Source code is typically the first encoded form of a program. A short example of source code is:

```
RD-MASTER
  READ GL-MASTER-IN AT END GO TO EOJ-MAS COMP-COM.
  IF CC-NUMBER LESS THAN GL-COM PERFORM
    RD-COMP-CTRL GO TO COMP-COM.
  IF CC-GLP15 = 0 GO TO RD-MASTER
  MOVE CC-MO-END DATE TO SLASHED DATE
  MOVE CORRESPONDING SLASHED DATE TO WRK-DATE6.
  MOVE R-WRK DATE TO GL-BALDT.
```

noted that in order to use most computer programs without change, one would only need the object code; however, the source code indicates how the program is built up, and it is necessary for easy modification of the program. It is understood that the Copyright Office will give limited registration to an object code even if the source code cannot be made available.

Also, as of the present writing, it is understood that the Copyright Office has no procedure for maintaining computer programs in secrecy while proceeding to register the programs. Accordingly, at such time as formal copyright registration of a program is sought, trade secret protection may no longer be available. In some cases, however, where the program is lengthy, only selected portions are required or requested for deposit in the Copyright Office.

VI. RECENT VIDEO GAME COPYRIGHT DECISIONS

There have not been many decisions under the new copyright act, as it only came into force on January 1, 1978, and it normally takes more than two or three years for a federal case to be tried. However, a preliminary injunction was granted in a copyright case involving an "audiovisual display" for an electronic or video game called "Scramble," despite the fact the underlying computer program was not copyrighted.⁸³

In two other more recent similar cases, however, the plaintiffs

Object code is machine-generated code. The source code is read by the computer and compiled into object code, which may actually be used by the computer. A simplified description of the difference between source code and object code is that source code is "general" while object code is "specifically adapted" to the particular computer using the program. An example of the object code form of the source code is:

```
58 10 C 0D0
18 21
D2 02 2 021 C 059
58 FO 1 030
05 EF
50 10 D 1F8
58 80 D 1F8
58 50 C 024
```

```
07 F5
58 10 C 04C
```

```
07 F1
D7 D3 E 6D40309
```

See Comment, *supra* note 5, at 180.

83. Only a videotape of the output was copyrighted and registered with the Copyright Office. Since the underlying program itself was not copyrighted, extending protection from the output display to cover the underlying program becomes problematic. The Judge reasoned that the output display was an audiovisual work, and the program was like the film with the computer a projector. *Stern Elec. v. Kaufman*, 669 F.2d 852 (2d Cir. 1982).

were less successful, with their video games being considered valid but not infringed. More specifically in *Atari Inc. v. Amusement World Inc.*,⁸⁴ the court found that defendant's "Meteor" game did not infringe plaintiff's "Asteroids" game. In the case of *Atari, Inc. v. North American Philips Consumer Electronics Corp.*,⁸⁵ the district court refused to grant a preliminary injunction based on plaintiff's copyrighted "Pac-Man" maze-chase game, based on the judge's opinion that plaintiffs were unlikely to prevail on the infringement issue involving defendants' "K. C. Munchkin" maze-chase game.

VII. COPYRIGHT PROTECTION FOR COMPUTER MEMORY CHIPS

As mentioned above, many computers now include digital program information in semi-conductor chips. These are often in the form of Programmable Read-Only Memory chips, or PROMS.

The following questions naturally arise: First, are these programs protectable by the copyright laws? And, secondly, if copyright protection is available, how would the manufacture of the computer invoke protection? These questions were considered by the Seventh Circuit in *Data Cash Systems, Inc. v. J.S. & A. Group, Inc.*,⁸⁶ and more recently in *Tandy Corporation v. Personal Micro Computers, Inc.*⁸⁷ In *Data Cash*,⁸⁸ the district court decision included dicta to the effect that such chips would not be protectable by the copyright laws; nevertheless, the Seventh Circuit held that the chips would be subject to copyright protection. However, the absence of a proper copyright notice barred recovery. In the *Tandy* case, the defendant's motion for summary judgment based on the proposition that copying a semiconductor chip is not a "copy" of the underlying copyrighted program was denied.

84. [1981] COPYRIGHT L. REP. (CCH) ¶ 25,347.

85. No. 81 C 6434 (N.D. Ill., filed Dec. 4, 1981), reversed on appeal, No. 81-2920 (7th Cir., filed Mar. 2, 1982).

The Court of Appeals for the Seventh Circuit reviewed the decision of the district court, and held that because the test for copyright infringement was based on visual comparison, they were in as good a position to review the similarity of the games. They concentrated upon the overall similarity of the characters in the two games, rather than their specific differences, and felt that a preliminary injunction against defendant's game was warranted. They were careful to note, however, that this decision would not affect the decision on the merits.

86. 628 F.2d 1038 (C.C.P.A. 1980).

87. 524 F. Supp. 171 (N.D. Cal., 1981).

88. 480 F. Supp. 1063 (N.D. Ill. 1979).

In view of these cases, it would appear desirable to include a proper copyright notice on electronic equipment including permanent or read-only memory chips. In this way, copyright remedies are preserved, and if infringement occurs, the copyright may be registered and the infringer sued.

VIII. PROTECTION POSSIBILITIES

Various possibilities for protecting proprietary rights in computers and computer programs have been outlined above, and the possible effect of recent judicial and legislative changes has been analyzed. It is clear that further case law development will occur. However, certain practical steps to protect proprietary rights in software and firmware include the following:

(1) Invoking TRADE SECRET protection with a suitable confidentiality legend, before widespread distribution occurs;

(2) Putting a COPYRIGHT NOTICE on a program and mentioning "unpublished work" when both trade secret and copyright protection are being invoked;

(3) Having PROPRIETARY NOTICES (trade secret and/or copyright) printed out at the same time as the computer program prints out or as the results of the program are printed out.

(4) Putting COPYRIGHTED NOTICES on Read Only Memories or electronic equipment labels;⁸⁹

(5) Not calling program licenses "LEASES", since the lease of a computer program may be construed as a publication which could destroy trade secret protection; and

(6) In the patent area, the claims should emphasize the structure and the physical aspects of the particular system or the method. Any mathematics should be characterized as being a small part of the system, and claims should be presented so as to not wholly preempt a mathematical algorithm. If control can be accomplished by a cam and a mechanical linkage, a "hard-wired" electrical circuit, or other similar structure, these alternatives should be mentioned in the patent specification.

IX. CONCLUSION

In summary, the recent decisions of the Supreme Court and the amendment of section 117 of the Copyright Act of 1976 both appear to favor the protection of intellectual property rights in computers and computer programs. In the patent field, at least some types of subject matter involving computer programs are patentable, while in the copyright field, computer programs may be copy-

89. 628 F.2d 1038 (1980).

righted, and even a noneye-readable computer program may constitute a copyright infringement. Through the judicious use of trade secret, copyright, and patent protection, appropriate protection for both computers and computer programs may be secured.

