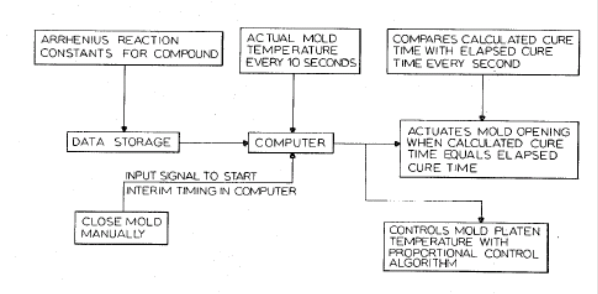
US Supreme Court, 3 March 1981, Diamond v Diehr

US Patent 4,344,142



PATENT LAW

Patentable "process": transformation and reduction to a different state or thing

- **A process is a mode of treatment of certain materials to produce a given result. It is an act, or a series of acts, performed upon the subject-matter to be transformed and reduced to a different state or thing.**

Cochrane v. Deener, 94 U.S. 780, 787 -788 (1877).

- **"Transformation and reduction of an article `to a different state or thing' is the clue to the patentability of a process claim that does not include particular machines."**

Gottschalk v. Benson, 409 U.S. 63 (1972).

- **Analyzing respondents' claims according to the above statements from our cases, we think that a physical and chemical process for molding precision synthetic rubber products falls within the 101 categories of possibly patentable subject matter.**

That respondents' claims involve the transformation of an article, in this case raw, uncured synthetic rubber, into a different state or thing cannot be disputed. The respondents' claims describe in detail a step-by-step method for accomplishing such, beginning with the loading of a mold with raw, uncured rubber and ending with the eventual opening of the press at the conclusion of the cure. Industrial processes such as this are the types which have historically been eligible to receive the protection of our patent laws.

Mathematical equation in conjunction with other steps in claimed process

- **In contrast, the respondents here do not seek to patent a mathematical formula. Instead, they seek patent protection for a process of curing synthetic rubber. Their process admittedly employs a well-known mathematical equation, but they do not seek to pre-empt the use of that equation. Rather, they seek only to foreclose from others the use of that equation in conjunction with all of the other steps in their claimed process.**

These include installing rubber in a press, closing the mold, constantly determining the temperature of the mold, constantly recalculating the appropriate cure time through the use of the formula and a digital computer, and automatically opening the press at the proper time.

- **Obviously, one does not need a "computer" to cure natural or synthetic rubber, but if the computer use incorporated in the process patent significantly lessens the possibility of "overcuring" or "undercuring," the process as a whole does not thereby become unpatentable subject matter.**

Claims must be considered as a whole

- **It is inappropriate to dissect the claims into old and new elements and then to ignore the presence of the old elements in the analysis. This is particularly true in a process claim because a new combination of steps in a process may be patentable even though all the constituents of the combination were well known and in common use before the combination was made.**

Patentable process claim

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

Because we do not view respondents' claims as an attempt to patent a mathematical formula, but rather to be drawn to an industrial process [450 U.S. 175, 193] for the molding of rubber products, we affirm the judgment of the Court of Customs and Patent Appeals. 15

Source: **findlaw.com**; 450 U.S. 175

US Supreme Court, 3 March 1981

(REHNQUIST, BURGER, STEWART, WHITE, POWELL, STEVENS, BRENNAN, MARSHALL, BLACKMUN)

U.S. Supreme Court

DIAMOND v. DIEHR, 450 U.S. 175 (1981)

450 U.S. 175

DIAMOND, COMMISSIONER OF PATENTS AND TRADEMARKS v. DIEHR ET AL.

CERTIORARI TO THE UNITED STATES COURT OF CUSTOMS AND PATENT APPEALS.

No. 79-1112.

Argued October 14, 1980.

Decided March 3, 1981.

[…]

602 F.2d 982, affirmed.

REHNQUIST, J., delivered the opinion of the Court, in which BURGER, C. J., and STEWART, WHITE, and POWELL, JJ., joined.

STEVENS, J., filed a dissenting opinion, in which BRENNAN, MARSHALL, and BLACKMUN, JJ., joined, post, p. 193.

Deputy Solicitor General Wallace argued the cause for petitioner. With him on the briefs were Solicitor General McCree, Assistant Attorney General Litvack, Harriet S. Shapiro, Robert B. Nicholson, Frederic Freilicher, Joseph F. Nakamura, and Thomas E. Lynch.

Robert E. Wichersham argued the cause for respondents. With him on the brief were Robert F. Hess, Jay M. Cantor, and Thomas M. Freiburger. *

[Footnote *] Edward S. Irons, Mary Helen Sears, and Robert P. Beshar filed a brief for National Semiconductor Corp. as amicus curiae urging reversal.

Briefs of amici curiae urging affirmance were filed by Donald R. Dunner, Kenneth E. Kuffner, and Travis Gordon White for the American Patent Law Association, Inc.; by Morton C. Jacobs for Applied Data Research, Inc.; by William L. Mathis and Harold D. Messner for Chevron Research Co.; and by Reed C. Lawlor and James W. Geriak for the Los Angeles Patent Law Association.

JUSTICE REHNQUIST delivered the opinion of the Court.

We granted certiorari to determine whether a process for curing synthetic rubber which includes in several of its steps the use of a mathematical formula and a programmed digital computer is patentable subject matter under 35 U.S.C. 101.

I

The patent application at issue was filed by the respondents on August 6, 1975. The claimed invention is a process for molding raw, uncured synthetic rubber into cured precision products. The process uses a mold for precisely shaping the uncured material under heat and pressure and then curing the synthetic rubber in the mold so that the product will retain its shape and be functionally operative after the molding is completed. 1

Respondents claim that their process ensures the production of molded articles which are properly cured. Achieving the perfect cure depends upon several factors including the thickness of the article to be molded, the temperature of the molding process, and the amount of time that the article is allowed to remain in the press. It is possible using well-known time, temperature, and cure relationships to calculate by means of the Arrhenius equation 2 when to open the press [450 U.S. 175, 178] and remove the cured product. Nonetheless, according to the respondents, the industry has not been able to obtain uniformly accurate cures because the temperature of the molding press could not be precisely measured, thus making it difficult to do the necessary computations to determine cure time. 3 Because the temperature inside the press has heretofore been viewed as an uncontrollable variable, the conventional industry practice has been to calculate the cure time as the shortest time in which all parts of the product will definitely be cured, assuming a reasonable amount of mold-opening time during loading and unloading. But the shortcoming of this practice is that operating with an uncontrollable variable inevitably led in some instances to overestimating the mold-opening time and overcuring the rubber, and in other instances to underestimating that time and undercuring the product. 4

Respondents characterize their contribution to the art to reside in the process of constantly measuring the actual temperature inside the mold. These temperature measurements are then automatically fed into a computer which repeatedly recalculates the cure time by use of the Arrhenius equation. [450 U.S. 175, 179] When the recalculated time equals the actual time that has elapsed since the press was closed, the computer signals a device to open the press. According to the respondents, the continuous measuring of the temperature inside the mold cavity, the feeding of this information to a digital computer which constantly recalculates the cure time, and the signaling by the computer to open the press, are all new in the art.

The patent examiner rejected the respondents' claims on the sole ground that they were drawn to nonstatutory subject matter under 35 U.S.C. 101. 5 He determined that those [450 U.S. 175, 180] steps in respondents' claims that are carried out by a computer under control of a stored program constituted nonstatutory subject matter under this Court's decision in **Gottschalk v. Benson**, 409 U.S. 63 (1972). The remaining steps - installing rubber in the press and the subsequent closing of the [450 U.S. 175, 181] press - were "conventional and necessary to the process and cannot be the basis of patentability." The examiner concluded that respondents' claims defined and sought protection of a computer program for operating a rubber-molding press.

The Patent and Trademark Office Board of Appeals agreed with the examiner, but the Court of Customs and Patent Appeals reversed. In re Diehr, 602 F.2d 892 (1979). The court noted that a claim drawn to subject matter otherwise statutory does not become nonstatutory because a computer is involved. The respondents' claims were not directed to a mathematical algorithm or an improved method of calculation but rather recited an improved process for molding rubber articles by solving a practical problem which had arisen in the molding of rubber products.

The Commissioner of Patents and Trademarks sought certiorari arguing that the decision of the Court of Customs and Patent Appeals was inconsistent with prior decisions of this Court. Because of the importance of the question presented, we granted the writ. 445 U.S. 926 (1980).

II

Last Term in **Diamond v. Chakrabarty, 447 U.S. 303 (1980)**, this Court discussed the historical purposes of the patent laws and in particular 35 U.S.C. 101. As in Chakrabarty, we must here construe 35 U.S.C. 101 which provides:

"Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title." 6 [450 U.S. 175, 182]

In cases of statutory construction, we begin with the language of the statute. Unless otherwise defined, "words will be interpreted as taking their ordinary, contemporary, common meaning," Perrin v. United States, 444 U.S. 37, 42 (1979), and, in dealing with the patent laws, we have more than once cautioned that "courts `should not read into the patent laws limitations and conditions which the legislature has not expressed.'" **Diamond v. Chakrabarty**, supra, at 308, quoting

United States v. Dubilier Condenser Corp., 289 U.S. 178, 199 (1933).

The Patent Act of 1793 defined statutory subject matter as "any new and useful art, machine, manufacture or composition of matter, or any new or useful improvement [thereof]." Act of Feb. 21, 1793, ch. 11, 1, 1 Stat. 318. Not until the patent laws were recodified in 1952 did Congress replace the word "art" with the word "process." It is that latter word which we confront today, and in order to determine its meaning we may not be unmindful of the Committee Reports accompanying the 1952 Act which inform us that Congress intended statutory subject matter to "include anything under the sun that is made by man." S. Rep. No. 1979, 82d Cong., 2d Sess., 5 (1952); H. R. Rep. No. 1923, 82d Cong., 2d Sess., 6 (1952).

Although the term "process" was not added to 35 U.S.C. 101 until 1952, a process has historically enjoyed patent protection because it was considered a form of "art" as that term was used in the 1793 Act. 7 In defining the nature of a patentable process, the Court stated:

"That a process may be patentable, irrespective of the [450 U.S. 175, 183] particular form of the instrumentalities used, cannot be disputed. . . . A process is a mode of treatment of certain materials to produce a given result. It is an act, or a series of acts, performed upon the subject-matter to be transformed and reduced to a different state or thing. If new and useful, it is just as patentable as is a piece of machinery. In the language of the patent law, it is an art. The machinery pointed out as suitable to perform the process may or may not be new or patentable; whilst the process itself may be altogether new, and produce an entirely new result. The process requires [450 U.S. 175, 184] that certain things should be done with certain substances, and in a certain order; but the tools to be used in doing this may be of secondary consequence." Cochrane v. Deener, 94 U.S. 780, 787 -788 (1877).

Analysis of the eligibility of a claim of patent protection for a "process" did not change with the addition of that term to 101. Recently, in Gottschalk v. Benson, 409 U.S. 63 (1972), we repeated the above definition recited in Cochrane v. Deener, adding: "Transformation and reduction of an article `to a different state or thing' is the clue to the patentability of a process claim that does not include particular machines." 409 U.S., at 70 .

Analyzing respondents' claims according to the above statements from our cases, we think that a physical and chemical process for molding precision synthetic rubber products falls within the 101 categories of possibly patentable subject matter. That respondents' claims involve the transformation of an article, in this case raw, uncured synthetic rubber, into a different state or thing cannot be disputed. The respondents' claims describe in detail a step-by-step method for accomplishing such, beginning with the loading of a mold with raw, uncured rubber and ending with the eventual opening of the press at the conclusion of the cure. Industrial processes such as this are the types which have historically been eligible to receive the protection of our patent laws. 8

[450 U.S. 175, 185]

III

Our conclusion regarding respondents' claims is not altered by the fact that in several steps of the process a mathematical equation and a programmed digital computer are used. This Court has undoubtedly recognized limits to 101 and every discovery is not embraced within the statutory terms. Excluded from such patent protection are laws of nature, natural phenomena, and abstract ideas. See Parker v. Flook, 437 U.S. 584 (1978); Gottschalk v. Benson, supra, at 67; **Funk Bros. Seed Co. v. Kalo Inoculant Co**., 333 U.S. 127, 130 (1948). "An idea of itself is not patentable," Rubber-Tip Pencil Co. v. Howard, 20 Wall. 498, 507 (1874). "A principle, in the abstract, is a fundamental truth; an original cause; a motive; these cannot be patented, as no one can claim in either of them an exclusive right." Le Roy v. Tatham, 14 How. 156, 175 (1853). Only last Term, we explained:

"[A] new mineral discovered in the earth or a new plant found in the wild is not patentable subject matter. Likewise, Einstein could not patent his celebrated law that E=mc2.; nor could Newton have patented the law of gravity. Such discoveries are `manifestations of . . . nature, free to all men and reserved exclusively to none.'" **Diamond v. Chakrabarty**, 447 U.S., at 309 , quoting **Funk Bros. Seed Co. v. Kalo Inoculant Co**., supra, at 130.

Our recent holdings in Gottschalk v. Benson, supra, and Parker v. Flook, supra, both of which are computer-related, stand for no more than these long-established principles. In Benson, we held unpatentable claims for an algorithm used to convert binary code decimal numbers to equivalent pure binary numbers. The sole practical application of the algorithm was in connection with the programming of a [450 U.S. 175, 186] general purpose digital computer. We defined "algorithm" as a "procedure for solving a given type of mathematical problem," and we concluded that such an algorithm, or mathematical formula, is like a law of nature, which cannot be the subject of a patent. 9

Parker v. Flook, supra, presented a similar situation. The claims were drawn to a method for computing an "alarm limit." An "alarm limit" is simply a number and the Court concluded that the application sought to protect a formula for computing this number. Using this formula, the updated alarm limit could be calculated if several other variables were known. The application, however, did not purport to explain how these other variables were to be determined, 10 nor [450 U.S. 175, 187] did it purport "to contain any disclosure relating to the chemical processes at work, the monitoring of process variables, or the means of setting off an alarm or adjusting an alarm system. All that it provides is a formula for computing an updated alarm limit." 437 U.S., at 586 .

In contrast, the respondents here do not seek to patent a mathematical formula. Instead, they seek patent protection for a process of curing synthetic rubber. Their process admittedly employs a well-known mathematical equation, but they do not seek to pre-empt the use

of that equation. Rather, they seek only to foreclose from others the use of that equation in conjunction with all of the other steps in their claimed process. These include installing rubber in a press, closing the mold, constantly determining the temperature of the mold, constantly recalculating the appropriate cure time through the use of the formula and a digital computer, and automatically opening the press at the proper time. Obviously, one does not need a "computer" to cure natural or synthetic rubber, but if the computer use incorporated in the process patent significantly lessens the possibility of "overcuring" or "undercuring," the process as a whole does not thereby become unpatentable subject matter.

Our earlier opinions lend support to our present conclusion that a claim drawn to subject matter otherwise statutory does not become nonstatutory simply because it uses a mathematical formula, computer program, or digital computer. In Gottschalk v. Benson we noted: "It is said that the decision precludes a patent for any program servicing a computer. We do not so hold." 409 U.S., at 71 . Similarly, in Parker v. Flook we stated that "a process is not unpatentable simply because it contains a law of nature or a mathematical algorithm." 437 U.S., at 590 . It is now commonplace that an application of a law of nature or mathematical formula to a known structure or process may well be deserving of patent protection. See, e. g., **Funk Bros. Seed [450 U.S. 175, 188] Co. v. Kalo Inoculant Co.,** 333 U.S. 127 (1948); Eibel Process Co. v. Minnesota & Ontario Paper Co., 261 U.S. 45 (1923); Cochrane v. Deener, 94 U.S. 780 (1877); O'Reilly v. Morse, 15 How. 62 (1854); and Le Roy v. Tatham, 14 How. 156 (1853). As Justice Stone explained four decades ago:

"While a scientific truth, or the mathematical expression of it, is not a patentable invention, a novel and useful structure created with the aid of knowledge of scientific truth may be." Mackay Radio & Telegraph Co. v. Radio Corp. of America, 306 U.S. 86, 94 (1939). 11

We think this statement in Mackay takes us a long way toward the correct answer in this case. Arrhenius' equation is not patentable in isolation, but when a process for curing rubber is devised which incorporates in it a more efficient solution of the equation, that process is at the very least not barred at the threshold by 101.

In determining the eligibility of respondents' claimed process for patent protection under 101, their claims must be considered as a whole. It is inappropriate to dissect the claims into old and new elements and then to ignore the presence of the old elements in the analysis. This is particularly true in a process claim because a new combination of steps in a process may be patentable even though all the constituents of the combination were well known and in common use before the combination was made. The "novelty" of any element or steps in a process, or even of the [450 U.S. 175, 189] process itself, is of no relevance in determining whether the subject matter of a claim falls within the 101 categories of possibly patentable subject matter. 12

It has been urged that novelty is an appropriate consideration under 101. Presumably, this argument results from the language in 101 referring to any "new and useful" process, machine, etc. Section 101, however, is a general statement of the type of subject matter that is eligible for patent protection "subject to the conditions and requirements of this title." Specific conditions for patentability follow and 102 covers in detail the conditions relating to novelty. 13 [450 U.S. 175, 190] The question therefore of whether a particular invention is novel is "wholly apart from whether the invention falls into a category of statutory subject matter." In re Bergy, 596 F.2d 952, 961 (CCPA 1979) (emphasis deleted). See also Nickola v. Peterson, 580 F.2d 898 (CA6 1978). The legislative history of the 1952 Patent Act is in accord with this reasoning. The Senate Report stated: "Section 101 sets forth the subject matter that can be patented, `subject to the conditions and requirements of this title.' The conditions under which a patent may be obtained follow, and Section 102 covers the conditions relating to novelty." S. Rep. No. 1979, 82d Cong., 2d Sess., 5 (1952) (emphasis supplied).

It is later stated in the same Report:

"Section 102, in general, may be said to describe the statutory novelty required for patentability, and includes, [450 U.S. 175, 191] in effect, an amplification and definition of `new' in section 101." Id., at 6.

Finally, it is stated in the "Revision Notes":

"The corresponding section of [the] existing statute is split into two sections, section 101 relating to the subject matter for which patents may be obtained, and section 102 defining statutory novelty and stating other conditions for patentability." Id., at 17.

See also H. R. Rep. No. 1923, 82d Cong., 2d Sess., 6, 7, and 17 (1952).

In this case, it may later be determined that the respondents' process is not deserving of patent protection because it fails to satisfy the statutory conditions of novelty under 102 or nonobviousness under 103. A rejection on either of these grounds does not affect the determination that respondents' claims recited subject matter which was eligible for patent protection under 101.

IV

We have before us today only the question of whether respondents' claims fall within the 101 categories of possibly patentable subject matter. We view respondents' claims as nothing more than a process for molding rubber products and not as an attempt to patent a mathematical formula. We recognize, of course, that when a claim recites a mathematical formula (or scientific principle or phenomenon of nature), an inquiry must be made into whether the claim is seeking patent protection for that formula in the abstract. A mathematical formula as such is not accorded the protection of our patent laws, Gottschalk v. Benson, 409 U.S. 63 (1972), and this principle cannot be circumvented by attempting to limit the use of the formula to a particular technological environment. **Parker v. Flook**, 437 U.S. 584 (1978). Similarly, insignificant postsolution activity will not transform [450 U.S. 175, 192] an unpatentable principle into a patentable process. Ibid.

14 To hold otherwise would allow a competent draftsman to evade the recognized limitations on the type of subject matter eligible for patent protection.

On the other hand, when a claim containing a mathematical formula implements or applies that formula in a structure or process which, when considered as a whole, is performing a function which the patent laws were designed to protect (e. g., transforming or reducing an article to a different state or thing), then the claim satisfies the requirements of 101. Because we do not view respondents' claims as an attempt to patent a mathematical formula, but rather to be drawn to an industrial process [450 U.S. 175, 193] for the molding of rubber products, we affirm the judgment of the Court of Customs and Patent Appeals. 15

It is so ordered.

Footnotes

[Footnote 1] A "cure" is obtained by mixing curing agents into the uncured polymer in advance of molding, and then applying heat over a period of time. If the synthetic rubber is cured for the right length of time at the right temperature, it becomes a usable product.

[Footnote 2] The equation is named after its discoverer Svante Arrhenius and has long been used to calculate the cure time in rubber-molding presses. The equation can be expressed as follows:

$$\ln v=CZ+x$$

wherein ln v is the natural logarithm of v, the total required cure time; [450 U.S. 175, 178] C is the activation constant, a unique figure for each batch of each compound being molded, determined in accordance with rheometer measurements of each batch; Z is the temperature in the mold; and x is a constant dependent on the geometry of the particular mold in the press. A rheometer is an instrument to measure flow of viscous substances.

[Footnote 3] During the time a press is open for loading, it will cool. The longer it is open, the cooler it becomes and the longer it takes to reheat the press to the desired temperature range. Thus, the time necessary to raise the mold temperature to curing temperature is an unpredictable variable. The respondents claim to have overcome this problem by continuously measuring the actual temperature in the closed press through the use of a thermocouple.

[Footnote 4] We note that the petitioner does not seriously contest the respondents' assertions regarding the inability of the industry to obtain accurate cures on a uniform basis. See Brief for Petitioner 3.

[Footnote 5] Respondents' application contained 11 different claims. Three examples are claims 1, 2, and 11 which provide:

"1. A method of operating a rubber-molding press for precision molded compounds with the aid of a digital computer, comprising:

"providing said computer with a data base for said press including at least,

"natural logarithm conversion data (ln),

"the activation energy constant (C) unique to each batch of said compound being molded, and

"a constant (x) dependent upon the geometry of the particular mold of the press,

"initiating an interval timer in said computer upon the closure of the press for monitoring the elapsed time of said closure,

"constantly determining the temperature (Z) of the mold at a location closely adjacent to the mold cavity in the press during molding,

"constantly providing the computer with the temperature (Z),

"repetitively calculating in the computer, at frequent intervals during each cure, the Arrhenius equation for reaction time during the cure, which is

"ln v=CZ+x

"where v is the total required cure time,

"repetitively comparing in the computer at said frequent intervals during the cure each said calculation of the total required cure time calculated with the Arrhenius equation and said elapsed time, and

"opening the press automatically when a said comparison indicates equivalence.

"2. The method of claim 1 including measuring the activation energy constant for the compound being molded in the press with a rheometer and automatically updating said data base within the computer in the [450 U.S. 175, 180] event of changes in the compound being molded in said press as measured by said rheometer.

. . . . .

"11. A method of manufacturing precision molded articles from selected synthetic rubber compounds in an openable rubber molding press having at least one heated precision mold, comprising:

"(a) heating said mold to a temperature range approximating a pre-determined rubber curing temperature,

"(b) installing prepared unmolded synthetic rubber of a known compound in a molding cavity of predetermined geometry as defined by said mold,

"(c) closing said press to mold said rubber to occupy said cavity in conformance with the contour of said mold and to cure said rubber by transfer of heat thereto from said mold,

"(d) initiating an interval timer upon the closure of said press for monitoring the elapsed time of said closure,

"(e) heating said mold during said closure to maintain the temperature thereof within said range approximating said rubber curing temperature,

"(f) constantly determining the temperature of said mold at a location closely adjacent said cavity thereof throughout closure of said press,

"(g) repetitively calculating at frequent periodic intervals throughout closure of said press the Arrhenius equation for reaction time of said rubber to determine total required cure time v as follows:

"ln v=cz+x

"wherein c is an activation energy constant determined for said rubber being molded and cured in said press, z is the temperature of said mold at the time of each calculation of said Arrhenius equation, and x is a constant which is a function of said predetermined geometry of

said mold,
"(h) for each repetition of calculation of said Arrhenius equation herein, comparing the resultant calculated total required cure time with the monitored elapsed time measured by said interval timer,
"(i) opening said press when a said comparison of calculated total required cure time and monitored elapsed time indicates equivalence, and
"(j) removing from said mold the resultant precision molded and cured rubber article."
[Footnote 6] The word "process" is defined in 35 U.S.C. 100 (b):
"The term `process' means process, art or method, and includes a new use of a known process, machine, manufacture, composition of matter, or material."
[Footnote 7] In Corning v. Burden, 15 How. 252, 267-268 (1854), this Court explained:
"A process, eo nomine, is not made the subject of a patent in our act of congress. It is included under the general term `useful art.' An art may require one or more processes or machines in order to produce a certain result or manufacture. The term machine includes every mechanical device or combination of mechanical powers and devices to perform some [450 U.S. 175, 183] function and produce a certain effect or result. But where the result or effect is produced by chemical action, by the operation or application of some element or power of nature, or of one substance to another, such modes, methods, or operations, are called processes. A new process is usually the result of discovery; a machine, of invention. The arts of tanning, dyeing, making water-proof cloth, vulcanizing India rubber, smelting ores, and numerous others, are usually carried on by processes as distinguished from machines. One may discover a new and useful improvement in the process of tanning, dyeing, &c., irrespective of any particular form of machinery or mechanical device. And another may invent a labor-saving machine by which this operation or process may be performed, and each may be entitled to his patent. As, for instance, A has discovered that by exposing India rubber to a certain degree of heat, in mixture or connection with certain metalic salts, he can produce a valuable product, or manufacture; he is entitled to a patent for his discovery, as a process or improvement in the art, irrespective of any machine or mechanical device. B, on the contrary, may invent a new furnace or stove, or steam apparatus, by which this process may be carried on with much saving of labor, and expense of fuel; and he will be entitled to a patent for his machine, as an improvement in the art. Yet A could not have a patent for a machine, or B for a process; but each would have a patent for the means or method of producing a certain result, or effect, and not for the result or effect produced. It is for the discovery or invention of some practical method or means of producing a beneficial result or effect, that a patent is granted, and not for the result or effect itself. It is when the term process is used to represent the means or method of producing a result that it is patentable, and it will include all methods or means which are not effected by mechanism or mechanical combinations."
[Footnote 8] We note that as early as 1854 this Court approvingly referred to patent eligibility of processes for curing rubber. See id., at 267; n. 7, supra. In Tilghman v. Proctor, 102 U.S. 707 (1881), we referred to the original patent Charles Goodyear received on his process for "vulcanizing" or curing rubber. We stated:
"That a patent can be granted for a process, there can be no doubt. The patent law is not confined to new machines and new compositions of matter, but extends to any new and useful art or manufacture. A manufacturing process is clearly an art, within the meaning of the law. Good-year's patent was for a process, namely, the process of vulcanizing india-rubber by subjecting it to a high degree of heat when mixed with sulphur [450 U.S. 175, 185] and a mineral salt. The apparatus for performing the process was not patented, and was not material. The patent pointed out how the process could be effected, and that was deemed sufficient." Id., at 722.
[Footnote 9] The term "algorithm" is subject to a variety of definitions. The petitioner defines the term to mean:
"`1. A fixed step-by-step procedure for accomplishing a given result; usually a simplified procedure for solving a complex problem, also a full statement of a finite number of steps. 2. A defined process or set of rules that leads [sic] and assures development of a desired output from a given input. A sequence of formulas and/or algebraic/logical steps to calculate or determine a given task; processing rules.'" Brief for Petitioner in Diamond v. Bradley, O. T. 1980, No. 79-855, p. 6, n. 12, quoting C. Sippl & R. Sippl, Computer Dictionary and Handbook 23 (2d ed. 1972).
This definition is significantly broader than the definition this Court employed in Benson and Flook. Our previous decisions regarding the patentability of "algorithms" are necessarily limited to the more narrow definition employed by the Court, and we do not pass judgment on whether processes falling outside the definition previously used by this Court, but within the definition offered by the petitioner, would be patentable subject matter.
[Footnote 10] As we explained in Flook, in order for an operator using the formula to calculate an updated alarm limit the operator would need to know the original alarm base, the appropriate margin of safety, the time interval that should elapse between each updating, the current temperature (or other process variable), and the appropriate weighing factor to be used to average the alarm base and the current temperature. 437 U.S., at 586 . The patent application did not "explain how to select the approximate margin of safety, the weighing factor, or any of the other variables." Ibid.
[Footnote 11] We noted in **Funk Bros. Seed Co. v. Kalo Inoculant Co**., 333 U.S. 127, 130 (1948):
"He who discovers a hitherto unknown phenomenon of nature has no claim to a monopoly of it which the law recognizes. If there is to be invention from such a discovery, it must come from the application of the law of nature to a new and useful end."
Although we were dealing with a "product" claim in

Funk Bros., the same principle applies to a process claim. **Gottschalk v. Benson**, 409 U.S. 63, 68 (1972).

[Footnote 12] It is argued that the procedure of dissecting a claim into old and new elements is mandated by our decision in Flook which noted that a mathematical algorithm must be assumed to be within the "prior art." It is from this language that the petitioner premises his argument that if everything other than the algorithm is determined to be old in the art, then the claim cannot recite statutory subject matter. The fallacy in this argument is that we did not hold in Flook that the mathematical algorithm could not be considered at all when making the 101 determination. To accept the analysis proffered by the petitioner would, if carried to its extreme, make all inventions unpatentable because all inventions can be reduced to underlying principles of nature which, once known, make their implementation obvious. The analysis suggested by the petitioner would also undermine our earlier decisions regarding the criteria to consider in determining the eligibility of a process for patent protection. See, e. g., **Gottschalk v. Benson**, supra; and Cochrane v. Deener, 94 U.S. 780 (1877).

[Footnote 13] Section 102 is titled "Conditions for patentability; novelty and loss of right to patent," and provides:

"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 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 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 [450 U.S. 175, 190] 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 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 the other."

[Footnote 14] Arguably, the claims in Flook did more than present a mathematical formula. The claims also solved the calculation in order to produce a new number or "alarm limit" and then replaced the old number with the number newly produced. The claims covered all uses of the formula in processes "comprising the catalytic chemical conversion of hydrocarbons." There are numerous such processes in the petrochemical and oil refinery industries and the claims therefore covered a broad range of potential uses. 437 U.S., at 586 . The claims, however, did not cover every conceivable application of the formula. We rejected in Flook the argument that because all possible uses of the mathematical formula were not pre-empted, the claim should be eligible for patent protection. Our reasoning in Flook is in no way inconsistent with our reasoning here. A mathematical formula does not suddenly become patentable subject matter simply by having the applicant acquiesce to limiting the reach of the patent for the formula to a particular technological use. A mathematical formula in the abstract is nonstatutory subject matter regardless of whether the patent is intended to cover all uses of the formula or only limited uses. Similarly, a mathematical formula does not become patentable subject matter merely by including in the claim for the formula token postsolution activity such as the type claimed in Flook. We were careful to note in Flook that the patent application did not purport to explain how the variables used in the formula were to be selected, nor did the application contain any disclosure relating to chemical processes at work or the means of setting off an alarm or adjusting the alarm limit. Ibid. All the application provided was a "formula for computing an updated alarm limit." Ibid.

[Footnote 15] The dissent's analysis rises and falls on its characterization of respondents' claims as presenting nothing more than "an improved method of calculating the time that the mold should remain closed during the curing process." Post, at 206-207. The dissent states that respondents claim only to have developed "a new method of programming a digital computer in order to calculate - promptly and repeatedly - the correct curing time in a familiar process." Post, at 213. Respondents' claims, however, are not limited to the isolated step of "programming a digital computer." Rather, respondents' claims describe a process of curing rubber beginning with the loading of the mold and ending with the opening of the press and the production of a synthetic rubber product that has been perfectly cured - a result heretofore unknown in the art. See n. 5, supra. The fact that one or more of the steps in respondents' process may not, in isolation, be novel or independently eligible for patent protection is irrelevant to the question of whether the claims as a whole recite subject matter eligible for patent protection under 101. As we explained when discussing machine patents in Deepsouth Packing Co. v. Laitram Corp., 406 U.S. 518 (1972):

"The patents were warranted not by the novelty of their

elements but by the novelty of the combination they represented. Invention was recognized because Laitram's assignors combined ordinary elements in an extraordinary way - a novel union of old means was designed to achieve new ends. Thus, for both inventions `the whole in some way exceed[ed] the sum of its parts.' Great A. & P. Tea Co. v. Supermarket Equipment Corp., 340 U.S. 147, 152 (1950)." Id., at 521-522 (footnote omitted).

In order for the dissent to reach its conclusion it is necessary for it to read out of respondents' patent application all the steps in the claimed process which it determined were not novel or "inventive." That is not the purpose of the 101 inquiry and conflicts with the proposition recited above that a claimed invention may be entitled to patent protection even though some or all of its elements are not "novel."

JUSTICE STEVENS, with whom JUSTICE BRENNAN, JUSTICE MARSHALL, and JUSTICE BLACKMUN join, dissenting.

The starting point in the proper adjudication of patent litigation is an understanding of what the inventor claims [450 U.S. 175, 194] to have discovered. The Court's decision in this case rests on a misreading of the Diehr and Lutton patent application. Moreover, the Court has compounded its error by ignoring the critical distinction between the character of the subject matter that the inventor claims to be novel - the 101 issue - and the question whether that subject matter is in fact novel - the 102 issue.

I

Before discussing the major flaws in the Court's opinion, a word of history may be helpful. As the Court recognized in Parker v. Flook, 437 U.S. 584, 595 (1978), the computer industry is relatively young. Although computer technology seems commonplace today, the first digital computer capable of utilizing stored programs was developed less than 30 years ago. 1 Patent law developments in response to this new technology are of even more recent vintage. The subject of legal protection for computer programs did not begin to receive serious consideration until over a decade after completion of the first programmable digital computer. 2 It was 1968 before [450 U.S. 175, 195] the federal courts squarely addressed the subject, 3 and 1972 before this Court announced its first decision in the area. 4

Prior to 1968, well-established principles of patent law probably would have prevented the issuance of a valid patent on almost any conceivable computer program. Under the "mental steps" doctrine, processes involving mental operations were considered unpatentable. See, e. g., In re Heritage, 32 C. C. P. A. (Pat.) 1170, 1173-1177, 150 F.2d 554, 556-558 (1945); In re Shao Wen Yuan, 38 C. C. P. A. (Pat.) 967, 972-976, 188 F.2d 377, 380-383 (1951). The mental-steps doctrine was based upon the familiar principle that a scientific concept or mere idea cannot be the subject of a valid patent. See In re Bolongaro, 20 C. C. P. A. (Pat.) 845, 846-847, 62 F.2d 1059, 1060 (1933). 5 The doctrine was regularly invoked to deny patents to inventions consisting primarily of mathematical formulae or methods of computation. 6 It was also applied against patent claims in which a mental operation or mathematical computation was the sole novel element or inventive contribution; it was clear that patentability [450 U.S. 175, 196] could not be predicated upon a mental step. 7 Under the "function of a machine" doctrine, a process which amounted to nothing more than a description of the function of a machine was unpatentable. This doctrine had its origin in several 19th-century decisions of this Court, 8 and it had been consistently followed thereafter by the lower federal courts. 9 [450 U.S. 175, 197] Finally, the definition of "process" announced by this Court in Cochrane v. Deener, 94 U.S. 780, 787 -788 (1877), seemed to indicate that a patentable process must cause a physical transformation in the materials to which the process is applied. See ante, at 182-184.

Concern with the patent system's ability to deal with rapidly changing technology in the computer and other fields led to the formation in 1965 of the President's Commission on the Patent System. After studying the question of computer program patentability, the Commission recommended that computer programs be expressly excluded from the coverage of the patent laws; this recommendation was based primarily upon the Patent Office's inability to deal with the administrative burden of examining program applications. 10 At approximately the time that the Commission issued its report, the Patent Office published notice of its intention to prescribe guidelines for the examination of applications for patents on computer programs. See 829 Off. Gaz. Pat. Off. 865 (Aug. 16, 1966). Under the proposed guidelines, a computer program, whether claimed as an apparatus or as a process, was unpatentable. 11 The Patent Office indicated, however, [450 U.S. 175, 198] that a programmed computer could be a component of a patentable process if combined with unobvious elements to produce a physical result. The Patent Office formally adopted the guidelines in 1968. See 33 Fed. Reg. 15609 (1968).

The new guidelines were to have a short life. Beginning with two decisions in 1968, a dramatic change in the law as understood by the Court of Customs and Patent Appeals took place. By repudiating the well-settled "function of a machine" and "mental steps" doctrines, that court reinterpreted 101 of the Patent Code to enlarge drastically the categories of patentable subject matter. This reinterpretation would lead to the conclusion that computer programs were within the categories of inventions to which Congress intended to extend patent protection.

In In re Tarczy-Hornoch, 55 C. C. P. A. (Pat.) 1441, 397 F.2d 856 (1968), a divided Court of Customs and Patent Appeals overruled the line of cases developing and applying the "function of a machine" doctrine. The majority acknowledged that the doctrine had originated with decisions of this Court and that the lower federal

courts, including the Court of Customs and Patent Appeals, had consistently adhered to it during the preceding 70 years. Nonetheless, the court concluded that the doctrine rested on a misinterpretation of the precedents and that it was contrary to "the basic purposes of the patent system and productive of a range of undesirable results from the harshly inequitable to the silly." Id., at 1454, 397 F.2d, at 867. 12 Shortly thereafter, a similar [450 U.S. 175, 199] fate befell the "mental steps" doctrine. In In re Prater, 56 C. C. P. A. (Pat.) 1360, 415 F.2d 1378 (1968), modified on rehearing, 56 C. C. A. P. (Pat.) 1381, 415 F.2d 1393 (1969), the court found that the precedents on which that doctrine was based either were poorly reasoned or had been misinterpreted over the years. 56 C. C. P. A. (Pat.), at 1366-1372, 415 F.2d, at 1382-1387. The court concluded that the fact that a process may be performed mentally should not foreclose patentability if the claims reveal that the process also may be performed without mental operations. Id., at 1374-1375, 415 F.2d, at 1389. 13 This aspect of the original Prater opinion was substantially undisturbed by the opinion issued after rehearing. However, the second Prater opinion clearly indicated that patent claims broad enough to encompass the operation of a programmed computer would not be rejected for lack of patentable subject matter. 56 C. C. P. A. (Pat.), at 1394, n. 29, 415 F.2d, at 1403, n. 29. 14 [450 U.S. 175, 200]

The Court of Customs and Patent Appeals soon replaced the overruled doctrines with more expansive principles formulated with computer technology in mind. In In re Bernhart, 57 C. C. P. A. (Pat.) 737, 417 F.2d 1395 (1969), the court reaffirmed Prater, and indicated that all that remained of the mental-steps doctrine was a prohibition on the granting of a patent that would confer a monopoly on all uses of a scientific principle or mathematical equation. Id., at 743, 417 F.2d, at 1399. The court also announced that a computer programmed with a new and unobvious program was physically different from the same computer without that program; the programmed computer was a new machine or at least a new improvement over the unprogrammed computer. Id., at 744, 417 F.2d, at 1400. Therefore, patent protection could be obtained for new computer programs if the patent claims were drafted in apparatus form.

The Court of Customs and Patent Appeals turned its attention to process claims encompassing computer programs in In re Musgrave, 57 C. C. P. A. (Pat.) 1352, 431 F.2d 882 (1970). In that case, the court emphasized the fact that Prater had done away with the mental-steps doctrine; in particular, the court rejected the Patent Office's continued reliance upon the "point of novelty" approach to claim analysis. Id., at 1362, 431 F.2d, at 889. 15 The court also announced a new standard for evaluating process claims under 101: any sequence of operational steps was a patentable process under 101 as long as it was within the "technological arts." Id., at 1366-1367, 431 F.2d, at 893. This standard effectively disposed of any vestiges of the mental-steps doctrine remaining [450 U.S. 175, 201] after Prater and Bernhart. 16 The "technological arts" standard was refined in In re Benson, 58 C. C. P. A. (Pat.) 1134, 441 F.2d 682 (1971), in which the court held that computers, regardless of the uses to which they are put, are within the technological arts for purposes of 101. Id., at 1142, 441 F.2d, at 688.

In re Benson, of course, was reversed by this Court in Gottschalk v. Benson, 409 U.S. 63 (1972). 17 Justice Douglas' opinion for a unanimous Court made no reference to the lower court's rejection of the mental-steps doctrine or to the new technological-arts standard. 18 Rather, the Court clearly held that new mathematical procedures that can be conducted in old computers, like mental processes and abstract intellectual concepts, see id., at 67, are not patentable processes within the meaning of 101. [450 U.S. 175, 202]

The Court of Customs and Patent Appeals had its first opportunity to interpret Benson in In re Christensen, 478 F.2d 1392 (1973). In Christensen, the claimed invention was a method in which the only novel element was a mathematical formula. The court resurrected the point-of-novelty approach abandoned in Musgrave and held that a process claim in which the point of novelty was a mathematical equation to be solved as the final step of the process did not define patentable subject matter after Benson. 478 F.2d, at 1394. Accordingly, the court affirmed the Patent Office Board of Appeals' rejection of the claims under 101.

The Court of Customs and Patent Appeals in subsequent cases began to narrow its interpretation of Benson. In In re Johnston, 502 F.2d 765 (1974), the court held that a record-keeping machine system which comprised a programmed digital computer was patentable subject matter under 101. Id., at 771. The majority dismissed Benson with the observation that Benson involved only process, not apparatus, claims. 502 F.2d, at 771. Judge Rich dissented, arguing that to limit Benson only to process claims would make patentability turn upon the form in which a program invention was claimed. 502 F.2d, at 773-774. 19 The court again construed Benson as limited only to process claims in In re Noll, 545 F.2d 141 (1976), cert. denied, 434 U.S. 875 (1977); apparatus claims were governed by the court's pre-Benson conclusion that a programmed computer was structurally different from the same computer without that particular program. 545 F.2d, at 148. In dissent, Judge Lane, joined by Judge Rich, argued that Benson should be read as a general proscription of the patenting of computer programs regardless of the form of the claims. 545 F.2d, at 151-152. Judge Lane's interpretation of Benson was rejected by the majority [450 U.S. 175, 203] in In re Chatfield, 545 F.2d 152 (1976), cert. denied, 434 U.S. 875 (1977), decided on the same day as Noll. In that case, the court construed Benson to preclude the patenting of program inventions claimed as processes only where the claims would preempt all uses of an algorithm or mathematical formula. 545 F.2d, at 156, 158-159. 20 The dissenting judges argued, as they had in Noll, that Benson held that programs for general-purpose digital computers are not patentable subject matter. 545 F.2d, at 161.

Following Noll and Chatfield, the Court of Customs and Patent Appeals consistently interpreted Benson to preclude the patenting of a program-related process invention only when the claims, if allowed, would wholly pre-empt the algorithm itself. One of the cases adopting this view was In re Flook, 559 F.2d 21 (1977), 21 which was reversed in Parker v. Flook, 437 U.S. 584 (1978). Before this Court decided Flook, however, the lower court developed a two-step procedure for analyzing program-related inventions in light of Benson. In In re Freeman, 573 F.2d 1237 (1978), the court held that such inventions must first be examined to determine whether a mathematical algorithm is directly or indirectly claimed; if an algorithm is recited, the court must then determine whether the claim would wholly preempt that algorithm. Only if a claim satisfied both inquiries was Benson considered applicable. 573 F.2d, at 1245. See also In re Toma, 575 F.2d 872, 877 (CCPA 1978). [450 U.S. 175, 204]

In Flook, this Court clarified Benson in three significant respects. First, Flook held that the Benson rule of unpatentable subject matter was not limited, as the lower court believed, to claims which wholly preempted an algorithm or amounted to a patent on the algorithm itself. 437 U.S., at 589 -590. Second, the Court made it clear that an improved method of calculation, even when employed as part of a physical process, is not patentable subject matter under 101. Id., at 595, n. 18. Finally, the Court explained the correct procedure for analyzing a patent claim employing a mathematical algorithm. Under this procedure, the algorithm is treated for 101 purposes as though it were a familiar part of the prior art; the claim is then examined to determine whether it discloses "some other inventive concept." Id., at 591-595. 22

Although the Court of Customs and Patent Appeals in several post-Flook decisions held that program-related inventions were not patentable subject matter under 101, see, e. g., In re Sarkar, 588 F.2d 1330 (1978); In re Gelnovatch, 595 F.2d 32 (1979), in general Flook was not enthusiastically received by that court. In In re Bergy, 596 F.2d 952 (1979), the majority engaged in an extensive critique of Flook, concluding that this Court had erroneously commingled "distinct statutory provisions which are conceptually unrelated." 596 F.2d, at 959. 23 In subsequent cases, the court construed [450 U.S. 175, 205] Flook as resting on nothing more than the way in which the patent claims had been drafted, and it expressly declined to use the method of claim analysis spelled out in that decision. The Court of Customs and Patent Appeals has taken the position that, if an application is drafted in a way that discloses an entire process as novel, it defines patentable subject matter even if the only novel element that the inventor claims to have discovered is a new computer program. 24 The court interpreted Flook in this manner in its opinion in this case. See In re Diehr, 602 F.2d 982, 986-989 (1979). In my judgment, this reading of Flook - although entirely consistent with the lower court's expansive approach to 101 during the past 12 years - trivializes the holding in Flook, the principle that underlies Benson, and the settled line of authority reviewed in those opinions.

II

As I stated at the outset, the starting point in the proper adjudication of patent litigation is an understanding of what the inventor claims to have discovered. Indeed, the outcome of such litigation is often determined by the judge's understanding of the patent application. This is such a case.

In the first sentence of its opinion, the Court states the question presented as "whether a process for curing synthetic rubber . . . is patentable subject matter." Ante, at 177. Of course, that question was effectively answered many years ago when Charles Goodyear obtained his patent on the vulcanization process. 25 The patent application filed by Diehr [450 U.S. 175, 206] and Lutton, however, teaches nothing about the chemistry of the synthetic rubber-curing process, nothing about the raw materials to be used in curing synthetic rubber, nothing about the equipment to be used in the process, and nothing about the significance or effect of any process variable such as temperature, curing time, particular compositions of material, or mold configurations. In short, Diehr and Lutton do not claim to have discovered anything new about the process for curing synthetic rubber.

As the Court reads the claims in the Diehr and Lutton patent application, the inventors' discovery is a method of constantly measuring the actual temperature inside a rubber molding press. 26 As I read the claims, their discovery is an [450 U.S. 175, 207] improved method of calculating the time that the mold should remain closed during the curing process. 27 If the Court's reading of the claims were correct, I would agree that they disclose patentable subject matter. On the other hand, if the Court accepted my reading, I feel confident that the case would be decided differently.

There are three reasons why I cannot accept the Court's conclusion that Diehr and Lutton claim to have discovered a new method of constantly measuring the temperature inside a mold. First, there is not a word in the patent application that suggests that there is anything unusual about the temperature-reading devices used in this process - or indeed that any particular species of temperature-reading device should be used in it. 28 Second, since devices for constantly [450 U.S. 175, 208] measuring actual temperatures - on a back porch, for example - have been familiar articles for quite some time, I find it difficult to believe that a patent application filed in 1975 was premised on the notion that a "process of constantly measuring the actual temperature" had just been discovered. Finally, the Patent and Trademark Office Board of Appeals expressly found that "the only difference between the conventional methods of operating a molding press and that claimed in [the] application rests in those steps of the claims which relate to the calculation incident to the solution of the mathematical problem or formula used to control the mold heater and the automatic opening of the press." 29 This finding was not disturbed by the Court of Customs and Patent Appeals and is clearly correct.

A fair reading of the entire patent application, as well as the specific claims, makes it perfectly clear that what Diehr and Lutton claim to have discovered is a method of using a digital computer to determine the amount of time that a rubber molding press should remain closed during the synthetic rubber-curing process. There is no suggestion that there is anything novel in the instrumentation of the mold, in actuating a timer when the press is closed, or in automatically opening the press when the computed time expires. 30 Nor does the [450 U.S. 175, 209] application suggest that Diehr and Lutton have discovered anything about the temperatures in the mold or the amount of curing time that will produce the best cure. What they claim to have discovered, in essence, is a method of updating the original estimated curing time by repetitively recalculating that time pursuant to a well-known mathematical formula in response to variations in temperature within the mold. Their method of updating the curing time calculation is strikingly reminiscent of the method of updating alarm limits that Dale Flook sought to patent.

Parker v. Flook, 437 U.S. 584 (1978), involved the use of a digital computer in connection with a catalytic conversion process. During the conversion process, variables such as temperature, pressure, and flow rates were constantly monitored and fed into the computer; in this case, temperature in the mold is the variable that is monitored and fed into the computer. In Flook, the digital computer repetitively recalculated the "alarm limit" - a number that might signal the need to terminate or modify the catalytic conversion process; in this case, the digital computer repetitively recalculates the correct curing time - a number that signals the time when the synthetic rubber molding press should open.

The essence of the claimed discovery in both cases was an algorithm that could be programmed on a digital computer. 31 [450 U.S. 175, 210] In Flook, the algorithm made use of multiple process variables; in this case, it makes use of only one. In Flook, the algorithm was expressed in a newly developed mathematical formula; in this case, the algorithm makes use of a well-known mathematical formula. Manifestly, neither of these differences can explain today's holding. 32 What I believe [450 U.S. 175, 211] does explain today's holding is a misunderstanding of the applicants' claimed invention and a failure to recognize the critical difference between the "discovery" requirement in 101 and the "novelty" requirement in 102. 33

III

The Court misapplies Parker v. Flook because, like the Court of Customs and Patent Appeals, it fails to understand or completely disregards the distinction between the subject matter of what the inventor claims to have discovered - the 101 issue - and the question whether that claimed discovery is in fact novel - the 102 issue. 34 If there is not even a [450 U.S. 175, 212] claim that anything constituting patentable subject matter has been discovered, there is no occasion to address the novelty issue. 35 Or, as was true in Flook, if the only concept that the inventor claims to have discovered is not patentable subject matter, 101 requires that the application be rejected without reaching any issue under 102; for it is irrelevant that unpatentable subject matter - in that case a formula for updating alarm limits - may in fact be novel.

Proper analysis, therefore, must start with an understanding of what the inventor claims to have discovered - or phrased somewhat differently - what he considers his inventive concept to be. 36 It seems clear to me that Diehr and [450 U.S. 175, 213] Lutton claim to have developed a new method of programming a digital computer in order to calculate - promptly and repeatedly - the correct curing time in a familiar process. 37 In the 101 analysis, we must assume that the sequence of steps in this programming method is novel, unobvious, and useful. The threshold question of whether such a method is patentable subject matter remains.

If that method is regarded as an "algorithm" as that term was used in Gottschalk v. Benson, 409 U.S. 63 (1972), and in [450 U.S. 175, 214] Parker v. Flook, 437 U.S. 584 (1978), 38 and if no other inventive concept is disclosed in the patent application, the question must be answered in the negative. In both Benson and Flook, the parties apparently agreed that the inventor's discovery was properly regarded as an algorithm; the holding that an algorithm was a "law of nature" that could not be [450 U.S. 175, 215] patented therefore determined that those discoveries were not patentable processes within the meaning of 101.

As the Court recognizes today, Flook also rejected the argument that patent protection was available if the inventor did not claim a monopoly on every conceivable use of the algorithm but instead limited his claims by describing a specific postsolution activity - in that case setting off an alarm in a catalytic conversion process. In its effort to distinguish Flook from the instant case, the Court characterizes that postsolution activity as "insignificant," ante, at 191, or as merely "token" activity, ante, at 192, n. 14. As a practical matter, however, the postsolution activity described in the Flook application was no less significant than the automatic opening of the curing mold involved in this case. For setting off an alarm limit at the appropriate time is surely as important to the safe and efficient operation of a catalytic conversion process as is actuating the mold-opening device in a synthetic rubber-curing process. In both cases, the post-solution activity is a significant part of the industrial process. But in neither case should that activity have any legal significance because it does not constitute a part of the inventive concept that the applicants claimed to have discovered. 39

In Gottschalk v. Benson, we held that a program for the [450 U.S. 175, 216] solution by a digital computer of a mathematical problem was not a patentable process within the meaning of 101. In Parker v. Flook, we further held that such a computer program could not be transformed into a patentable process by the addition of postsolution activity that was not claimed to be novel. That holding plainly requires the rejection of Claims 1 and 2 of the Diehr and Lutton application quoted in the Court's opinion. Ante, at 179-180, n. 5. In my opinion, it equally requires rejection of Claim 11 because the

presolution activity described in that claim is admittedly a familiar part of the prior art. 40

Even the Court does not suggest that the computer program developed by Diehr and Lutton is a patentable discovery. Accordingly, if we treat the program as though it were a familiar part of the prior art - as well-established precedent requires 41 - it is absolutely clear that their application contains no claim of patentable invention. Their application was therefore properly rejected under 101 by the Patent Office and the Board of Appeals.

IV

The broad question whether computer programs should be given patent protection involves policy considerations that [450 U.S. 175, 217] this Court is not authorized to address. See Gottschalk v. Benson, 409 U.S., at 72 -73; Parker v. Flook, 437 U.S., at 595 -596. As the numerous briefs amicus curiae filed in Gottschalk v. Benson, supra, Dann v. Johnston, 425 U.S. 219 (1976), Parker v. Flook, supra, and this case demonstrate, that question is not only difficult and important, but apparently also one that may be affected by institutional bias. In each of those cases, the spokesmen for the organized patent bar have uniformly favored patentability and industry representatives have taken positions properly motivated by their economic self-interest. Notwithstanding fervent argument that patent protection is essential for the growth of the software industry, 42 commentators have noted that "this industry is growing by leaps and bounds without it." 43 In addition, even [450 U.S. 175, 218] some commentators who believe that legal protection for computer programs is desirable have expressed doubts that the present patent system can provide the needed protection. 44

Within the Federal Government, patterns of decision have also emerged. Gottschalk, Dann, Parker, and Diamond were not ordinary litigants - each was serving as Commissioner of Patents and Trademarks when he opposed the availability of patent protection for a program-related invention. No doubt each may have been motivated by a concern about the ability of the Patent Office to process effectively the flood of applications that would inevitably flow from a decision that computer programs are patentable. 45 The consistent concern evidenced by the Commissioner of Patents and Trademarks and by the Board of Appeals of the Patent and Trademark Office has not been shared by the Court of Customs and Patent Appeals, which reversed the Board in Benson, Johnston, and Flook, and was in turn reversed by this Court in each of those cases. 46 [450 U.S. 175, 219]

Scholars have been critical of the work of both tribunals. Some of that criticism may stem from a conviction about the merits of the broad underlying policy question; such criticism may be put to one side. Other criticism, however, identifies two concerns to which federal judges have a duty to respond. First, the cases considering the patentability of program-related inventions do not establish rules that enable a conscientious patent lawyer to determine with a fair degree of accuracy which, if any, program-related inventions will be patentable. Second, the inclusion of the ambiguous concept of an "algorithm" within the "law of nature" category of unpatentable subject matter has given rise to the concern that almost any process might be so described and therefore held unpatentable.

In my judgment, today's decision will aggravate the first concern and will not adequately allay the second. I believe both concerns would be better addressed by (1) an unequivocal holding that no program-related invention is a patentable process under 101 unless it makes a contribution to the art that is not dependent entirely on the utilization of a computer, and (2) an unequivocal explanation that the term "algorithm" as used in this case, as in Benson and Flook, is synonymous with the term "computer program." 47 Because [450 U.S. 175, 220] the invention claimed in the patent application at issue in this case makes no contribution to the art that is not entirely dependent upon the utilization of a computer in a familiar process, I would reverse the decision of the Court of Customs and Patent Appeals.

[Footnote 1] ENIAC, the first general purpose electronic digital computer, was built in 1946. Unlike modern computers, this machine was externally programmed; its circuitry had to be manually rewired each time it was used to perform a new task. See Gemignani, Legal Protection for Computer Software: The View From `79, 7 Rutgers J. Computers, Tech. & L. 269, 270 (1980). In 1952, a group of scientists at the Institute for Advanced Study completed MANIAC I, the first digital computer capable of operating upon stored programs, as opposed to hard-wired circuitry. See Ulam, Computers, 211 Scientific American 203 (1964).

[Footnote 2] The subject received some scholarly attention prior to 1964. See, e. g., Seidel, Antitrust, Patent and Copyright Law Implications of Computer Technology, 44 J. Pat. Off. Soc. 116 (1962); Comment, The Patentability of Computer Programs, 38 N. Y. U. L. Rev. 891 (1963). In 1964, the Copyright Office began registering computer programs. See 11 Copyright Soc. Bull. 361 (1964); Davis, Computer Programs and Subject Matter Patentability, 6 Rutgers J. Computers, Tech. & L. 1, 5 (1977). Also in 1964, the Patent Office Board of Appeals issued what appears to be the first published opinion concerning the patentability of a computer-related invention. See Ex parte King, 146 USPQ 590.

[Footnote 3] In re Prater, 56 C. C. P. A. (Pat.) 1360, 415 F.2d 1378 (1968), modified on rehearing, 56 C. C. P. A. (Pat.) 1381, 415 F.2d 1393 (1969), is generally identified as the first significant judicial decision to consider the subject-matter patentability of computer program-related inventions. The Court of Customs and Patent Appeals earlier decided In re Naquin, 55 C. C. P. A. (Pat.) 1428, 398 F.2d 863 (1968), in which it rejected a challenge to an application for a patent on a program-related invention on grounds of inadequate disclosure under 112.

[Footnote 4] See Gottschalk v. Benson, 409 U.S. 63

(1972).

[Footnote 5] See also Novick & Wallenstein, The Algorithm and Computer Software Patentability: A Scientific View of a Legal Problem, 7 Rutgers J. Computers, Tech. & L. 313, 316-317 (1980).

[Footnote 6] See, e. g., Don Lee, Inc. v. Walker, 61 F.2d 58, 67 (CA9 1932); In re Bolongaro, 20 C. C. P. A. (Pat.) 845, 846-847, 62 F.2d 1059, 1060 (1933); In re Shao Wen Yuan, 38 C. C. P. A. (Pat.) 967, 969-972, 188 F.2d 377, 379-380 (1951); Lyman v. Ladd, 120 U.S. App. D.C. 388, 389, 347 F.2d 482, 483 (1965).

[Footnote 7] See, e. g., In re Cooper, 30 C. C. P. A. (Pat.) 946, 949, 134 F.2d 630, 632 (1943); Halliburton Oil Well Cementing Co. v. Walker, 146 F.2d 817, 821, 823 (CA9 1944), rev'd on other grounds, 329 U.S. 1 (1946); In re Heritage, 32 C. C. P. A. (Pat.) 1170, 1173-1177, 150 F.2d 554, 556-558 (1945); In re Abrams, 38 C. C. P. A. (Pat.) 945, 950-953, 188 F.2d 165, 168-170 (1951); In re Shao Wen Yuan, supra, at 975-976, 188 F.2d, at 383; In re Lundberg, 39 C. C. P. A. (Pat.) 971, 975, 197 F.2d 336, 339 (1952); In re Venner, 46 C. C. P. A. (Pat.) 754, 758-759, 262 F.2d 91, 95 (1958).

[Footnote 8] The "function of a machine" doctrine is generally traced to Corning v. Burden, 15 How. 252, 268 (1854), in which the Court stated: "[I]t is well settled that a man cannot have a patent for the function or abstract effect of a machine, but only for the machine which produces it." The doctrine was subsequently reaffirmed on several occasions. See, e. g., Risdon Iron & Locomotive Works v. Medart, 158 U.S. 68, 78 -79, 84 (1895); Westinghouse v. Boyden Power Brake Co., 170 U.S. 537, 554 -557 (1898); Busch v. Jones, 184 U.S. 598, 607 (1902); Expanded Metal Co. v. Bradford, 214 U.S. 366, 383 (1909).

[Footnote 9] See, e. g., In re Weston, 17 App. D.C. 431, 436-442 (1901); Chisholm-Ryder Co. v. Buck, 65 F.2d 735, 736 (CA4 1933); In re Ernst, 21 C. C. P. A. (Pat.) 1235, 1238-1240, 71 F.2d 169, 171-172 (1934); In re McCurdy, 22 C. C. P. A. (Pat.) 1140, 1142-1145, 76 F.2d 400, 402-403, (1935); In re Parker, 23 C. C. P. A. (Pat.) 721, 722-725, 79 F.2d 908, 909-910 (1935); Black-Clawson Co. v. Centrifugal Engineering & Patents Corp., 83 F.2d 116, 119-120 (CA6), cert. denied, 299 U.S. 554 (1936); In re Wadman, 25 C. C. P. A. (Pat.) 936, 943-944, 94 F.2d 993, 998 (1938); In re Mead, 29 C. C. P. A. (Pat.) 1001, 1004, 127 F.2d 302, 304 (1942); In re Solakian, 33 C. C. P. A. (Pat.) 1054, 1059, 155 F.2d 404, 407 (1946); In re Middleton, 35 C. C. P. A. (Pat.) 1166, 1167-1168, 167 F.2d 1012, 1013-1014 (1948); In re Nichols, 36 C. C. P. A. (Pat.) 759, 762-763, 171 F.2d 300, 302-303 (1948); In re Ashbaugh, 36 C. C. P. A. (Pat.) 902, 904-905, 173 F.2d 273, 274-275 (1949); In re Horvath, 41 C. C. P. A. (Pat.) 844, 849-851, 211 F.2d 604, 607-608 (1954); In re Gartner, 42 C. C. P. A. (Pat.) 1022, 1025-1026, 223 F.2d 502, 504 (1955).

[Footnote 10] The Commission's report contained the following evaluation of the current state of the law with respect to computer program patentability:

"Uncertainty now exists as to whether the statute permits a valid patent to be granted on programs. Direct attempts to patent programs have been rejected on the ground of nonstatutory subject matter. Indirect attempts to obtain patents and avoid the rejection, by drafting claims as a process, or a machine or components thereof programmed in a given manner, rather than as a program itself, have confused the issue further and should not be permitted." Report of the President's Commission on the Patent System, "To Promote the Progress of . . . Useful Arts" in an Age of Exploding Technology 14 (1966).

[Footnote 11] The Patent Office guidelines were based primarily upon the mental-steps doctrine and the Cochrane v. Deener, 94 U.S. 780 (1877), definition of "process." See 829 Off. Gaz. Pat. Off. 865 (Aug. 16, 1966); 33 Fed. Reg. 15609 (1968).

[Footnote 12] Judge Kirkpatrick, joined by Chief Judge Worley, wrote a vigorous dissent objecting to the majority's decision to abandon "a rule which is about as solidly established as any rule of the patent law." 55 C. C. P. A. (Pat.), at 1457, 397 F.2d, at 868. Unlike the majority, the dissenting judges did not consider the doctrine inequitable or silly, and they observed that it had functioned in a satisfactory manner in the past. Id., at 1457-1458, 397 F.2d, at 869. In addition, they considered the doctrine to be so well established that it had been adopted by implication in the Patent Act of 1952. Id., at 1458, 397 F.2d, at 869.

[Footnote 13] In Prater, the patent application claimed an improved method for processing spectrographic data. The method analyzed conventionally obtained data by using well-known equations. The inventors had discovered a particular mathematical characteristic of the equations which enabled them to select the specific subset of equations that would yield optimum results. The application disclosed an analog computer as the preferred embodiment of the invention, but indicated that a programmed digital computer could also be used. 56 C. C. P. A. (Pat.), at 1361-1363, 415 F.2d, at 1379-1380. The Patent Office had rejected the process claims on a mental-steps theory because the only novel aspect of the claimed method was the discovery of an unpatentable mathematical principle. The apparatus claim was rejected essentially because, when the mathematical principle was assumed to be within the prior art, the claim disclosed no invention entitled to patent protection. Id., at 1364-1365, 1375, 415 F.2d, at 1381, 1399.

[Footnote 14] It is interesting to note that the Court of Customs and Patent Appeals in the second Prater opinion expressly rejected the Patent Office's procedure for analyzing the apparatus claim pursuant to which the mathematical principle was treated as though it were within the prior art. 56 C. C. P. A. (Pat.), at 1397, 415 F.2d, at 1405-1406. This precise procedure, of course, was later employed by this Court in Parker v. Flook, 437 U.S. 584 (1978).

[Footnote 15] Under the "point of novelty" approach, if the novelty or advancement in the art claimed by the inventor resided solely in a step of the process embodying a mental operation or other unpatentable element, the claim was rejected under 101 as being directed to

nonstatutory subject matter. See Blumenthal & Riter, Statutory or Non-Statutory?: An Analysis of the Patentability of Computer Related Inventions, 62 J. Pat. Off. Soc. 454, 457, 461, 470 (1980).

[Footnote 16] The author of the second Prater opinion, Judge Baldwin, disagreed with the Musgrave "technological arts" standard for process claims. He described that standard as "a major and radical shift in this area of the law." 57 C. C. P. A. (Pat.), at 1367, 431 F.2d, at 893-894. As Judge Baldwin read the majority opinion, claims drawn solely to purely mental processes were now entitled to patent protection. Id., at 1369, 431 F.2d, at 895-896. Judge Baldwin's understanding of Musgrave seems to have been confirmed in In re Foster, 58 C. C. P. A. (Pat.) 1001, 1004-1005, 438 F.2d 1011, 1014-1015 (1971).

[Footnote 17] In the interval between the two Benson decisions, the Court of Customs and Patent Appeals decided several cases in which it addressed the patentability of computer-related inventions. In In re McIlroy, 58 C. C. P. A. (Pat.) 1249, 442 F.2d 1397 (1971), and In re Waldbaum, 59 C. C. P. A. (Pat.) 940, 457 F.2d 997 (1972), the court relied primarily upon Musgrave and Benson. In In re Ghiron, 58 C. C. P. A. (Pat.) 1207, 442 F.2d 985 (1971), the court reaffirmed Tarczy-Hornoch's rejection of the "function of a machine" doctrine.

[Footnote 18] Although the Court did not discuss the mental-steps doctrine in Benson, some commentators have suggested that the Court implicitly relied upon the doctrine in that case. See, e. g., Davis, supra n. 2, at 14, and n. 92. Other commentators have observed that the Court's analysis in Benson was entirely consistent with the mental-steps doctrine. See, e. g., Comment, Computer Program Classification: A Limitation on Program Patentability as a Process, 53 Or. L. Rev. 501, 517-518, n. 132 (1974).

[Footnote 19] The decision of the Court of Customs and Patent Appeals was reversed by this Court on other grounds in Dann v. Johnston, 425 U.S. 219 (1976).

[Footnote 20] In addition to interpreting Benson, the majority also maintained that Christensen, despite its point-of-novelty language, had not signalled a return to that form of claim analysis. 545 F.2d, at 158. The court would reaffirm this proposition consistently thereafter. See, e. g., In re de Castelet, 562 F.2d 1236, 1240 (1977); In re Richman, 563 F.2d 1026, 1029-1030 (1977); In re Freeman, 573 F.2d 1237, 1243-1244 (1978); In re Toma, 575 F.2d 872, 876 (1978); In re Walter, 618 F.2d 758, 766-767 (1980).

[Footnote 21] See also In re Deutsch, 553 F.2d 689, 692-693 (CCPA 1977); In re Waldbaum, 559 F.2d 611, 616-617 (CCPA 1977); In re de Castelet, supra, at 1243-1245.

[Footnote 22] This form of claim analysis did not originate with Flook. Rather, the Court derived it from the landmark decision of O'Reilly v. Morse, 15 How. 62, 115 (1854). In addition, this analysis is functionally the same as the point-of-novelty analysis used in conjunction with the mental-steps doctrine. In fact, the Patent Office in the past occasionally phrased its mental-steps rejections in essentially the terms later employed in Flook. See nn. 13-15, supra. See generally Comment, 35 U.S.C. 101 Claim Analysis - The Point of Novelty Approach, 62 J. Pat. Off. Soc. 521 (1980).

[Footnote 23] The Court of Customs and Patent Appeals suggested that the cause of this Court's error was the argument presented by the Solicitor General in Flook. According to the majority, the Solicitor General's briefs "badly, and with a seeming sense of purpose" confused the statutory requirements. [450 U.S. 175, 205] 596 F.2d, at 962. The court went on to describe part of the Solicitor General's argument in Flook as "subversive nonsense." 596 F.2d, at 963.

[Footnote 24] See, e. g., In re Johnson, 589 F.2d 1070 (1978); In re Phillips, 608 F.2d 879 (1979); In re Sherwood, 613 F.2d 809 (1980), cert. pending, No. 79-1941.

[Footnote 25] In an opinion written over a century ago, the Court noted:

"A manufacturing process is clearly an art, within the meaning of the law. Goodyear's patent was for a process, namely, the process of vulcanizing [450 U.S. 175, 206] india-rubber by subjecting it to a high degree of heat when mixed with sulphur and a mineral salt.

. . . . .

"The mixing of certain substances together, or the heating of a substance to a certain temperature, is a process." Tilghman v. Proctor, 102 U.S. 707, 722 , 728 (1881).

See also Corning v. Burden, 15 How. 252, 267 (1854).

Modern rubber curing methods apparently still are based in substantial part upon the concept discovered by Goodyear:

"Since the day 120 years ago when Goodyear first heated a mixture of rubber and sulphur on a domestic stove and so discovered vulcanisation, this action of heat and sulphur has remained the standard method of converting crude rubber, with all its limitations, into a commercially usable product, giving it the qualities of resistance to heat and cold in addition to considerable mechanical strength.

"Goodyear also conjured up the word `cure' for vulcanisation, and this has become the recognised term in production circles." Mernagh, Practical Vulcanisation, in The Applied Science of Rubber 1053 (W. Naunton ed. 1961).

See generally Kimmich, Making Rubber Products for Engineering Uses, in Engineering Uses of Rubber 18, 28-34 (A. McPherson & A. Klemin eds. 1956)

[Footnote 26] "Respondents characterize their contribution to the art to reside in the process of constantly measuring the actual temperature inside the mold." See ante, at 178.

[Footnote 27] Claim 1 is quoted in full in n. 5 of the Court's opinion, ante, at 179. It describes a "method of operating a rubber-molding press for precision molded compounds with the aid of a digital computer." As the Court of Customs and Patent Appeals noted, the improvement claimed in the application consists of "opening the mold at precisely the correct time rather than at a time which has been determined by approxi-

mation or guesswork." In re Diehr, 602 F.2d 982, 988 (1979).

[Footnote 28] In the portion of the patent application entitled "Abstract of the Disclosure," the following reference to monitoring the temperature is found:

"An interval timer starts running from the time of mold closure, and the temperature within the mold cavity is measured often, typically every ten seconds. The temperature is fed to a computer . . . ." App. to Pet. for Cert. 38a.

In the portion of the application entitled "Background of the Invention," the following statement is found:

"By accurate and constant calculation and recalculation of the correct mold time under the temperatures actually present in the mold, the material can be cured accurately and can be relied upon to produce very few rejections, perhaps completely eliminating all rejections due to faulty mold cure." Id., at 41a.

And, in the "Summary of the Invention," this statement appears:

"A surveillance system is maintained over the mold to determine the actual mold temperature substantially continuously, for example, every [450 U.S. 175, 208] ten seconds, and to feed that information to the computer along with the pertinent stored data and along with the elapsed time information." Ibid.

Finally, in a description of a simple hypothetical application using the invention described in Claim 1, this is the reference to the temperature-reading device:

"Thermocouples, or other temperature-detecting devices, located directly within the mold cavity may read the temperature at the surface where the molding compound touches the mold, so that it actually gets the temperature of the material at that surface." Id., at 45a.

[Footnote 29] Id., at 24a.

[Footnote 30] These elements of the rubber-curing process apparently have been well known for years. The following description of the vulcanization process appears in a text published in 1961:

"Vulcanisation is too important an operation to be left to human control, however experienced and conscientious. Instrumentation makes controlled [450 U.S. 175, 209] cure possible, and in consequence instrument engineering is a highly important function in the modern rubber factory, skilled attention being necessary, not only in the maintenance of the instruments but also in their siting. There are instruments available which will indicate, record or control all the services involved in vulcanisation, including time, temperature and pressure, and are capable of setting in motion such operations as the opening and closing of moulds and, in general, will control any process variable which is capable of being converted into an electric charge or pneumatic or hydraulic pressure impulse." Mernagh, supra n. 25, at 1091-1092.

[Footnote 31] Commentators critical of the Flook decision have noted the essential similarity of the two inventions:

"The Diehr invention improved the control system by continually remeasuring [450 U.S. 175, 210] the temperature and recalculating the proper cure time. The computer would simultaneously keep track of the elapsed time. When the elapsed time equalled the proper cure time, the rubber would be released automatically from the mold.

"The facts are difficult to distinguish from those in Flook. Both processes involved (1) an initial calculation, (2) continual remeasurement and recalculation, and (3) some control use of the value obtained from the calculation." Novick & Wallenstein, supra n. 5, at 326 (footnotes omitted).

[Footnote 32] Indeed, the most significant distinction between the invention at issue in Flook and that at issue in this case lies not in the characteristics of the inventions themselves, but rather in the drafting of the claims. After noting that "[t]he Diehr claims are reminiscent of the claims in Flook," Blumenthal & Riter, supra n. 15, at 502-503 (footnote omitted), the authors of a recent article on the subject observe that the Court of Customs and Patent Appeals' analysis in this case "lends itself to an interesting exercise in claim drafting." Id., at 505. To illustrate their point, the authors redrafted the Diehr and Lutton claims into the format employed in the Flook application:

"An improved method of calculating the cure time of a rubber molding process utilizing a digital computer comprising the steps of:

"a. inputting into said computer input values including

"1. natural logarithm conversion data (1.n),

"2. an activation energy constant (C) unique to each batch of rubber being molded,

"3. a constant (X) dependent upon the geometry of the particular mold of the press, and

"4. continuous temperature values (Z) of the mold during molding;

"b. operating said computer for

"1. counting the elapsed cure time,

"2. calculating the cure time from the input values using the Arrhenius equation [l]n V=CZ+X, where V is the total cure time, and [450 U.S. 175, 211]

"c. providing output signals from said computer when said calculated cure time is equal to said elapsed cure time." Ibid.

The authors correctly conclude that even the lower court probably would have found that this claim was drawn to unpatentable subject matter under 101. Id., at 505-506.

[Footnote 33] In addition to confusing the requirements of 101 and 102, the Court also misapprehends the record in this case when it suggests that the Diehr and Lutton patent application may later be challenged for failure to satisfy the requirements of 102 and 103. See ante, at 191. This suggestion disregards the fact that the applicants overcame all objections to issuance of the patent except the objection predicated on 101. The Court seems to assume that 102 and 103 issues of novelty and obviousness remain open on remand. As I understand the record, however, those issues have already been resolved. See Brief for Respondents 11-14; Reply Memorandum for Petitioner 3-4, and n. 4. Therefore, the Court is now deciding that the patent will issue.

[Footnote 34] The early cases that the Court of Customs and Patent Appeals refused to follow in Prater, Musgrave, and Benson had recognized the distinction between the 101 requirement that what the applicant claims to have invented must be patentable subject matter and the 102 requirement that the invention must actually be novel. See, e. g., In re Shao Wen Yuan, 38 C. C. P. A. (Pat.), at 973-976, 188 F.2d, at 382-383; In re Abrams, 38 C. C. P. A. (Pat.), at 951-952, 188 F.2d, at 169; In re Heritage, 32 C. C. P. A. (Pat.), at 1173-1174, 1176-1177, 150 F.2d, at 556, 558; Halliburton Oil Well Cementing Co. v. Walker, 146 F.2d, at 821, 823. The lower court's error in this case, and its unenthusiastic reception of Gottschalk v. Benson and Parker v. Flook, is, of course, consistent [450 U.S. 175, 212] with its expansive reading of 101 in Tarczy-Hornoch, Prater, and their progeny.

[Footnote 35] The Court's opinion in Flook itself pointed out this distinction:

"The obligation to determine what type of discovery is sought to be patented must precede the determination of whether that discovery is, in fact, new or obvious." 437 U.S., at 593 .

As the Court of Customs and Patent Appeals noted in this case, "for the claim to be statutory, there must be some substance to it other than the recitation and solution of the equation or formula." 602 F.2d, at 988. See Comment, 62 J. Pat. Off. Soc., supra n. 22, at 522-523.

[Footnote 36] The Court fails to focus upon what Diehr and Lutton claim to have discovered apparently because it believes that this method of analysis would improperly import novelty considerations into 101. See ante, at 188-191, 193, n. 15. Rather than directing its attention to the applicants' claimed discovery, the Court instead focuses upon the general industrial context in which the applicants intend their discovery to be used. Implicit in this interpretation of the patent application is the assumption that, as long as the claims describe a specific implication of the applicants' discovery, patentable subject matter is defined. This assumption was expressly rejected in Flook:

"This assumption is based on respondent's narrow reading of Benson, and is as untenable in the context of 101 as it is in the context of that case. It would make the determination of patentable subject matter depend simply on the draftsman's art and would ill serve the principles underlying the prohibition against patents for `ideas' or phenomena of nature. The rule that the discovery of a law of nature cannot be patented [450 U.S. 175, 213] rests, not on the notion that natural phenomena are not processes, but rather on the more fundamental understanding that they are not the kind of `discoveries' that the statute was enacted to protect." 437 U.S., at 593 (footnote omitted).

[Footnote 37] A few excerpts from the original patent application will emphasize this point:

"The invention will probably best be understood by first describing a simple example, in which a single mold is involved and in which the information is relatively static.

. . . . .

"A standard digital computer may be employed in this method. It has a data storage bank of suitable size which, of course, may vary when many molds are used and when more refinements are employed. However, Fig. 1 shows a relatively simple case which achieves results that are vast improvements over what has been done up to now. . . .

"The data bank of the computer is provided with a digital input into which the time-temperature cure data for the compound involved is fed, as shown in Fig. 1. All the data is available to the computer upon call, by random access, and the call can be automatic depending upon the temperature actually involved. In other words, the computer over and over questions the data storage, asking, what is the proper time of cure for the following summation of temperatures? The question may be asked each second, and the answer is readily provided.

. . . . .

"Recalculation continues until the time that has elapsed since mold closure corresponds with the calculated time. Then, the computer actuates the mold-opening device and the mold is automatically opened." App. to Pet. for Cert. 43a-45a.

The Figure 1 referred to in the application is as follows: Id., at 53a.

[Footnote 38] In Benson, we explained the term "algorithm" in the following paragraph:

"The patent sought is on a method of programming a general-purpose digital computer to convert signals from binary-coded decimal form into pure binary form. A procedure for solving a given type of mathematical problem is known as an `algorithm.' The procedures set forth in the present claims are of that kind; that is to say, they are a generalized formulation for programs to solve mathematical problems of converting one form of numerical representation to another. From the generic formulation, programs may be developed as specific applications." 409 U.S., at 65 .

[Footnote 39] In Flook, the Court's analysis of the postsolution activity recited in the patent application turned, not on the relative significance of that activity in the catalytic conversion process, but rather on the fact that that activity was not a part of the applicant's discovery:

"The notion that post-solution activity, no matter how conventional or obvious in itself, can transform an unpatentable principle into a patentable process exalts form over substance. A competent draftsman could attach some form of post-solution activity to almost any mathematical formula; the Pythagorean theorem would not have been patentable, or partially patentable, because a patent application contained a final step indicating that the formula, when solved, could be usefully applied to existing surveying techniques. The concept of patentable subject matter under 101 is not `like a nose of wax which may be turned and twisted in any direction . . . .' White v. Dunbar, 119 U.S. 47, 51 ." 437 U.S., at 590 (footnote omitted).

[Footnote 40] Although the Court of Customs and Patent Appeals erred because it ignored the distinction between the 101 requirement that the applicant must

claim to have discovered a novel process and the 102 requirement that the discovery must actually be novel, that court correctly rejected the argument that any difference between Claim 11 and the earlier claims was relevant to the 101 inquiry. See 602 F.2d, at 984, 987-988.

[Footnote 41] This well-established precedent was reviewed in Parker v. Flook:

"Mackay Radio and **Funk Bros**. point to the proper analysis for this case: The process itself, not merely the mathematical algorithm, must be new and useful. Indeed, the novelty of the mathematical algorithm is not a determining factor at all. Whether the algorithm was in fact known or unknown at the time of the claimed invention, as one of the `basic tools of scientific and technological work,' see Gottschalk v. Benson, 409 U.S., at 67 , it is treated as though it were a familiar part of the prior art." 437 U.S., at 591 -592.

[Footnote 42] For example, the Association of Data Processing Service Organizations, appearing as amicus curiae in Flook, made the following policy argument:

"The need of the incentive of patents for software is at least as great as that of the incentive available for hardware, because: "Today, providing computer software involves greater . . . risk than providing computer . . . hardware. . . .'

"To a financial giant, the economic value of a patent may not loom large; to the small software products companies upon which the future of the development of quality software depends, the value of the patent in financing a small company may spell the difference between life and death. To banks and financial institutions the existence of a patent or even the potentiality of obtaining one may well be a decisive factor in determining whether a loan should be granted. To prospective investors a patent or the possibility of obtaining one may be the principal element in the decision whether to invest.

"Making clear that patents may be available for inventions in software would unleash important innovative talent. It would have the direct opposite effect forecast by the . . . hardware manufacturers; it would enable competition with those companies and provide the needed incentive to stimulate innovation." Brief for ADAPSO as Amicus Curiae in Parker v. Flook, O. T. 1977, No. 77-642, p. 44 (footnote omitted).

[Footnote 43] Gemignani, supra n. 1, at 309. In a footnote to that comment, Professor Gemignani added that the rate of growth of the software industry [450 U.S. 175, 218] "has been even faster lately than that of the hardware industry which does enjoy patent protections." Id., at 309, n. 259. Other commentators are in accord. See Nycum, Legal Protection for Computer Programs, 1 Computer L. J. 1, 55-58 (1978); Note, Protection of Computer Programs: Resurrection of the Standard, 50 Notre Dame Law. 333, 344 (1974).

[Footnote 44] See, e. g., Gemignani, supra n. 1, at 301-312; Keefe & Mahn, Protecting Software: Is It Worth All the Trouble?, 62 A. B. A. J. 906, 907 (1976).

[Footnote 45] This concern influenced the President's Commission on the Patent System when it recommended against patent protection for computer programs. In its report, the President's Commission stated:

"The Patent Office now cannot examine applications for programs because of the lack of a classification technique and the requisite search files. Even if these were available, reliable searches would not be feasible or economic because of the tremendous volume of prior art being generated. Without this search, the patenting of programs would be tantamount to mere registration and the presumption of validity would be all but nonexistent." Report of the President's Commission, supra n. 10, at 13.

[Footnote 46] It is noteworthy that the position of the Court of Customs and Patent Appeals in the process patent area had been consistent with that [450 U.S. 175, 219] of the Commissioner of Patents and Trademarks for decades prior to 1968. As discussed in Part I, supra, in that year the court rejected two longstanding doctrines that would have foreclosed patentability for most computer programs under 101.

[Footnote 47] A number of authorities have drawn the conclusion that the terms are in fact synonymous. See, e. g., Novick & Wallenstein, supra n. 5, at 333, n. 172; Anderson, Algorithm, 1 Encyclopedia of Computer Science & Technology 364, 369 (J. Belzer, A. Holzman & A. Kent eds. 1975); E. Horowitz & S. Sahni, Fundamentals of Computer Algorithms 2 (1978); A. Tanenbaum, Structured Computer Organization 10 (1976). Cf. Blumenthal & Riter, supra n. 15, at 455-456; Gemignani, supra n. 1, at 271-273, 276, n. 37. [450 U.S. 175, 221]