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(Cite as: 437 U.S. 584, 98 S.Ct. 2522)
57 L.Ed.2d 451, 198 U.S.P.Q. 193
Supreme Court of the United States

Lutrelle F. PARKER, Acting Commissioner of Patents and Trademarks,
Petitioner,
v.
Dale R. FLOOK.

No. 77-642.

Argued April 25, 1978.
Decided June 22, 1978.

Appeal was taken from a decision of the Patent and Trademark Office Board of Appeals sustaining rejection of claims for a "Method For Updating Alarm Limits" as not being statutory subject matter. The Court of Customs and Patent Appeals, 559 F.2d 21, reversed, holding that the claims involved statutory subject matter since they included recitation of postsolution activity and did not preempt the formula or algorithm used. Certiorari was granted. The Supreme Court, Mr. Justice Stevens, held that: (1) the identification of postsolution applications of the formula did not make the method eligible for patent protection, and (2) the application simply provided a new and presumably better method for calculating alarm limit values, in which the only novel feature was the mathematical formula or algorithm, and thus did not describe patentable subject matter.

Reversed.

Mr. Justice Stewart filed a dissenting opinion in which THE CHIEF JUSTICE and Mr. Justice Rehnquist joined.

West Headnotes

[1] Patents k7.14
291k7.14

Identification of postsolution applications of mathematical formula did not make method eligible for patent protection. 35 U.S.C.A. ¤ 101.

[2] Patents k7.14
291k7.14

[2] Patents k16.4
291k16.4

Process is not unpatentable simply because it contains law of nature or mathematical algorithm; however, process itself, not merely mathematical algorithm, must be new and useful. 35 U.S.C.A. ¤ 101.

[3] Patents k7.14
291k7.14

[3] Patents k16.4
291k16.4

Novelty of mathematical formula or algorithm is not determining factor as to patentability of process employing algorithm; whether algorithm was in fact known or unknown at time of claimed invention as one of basic tools of scientific and technological works, it is treated as though it were familiar part of prior art. 35 U.S.C.A. ¤ 101.

[4] Patents k6
291k6

Rule that discovery of law of nature cannot be patented rests, not on notion that natural phenomena are not processes, but rather on the more fundamental understanding that they are not kind of "discoveries" that patent law was enacted to protect; mere recognition of theretofore existing phenomenon or relationship carries with it no rights to exclude others from its enjoyment. 35 U.S.C.A. ¤¤ 101-103.

[5] Patents k314(6)
291k314(6)
(Formerly 291k18)

Obligation to determine what type of discovery is sought to be patented must precede determination of whether that discovery is, in fact, new or obvious. 35 U.S.C.A. ¤¤ 101-103.

[6] Patents k7.14
291k7.14

Even though phenomenon of nature or mathematical formula may be well-known, inventive application of principle may be patented; conversely, discovery of such phenomenon cannot support patent unless there is some other concept in its application. 35 U.S.C.A. ¤ 101.

[7] Patents k7.14
291k7.14

Claim for improved method of calculation, even when tied to specific end use, is unpatentable subject matter. 35 U.S.C.A. ¤ 101.

[8] Patents k7.14
291k7.14

Application providing for new and presumably better method for calculating alarm limit values during catalytic conversion processes, in which only novel feature was mathematical formula, did not describe patentable subject matter. 35 U.S.C.A. ¤ 101.
**2523 Syllabus [FN*]

FN* The syllabus constitutes no part of the opinion of the Court but has been prepared by the Reporter of Decisions for the convenience of the reader. See United States v. Detroit Timber & Lumber Co., 200 U.S. 321, 337, 26 S.Ct. 282, 287, 50 L.Ed. 499.

*584 Respondent's method for updating alarm limits during catalytic conversion processes, in which the only novel feature is a mathematical formula, held not patentable under ¤ 101 of the Patent Act. The identification of a limited category of useful, though conventional, post-solution applications of such a formula does not make the method eligible for patent protection, since assuming the formula to be within prior art, as it must be, O'Reilly v. Morse, 15 How. 62, 14 L.Ed. 601, respondent's application contains no patentable invention. The chemical processes involved in catalytic conversion are well known, as are the monitoring of process variables, the use of alarm limits to trigger alarms, the notion that alarm limit values must be recomputed and readjusted, and the use of computers for "automatic process monitoring." Pp. 2524-2529.

559 F.2d 21, reversed.

Lawrence G. Wallace, Washington, D.C., for petitioner.

D. Dennis Allegretti, Chicago, Ill., for respondent.

*585 Mr. Justice STEVENS delivered the opinion of the Court.

Respondent applied for a patent on a "Method for Updating Alarm Limits." The only novel feature of the method is a mathematical formula. In Gottschalk v. Benson, 409 U.S. 63, 93 S.Ct. 253, 34 L.Ed.2d 273, we held that the discovery of a novel and useful mathematical formula may not be patented. The question in this case is whether the identification of a limited category of useful, though conventional, post-solution applications of such a formula makes respondent's method eligible for patent protection.

I

An "alarm limit" is a number. During catalytic conversion processes, operating conditions such as temperature, pressure, and flow rates are constantly monitored. When any of these "process variables" exceeds a predetermined "alarm limit," an alarm may signal the presence of an abnormal condition indicating either inefficiency or perhaps danger. Fixed alarm limits may be appropriate for a steady operation, but during transient operating situations, such as start-up, it may be necessary to "update" the alarm limits periodically.

Respondent's patent application describes a method of updating alarm limits. In essence, the method consists of three steps: an initial step which merely measures the present value of the process variable (e. g., the temperature); an intermediate step which uses an algorithm [FN1] to calculate an updated alarm-limit value; and a final step in which the actual alarm limit is adjusted to the updated value. [FN2] The only difference *586 between the conventional methods of changing alarm limits and that described in respondent's application rests in the second step--the mathematical algorithm or formula. Using the formula, an operator can calculate an updated alarm limit once he knows 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 weighting factor to be used to average the original alarm base and the current temperature.

FN1. We use the word "algorithm" in this case, as we did in Gottschalk v. Benson, 409 U.S. 63, 65, 93 S.Ct. 253, 254, 34 L.Ed.2d 273, to mean "[a] procedure for solving a given type of mathematical problem . . . ."

FN2. Claim 1 of the patent is set forth in the appendix to this opinion, which also contains a more complete description of these three steps.

The patent application does not purport to explain how to select the appropriate margin of safety, the weighting factor, or any of the other variables. Nor does 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 **2524 system. All that it provides is a formula for computing an updated alarm limit. Although the computations can be made by pencil and paper calculations, the abstract of disclosure makes it clear that the formula is primarily useful for computerized calculations producing automatic adjustments in alarm settings. [FN3]

FN3. App. 13A.

The patent claims cover any use of respondent's formula for updating the value of an alarm limit on any process variable involved in a process comprising the catalytic chemical conversion of hydrocarbons. Since there are numerous processes of that kind in the petrochemical and oil-refining industries, [FN4] the claims cover a broad range of potential uses of the method. They do not, however, cover every conceivable application of the formula.

FN4. Examples mentioned in the abstract of disclosure include naphtha reforming, petroleum distillate and petroleum residuum cracking, hydrocracking and desulfurization, aromatic hydrocarbon and paraffin isomerization and disproportionation, paraffin-olefin alkylation, and the like. Id., at 8A.

*587 II

The patent examiner rejected the application. He found that the mathematical formula constituted the only difference between respondent's claims and the prior act and therefore a patent on this method "would in practical effect be a patent on the formula or mathematics itself." [FN5] The examiner concluded that the claims did not describe a discovery that was eligible for patent protection.

FN5. Id., at 47A.

The Board of Appeals of the Patent and Trademark Office sustained the examiner's rejection. The Board also concluded that the "point of novelty in [respondent's] claimed method" [FN6] lay in the formula or algorithm described in the claims, a subject matter that was unpatentable under Benson, supra.

FN6. Id., at 60A.

The Court of Customs and Patent Appeals reversed. In re Flook, 559 F.2d 21. It read Benson as applying only to claims that entirely pre-empt a mathematical formula or algorithm, and noted that respondent was only claiming on the use of his method to update alarm limits in a process comprising the catalytic chemical conversion of hydrocarbons. The court reasoned that since the mere solution of the algorithm would not constitute infringement of the claims, a patent on the method would not pre-empt the formula.

The Acting Commissioner of Patents and Trademarks filed a petition for a writ of certiorari, urging that the decision of the Court of Customs and Patent Appeals will have a debilitating effect on the rapidly expanding

computer "software" industry, [FN7] and will require him to process thousands of addi *588 tional patent applications. Because of the importance of the question, we granted certiorari, 434 U.S. 1033, 98 S.Ct. 764, 54 L.Ed.2d 780.

FN7. The term "software" is used in the industry to describe computer programs. The value of computer programs in use in the United States in 1976 was placed at $43.1 billion, and projected at $70.7 billion by 1980 according to one industry estimate. See Brief for the Computer & Business Equipment Manufacturers Assn. as Amicus Curiae 17-18, n. 16.

III

This case turns entirely on the proper construction of ¤ 101 of the Patent Act, which describes the subject matter that is eligible for patent protection. [FN8] It does not involve the familiar issues of novelty and obviousness that routinely arise under ¤¤ 102 and 103 when the validity of a patent is challenged. For the purpose of our analysis, we assume that respondent's **2525 formula is novel and useful and that he discovered it. We also assume, since respondent does not challenge the examiner's finding, that the formula is the only novel feature of respondent's method. The question is whether the discovery of this feature makes an otherwise conventional method eligible for patent protection.

FN8. Title 35 U.S.C. ¤ 101 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."
Section 100(b) provides:
"The term 'process' means process, art or method, and includes a new use of a known process, machine, manufacture, composition of matter, or material."

The plain language of ¤ 101 does not answer the question. It is true, as respondent argues, that his method is a "process" in the ordinary sense of the word. [FN9] But that was also true of the algorithm, which described a method for converting binary-coded decimal numerals into pure binary numerals, *589 that was involved in Gottschalk v. Benson. The holding that the discovery of that method could not be patented as a "process" forecloses a purely literal reading of ¤ 101. [FN10] Reasoning that an algorithm, or mathematical formula, is like a law of nature, Benson applied the established rule that a law of nature cannot be the subject of a patent. Quoting from earlier cases, we said:

FN9. The statutory definition of "process" is broad. See n. 8, supra. An argument can be made, however, that this Court has only recognized a process as within the statutory definition when it either was tied to a particular apparatus or operated to change materials to a "different state or thing." See Cochrane v. Deener, 94 U.S. 780, 787- 788, 24 L.Ed. 139. As in Benson, we assume that a valid process patent may issue even if it does not meet one of these qualifications of our earlier precedents. 409 U.S., at 71, 93 S.Ct., at 257.

FN10. In Benson we phrased the issue in this way: "The question is whether the method described and claimed is a 'process' within the meaning of the Patent Act." Id., at 64, 93 S.Ct., at 254.

" '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, 14 L.Ed. 367. Phenomena of nature, though just discovered, mental processes, and abstract intellectual concepts are not patentable, as they are the basic tools of scientific and technological work." 409 U.S., at 67, 93 S.Ct., at 255.

The line between a patentable "process" and an unpatentable "principle" is not always clear. Both are "conception[s] of the mind, seen only by [their] effects when being executed or performed." Tilghman v. Proctor, 102 U.S. 707, 728, 26 L.Ed. 279. In Benson we concluded that the process application in fact sought to patent an idea, noting that "[t]he mathematical formula involved here has no substantial practical application except in connection with a digital computer, which means that if the judgment below is affirmed, the patent would wholly pre-empt the mathematical formula and in practical effect would be a patent on the algorithm itself." 409 U.S., at 71-72, 93 S.Ct., at 257.

[1] Respondent correctly points out that this language does not apply to his claims. He does not seek to "wholly preempt the mathematical formula," since there are uses of his *590 formula outside the petrochemical and oil-refining industries that remain in the public domain. And he argues that the presence of specific "post-solution" activity--the adjustment of the alarm limit to the figure computed according to the formula--distinguishes this case from Benson and makes his process patentable. We cannot agree.

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. [FN11] The concept of patentable **2526 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, 7 S.Ct. 72, 74, 30 L.Ed. 303.

FN11. It should be noted that in Benson there was a specific end use contemplated for the algorithm--utilization of the algorithm in computer programming. See In re Chatfield, 545 F.2d 152, 161 (Cust. & Pat. App. 1976) (Rich, J., dissenting). Of course, as the Court pointed out, the formula had no other practical application; but it is not entirely clear why a process claim is any more or less patentable because the specific end use contemplated is the only one for which the algorithm has any practical application.

[2] Yet it is equally clear that a process is not unpatentable simply because it contains a law of nature or a mathematical algorithm. See Eibel Process Co. v. Minnesota & Ontario Paper Co., 261 U.S. 45, 43 S.Ct. 322, 67 L.Ed. 523; Tilghman v. Proctor, supra. [FN12] For *591 instance, in Mackay Radio & Telegraph Co. v. Radio Corp. of America, 306 U.S. 86, 59 S.Ct. 427, 83 L.Ed. 506, the applicant sought a patent on a directional antenna system in which the wire arrangement was determined by the logical application of a mathematical formula. Putting the question of patentability to one side as a preface to his analysis of the infringement issue, Mr. Justice Stone, writing for the Court, explained:

FN12. In Eibel Process Co., the Court upheld a patent on an improvement on a papermaking machine that made use of the law of gravity to enhance the flow of the product. The patentee, of course, did not claim to have discovered the force of gravity, but that force was an element in his novel conception.

Tilghman v. Proctor involved a process claim for " 'the manufacturing of fat acids and glycerine from fatty bodies.' " The Court distinguished the process from the principle involved as follows:
"[T]he claim of the patent is not for a mere principle. The chemical principle or scientific fact upon which it is founded is, that the elements of neutral fat require to be severally united with an atomic equivalent of water in order to separate from each other and become free. This chemical fact was not discovered by Tilghman. He only claims to have invented a particular mode of bringing about the desired chemical union between the fatty elements and water." 102 U.S., at 729.

"While a scientific truth, or the mathematical expression of it, is not patentable invention, a novel and useful structure created with the aid of knowledge of scientific truth may be." Id., at 94, 59 S.Ct., at 431.
Funk Bros. Seed Co. v. Kalo Co., 333 U.S. 127, 130, 68 S.Ct. 440, 441, 92 L.Ed. 588, expresses a similar approach:
"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."
[3] 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, *592 409 U.S., at 67, 93 S.Ct., at 255, it is treated as though it were a familiar part of the prior art.
This is also the teaching of our landmark decision in O'Reilly v. Morse, 15 How. 62. In that case the Court rejected Samuel Morse's broad claim covering any use of electromagnetism for printing intelligible signs, characters, or letters at a distance. Id., at 112-121. In reviewing earlier cases applying the rule that a scientific principle cannot be patented, the Court placed particular emphasis on the English case of Neilson v. Harford, Web. Pat. Cases 295, 371 (1844), which involved the circulation of heated air in a furnace system to increase its efficiency. The English court rejected the argument that the patent merely covered the principle that furnace temperature could be increased by injecting hot air, instead of cold into the furnace. That court's explanation of its decision was relied on by this Court in Morse :
" 'It is very difficult to distinguish it [the Neilson patent] from the specification of a patent for a principle, and this at first created in the minds of the court much difficulty; but after full consideration, **2527 we think that the plaintiff does not merely claim a principle, but a machine, embodying a principle, and a very valuable one. We think the case must be considered as if the principle being well known, the plaintiff had first invented a mode of applying it . . . .' " 15 How., at 115 (emphasis added). [FN13]

FN13. See also Risdon Locomotive Works v. Medart, 158 U.S. 68, 15 S.Ct. 745, 39 L.Ed. 899; Tilghman v. Proctor, supra.

We think this case must also be considered as if the principle or mathematical formula were well known.
Respondent argues that this approach improperly imports into ¤ 101 the considerations of "inventiveness" which are the proper concerns of ¤¤ 102 and 103. [FN14] This argument is based on two fundamental misconceptions.

FN14. Sections 102 and 103 establish certain conditions, such as novelty and nonobviousness, to patentability.

[4][5] *593 First, respondent incorrectly assumes that if a process application implements a principle in some specific fashion, it automatically falls within the patentable subject matter of ¤ 101 and the substantive patentability of the particular process can then be determined by the conditions of ¤¤ 102 and 103. 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 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. [FN15] 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.

FN15. The underlying notion is that a scientific principle, such as that expressed in respondent's algorithm, reveals a relationship that has always existed.
"An example of such a discovery [of a scientific principle] was Newton's formulation of the law of universal gravitation, relating the force of attraction between two bodies, F, to their masses, m and m', and the square of the distance, d, between their centers, according to the equation F=mm'/ d2. But this relationship always existed--even before Newton announced his celebrated law. Such 'mere' recognition of a theretofore existing phenomenon or relationship carries with it no rights to exclude others from its enjoyment. . . . Patentable subject matter must be new (novel); not merely heretofore unknown. There is a very compelling reason for this rule. The reason is founded upon the proposition that in granting patent rights, the public must not be deprived of any rights that it theretofore freely enjoyed." P. Rosenberg, Patent Law Fundamentals, ¤ 4, p. 13 (1975).

[6] Second, respondent assumes that the fatal objection to his application is the fact that one of its components--the mathematical *594 formula--consists of unpatentable subject matter. In countering this supposed objection, respondent relies on opinions by the Court of Customs and Patent Appeals which reject the notion "that a claim may be dissected, the claim components searched in the prior art, and, if the only component found novel is outside the statutory classes of invention, the claim may be rejected under 35 U.S.C. ¤ 101." In re Chatfield, 545 F.2d 152, 158 (Cust. & Pat.App.1976). [FN16] Our approach to respondent's application is, however, not at all inconsistent with the view that a patent claim must be considered as a whole. Respondent's process is unpatentable under ¤ 101, not because it contains a mathematical algorithm as one component, but because once that algorithm is assumed to be within the prior art, the application, considered as a whole, contains **2528 no patentable invention. Even though a phenomenon of nature or mathematical formula may be well known, an inventive application of the principle may be patented. Conversely, the discovery of such a phenomenon cannot support a patent unless there is some other inventive concept in its application.

FN16. Section 103, by its own terms, requires that a determination of obviousness be made by considering "the subject matter as a whole," 35 U.S.C. ¤ 103. Although this does not necessarily require that analysis of what is patentable subject matter under ¤ 101 proceed on the same basis, we agree that it should.

[7][8] Here it is absolutely clear that respondent's application contains no claim of patentable invention. The chemical processes involved in catalytic conversion of hydrocarbons are well known, as are the practice of monitoring the chemical process variables, the use of alarm limits to trigger alarms, the notion that alarm limit values must be recomputed and readjusted, and the use of computers for "automatic monitoring-alarming." [FN17] Respondent's application simply provides a new and presumably better method for calculating alarm limit *595 values. If we assume that that method was also known, as we must under the reasoning in Morse, then respondent's claim is, in effect, comparable to a claim that the formula 2 r can be usefully applied in determining the circumference of a wheel. [FN18] As the Court of Customs and Patent Appeals has explained, "if a claim is directed essentially to a method of calculating, using a mathematical formula, even if the solution is for a specific purpose, the claimed method is nonstatutory." In re Richman, 563 F.2d 1026, 1030 (1977).

FN17. App. 22.

FN18. Respondent argues that the inventiveness of his process must be determined as of "the time the invention is made" under ¤ 103, and that, therefore, it is improper to judge the obviousness of his process by assessing the application of the formula as though the formula were part of the prior art. This argument confuses the issue of patentable subject matter under ¤ 101 with that of obviousness under ¤ 103. Whether or not respondent's formula can be characterized as "obvious," his process patent rests solely on the claim that his mathematical algorithm, when related to a computer program, will improve the existing process for updating alarm units. Very simply, our holding today is that a claim for an improved method of calculation, even when tied to a specific end use, is unpatentable subject matter under ¤ 101.

To a large extent our conclusion is based on reasoning derived from opinions written before the modern business of developing programs for computers was conceived. The youth of the industry may explain the complete absence of precedent supporting patentability. Neither the dearth of precedent, nor this decision, should therefore be interpreted as reflecting a judgment that patent protection of certain novel and useful computer programs will not promote the progress of science and the useful arts, or that such protection is undesirable as a matter of policy. Difficult questions of policy concerning the kinds of programs that may be appropriate for patent protection and the form and duration of such protection can be answered by Congress on the basis of current empirical data not equally available to this tribunal. [FN19]

FN19. Articles assessing the merits and demerits of patent protection for computer programming are numerous. See, e. g., Davis, Computer Programs and Subject Matter Patentability, 6 Rutgers J. of Computers and Law 1 (1977), and articles cited therein, at 2 n. 5. Even among those who favor patentability of computer programs, there is questioning of whether the 17-year protection afforded by the current Patent Act is either needed or appropriate. See id., at 20 n. 133.

*596 It is our duty to construe the patent statutes as they now read, in light of our prior precedents, and we must proceed cautiously when we are asked to extend patent rights into areas wholly unforeseen by Congress. As Mr. Justice White explained in writing for the Court in Deepsouth Packing Co. v. Laitram Corp., 406 U.S. 518, 531, 92 S.Ct. 1700, 1708, 32 L.Ed.2d 273: "[W]e should not expand patent rights by overruling or modifying our prior cases construing the patent statutes, unless the argument for expansion of privilege is based on more than mere inference from ambiguous statutory language. We would require a clear and certain signal from Congress before approving the position of a litigant who, as respondent here, argues that the beachhead of privilege is **2529 wider, and the area of public use narrower, than courts had previously thought. No such signal legitimizes respondent's position in this litigation."

The judgment of the Court of Customs and Patent Appeals is

Reversed.

APPENDIX TO OPINION OF THE COURT

Claim 1 of the patent describes the method as follows:

"1. A method for updating the value of at least one alarm limit on at least one process variable involved in a process comprising the catalytic chemical conversion of hydrocarbons wherein said alarm limit has a current value of

Bo + K

"wherein Bo is the current alarm base and K is a predetermined alarm offset which comprises:

*597 "(1) Determining the present value of said process variable, said present value being defined as PVL;

"(2) Determining a new alarm base B sub1 , using the following equation:

B sub1 = Bo(1.0--F) + PVL(F)

"where F is a predetermined number greater than zero and less than 1.0;

"(3) Determining an updated alarm limit which is defined as B sub1 + K; and thereafter

"(4) Adjusting said alarm limit to said updated alarm limit value." App. 63A.

In order to use respondent's method for computing a new limit, the operator must make four decisions. Based on his knowledge of normal operating conditions, he first selects the original "alarm base" (Bo); if a temperature of 400 degrees is normal, that may be the alarm base. He next decides on an appropriate margin of safety, perhaps 50 degrees; that is his "alarm offset" (K). The sum of the alarm base and the alarm offset equals the alarm limit. Then he decides on the time interval that will elapse between each updating; that interval has no effect on the computation although it may, of course, be of great practical importance. Finally, he selects a weighting factor (F), which may be any number between 99% and 1%, [FN*] and which is used in the updating calculation.

FN* More precisely, it is defined as a number greater than 0, but less than 1.

If the operator has decided in advance to use an original alarm base (Bo) of 400 degrees, a constant alarm offset (K) of 50 degrees, and a weighting factor (F) of 80%, the only additional information he needs in order to compute an updated alarm limit (UAV), is the present value of the process variable (PVL). The computation of the updated alarm limit according to respondent's method involves these three steps:

First, at the predetermined interval, the process variable *598 is measured; if we assume the temperature is then 425 degrees, PVL will then equal 425.

Second, the solution of respondent's novel formula will produce a new alarm base (B sub1) that will be a weighted average of the preceding alarm base (Bo) of 400 degrees and the current temperature (PVL) of 425. It will be closer to one or the other depending on the value of the weighting factor (F) selected by the operator. If F is 80%, that percentage of 425 (340) plus 20% (1--F) of 400 (80) will produce a new alarm base of 420 degrees.

Third, the alarm offset (K) of 50 degrees is then added to the new alarm base (B sub1) of 420 to produce the updated alarm limit (UAV) of 470.

The process is repeated at the selected time intervals. In each updating computation, the most recently calculated alarm base and the current measurement of the process variable will be substituted for the corresponding numbers in the original calculation, but the alarm offset and the weighting factor will remain constant.

Mr. Justice STEWART, with whom THE CHIEF JUSTICE and Mr. Justice REHNQUIST join, dissenting.

It is a commonplace that laws of nature, physical phenomena, and abstract ideas are **2530 not patentable subject matter. [FN1] A patent could not issue, in other words, on the law of gravity, or the multiplication tables, or the phenomena of magnetism, or the fact that water at sea level boils at 100 degrees centigrade and freezes at zero--even though newly discovered. Le Roy v. Tatham, 14 How. 156, 175; O'Reilly v. Morse, 15 How. 62, 112-121; Rubber-Tip Pencil Co. v. Howard, 20 Wall. *599 498, 507, 22 L.Ed. 410; Tilghman v. Proctor, 102 U.S. 707, 26 L.Ed. 279; Mackay Radio & Telegraph Co. v. Radio Corp. of America, 306 U.S. 86, 94, 59 S.Ct. 427, 431, 83 L.Ed. 506; Funk Bros. Seed Co. v. Kalo Co., 333 U.S. 127, 130, 68 S.Ct. 440, 441, 92 L.Ed. 588.

FN1. Title 35 U.S.C. ¤ 101 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."

The recent case of Gottschalk v. Benson, 409 U.S. 63, 93 S.Ct. 253, 34 L.Ed.2d 273, stands for no more than this long-established principle, which the Court there stated in the following words:
"Phenomena of nature, though just discovered, mental processes, and abstract intellectual concepts are not patentable, as they are the basic tools of scientific and technological work." Id., at 67, 93 S.Ct., at 255.
In Benson the Court held unpatentable claims for an algorithm that "were not limited to any particular art or technology, to any particular apparatus or machinery, or to any particular end use." Id., at 64, 93 S.Ct., at 254. A patent on such claims, the Court said, "would wholly pre-empt the mathematical formula and practical effect would be a patent on the algorithm itself." Id., at 72, 93 S.Ct., at 257.

The present case is a far different one. The issue here is whether a claimed process [FN2] loses its status of subject-matter patentability simply because one step in the process would not be patentable subject matter if considered in isolation. The Court of Customs and Patent Appeals held that the process is patentable subject matter, Benson being inapplicable since "[t]he present claims do not preempt the formula or algorithm contained

therein, because solution of the algorithm, per se, would not infringe the claims." In re Flock, 559 F.2d 21, 23.

FN2. Title 35 U.S.C. ¤ 100(b) provides:
"The term 'process' means process, art or method, and includes a new use of a known process, machine, manufacture, composition of matter, or material."

That decision seems to me wholly in conformity with basic principles of patent law. Indeed, I suppose that thousands of processes and combinations have been patented that contained one or more steps or elements that themselves would have been *600 unpatentable subject matter. [FN3] Eibel Process Co. v. Minnesota & Ontario Paper Co., 261 U.S. 45, 43 S.Ct. 322, 67 L.Ed. 523, is a case in point. There the Court upheld the validity of an improvement patent that made use of the law of gravity, which by itself was clearly unpatentable. See also, e. g., Tilghman v. Proctor, supra.

FN3. In Gottschalk v. Benson, the Court equated process and product patents for the purpose of its inquiry: "We dealt there with a 'product' claim, while the present case deals with a 'process' claim. But we think the same principle applies." 409 U.S., at 67-68, 93 S.Ct., at 255.

The Court today says it does not turn its back on these well-settled precedents, ante, at 2527-2528, but it strikes what seems to me an equally damaging blow at basic principles of patent law by importing into its inquiry under 35 U.S.C. ¤ 101 the criteria of novelty and inventiveness. Section 101 is concerned only with subject-matter patentability. Whether a patent will actually issue depends upon the criteria of ¤¤ 102 and 103, which include novelty and inventiveness, among many others. It may well be that under the criteria of ¤¤ 102 and 103 no patent should issue on the process claimed in this case, because of anticipation, abandonment, obviousness, or for some other reason. But in my view the claimed process **2531 clearly meets the standards of subject-matter patentability of ¤ 101.

In short, I agree with the Court of Customs and Patent Appeals in this case, and with the carefully considered opinions of that court in other cases presenting the same basic issue. See In re Freeman, 573 F.2d 1237; In re Richman, 563 F.2d 1026; In re De Castelet, 562 F.2d 1236; In re Deutsch, 553 F.2d 689; In re Chatfield, 545 F.2d 152. Accordingly, I would affirm the judgment before us.

98 S.Ct. 2522, 437 U.S. 584, 57 L.Ed.2d 451, 198 U.S.P.Q. 193
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